No. CP-SP-1439E

Dynamic Self-Checking Burner Controller

Model AUR455

User's Manual

Thank you for purchasing an Azbil Corporation product.

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

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

Azbil Corporation

NOTICE

Please make sure that this manual is available to the user of the product.

Unauthorized duplication of this user's manual in part or in whole is forbidden.

The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.

Please understand that we cannot in some cases accept responsibility for the results of the use of this equipment by the customer.

Conventions Used in This Manual

■ The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.

WARNING	**Warnings are indicated when mishandling this product may result in death or serious injury.**
CAUTION	**Cautions are indicated when mishandling this product may result in minor injury or property damage only.**

■ In describing the product, this manual uses the icons and wording listed below.

	Indicates that caution is required in handling.
	The indicated action is prohibited.
	Be sure to follow the indicated instructions.
Handling Precautions:	Information to be aware of when handling.
Note:	Indicates information that may be useful.
☞:	Indicates an item or page to which the user may refer.
(1) (2) (3):	Steps in a sequence or parts of a figure, etc.

Safety Precautions

⚠WARNING

This device is equipped with functions that are extremely important for the safe operation of combustion equipment. Be sure to follow the instructions stated in this user's manual.
This device does not have a prepurge function. Use this device as part of a system whose design gives careful consideration to the prepurge timer and ignition sequence timing, following established safety guidelines.
Check the model number carefully and check that the sequence timing is as specified by the combustion equipment manufacturer. Installing the wrong model can result in an explosion hazard.
Make sure that the AUD flame sensor does not detect UV rays from a source other than the burner.
Do not touch terminal 14 (F) after turning the power off. An electric charge may remain on terminal 14 (F) and may cause an electric shock.
Carry out the pilot turndown test carefully.
Be sure to do a prepurge before restarting the system when lockout occurs. If the combustion chamber and gas flue are not ventilated to remove any unburned gas, the ignition process may cause an explosion.
Do not reset this device until the cause of the problem has been eliminated when lockedout occurs.
Do not reset this device repeatedly when lockout occurs. If this device is misused, a serious combustion equipment accident may occur.
Do not reset this device from a remote location. Because it is difficult to make a safety check when far from the equipment, there is an increased risk of explosion.
Do not use the event output or alarm output as safety output.
This device has a limited product life. Beyond the product life, the risk of device failure becomes higher. Replace this device within its product life.
Do not disassemble this device. Doing so may cause malfunction, device failure, or electric shock.
Do not operate this device without first completing its adjustment and testing, and also the testing specified by the combustion equipment manufacturer.
Do not extend the lead wires of the contact reset for more than the allowable length of 10 meters. If the device is reset from a location where it is difficult to check the safety of combustion, there is a risk of explosion.
The ignition time for the pilot and main burners should not exceed the time defined by the burner or device manufacturer. If it does, fuel will accumulate in the combustion chamber and form an explosive mixture, resulting in a very dangerous situation in which an explosion could occur.
Do not connect the solenoid valve to the high potential side (L1). If it is connected to L1 and a ground fault occurs, current can leak to the solenoid valve and open it, allowing fuel to flow out, regardless of the status of the burner controller.

⚠WARNING

Before doing the pilot turn-down test, always make sure that all manual fuel valves are closed.
If the pilot turn-down test must be repeated, stop the combustion equipment completely each time and discharge all of the unburned gas and oil from the fuel chamber and flue. Failure to discharge unburned gas may result in an explosion hazard.
After completing the pilot turn-down test, turn off the power switch to turn off the power supply. Make sure to return all test jumpers and limit or controller settings to their original values. Resuming normal operation without returning the settings to their original values, etc., may damage the equipment or cause a gas leak or explosion.
Close the fuel valve before using the flame simulator for a check while this device is attached. If you use the flame simulator during normal operation, since a flame will seem to be present, fuel will continue to be supplied even if the pilot burner or main burner is off, possibly causing an explosion.

⚠CAUTION

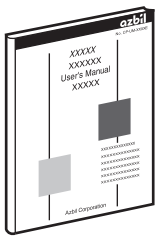
To ensure proper operation of this device, follow the directions given in this user's manual and in the manuals for the combustion equipment and for any other devices that are used. When planning a combustion safety control system, please discuss the details with our sales representatives.
Installation, wiring, maintenance, inspection, and adjustment must be carried out by a professional with technical training in combustion equipment and flame safeguard system.
Use this product correctly within the range of the rated specifications stated in the user's manual. Not doing so may cause device failure or malfunction.
Do not install where exposed to any of the following: • **Certain chemicals or corrosive gases (ammonia, sulfur, chlorine, ethylene compounds, acid, etc.)** • **Splashing water or excessive humidity.** • **High temperatures** • **Prolonged vibration**
All wiring and installation must comply with applicable local electrical codes, ordinances and regulations.
Provide appropriate maintenance and inspection for the product, following the methods, procedures, replacement cycle, etc., specified by this user's manual.
When discarding of this device, dispose of it as industrial waste, following local regulations.
If timers and auxiliary relays are needed for additional functions, select ones with being listed or component recognized by authorities, and be sure to design the circuit correctly.
Use this device within the operating ranges given in the specifications for temperature, humidity, voltage, vibration, shock, mounting position, atmosphere, etc.
Make sure that the flame detector does not detect the ignition spark. If the ignition spark is detected, change the position of the flame detector or ignition electrode.

⚠ CAUTION

Do not connect a load that exceeds the rating stated in the specifications to the control load terminals (6, 7, 8), and do not short-circuit the load. Doing so will burn out the internal fuse, making this device unusable.
The protection rating of this device is equivalent to IP10 or IP40. According to equipment requirements, install this device in a control panel with appropriate protection rating.
For mounting and wiring, follow the instructions in this user's manual or in manuals provided by the combustion equipment manufacturer.
The ignition transformer ground must be directly connected to the burner itself or to metal that is electrically connected to the burner.
Keep power wires and the ignition transformer high voltage cable separate from the flame detector wiring.
Make sure that ignition transformer high-voltage cables are properly connected to prevent faulty contact. Faulty contact may generate high-frequency radio waves, causing malfunction.
Always supply electricity at the voltage and frequency stated on the model label of this device.
Make sure the burner frame is properly grounded in compliance with applicable local electrical codes, ordinances, and regulations.
The pilot turn-down test should be carried out only by an experienced specialist possessing knowledge and skills pertaining to combustion equipment and combustion safety.
If the combustion equipment is restarted as a result of a lockout, do all of the inspection steps described in ☞ Chapter 5, "Trial Operation and Adjustment."
When doing a maintenance inspection of the burner, be sure to do the pilot turn-down test. Inspection must be done at least once a year.
Inspect the combustion equipment periodically in accordance with the instructions given in the manual provided by the equipment manufacturer.
When cleaning the burner, clean the flame detector also.
When transporting or storing this device, temporarily remove it from the sub-base and pack it in the box it was originally shipped in. Transportation while attached to a panel, etc., may cause damage.

The Role of This Manual

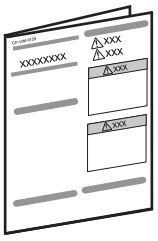
There are three different manuals related to model AUR455. Read them as necessary for your specific requirements. If you do not have a manual you require, please contact us or one of our dealers.



Dynamic Self-Checking Burner Controller Model AUR455 User's Manual
Document No. CP-SP-1439E

This manual.

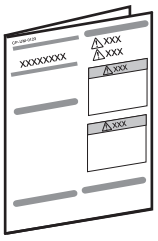
Personnel who are using model AUR455 for the first time, or are designing combustion equipment that uses the AUR455, or are designing hardware used to incorporate it into a control panel, etc., or are maintaining the AUR455, should read this manual thoroughly. This manual gives an overview of the product, tells how to install and wire it for incorporation into equipment, and gives an overview of operation, trial operation and adjustment methods, communication, maintenance and inspection, and specifications.



Dynamic Self-Checking Burner Controller Model AUR455
User's Manual for Installation **Document No. CP-UM-5955JE**

This manual is supplied with the AUR455.

Personnel who design or maintain equipment that uses the AUR455 should read this manual thoroughly. This manual describes installation of this device.



Installation and Usage Guide for Smart Loader Package Model SLP-A55
for Burner Controller Model AUR_55 **Document No. CP-UM-5956JE**

This manual is supplied with Smart Loader Package model SLP-A55.

Personnel who design equipment that uses the AUR455 or who configure and maintain the AUR455 using the SLP-A55 should read this manual thoroughly. It describes the PC software used to configure various settings for the AUR455 and to read out internal data from the AUR455. The manual describes installation of the software on a PC, its operation on the PC, and setup procedures.

Contents

-MEMO-

Chapter 1. Overview

The AUR455 dynamic self-checking burner controller (hereafter “this device”) can be used for both continuous operation and batch operation. It is a combustion safety controller that employs the correct ignition sequence to automatically and safely ignite gas burners and oil burners. This device can be used in combination with the AUD300C advanced ultraviolet flame detector, the AUD500C explosion-proof advanced ultraviolet flame detector, or a flame rod.

The AUR455 drives the shutter that is built into the AUD300C/500C to continuously check both its own flame detection circuit and the ultraviolet detector in order to provide flame detection for continuous burner operation. When used with a flame rod, the AUR455 continuously checks its own built-in flame detection circuit to provide flame detection for continuous burner operation. Also, it is equipped with a 7-segment display that can be used in maintenance, a trial operation mode that is convenient for trial operation and adjustment, and other features. Additionally, the device is equipped with host communications (RS-485) and a smart loader package function, allowing more detailed observation of status and troubleshooting.

- The combustion sequence, alarm codes and flame voltage are shown on the 7-segment display.
- LED indicators show whether there is a flame signal and indicate lockout.
- Self-diagnosis of the internal control relay circuit
- If lockout occurs due to ignition failure or unexpected flame failure, the controller does not restart without a manual reset.
- Equipped with host communications (RS-485) to enable remote monitoring.
- DIN rail mounting and a sub-base structure are provided for easy installation and replacement.

■ Handling Precautions

- This device has functions that are extremely important for the safe operation of combustion equipment. Carefully follow the instructions for its use that are given in this user’s manual.
- This device should be installed, wired, inspected, adjusted, and maintained by experienced specialists who have knowledge and skills concerning combustion equipment and flame safeguard system.

■ Cautions for combustion equipment design

Facilities that use flame safeguard system must be designed in compliance with relevant laws, standards, safety guidelines, and the like.

If the system is designed to foreign specifications, please observe the local laws and standards.

Main safety policies in Japan

- Technical Policy on Safety Standards for Combustion Equipment in Industrial Furnaces, by Ministry of Health, Labor and Welfare
- Combustion Equipment in Compliance with the Safety Principles for Industrial Incinerators - JIS B 8415
- Forced Draught Burners — Part 1: Gas Burners (JIS B 8407-1)
- Forced Draught Burners — Part 2: Oil Burners (JIS B 8407-2)
- Index of Safety Technology of Industrial Gas Combustion Equipment, by Japan Gas Association
- Index of Safety Technology of Gas Boiler Combustion Facilities, by Japan Gas Association

■ Most important points for ensuring safety

Design the equipment observing the following points to ensure safety.

- Connect loads directly to this device.
- Make sure that the start check runs correctly at startup.
- Do not add a bypass circuit that allows manual operation of any load.
- Both the main valve and pilot valve must have redundant shutoffs.

■ Precautions for system design

Provide a purge function with external instrumentation, taking into account factors such as the conditions for purge and the time settings.

■ Model No.

The dedicated sub-base, sideboard, and front connector are not included with this device. Please order them separately.

● Interrupted pilot type

Example: AUR455C423100

Basic model No.	Flame detector	Ignition trial	Main trial	Flame failure response	Power	Pilot sequence	Other	Description	Note
AUR455									
	B							Flame rod	CE certification
	C							UV	CE certification
		4						4.5±0.5 s	
		8						9.0±1.0 s	
			2					7.0±1.0 s	
			3					4.5±0.5 s	JIS response time
				2				2 s max.	AUR455C only
				3				4 s max.	
					1			100 V AC	
					2			200 V AC	
					3			120 V AC	
					5			230 V AC	
						0		Interrupted pilot	*
							0	Without inspection data	
							D	With inspection data	

* If the ignition method is an intermittent pilot, select a direct ignition model.

● Direct ignition type

Example: AUR455C433110

Basic model No.	Flame detector	Ignition trial	(Not used)	Flame failure response	Power	Pilot sequence	Other	Description	Note
AUR455									
	B							Flame rod	CE certification
	C							UV	CE certification
		4						4.5±0.5 s	
		8						9.0±1.0 s	
			3					Fixed	
				2				2 s max.	AUR455C only
				3				4 s max.	
					1			100 V AC	
					2			200 V AC	
					3			120 V AC	
					5			230 V AC	
						1		Direct ignition, no shutoff valve closure check	
							0	Without inspection data	
							D	With inspection data	

■ Related devices

● Compatible ultraviolet flame detector (sold separately)

Model No.	Name
AUD500C11000	Explosion-proof advanced ultraviolet flame detector
AUD300C100_	Advanced ultraviolet flame detector
AUD300C110_	

_: 0 Standard product
D With inspection record (with data)
T With tropicalization
Y With traceability certificate
DT With tropicalization and inspection certificate
YT With traceability certificate and tropicalization

● Optional parts (sold separately)

Model No.	Name
BC-R05A100	Dedicated sub-base (a requirement for the AUR455)
81447514-001	Connector for front wiring Weidmüller model number BL3.5/11F Compatible wire: 0.2–1.5 mm^2 (28–14 AWG)
81447514-002	Connector for front wiring (for right-side wiring) Weidmüller model number BL3.5/11/270F Compatible wire: 0.2–1.5 mm^2 (28–14 AWG)
81447515-001	Sideboards (2)
SLP-A55J91	Smart Loader Package (without cable)
81441177-001	USB loader cable
FSP136A100	Analog flame meter
81447519-001	Jack cover (1)
83968019-001	Surge absorber

Chapter 2. Installation, Wiring

WARNING
Do not reset this device from a remote location. Because it is difficult to make a safety check when far from the equipment, there is an increased risk of explosion.
This device is equipped with functions that are extremely important for the safe operation of combustion equipment. Be sure to follow the instructions stated in this user's manual.
Check the model number carefully and check that the sequence timing is as specified by the combustion equipment manufacturer. Installing the wrong model can result in an explosion hazard.
Connect the load (ignition transformer, solenoid valve, etc.) directly to the output terminals of this device. If it is not directly connected, combustion safety cannot be ensured.
Before mounting, removing, or wiring, be sure to turn off the power to this device and all connected devices. Failure to do so may result in electric shock.
Never short-circuit the start contact in order to start and stop this device by switching the power on and off. This is very important for reliable activation of the self-check circuit at device startup. Failure to observe this warning could lead to an explosion.
Do not extend the lead wires of the contact reset for more than the allowable length of 10 meters. If the device is reset from a location where it is difficult to check the safety of combustion, there is a risk of explosion.

CAUTION
For mounting and wiring, follow the instructions in this user's manual or in manuals provided by the combustion equipment manufacturer.
All wiring and installation must comply with applicable local electrical codes, ordinances and regulations.
Do not use unused terminals on the device as relay terminals.
Use this product correctly within the range of the rated specifications stated in the user's manual. Not doing so may cause device failure or malfunction.
Always supply electricity at the voltage and frequency stated on the model label of this device.
Make sure the burner frame is properly grounded in compliance with applicable local electrical codes, ordinances, and regulations.
Run the high-voltage ignition transformer cable separately and keep it at least 30 cm away from this device.
Keep power wires and the ignition transformer high voltage cable separate from the flame detector wiring.
Make sure that ignition transformer high-voltage cables are properly connected to prevent faulty contact. Faulty contact may generate high-frequency radio waves, causing malfunction.

CAUTION
The ignition transformer ground must be directly connected to the burner itself or to metal that is electrically connected to the burner.
Check that the wiring is correct before use. Incorrect wiring may cause damage or faulty operation.
If the wiring from this device exceeds the recommended length, prevent malfunction due to the effects of external noise by running wires from the control panel to the case through a conduit, keeping power lines and input lines apart from each other, and other measures. Check the operation of the system after installation.
Use non-voltage contacts for connections to the input terminals of this device (19 through 24).
This device does not start operation until about 8 seconds after power-on.
When discarding of this device, dispose of it as industrial waste, following local regulations.
Use a surge protector or similar device if there is a risk of power surges caused by lightning.
Do not configure a circuit that turns off the interlock input (terminals 22–19 or 22–20) using the alarm output contacts (terminals 9–10). With such a circuit, if a false flame, UV alarm, ignition failure, or flame failure occurs, the interlock alarm (E1) may be displayed.
When the control load wiring is grounded, an alarm occurs.
Use the contact reset (terminal 24) input in isolation. Do not share the terminal with other AUR455 devices.
Do not share the output common (terminals 4 & 5) and the input common (terminals 19 & 20) with other AUR455 devices.
Do not provide instrumentation to stop the power to the device as soon as the alarm operates. When the power to this device is turned on again, an alarm may be activated (E908).
To prevent malfunction caused by the effect of external noise, in operations other than trial operation, maintenance, or troubleshooting, do not keep the loader cable connected during the operation.
Take countermeasures based on the instruction manual for that device if there is a device such as an inverter nearby that generates strong electrical noise.
Firmly tighten the terminal screws to the torque listed in the specifications.

■ Installation method

WARNING

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

CAUTION

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

Do not install where exposed to any of the following:

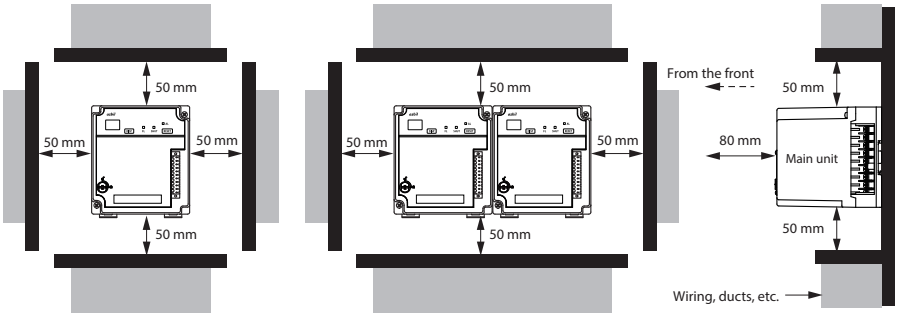
- **Certain chemicals or corrosive gases (ammonia, sulfur, chlorine, ethylene compounds, acid, etc.)**
- **Splashing water or excessive humidity.**
- **High temperatures**
- **Prolonged vibration**

Do not connect a load that exceeds the rating stated in the specifications to the control load terminals (6, 7, 8), and do not short-circuit the load. Doing so will burn out the internal fuse, making this device unusable.

When using this device as a burner control system, install it in a control panel with a rating of IP40 or more. If IP40 is required for this device, also use the sideboards (sold separately). The protective structure of this device is equivalent to IP10.

■ Cautions regarding installation

- Leave space 50 mm above and below, 50 mm on the left and right, and 80 mm in the front as space for removal, wiring, and maintenance. Also, do not install this device close to electrical power devices or other sources of heat.

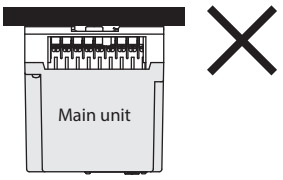


- This device must be installed in a grounded and conductive control panel to ensure safety.
- Do not pull on the wiring while it is attached to the device. Doing so can cause failure of the connectors or this device itself.
- If there is room, leave as much space as possible between them for heat dissipation.
- If the ambient temperature is close to the allowable upper limit, install a panel air conditioner or a fan to lower the temperature inside the panel.
  Upper limit of allowable ambient temperature, for installation of single unit: 60 °C, for gang mounting: 45 °C
- Firmly tighten the terminal screws with a torque of 0.5 N·m or less.

■ Installation orientation

Attach the device in the orientation shown below.

Do not install it in the orientation illustrated below.

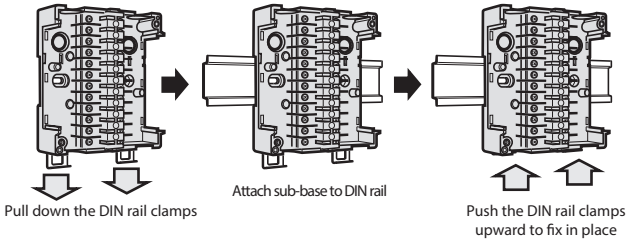


■ Mounting on a DIN Rail

(1) Pull down the sub-base's DIN rail clamps.

(2) Attach the sub-base to the DIN rail, making sure that the sub-base is not upside-down.

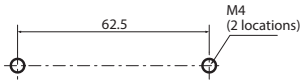
(3) Push up the DIN rail clamp to fasten the sub-base to the DIN rail.



■ Mounting in a panel

(1) Cut two M4 threaded holes in the panel.

Unit: mm



(2) Use screws to mount the sub-base in the panel.
(Maximum tightening torque: 1.2 N·m)

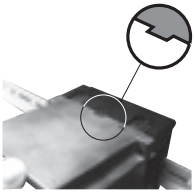
CAUTION

Turn the power off before mounting the device on the sub-base. Otherwise, device failure may result.

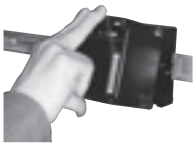
■ Mounting/removing the unit and the sub-base

● Mounting

(1) Align the indentation in the center of the top of the device with the projection on the sub-base.



(2) Once aligned as in (1), slowly push the device toward the sub-base.



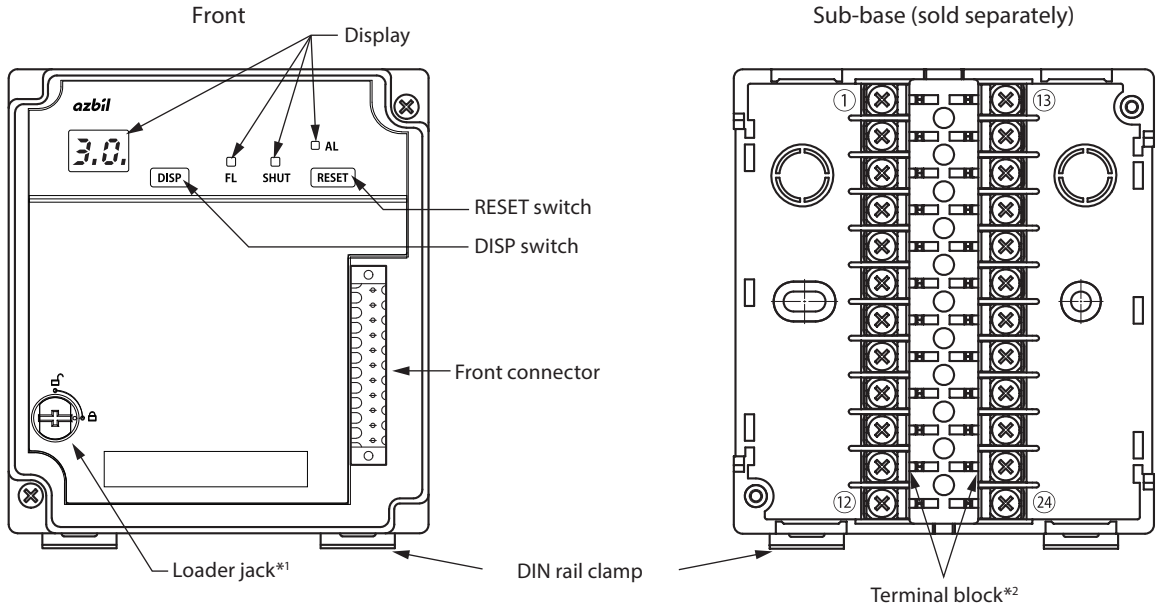
(3) Tighten the device's retaining screws to secure it in the sub-base. (Maximum tightening torque: 0.5 N·m).

● Removing

(1) Remove the mounting screws.

(2) Pull the device out toward you while holding down the sub-base.

■ Terminal numbers, front panel item names



*1 Also used as a Smart Loader Package jack

*2 Firmly tighten the terminal screws with a torque of 0.5 N·m or less.

■ Terminal No.

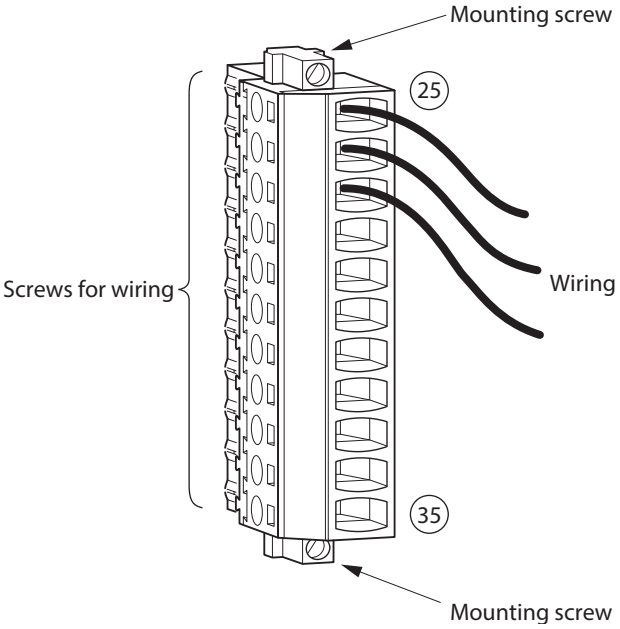
● Sub-base terminals

No.	Code	Function	No.	Code	Function
1	-	Load power	13	-	Not used
2	AC-H	Power (H)	14	F	Flame detector (F)
3	AC-G	Power (G)	15	G	Flame detector (G)
4	COM-G1	Output common 1	16	S1	Shutter output 1 (AUR455C only)
5	COM-G2	Output common 2	17	S2	Shutter output 2 (AUR455C only)
6	IG	Ignition transformer	18	-	Not used
7	PV	Pilot valve or Lo solenoid valve	19	COM1	Input common 1
8	MV	Main valve or Hi solenoid valve	20	COM2	Input common 2
9	AL-NO	Alarm output	21	START	Start input
10	AL-COM	Alarm output	22	IL	Interlock input
11	FL-NO	Flame monitor output	23	-	Not used
12	FL-COM	Flame monitor output	24	RESET	Contact reset input

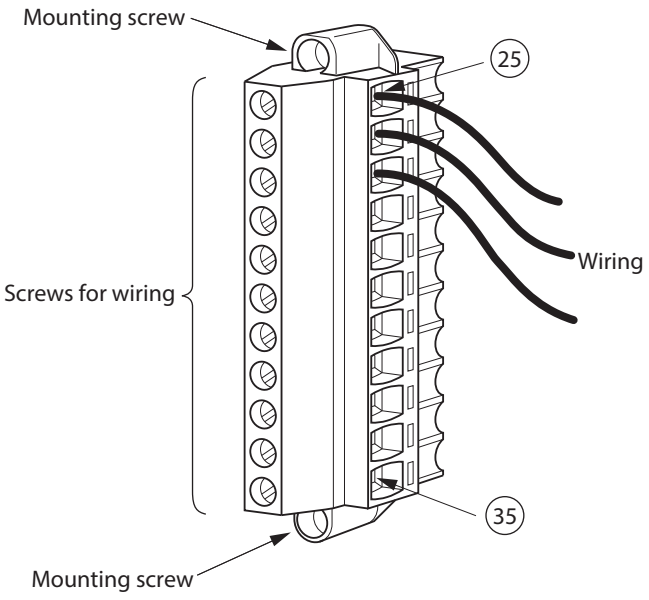
● Front connector terminals

No.	Function	
25	FV+	Flame voltage output (+)
26	FV-	Flame voltage output (–)
27	DA	RS-485 (DA)
28	DB	RS-485 (DB)
29	SG	RS-485 (SG)
30	-	Not used
31	EV-COM	Event output
32	EV-NO	Event output
33	-	Not used
34	-	Not used
35	-	Not used

● **Connector for front wiring (model 81447514-001) terminal layout**

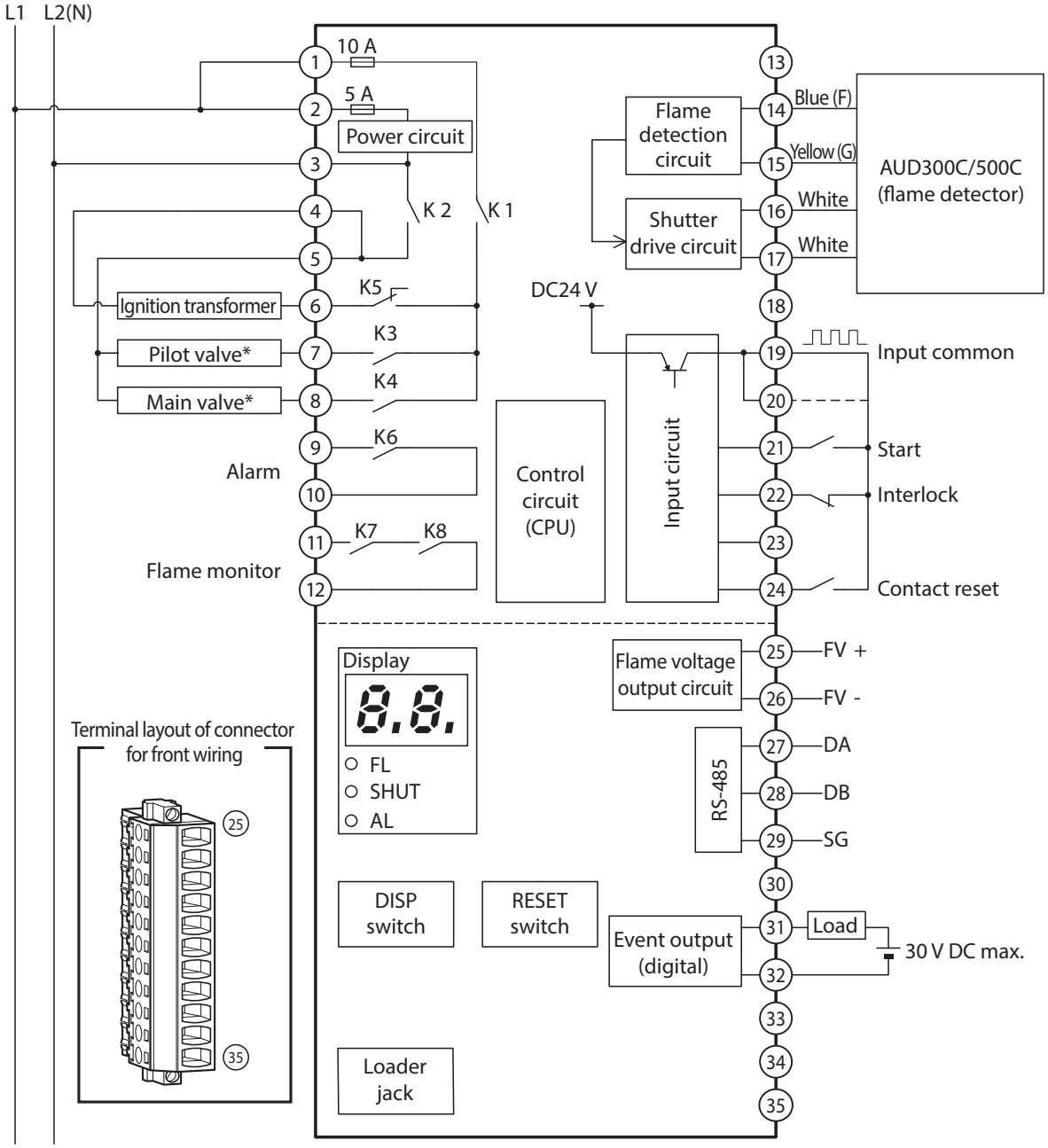


● **Connector for front wiring (for right side wiring) (model 81447514-002) terminal layout**



■ Example of wiring with external devices (terminals 1–24: sub-base; terminals 25–35: front connector)

● **Flame detector: UV flame detector**

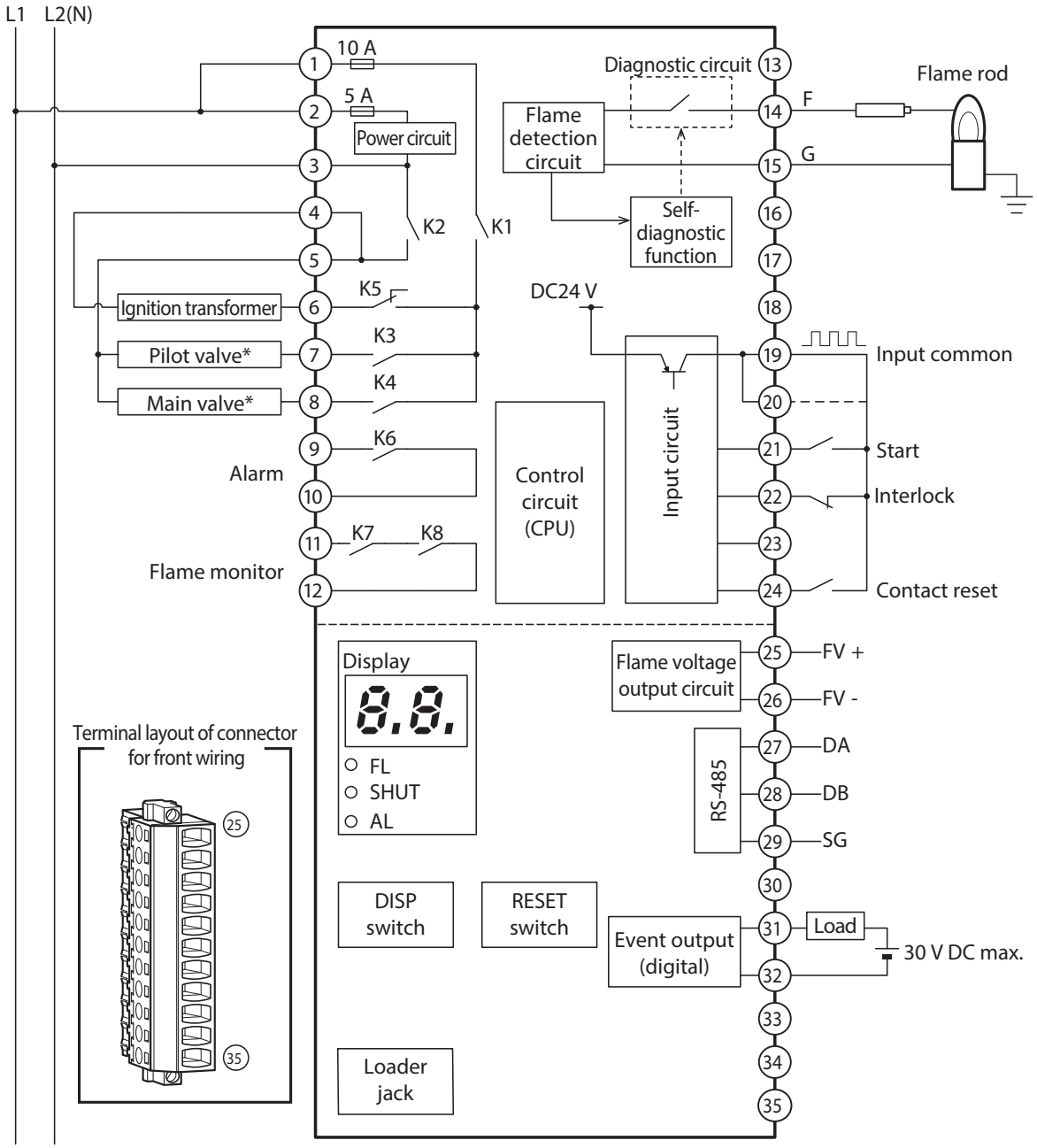


*The names used for the loads in the above diagram are for interrupted pilot systems only.
In the case of direct ignition, the pilot valve is the Lo solenoid valve, and the main valve is the Hi solenoid valve.

! Handling Precautions

- After mounting the connector for front wiring, secure it in place with the mounting screw on the side of the connector.
- Use the contact reset input (terminal 24) for one AUR455 only. Do not use the terminal for contact reset input to other AUR455 devices.
- Do not share the output common (terminals 4, 5) and the input common (terminals 19, 20) with other AUR455 devices.

● **Flame detector: flame rod**



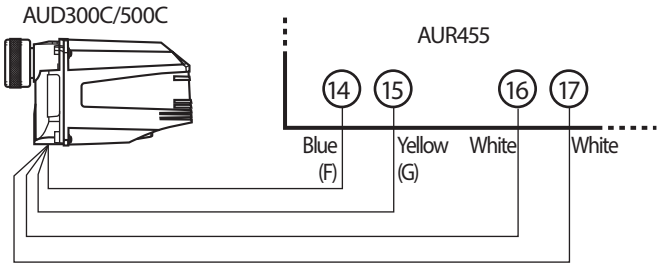
*The names used for the loads in the above diagram are for interrupted pilot systems only.
In the case of direct ignition, the pilot valve is the Lo solenoid valve, and the main valve is the Hi solenoid valve.

! Handling Precautions

- After mounting the connector for front wiring, secure it in place with the mounting screw on the side of the connector.
- Use the contact reset input (terminal 24) for one AUR455 only. Do not use the terminal for contact reset input to other AUR455 devices.
- Do not share the output common (terminals 4, 5) and the input common (terminals 19, 20) with other AUR455 devices.

■ Connection with model AUD300C/500C

Connect to the AUD300C or AUD500C as shown.



! Handling Precautions

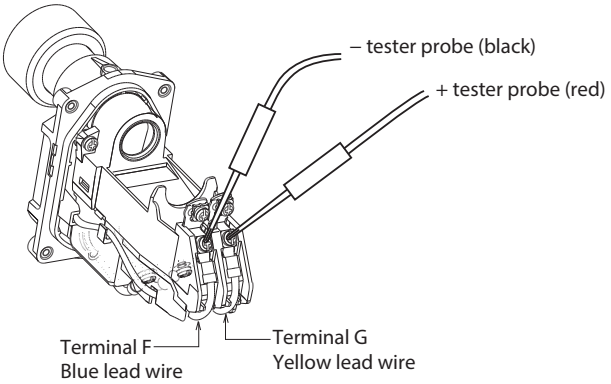
- AUD300C and 500C signal wires (blue and yellow) have polarity. Connect the blue wire to terminal 14 (F), and the yellow wire to terminal 15 (G). A reversed connection will damage the tube unit and cause a malfunction.
- To extend the wiring, use 1.25 mm^2 600 V PVC-insulated cable (IEC 60227-3), and keep the wiring no longer than 200 m.

■ Check of wiring between this device and model AUD300C or AUD500C

Necessary tools: tester
Input impedance of 100 kΩ or more

To check that wiring to this device is correct, remove the tube unit from the AUD300C or AUD500C and measure the DC voltage between terminals F and G with the tester as shown below.

Connect the + tester probe (red) to terminal G (yellow lead wire) and the – tester probe (black) to terminal F (blue lead wire).
≫ If the reading is between 160 and 220 V DC, the leads are connected correctly. If a negative voltage is measured, terminals F and G are reversed.

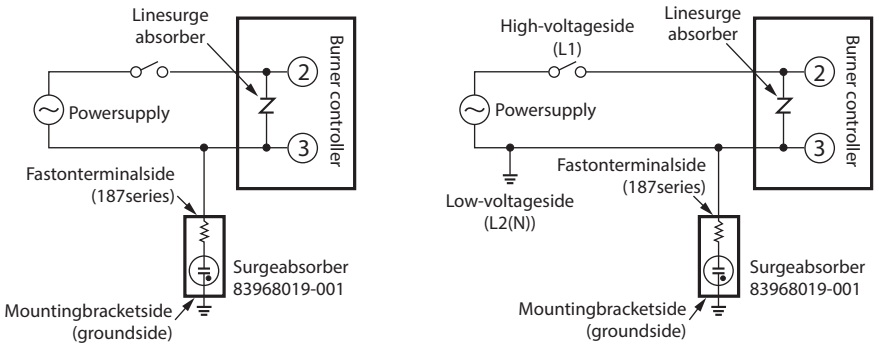


Terminal	Tester probe	Voltage
F	– (black)	160 to 220 V DC
G	+ (red)	

● Sample countermeasure for power surges caused by lightning

When using a surge absorber as a countermeasure for power surges caused by lightning, connect it between terminal 3 and ground, as shown below.

The mounting brackets of the surge absorber are electrically connected internally by crimping to the ground side of the absorber. Therefore, the absorber can be grounded simply by attaching the brackets to a grounded metal part such as the combustion equipment housing. For wiring to the power supply, use 0.75 mm^2 or larger wires (diameter: 0.18, strand count: 30), in compliance with JIS C 3306. Attach a #187 Faston receptacle at one end and keep the wire length as short as possible.

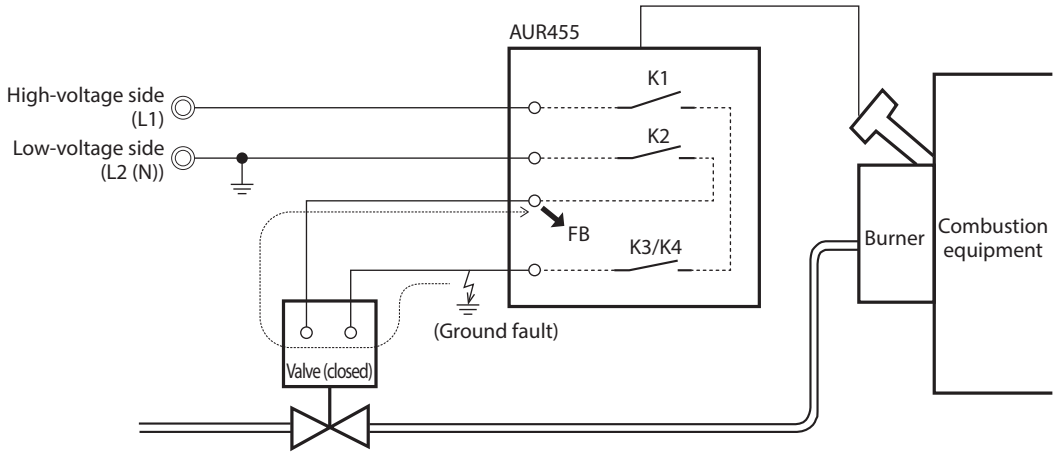


■ Connections to solenoid valve

CAUTION

Connect the load (ignition transformer, solenoid valve, etc.) directly to the output terminals of this device. If it is not directly connected, combustion safety cannot be ensured.

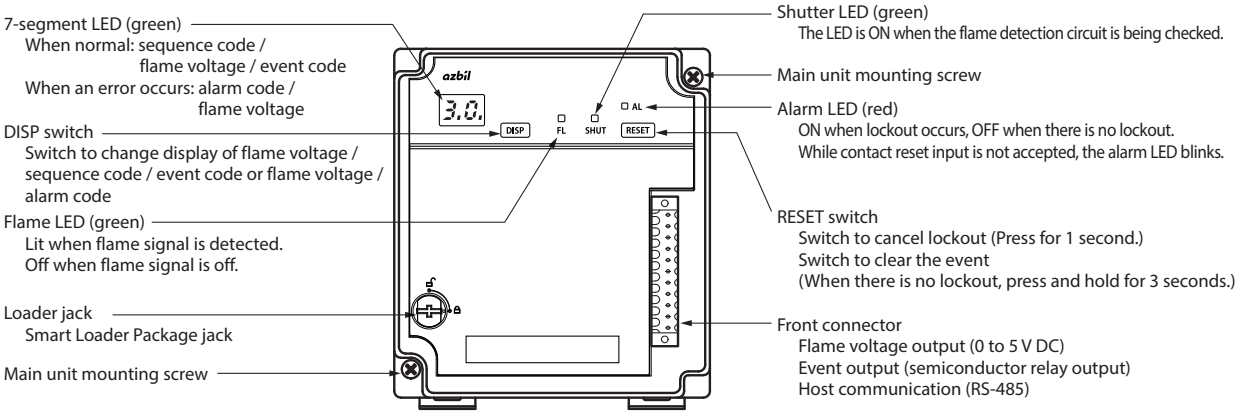
● Operation in case of a ground fault



If a ground fault occurs in the solenoid valve wiring, since both lines to the solenoid valve are cut off by the burner controller contacts, the solenoid valve will not operate. Therefore, since the solenoid valve will not open, there is no risk of fuel outflow. If the burner controller is started in this state, signal FB in the figure is detected and lockout occurs due to E904 (voltage generated on terminals 4 and 5).

Chapter 3. Operation

■ Part names



All the LEDs are lit for 4 seconds after the power is turned on, and then they turn off, and the display of the sequence code begins. If lockout occurs, an alarm code is displayed automatically. If an alarm occurs, the alarm code and the code for the sequence step where the lockout occurred are displayed alternately.

• Identifying information

Item		Notation
Product number		AUR455_ _ _ _ _ _ _
Voltage		AC _ _ _ V
Timing	Ignition trial (pilot or main burner ignition time)	IGT _ _ s
	Flame failure response time	FFRT _ _ s

● 7-segment display lower-right LED dot

If the dot at the bottom right of the 7-segment LED is blinking, initialize the settings. For the method of initialization, see ☞●Operation when the dot at the lower right of the 7-segment LED is blinking (Page 22).

■ Operation

● DISP switch

● During normal operation

The 7-segment display shows the combustion sequence code. Every time the DISP switch is pressed, the display cycles through the sequence code, the flame voltage, and (only if an event occurs) the event code.

• Sequence code

Code	Interrupted pilot method	Direct ignition method
P1	Start check	
P4	Ignition trial	
P5	Pilot only	Hi solenoid valve ignition standby
P6	Main trial	Hi solenoid valve ignition
P8	Run	
- -	Controlled shutdown	

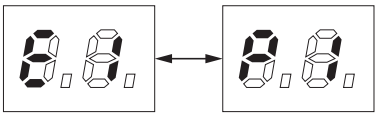
● When an error occurs

The 7-segment display alternately displays an alarm code and the code for the sequence step where the lockout occurred. Every time the DISP switch is pressed, the display changes between the flame voltage and alternate display of the alarm code and sequence code when lockout occurred.

• Alarm code

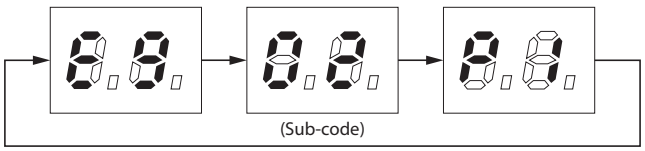
Alarm code	Sub-code	Description
E0	None	Interlock error
E1		False flame
E2		UV alarm
E6		Ignition failure
E7		Flame failure
E9	02	Malfunction operation switch
E9	03	Relay answerback error (K1)
E9	04	Relay answerback error (K2)
E9	05	Relay answerback error (PV)
E9	06	Relay answerback error (MV)
E9	07	Relay answerback error (IG)
E9	08	Alarm at power-on
E9	50–	Device error

Sample display when an error occurs (alarm code without a sub-code)



The item displayed changes every 0.8 s.

Sample display when an error occurs (alarm code with a sub-code)

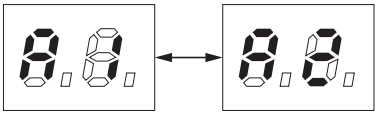


The item displayed changes every 0.8 s.

● If an event occurs

If an event specified in advance occurs, the 7-segment display displays the event code. If multiple events have occurred, all the corresponding event codes are sequentially displayed starting from the smallest one.

Display example (if events A1 and A2 have occurred)



The item displayed changes every 0.8 s.

Press the RESET switch for 3 s or longer or short the contact reset input for 3 s or longer to clear all active events at the same time. However, note that the RESET switch and contact reset input cannot be used to clear events during lockout.

Display	Event name	Operation
A1*	UV flame detector check (combustion time)	Turns ON if the combustion time exceeds the value set for the UV flame detector (combustion time) checking time.
A2	Product service life check (total operating time)	Turns ON if the total operating time exceeds the value set for the product service life (total operating time) checking time.
A3	Product service life check (total combustion count)	Turns ON if the total combustion count exceeds the values set for the product service life (total combustion count) checking time.

* This can also be used as a maintenance event for the flame detector or flame rod.

[!] Handling Precautions

- When the product is shipped, only A1 (UV flame detector check) is configured as an event.
- It is necessary to configure event settings in order to have an event code displayed when an event occurs. Configure event settings using Smart Loader Package model SLP-A55 (SLP-A55J91).

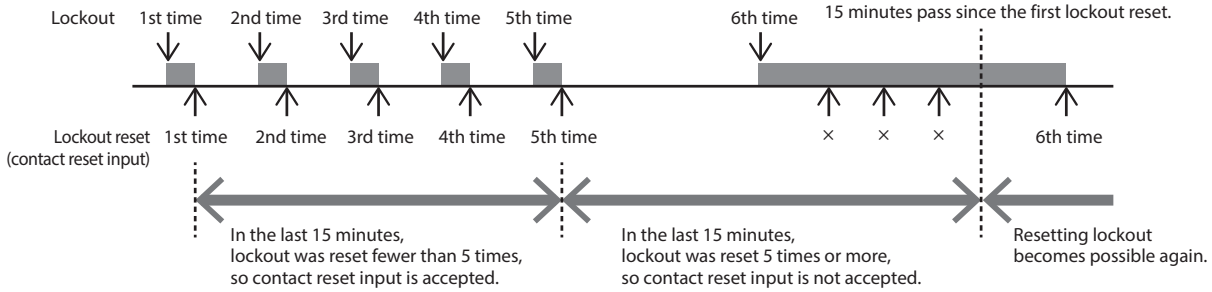
● RESET switch

Lockout can be canceled by pressing the RESET switch for 1 second. After lockout is canceled, start input is not accepted for about 5 seconds.

● Contact reset input (terminal 24)

Lockout can be canceled by shorting the contact reset input for 1 second. After lockout is canceled, start input is not accepted for about 5 seconds.

If lockout is canceled by contact reset input five times or more within 15 minutes, acceptance of contact reset input is temporarily suspended. When 15 minutes have passed since the first lockout cancellation, contact reset input is again accepted.

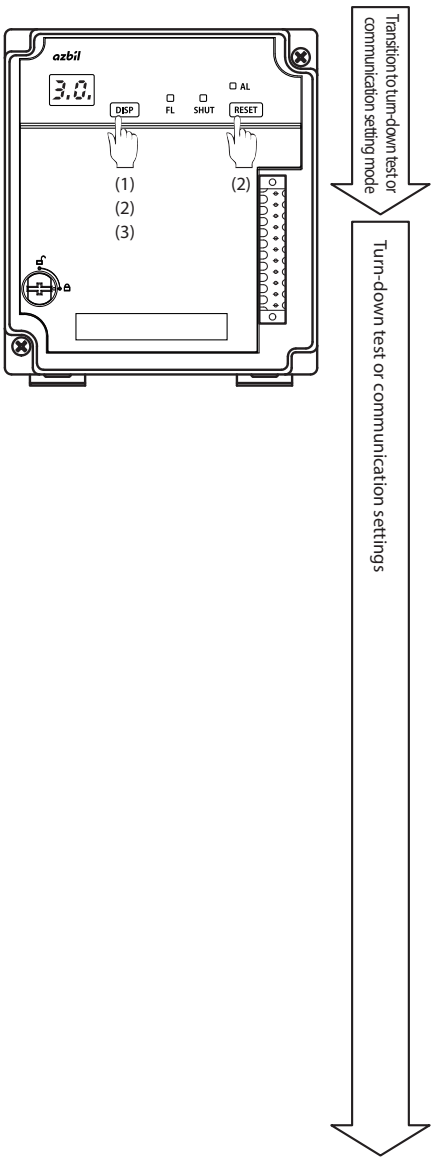


During the time when contact reset input is not accepted, the alarm LED blinks. Even if the alarm LED is blinking, lockout can be canceled by pressing the RESET switch on the burner controller.

■ Turn-down test and communication setting modes

WARNING

Loads operate for the blower, ignition transformer, valves, etc., in turn-down test and communication setting modes. The operator should be a specialist with comprehensive knowledge of the combustion equipment and the functions of this device. Otherwise there is a risk of a major accident.



(1) Press and hold the DISP switch for approximately 5 s or more during the stop stage of the sequence (when the start switch is OFF).
The 7-segment display changes to C1 and the system goes into turn-down test or communication setting mode. The central dot of the 7-segment display starts blinking. (a 1 s cycle)

(2) When the DISP switch is pressed, the display changes in the following order: ↱C1→H1→H2→H3→CL┐.
Select the turn-down test or communication setting type using the DISP switch.

Display	Description
C1	Continuous pilot burner combustion mode*
H1	Communication address setting
H2	Baud rate setting
H3	Communications format setting
CL	Initialization of settings

*Only output from main valve 1 with direct ignition

Note

- For the 200 V AC model, you can set H1, H2, and H3 even if the power is 100 V AC.

● Selection of turn-down test or communication setting mode

● When C1 is selected

1. Press the RESET switch when C1 is displayed. -- blinks on the 7-segment display.
2. The combustion sequence starts when start input is received. At this stage, the sequence code blinks. (It is steadily lit in normal operation mode.)

Turn-down test or communication settings

● **When a selection from H1 to CL is made**

• Communication address setting (H1)

Use the DISP switch to select H1 on the 7-segment display.

1. Press the RESET switch. The 7-segment display shows H1/_ _. _ _ is the address value. (Default setting: 1)
2. When the DISP switch is pressed in this situation, the display cycles through →H1/1→H1/2→H1/3……H1/32. Select the address.
3. After making a selection, press the RESET switch. "H1" blinks, and when the blinking ends, configuration is complete. At this time, H1 is displayed.

• Baud rate setting (H2)

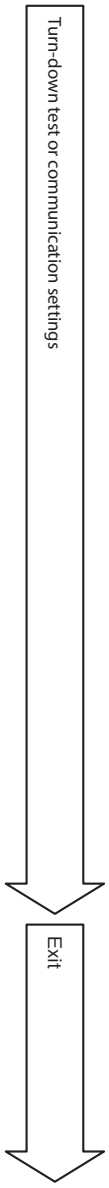
Use the DISP switch to select H2 on the 7-segment display.

1. Press the RESET switch. The 7-segment display shows H2/_ _. _ _ represents 1, 2, or 3. (Default setting: 3)
   1: 4800 bps
   2: 9600 bps
   3: 19200 bps
2. When the DISP switch is pressed in this situation, the display cycles through ┌H2/1→H2/2→H2/3┐. Select the baud rate.
3. After making a selection, press the RESET switch. "H2" blinks, and when the blinking stops, configuration is complete. At this time, "H2" is displayed.

• Communications format setting (H3)

Use the DISP switch to select H3 on the 7-segment display.

1. Press the RESET switch. The 7-segment display shows H3/_ _. _ _ represents 1, 2, 3, or 4. (Default setting: 1)
   1: Even parity, 1 stop bit
   2: Even parity, 2 stop bits
   3: Odd parity, 1 stop bit
   4: Odd parity, 2 stop bits
2. When the DISP switch is pressed in this situation, the display cycles through ┌H3/1→H3/2→H3/3┐. Select the communications format.
3. After making a selection, press the RESET switch. "H3" blinks, and when the blinking stops, configuration is complete. At this time, "H3" is displayed.



- Initialization of settings (CL)

Use the DISP switch to select CL on the 7-segment display.

1. Press the RESET switch. The 7-segment display shows CL/no.
2. When the DISP switch is pressed in this situation, the display toggles between CL/no (no) and CL/Y (yes). Select whether to initialize all the communication settings.

CL/Y	Execute initialization
CL/no	Cancel initialization

3. After making a selection, press the RESET switch. "CL" blinks, and when the blinking stops, initialization of settings is complete.

   Settings after initialization

Display	Description	Initial value
H1	Communication address setting	1
H2	Baud rate setting	3: 19200 bps
H3	Communications format setting	1: Even parity, 1 stop bit

4. After initialization, check the settings and change them as needed.

(3) Press and hold the DISP switch for 5 s or more to end the turn-down test or communication setting mode. Turn-down test and communication setting modes also end in the following cases:

- When the power goes OFF
- When a warning is issued during the turn-down test or communication setting mode (in continuous pilot burner combustion mode).

● Operation when the dot at the lower right of the 7-segment LED is blinking

If the communication settings are not correctly configured during communication setup due to a power shutdown or other cause, this device is locked out due to communication settings error E971 and the 7-segment display alternately shows E9 and 71. If lockout occurs due to E971, correctly rewrite the communication settings with the following procedure.

(1) Reset the E971 error. The reset operation returns the communication settings to the following initial values.

Communication address setting : 1
Baud rate setting : 3 (19200 bps)
Communications format setting : 1 (even parity, 1 stop bit)

(2) Enter the communication setting mode and rewrite the communication settings with the correct values.

■ Host communication setting using the Smart Loader Package (model SLP-A55)

! Handling Precautions

- Until configuration is complete, do not turn off the power or remove the loader cable. If the power is turned off during configuration, there may be an error.

RS-485 host communication settings H1 to H3 in turn-down test or communication setting mode can also be set using the Smart Loader Package.

(1) Turn off the power to the burner controller.

(2) Remove the RS-485 wires. Insert one end of the USB loader cable into the loader jack on the product, and insert the other end into a USB port on the PC.

(3) Turn on the power to the burner controller.

(4) Start the SLP-A55 and set up host communication.

(5) Turn off the power to the burner controller.

(6) Remove the USB loader cable.

(7) Connect the wiring for RS-485.

(8) Turn on the power to the burner controller.

(9) Start communications with the host device.

-MEMO-

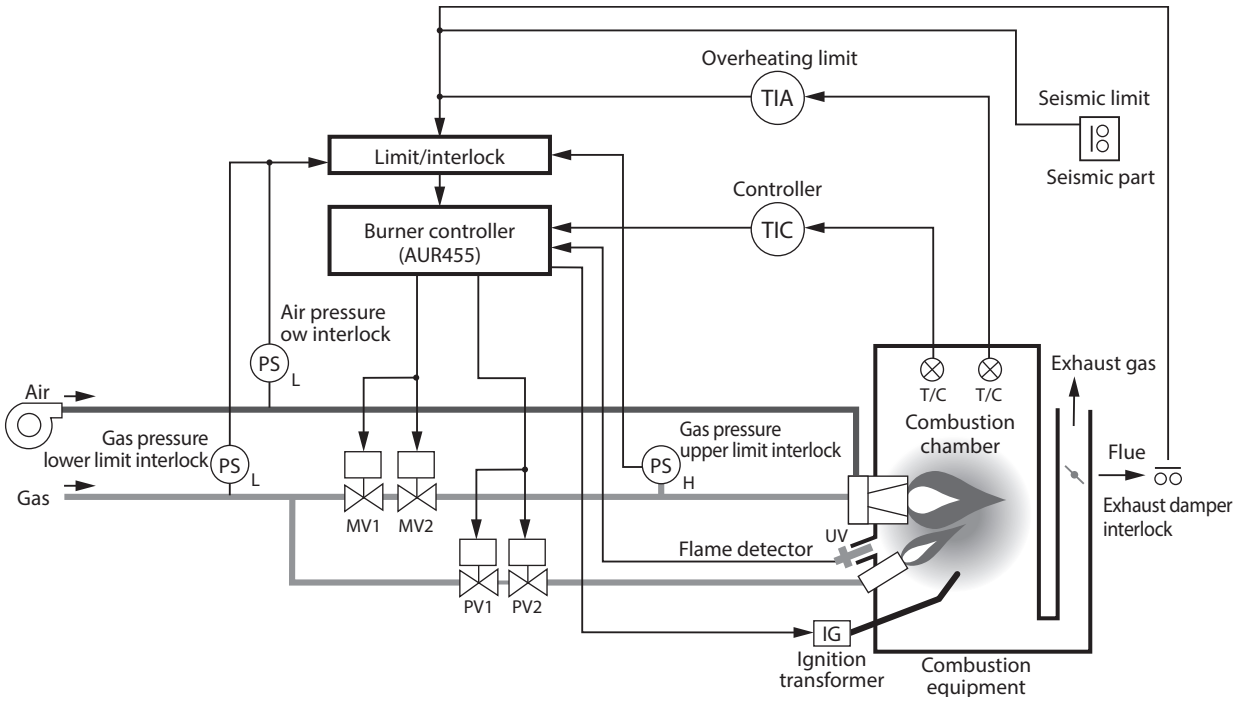
Chapter 4. Explanation of Operation

CAUTION

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

After lockout is canceled, start input is not accepted for about 5 seconds.

■ Instrumentation example of model AUR455 for an interrupted pilot



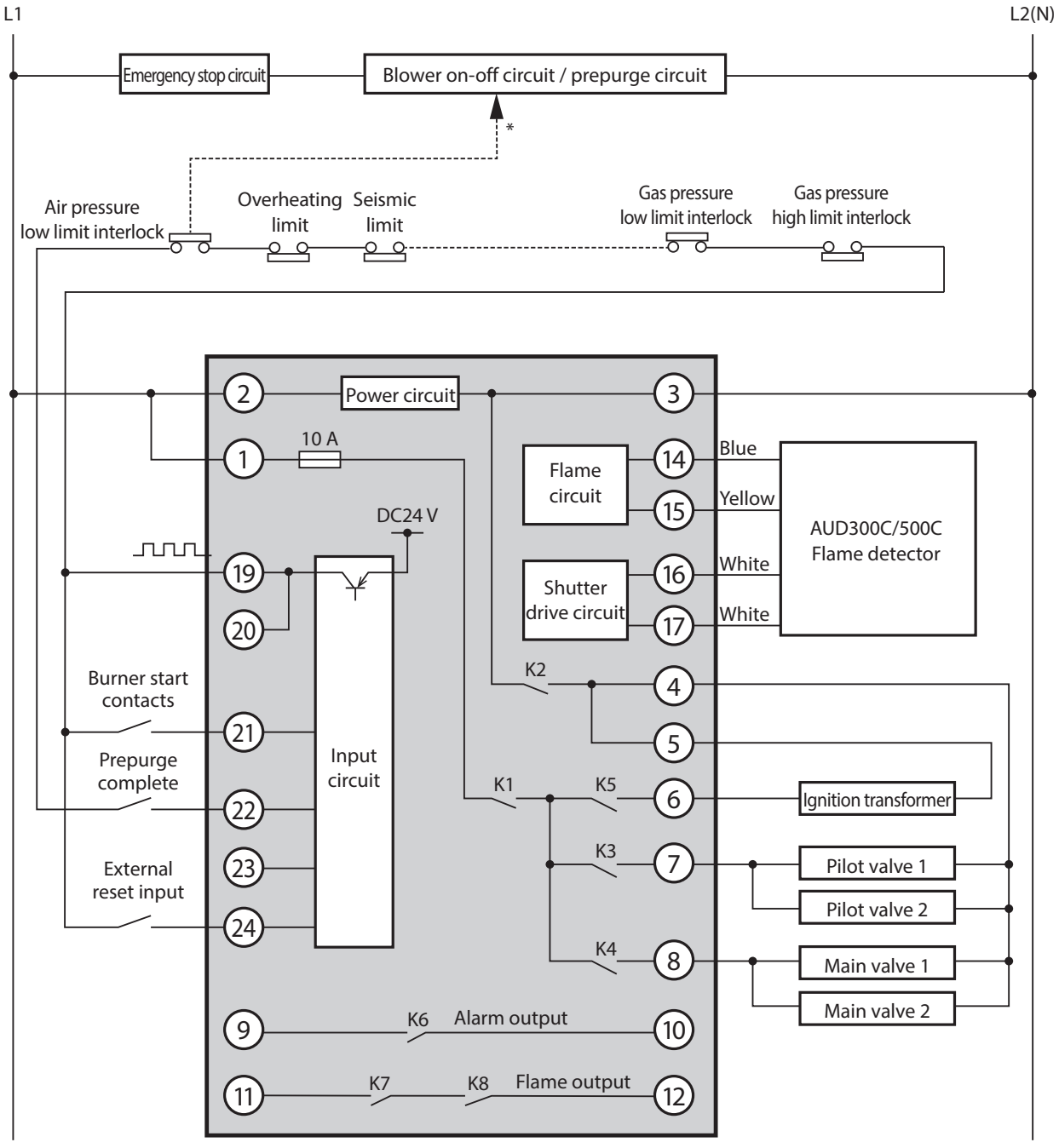
■ Notes about the instrumentation and circuit configuration for an interrupted pilot

In instrumentation and circuit configuration of the AUR455 for an interrupted pilot, note the following:

- For safety control and operation circuitry, implement inherent safety design measures based on risk assessment.
- Directly connect the interlock (including limit) contacts to the interlock input (terminal 19 or 20 with terminal 22) of the burner controller or configure the contacts to directly turn off the load (such as the ignition transformer, pilot safety shutoff valve, or main safety shutoff valve).
- Design a circuit that stops all the burners if the pilot or main burner fails to ignite or a flame failure occurs.
- Place all the shutoff contacts on the high voltage side of the power supply.
- Take countermeasures against a ground fault as needed, for example by using an earth leakage breaker or having both contacts cut off.
- Do not provide instrumentation to stop the power to the device as soon as the alarm output operates. In that case, error history data cannot be guaranteed.

■ Internal block diagram (interrupted pilot)

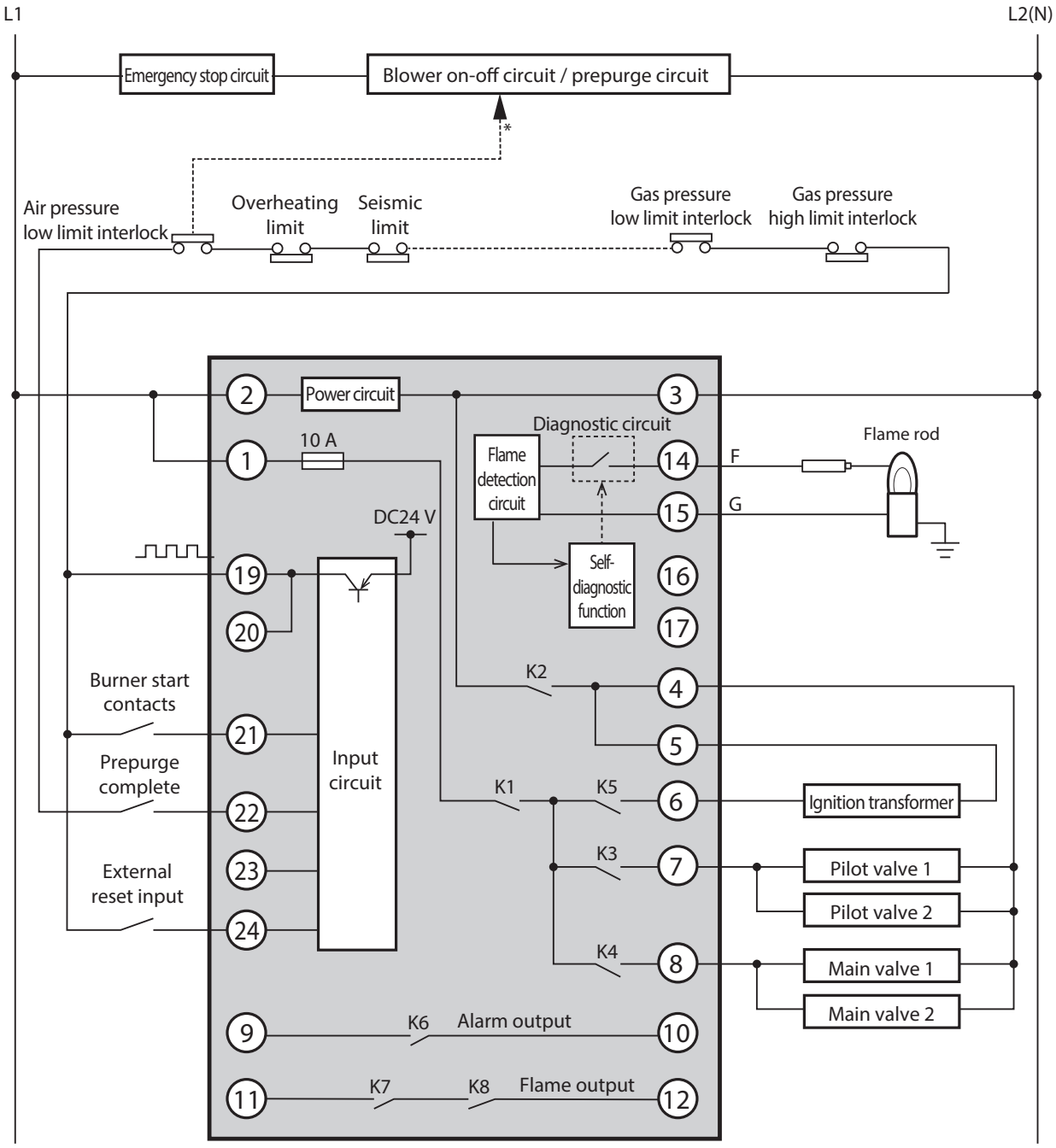
An example of wiring for external devices and an internal block diagram are shown below.



* Air pressure switch: install the following verification circuit.
When the blower is about to start, and there is no air flow, the circuit should verify that no pressure is detected.
If pressure is detected under these conditions, the blower should not be started.

Note

- According to JIS B 8415, the pilot burner ignition time should be no more than 10 seconds and the main burner ignition time should be no more than 5 seconds.



* Air pressure switch: install the following verification circuit.
When the blower is about to start, and there is no air flow, the circuit should verify that no pressure is detected.
If pressure is detected under these conditions, the blower should not be started.

Note

- According to JIS B 8415, the pilot burner ignition time should be no more than 10 seconds and the main burner ignition time should be no more than 5 seconds.

■ Sequence chart

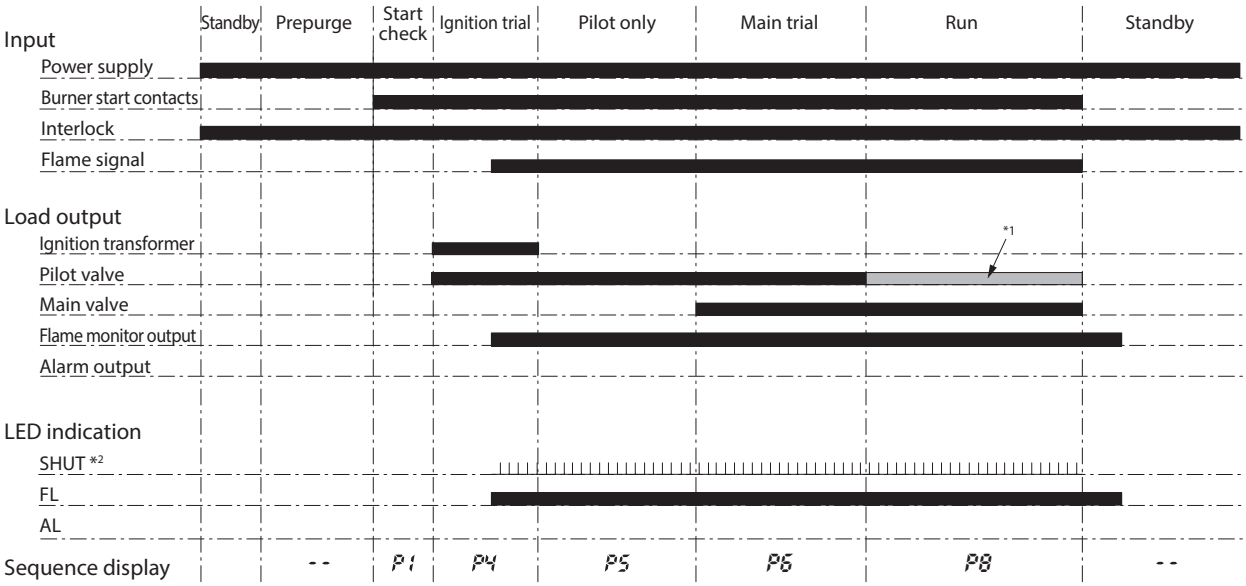
The sequence of operations for this device is shown.

! Handling Precautions

- After the blower on-off circuit / prepurge circuit completes the prepurge and the prepurge completion contacts connected to terminal 22 of the AUR455 turn ON, the operations after the burner start contacts turn ON are shown in the sequence chart.

● Normal operation

With the power supply, interlock, and prepurge completion contact ON, when the start contacts turn ON, this device operates according to the following sequence to RUN. When the start contacts are turned OFF, this device goes into standby mode.

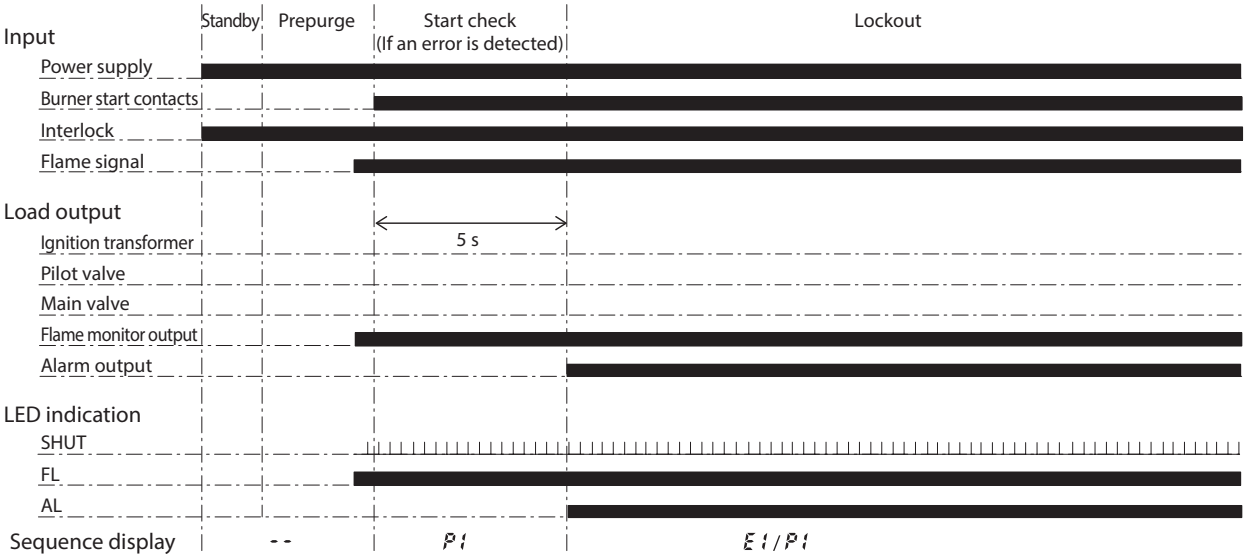


*1 ON in the case of a direct ignition model, OFF in the case of an interrupted pilot model.
This is because the AUR455 has one output with different operation depending on the type of model, while the AUR450 has two outputs for the pilot valve, one for the intermittent and one for the interrupted type.

*2 When the voltage output to the shutter is ON (shutter open), the shutter LED is off. When the voltage output to the shutter is OFF (shutter closed), the shutter LED is on.

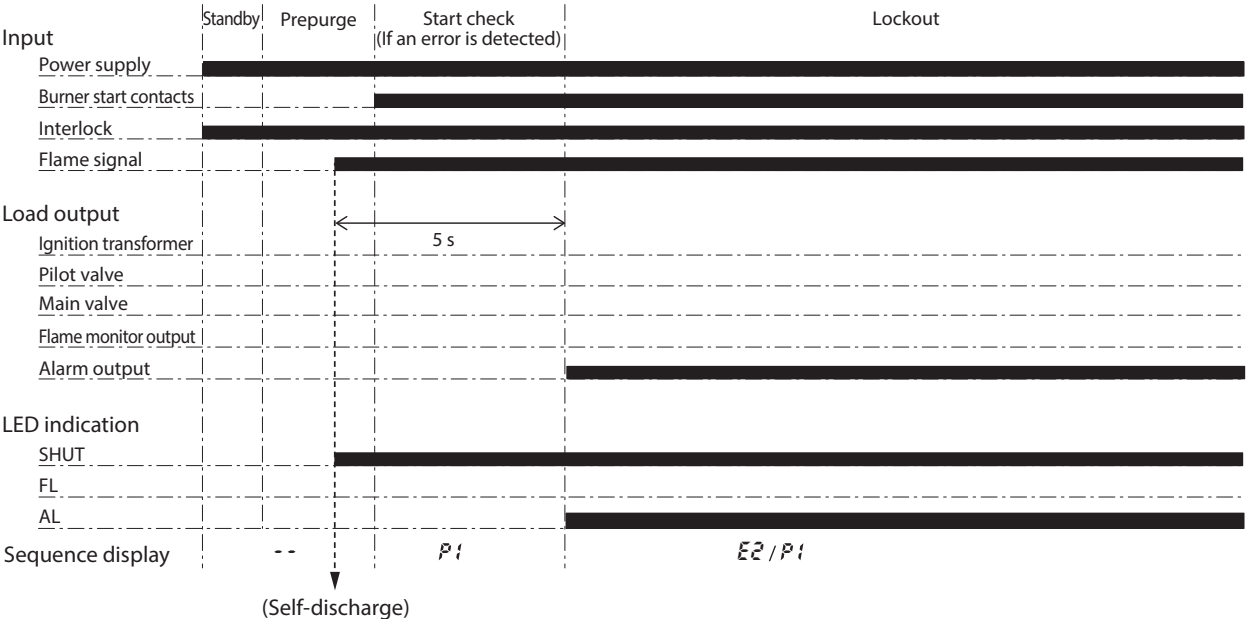
● Operation during start check error (false flame)

If a false flame is detected during the start check, and the error is not cleared after 5 seconds, lockout occurs. While a false flame is detected, the flame monitor output is ON. "E1" (false flame) and "P1" are displayed alternately.



● Operation during start check error (self-discharge)

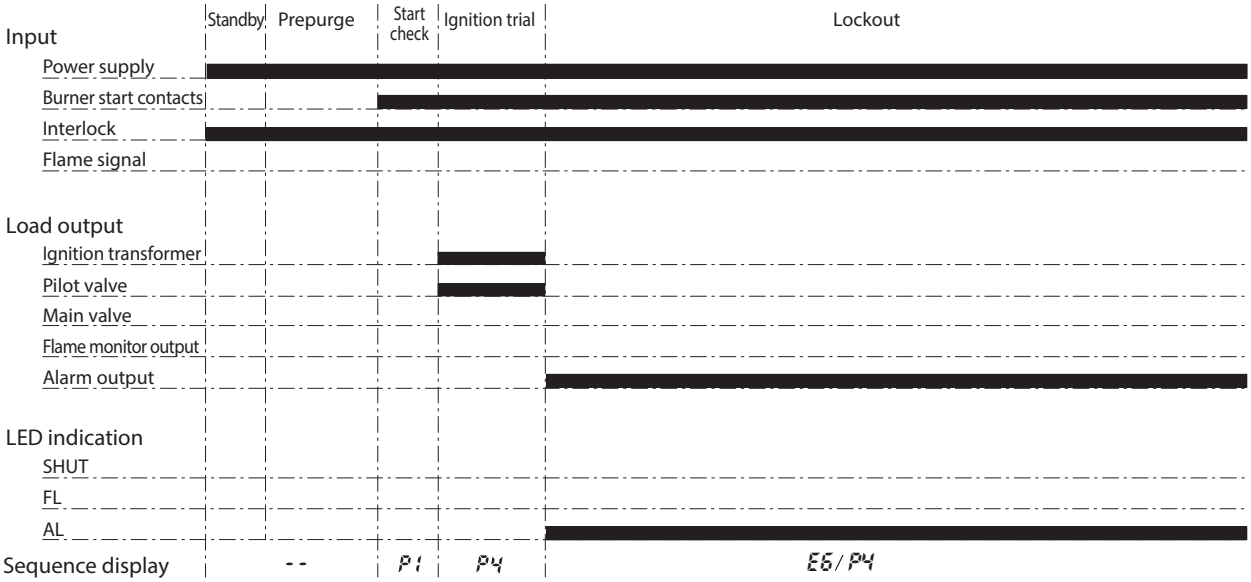
If self-discharge is detected during the start check, and the error is not cleared after 5 seconds, lockout occurs. At this time, the flame monitor does not output anything and the flame LED does not light up. "E2" (UV alarm) and "P1" are displayed alternately.



● Operation upon ignition failure

If a flame is not detected during the ignition trial, lockout occurs and an alarm is issued.

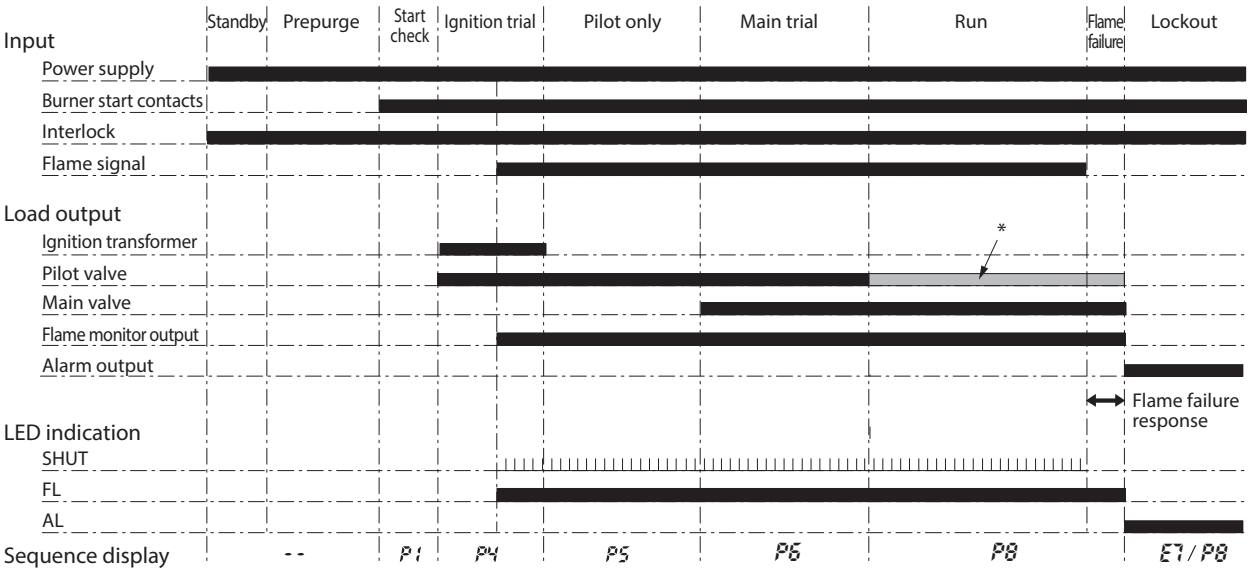
"E6" (ignition failure) and "P4" are alternately displayed.



● Operation at flame failure

If flame failure is detected during RUN, lockout occurs and an alarm is issued.

"E7" (flame failure) and "P8" are alternately displayed.

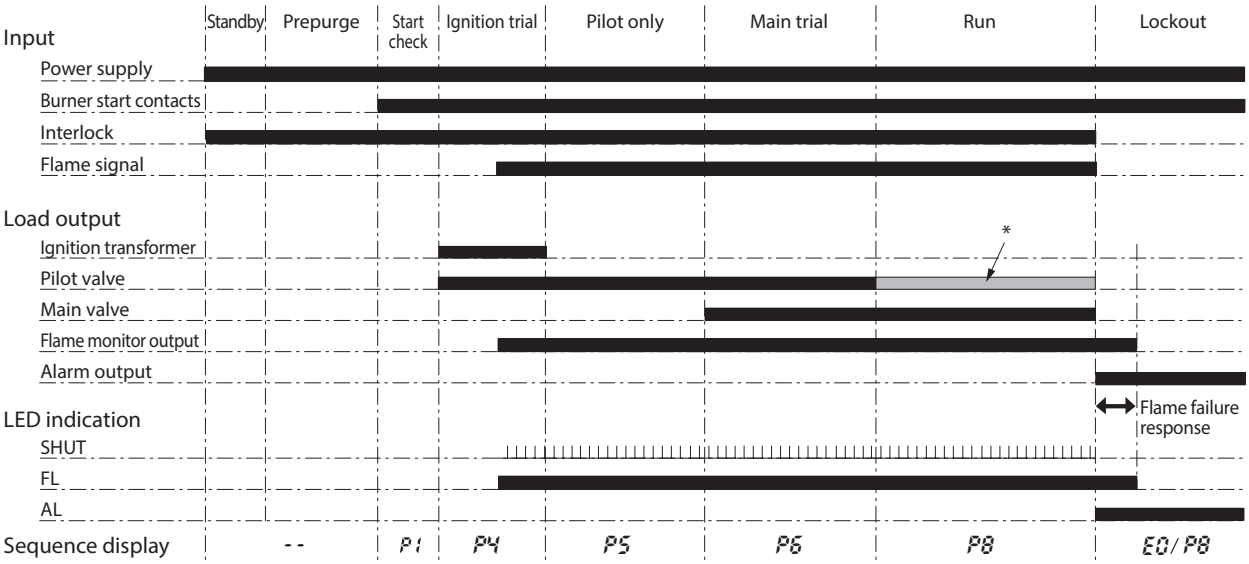


* ON in the case of a direct ignition model, OFF in the case of an interrupted pilot model.
This is because the AUR455 has one output with different operation depending on the type of model, while the AUR450 has two outputs for the pilot valve, one for the intermittent and one for the interrupted type.

● Operation during interlock (interlock activation during RUN)

If the interlock contacts are OFF, lockout occurs and an alarm is issued.

"E0" (interlock) and "P8" are displayed alternately.

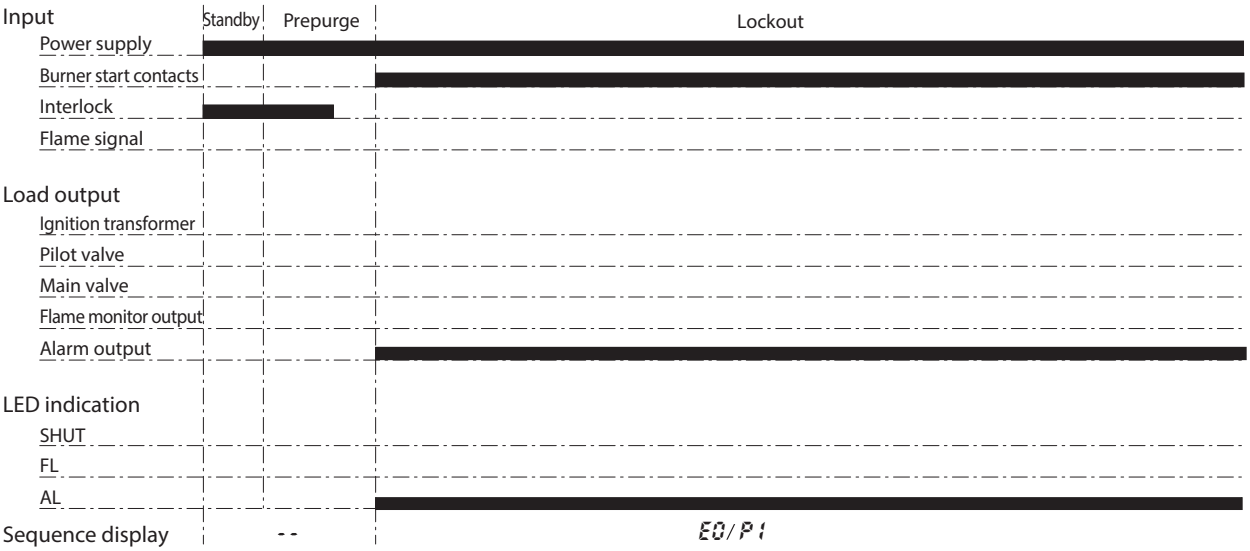


* ON in the case of a direct ignition model, OFF in the case of an interrupted pilot model.
This is because the AUR455 has one output with different operation depending on the type of model, while the AUR450 has two outputs for the pilot valve, one for the intermittent and one for the interrupted type.

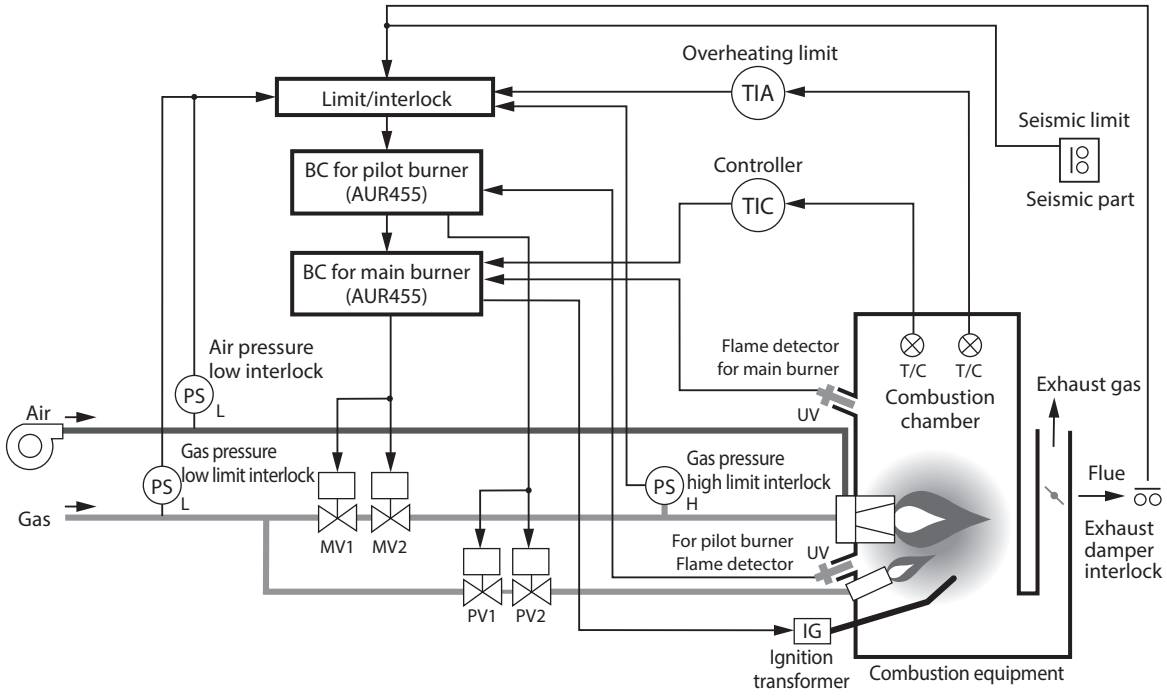
● Operation during interlock (interlock activation between standby and start signal)

Even if the interlock contacts turn OFF before the start contact input, lockout does not occur.

If the start signal is input in this state, lockout occurs and an alarm is issued. "E0" (interlock) and "P1" are displayed alternately.



■ Instrumentation example of model AUR455 for an intermittent pilot



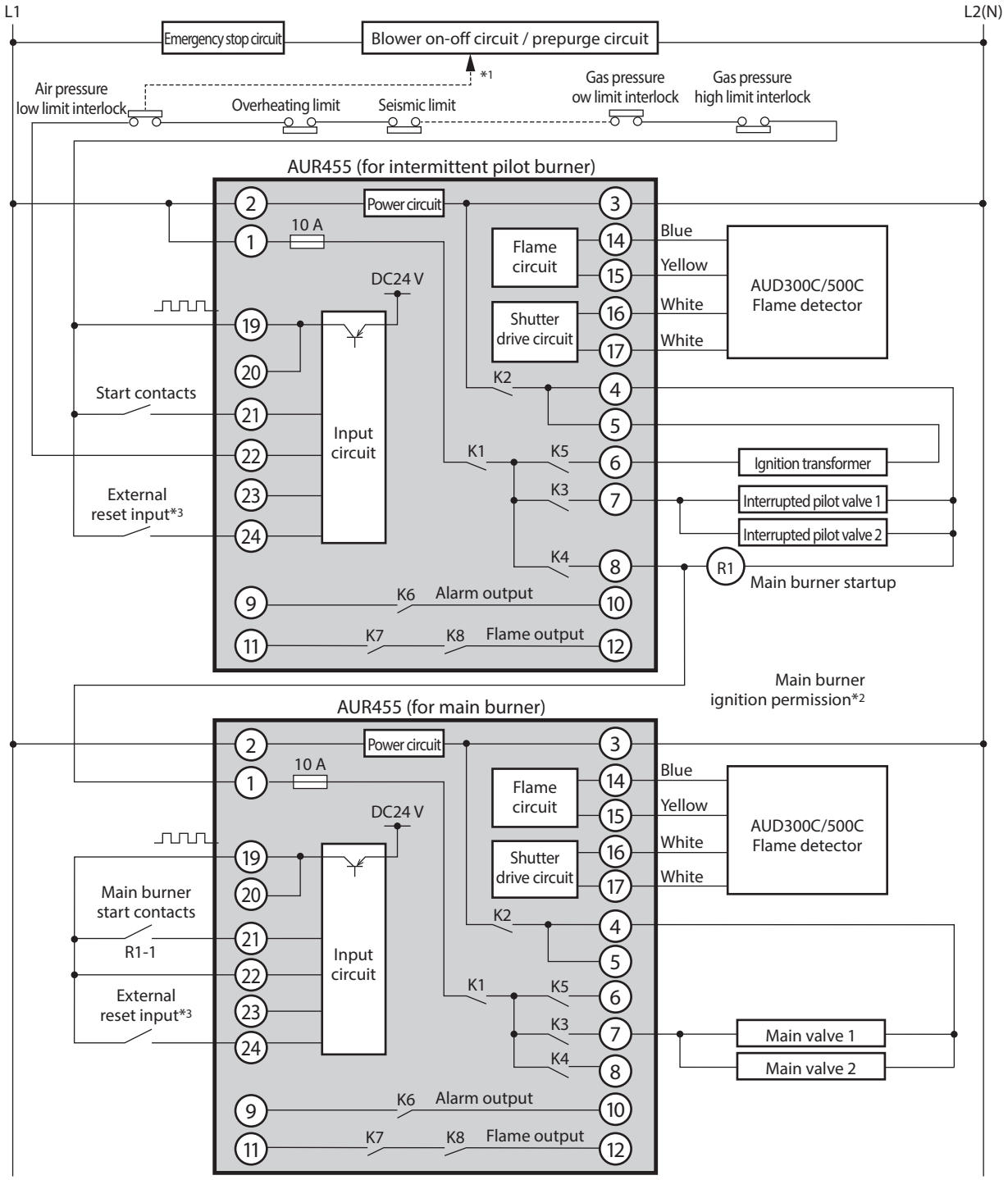
■ Notes about the instrumentation and circuit configuration for an intermittent pilot

In principle, instrumentation is needed to individually monitor the flame of the pilot burner and of the main burner in the case of an intermittent pilot. Also, for the instrumentation and circuit configuration of an intermittent pilot system, note the following:

- For safety control and operation circuitry, implement inherent safety design measures based on risk assessment.
- Individually install flame monitoring equipment (flame detector and burner controller) for the pilot burner and the main burner.
- Install the flame detector for the main burner at a position where it does not detect the pilot burner flame.
- Connect the limit contacts and the interlock contacts to the interlock input terminals of the burner controller for the pilot burner.
- Connect the main burner ignition permission output from the burner controller for the pilot burner to the load power terminal of the burner controller for the main burner.
- Design a circuit that stops all the burners if the pilot or main burner fails to ignite or if a flame failure occurs.
- Place all the shutoff contacts on the high voltage side of the power supply. Take countermeasures against a ground fault as needed, for example by using an earth leakage breaker or having both contacts cut off.
- Do not configure a circuit that turns off the interlock input (terminals 21 & 19, or 21 & 20) using the alarm output contacts (terminals 9 & 10). With such a circuit, if a false flame (E2), UV alarm (E3), ignition failure (E4), or flame failure (E5) occurs, the interlock error (E0) may be displayed.

■ Internal block diagram (intermittent pilot)

An example of wiring for external devices and an internal block diagram are shown below.



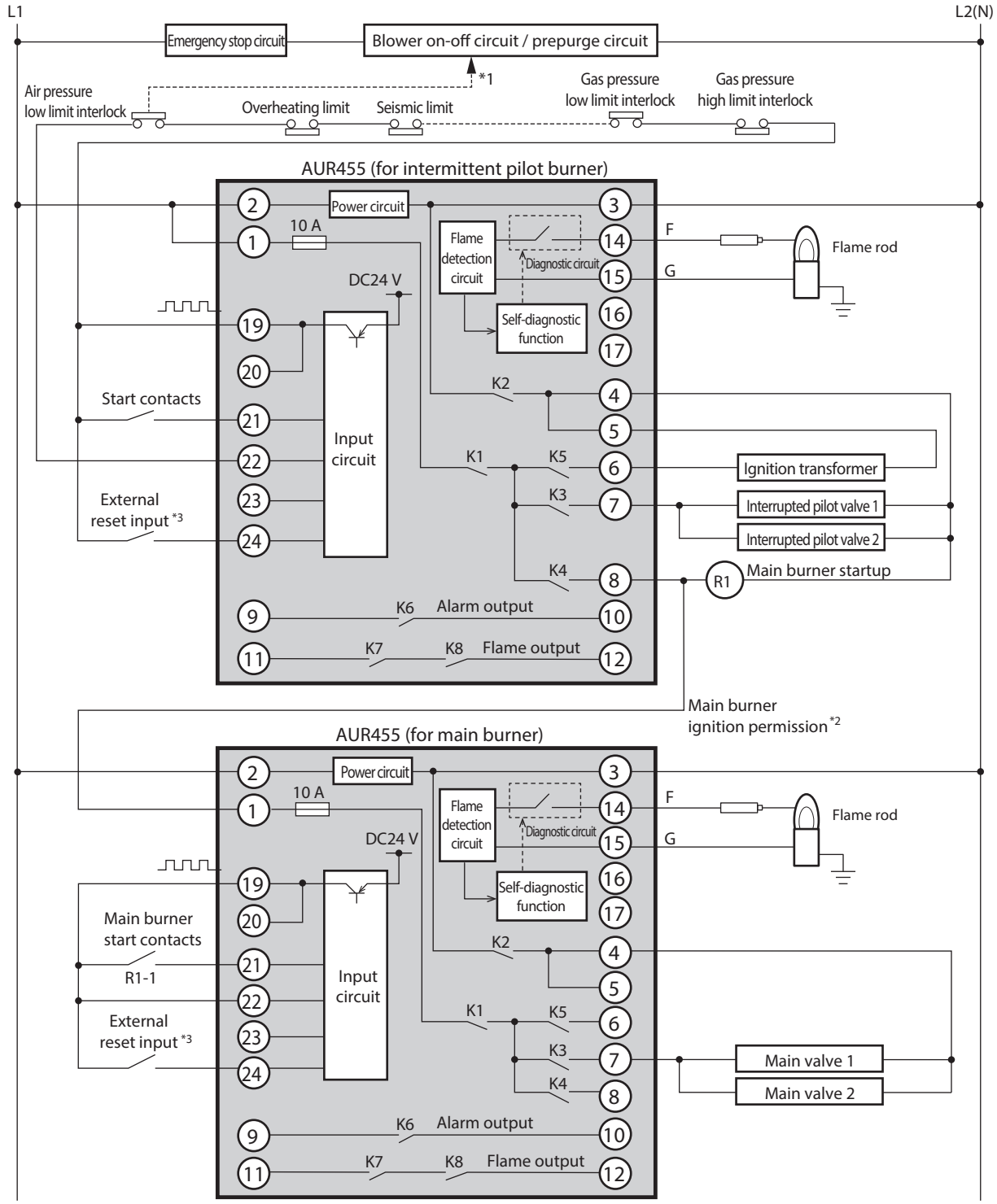
*1 Air pressure switch: Install the following verification circuit. When the blower is about to start, and there is no air flow, the circuit should verify that no pressure is detected. If pressure is detected under these conditions, the blower should not be started.

*2 Configure the circuit using the main burner ignition permission output (pilot flame ignition signal) as the condition for starting the main burner controller or as the condition for interlock.

*3 Provide a separate external reset input for each individual AUR455. Do not share the external reset input terminal with other AUR455 devices.

Note

- According to JIS B 8415, the pilot burner ignition time should be no more than 10 seconds and the main burner ignition time should be no more than 5 seconds.



*1 Air pressure switch: install the following verification circuit. When the blower is about to start, and there is no air flow, the circuit should verify that no pressure is detected. If pressure is detected under these conditions, the blower should not be started.

*2 Configure the circuit using the main burner ignition permission output (pilot flame ignition signal) as the condition for starting the main burner controller or as the condition for interlock.

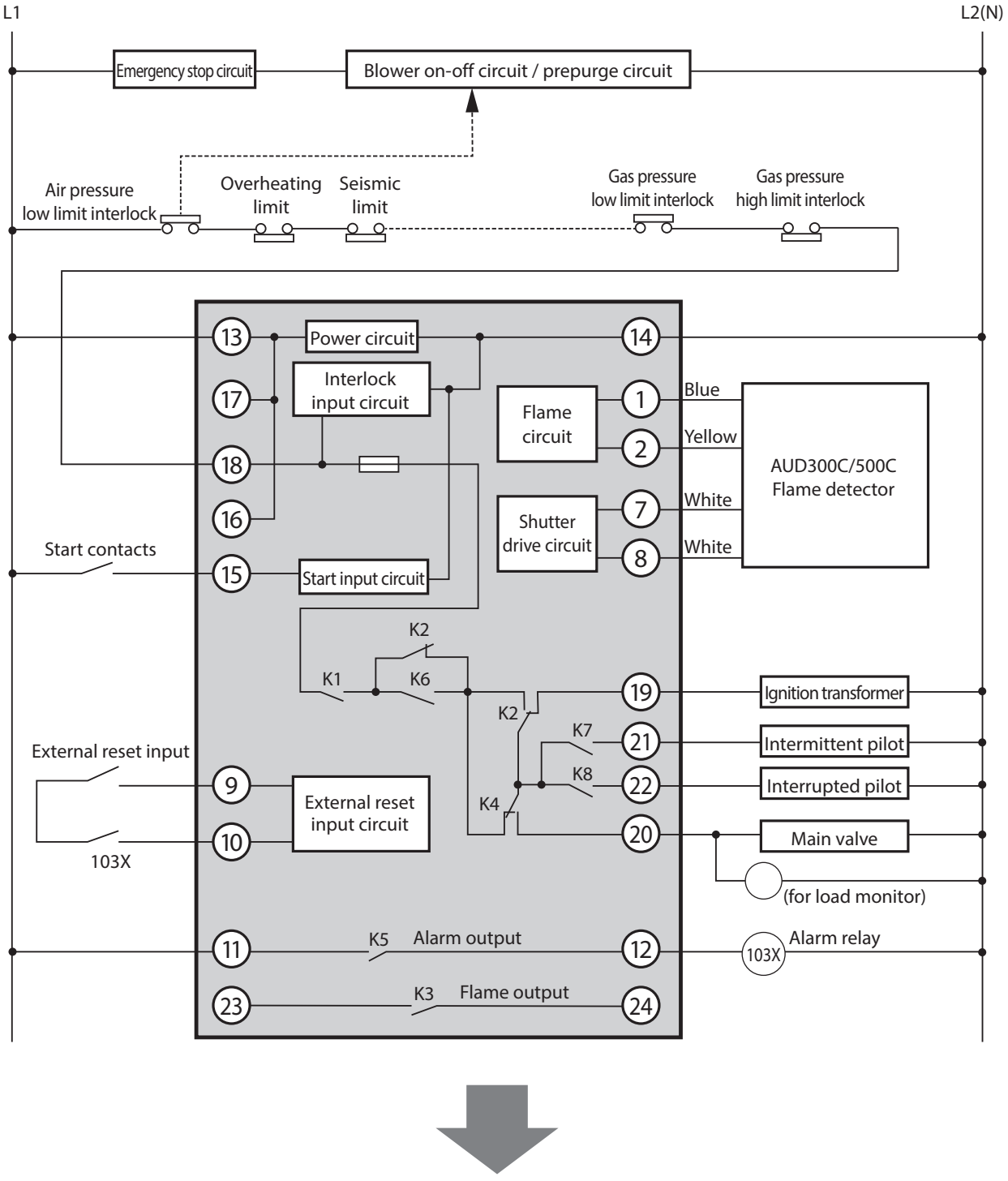
*3 Provide a separate external reset input for each individual AUR455. Do not share the external reset input terminal with other AUR455 devices.

Note

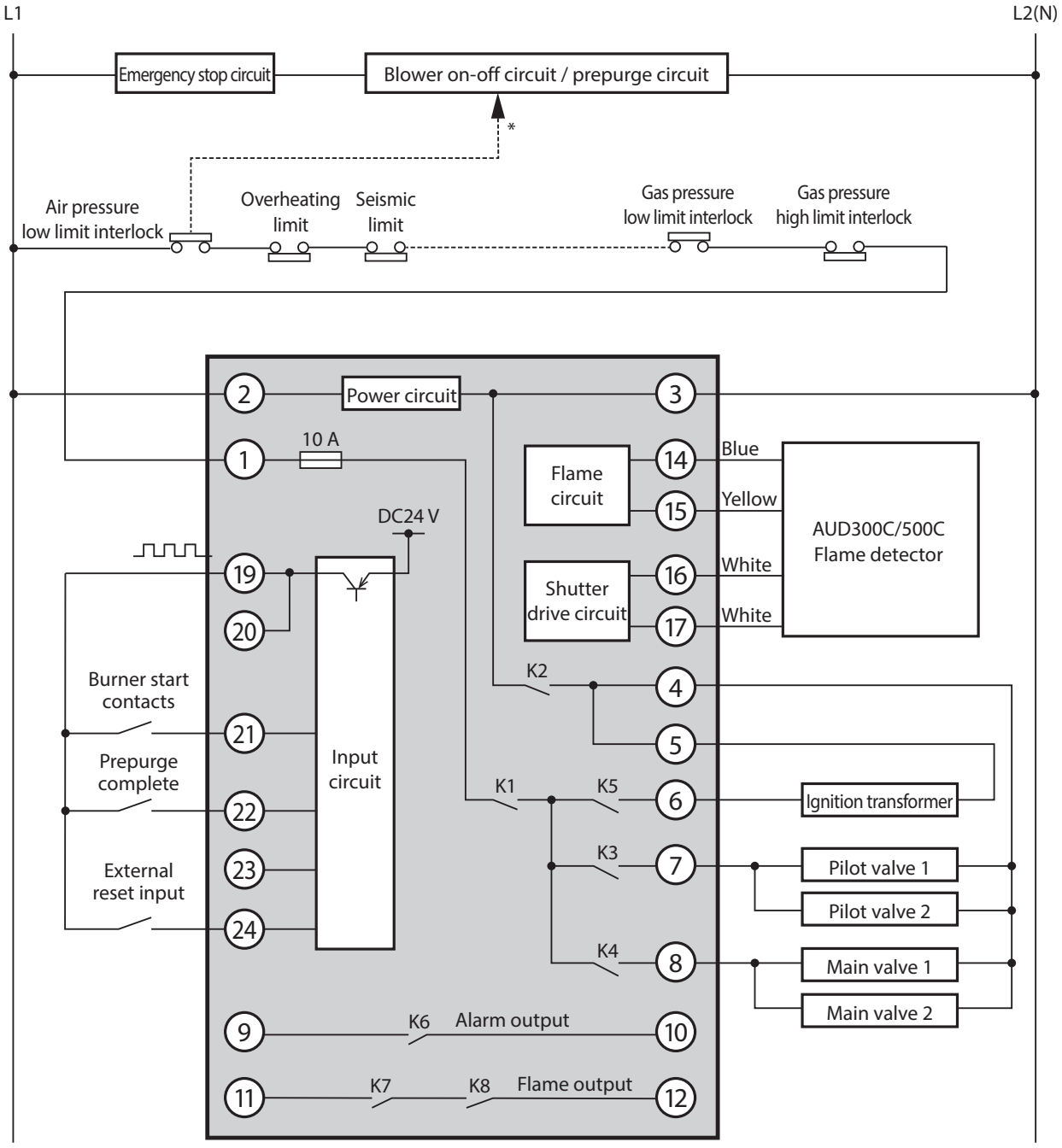
- According to JIS B 8415, the pilot burner ignition time should be no more than 10 seconds and the main burner ignition time should be no more than 5 seconds.

■ Wiring for replacement of model AUR450

● Wiring for model AUR450



● **Wiring for model AUR455**



*1 Air pressure switch: install the following verification circuit. When the blower is about to start, and there is no air flow, the circuit should verify that no pressure is detected. If pressure is detected under these conditions, the blower should not be started.

*2 The interlock that was connected in series with the load to terminal 18 of the AUR450 can be connected to terminal 1 of the AUR455. If this interlock in series with the load opens during combustion, the fuel valve will shut off and the flame will be extinguished. If the interlock in series with the load is open at startup, E966 occurs.

! Handling Precautions

- Be sure to connect the loads connected to terminals 6, 7, and 8 (ignition transformer, pilot valves, main valves) to terminals 4 or 5.
- When upgrading, before selecting a model, check whether the pilot is interrupted or intermittent.

■ Alarms and combustion sequence

Name	Code	Interlock error	False flame	UV alarm	Ignition failure	Flame failure
		E0	E1	E2	E6	E7
Stop	- -					
Start check	P1	○	○	○		
Ignition trial	P4	○		○	○	
Pilot only / Hi solenoid valve ignition standby	P5	○		○		○
Main trial / Hi solenoid valve ignition	P6	○		○		○
Run	P8	○		○		○

Blank: Not monitored, ○ : Monitored

■ Instantaneous power failure or instantaneous voltage drop during operation

If an instantaneous power failure or instantaneous voltage drop occurs during operation, this device operates as described below.

Instantaneous power failure	Shorter than 50 ms	Operation continues
	50 ms or longer	Operation continues or restarts from stop, or restarts after power-OFF
Instantaneous voltage drop (drop in power of 50 %)	Shorter than 100 ms	Operation continues
	100 ms or more	Operation continues or flame is extinguished due to voltage drop in the flame detector*

* Because the voltage to the fuel valve also drops, fuel supply may decrease, causing the flame to be extinguished.

-MEMO-

Chapter 5. Trial Operation and Adjustment

⚠WARNING

The ignition time for the pilot and main burners should not exceed the time defined by the burner or device manufacturer. If it does, fuel will accumulate in the combustion chamber and form an explosive mixture, resulting in a very dangerous situation in which an explosion could occur.

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

Do not operate this device without first completing its adjustment and testing, and also the testing specified by the combustion equipment manufacturer.

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

⚠CAUTION

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

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

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

■ Preliminary inspection

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

■ Inspection procedure

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

● **Ignition spark response**

WARNING

Make sure that the AUD flame detector does not detect UV rays from a source other than the burner.

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

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

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

(3) If the spark has an effect, such as causing the flame LED to light up, refer to the user's manual for the combustion equipment and make adjustments in the following way.

- Move the AUD flame detector or the ignition spark rod so that the spark does not affect the flame voltage.
- Attach a shield that prevents the spark's ultraviolet radiation from entering the optical path of the AUD flame detector. Adjust so that the spark's effect on the flame signal is no more than 0.4 V DC.
- If an S7200A_ _ _GH_ or S720A_ _ _GH_ igniter is used, swap the polarity of the power to the igniter. When this device is used in combination with an igniter, changing the polarity of the power can prevent the AUD flame detector from detecting the spark.

Handling Precautions

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

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

Examples:

Ultraviolet ray sources	1371 °C or hotter red-hot furnace wall (within 50 cm from wall)
	Spark of an ignition transformer or welding arc
	Gas laser
	Sunlamp
	Germicidal lamp, ultraviolet lamp, fluorescent lamp
	Strong flash of light (towards ultraviolet phototube)
Gamma ray and X-ray sources	X-ray diffractometer, gamma-ray analyzer
	Electron microscope
	X-ray machine
	High-voltage vacuum switch
	High-voltage capacitor
	Radioactive isotope
	Any other ultraviolet, gamma, or X-ray source

● Measurement of flame voltage

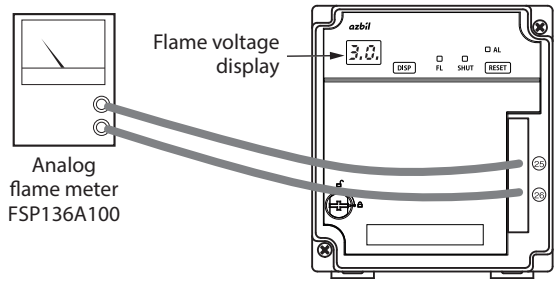
This device shows the flame voltage on the 7-segment display. The voltage can be checked by changing the display using the DISP switch on the front of the unit. Checking the flame voltage is the best way to determine whether or not the location of the flame detector is appropriate.
The flame voltage should be checked during installation and servicing. Checking it once per month or more can prevent shutdowns due to insufficient flame voltage. Start the device and measure the voltage under various conditions, such as at startup and during normal operation. Check to make sure that the flame voltage remains stable at 2.0 V DC or more. (The recommended flame voltage is 2.0 V DC or more and it must be stable.)

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

- The power supply voltage or frequency is not correct.
- The air supply pressure or air-fuel ratio is not correct.
- The flame detector is not correctly wired.
  - Open circuit
  - Short circuit
  - High-resistance short circuit of the lead wires due to humidity or dirt
- Incorrect flame detector mounting angle (AUR455C)
- Dirty flame detector sensing surface (AUR455C)
- Tube unit deterioration (AUR455C)
- Incorrect flame rod installation (AUR455B)
  - Area in contact with flame is insufficient.
  - Position of flame rod in flame is incorrect.
  - The flame rod insulator is at a high temperature (315 °C).
  - Flame rod is affected by the ignition transformer.

    If the ignition transformer is close to terminal F of the flame rod, electrons in the flame will be absorbed into the ignition transformer, and as a result, sufficient flame voltage will not be achieved.

The voltage can be checked on the 7-segment display or by connecting a flame meter to terminals 25 & 26 on the front connector. It is necessary to obtain a monitor/communication connector (81447514-001) to connect the FSP136A100 and the AUR455.



! Handling Precautions

- For the flame voltage output signal wires, use 600 V PVC-insulated cable (IEC 60227-3), 0.75 mm² or more in cross-sectional area. The wiring should be no longer than 10 m.
- The input impedance of a measuring instrument used with this device must be 100 kΩ or more.

● **Pilot turn-down test**

⚠WARNING

Carry out the pilot turn-down test carefully.

Before doing the pilot turn-down test, always make sure that all manual fuel valves are closed.

If the pilot turn-down test must be repeated, stop the combustion equipment completely each time and discharge all of the unburned gas and oil from the fuel chamber and flue. Failure to discharge unburned gas may result in an explosion hazard.

After completing the pilot turn-down test, turn off the power switch to turn off the power supply. Make sure to return all test jumpers and limit or controller settings to their original values. Resuming normal operation without returning the settings to their original values, etc., may damage the equipment or cause a gas leak or explosion.

⚠CAUTION

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

The purpose of this test is to determine the smallest possible pilot flame that will reliably ignite the main burner. Before and after this test, make sure to measure the flame voltage and confirm that it is 2.0 V or more. This device has turn-down test and communication setting modes. If "Continuous pilot burner combustion mode" is selected in the turn-down test or communication setting mode, pilot burner combustion will continue instead of progressing to main burner combustion. When the turn-down test or communication setting mode is used, the pilot turn-down test can be executed by turning on and off the start input. For instructions on starting the turn-down test or communication setting mode, see ☞■Turn-down test and communication setting modes (Page 20).

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

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

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

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

Note

- When turn-down test or communication setting mode is used, pilot burner combustion continues and there is no limitation on the pilot burner ignition time. Therefore, the smallest effective pilot flame can be easily determined.

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

(6) Changing the gas pressure between minimum and maximum, repeat steps (1) to (5) to check if the main burner ignites without fail.

Handling Precautions

- If it is necessary to repeat this test, in order to prevent an explosion, stop all combustion equipment devices each time the test is finished, and completely discharge unburned gas or fuel that has accumulated in the chamber, ducts, and flues.
- Before starting the pilot turn-down test in turn-down test or communication setting mode, shut off the gas to the main burner by closing the manual cock or disconnecting the wiring.

● Safety shutoff check

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

- Pilot ignition failure check
  Close the manual gas cock. Turn on the start input of the burners to begin operation. After prepurge, pilot burner ignition is attempted. Since the manual cock is closed, however, the pilot burner does not ignite and lockout occurs. After confirming the above behavior, open the manual cock. Turn on the RESET switch, restart the burner and check if it ignites normally.

- Flame failure check
  Close the manual gas cock while the burners are operating. After the flame failure response time elapses, the pilot valve and main valve close and lockout occurs. After confirming the above behavior, open the manual cock. Turn on the RESET switch, restart the burner and check if it ignites normally.

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

-MEMO-

Chapter 6. Maintenance and Inspection

WARNING

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

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

CAUTION

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

If the combustion equipment is restarted as a result of a lockout, do all of the inspection steps described in ☞ Chapter 5, "Trial Operation and Adjustment."

When doing a maintenance inspection of the burner, be sure to do the pilot turn-down test.

Inspection must be done at least once a year.

Inspect the combustion equipment periodically in accordance with the instructions given in the manual provided by the equipment manufacturer.

When cleaning the burner, clean the flame detector also.

■ General maintenance and inspection

- When replacing this device, observe the cautions (☞Page 1) and carry out all the inspections and adjustments of this device and the combustion equipment that are described in chapter 5.
- Do not lubricate any part of this device.
- Remove any products of combustion that have accumulated on the burner, etc.

■ Maintenance and inspection cycle

The maintenance and inspection cycle should be determined by taking into consideration the device type, ambient conditions at the installation location, the frequency of use, etc. The following are rough guidelines.

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

■ Alarm codes and details

When a lockout occurs, the alarm code and the code for the sequence step where the lockout occurred are displayed alternately. If the sequence step cannot be identified, the sequence code may be displayed as "--" (stopped). For the relationship between the combustion sequence and alarm codes, see ☞■Alarms and combustion sequence (Page 37).

Alarm code	Sub-code	Description	Status	Cancellation method
E0	None	Interlock error	A lockout interlock occurred.	Reset
E1		False flame	A flame signal was detected for 5 seconds during the period from startup to prepurge.	Reset
E2		UV alarm	Self-discharge of the ultraviolet flame detector occurred during combustion control.	Reset
E6		Ignition failure	After P4 (pilot or main ignition) finished, no flame was detected.	Reset
E7		Flame failure	The flame signal disappeared during or after sequence step P4 (pilot or main ignition).	Reset
E9	02	Malfunction operation switch	The DISP or RESET switch was pressed for 1 minute. Or, 1 minute passed with the contact reset input ON. Note: This error is always monitored while the power is on.	Reset
E9	03	Relay answerback error (K1)	K1 relay contact welding due to output short circuit, etc.	Reset
E9	04	Relay answerback error (K2)	Terminals 4 and 5 were connected to terminal 3 through the ground or load. Or, K2 relay contact welding due to output short circuit, etc., occurred.	Reset
E9	05	Relay answerback error (PV)	Terminal 7 was connected to terminal 2 through the load. Or, K3 relay contact welding due to output short circuit, etc., occurred.	Reset
E9	06	Relay answerback error (MV)	Terminal 8 was connected to terminal 2 through the load. Or, K4 relay contact welding due to output short circuit, etc., occurred.	Reset
E9	07	Relay answerback error (IG)	Terminal 6 was connected to terminal 2 through the load. Or, K5 relay contact welding due to output short circuit, etc., occurred.	Reset
E9	08	Alarm at power-on	When the cause of lockout cannot be identified • Device power was turned off before the cause of the error was saved. • The internal latch relay was set due to transportation vibration, etc. This does not indicate a problem with the device. Reset the device to restore normal operation.	Reset
E9	50	Internal error ROM checksum	ROM check code error	Reset
E9	51	Internal error EEPROM read	Error in reading from the EEPROM • Data was not correctly saved to the EEPROM with the Smart Loader Package (SLP-A55) because the power was turned OFF or the loader cable was removed while settings were being written, etc. • Due to some other failure of the EEPROM, data was not correctly saved.	See ☞■What to do if E951 occurs (Page 48).

Alarm code	Sub-code	Description	Status	Cancellation method
E9	52	Internal error EEPROM write	Error while writing to the EEPROM	Reset
E9	53	Internal error process data value	Internal memory error	Reset
E9	54	System error (1)	CPU communication error	Reset
E9	55	Internal error (input-circuit)	Detection of part failure (voltage applied to the input terminals by wrong wiring) or strong inductive electrical noise to the signal wire	Reset
E9	56	Internal error (input-circuit)	Internal clock error	Reset
E9	57	Internal error (EEPROM data value)	An error was found in CPU mutual check. There are discrepancies in EEPROM data.	Reset
E9	58	Internal error (CPU mutual check)	An error was found in the CPU internal status mutual check.	Reset
E9	60	Internal error (CPU mutual check)	An error was found in the CPU process status mutual check.	Reset
E9	61	Internal error (CPU mutual check)	CPU process synchronization error	Reset
E9	62	Internal error (Alarm timeout)	Internal feedback signal error of alarm output relay	Reset
E9	63	Internal error (CPU mutual check)	Internal memory data error • While settings were being written with the Smart Loader Package (SLP-A55), the power was turned OFF or the loader cable was removed.	Write settings using the Smart Loader Package (SLP-A55), and then do a reset.
E9	64	Internal error (flame circuit)	Error in the circuit for diagnosing the flame detection circuit	Reset
E9	65	Internal error (flame circuit)	Error in the interactive diagnosis of the flame detection circuit	Reset
E9	66	Internal error (K1 circuit)	Internal fuse burn-out, or internal feedback signal error	Reset
E9	67	Internal error (K2 circuit)	Internal feedback signal error	Reset
E9	68	Internal error (PV circuit)	Internal feedback signal error	Reset
E9	69	Internal error (MV circuit)	Internal feedback signal error	Reset
E9	70	Internal error (IG circuit)	Internal feedback signal error	Reset
E9	71	Internal error (Communication setting)	Internal memory error in host communication setting • In turn-down test or communication setting mode, the power was turned off during configuration (when the 7-segment display was blinking), and data was not saved correctly to the EEPROM. • Data was not correctly saved to the EEPROM with the Smart Loader Package (SLP-A55) because the power was turned OFF or the loader cable was removed while settings were being written, etc. • Due to some other failure of the EEPROM, data was not correctly saved.	Reset the error. The reset operation initializes the communication settings. Please rewrite them with the correct values. See ☞■Turn-down test and communication setting modes (Page 20).

Note

- If a sequence cannot be identified, the sequence code where lockout occurred may be "- -" (stopped).
- If lockout occurs even if the alarm is reset several times, there is a problem with the product.

■ What to do if E951 occurs

E951 occurs when the data read from the burner controller's EEPROM is abnormal. In order to write data correctly into the EEPROM, the following operations are required before and after resetting E951.

(1) If E951 occurs, do not reset the error immediately.

(2) Write correct data to event settings, AUR tag, and AUR memo using the Smart Loader Package (SLP-A55).

(3) When writing is complete, reset the E951 error.

(4) If any other error occurs, reset it.

(5) Wait for 5 seconds after the reset. If there is no error message, turn off the power of the burner controller.

(6) Turn the power back on. Wait for 5 seconds after "- -" is displayed on the 7-segment LED. If there is no error message, the settings have been properly stored in the EEPROM. If E951 occurs again, repeat the operation from step 1.

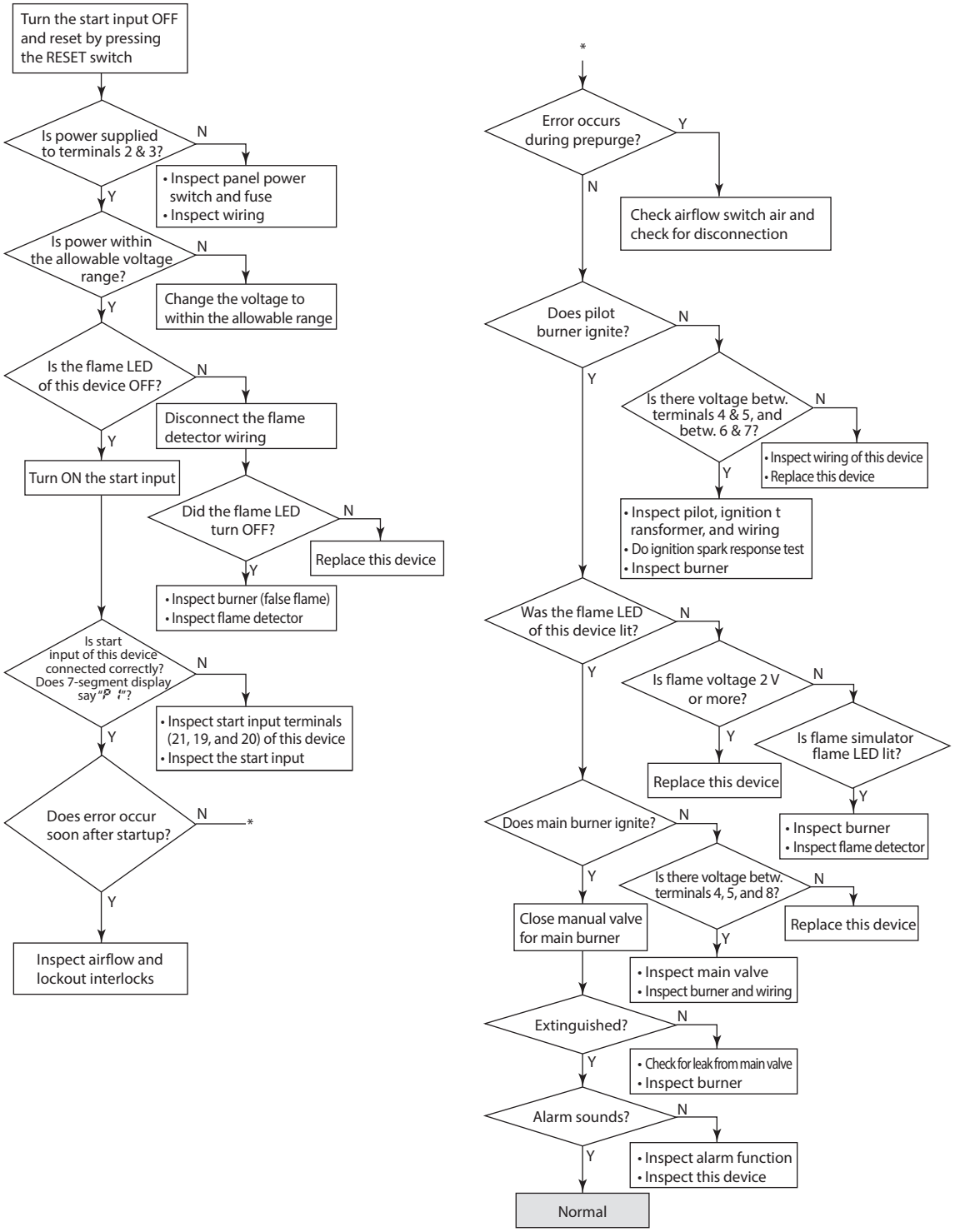
E951 occurs when data was not properly saved to the burner controller due to power shutoff or cable removal during data writing, due to an EEPROM error, etc. After giving a command to write the settings to the burner controller, do not turn off the burner controller until the writing completion message is displayed in the Smart Loader Package (SLP-A55).

■ Failure inspection flowchart

WARNING

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

If there is a problem with the equipment, follow the inspection procedure below.



-MEMO-

Chapter 7. Specification

Item			Description	
Application			Gas- or oil-burning combustion equipment	
Compatible flame detector			Model AUD300C/500C UV flame detector or flame rod	
Sequence	Sequence timing		Ignition trial: Selectable by model No. Pilot only (Hi solenoid valve ignition standby)*1: 7.0±1.0 s Main trial (Hi solenoid valve ignition)*1: Selectable by model No.	
	Flame failure response time		Model AUD300C/500C UV flame detector: 2 s max. or 4 s max. when flame voltage is 3 V Flame rod: 4 s max. when flame voltage is 2 V	
	Reset timing		1 s or longer (reset switch or contact reset input*3)	
	Alarm detection timing		False flame: 5 s Interlock error: 1 s or shorter	
	Lockout		Lockout requiring manual reset	
	Operation at ignition failure		Lockout	
	Operation at flame failure		Lockout	
Electrical specifications	Supply power rating		100/200/120/230 V AC, 50/60 Hz	
	Allowable supply voltage		85 to 110 % of rated power	
	Power consumption		15 W max. (AUR455C) 10 W max. (AUR455B)	
	Dielectric strength		1500 V AC for 1 min or 1800 V AC for 1 s Between each terminal and ground (the DIN rail clamp), except for flame detector connection terminals (terminals 14–15 and 16–17)	
	Insulation resistance		50 MΩ min. with a 500 V DC megger Between each terminal and ground (the DIN rail clamp), except for flame detector connection terminals (terminals 14–15 and 16–17)	
	Contact rating		Ignition transformer: 300 VA Pilot valve (Lo solenoid valve)*1: 200 VA Main valve (Hi solenoid valve)*1: 200 VA Alarm: 75 VA	
	Event output*2		30 mA max.	
			Model AUD300C/500C UV flame detector	Flame rod
	Flame detection level	Flame establishment	1.5–4.5 V DC	1.5–4.5 V DC
		Flame out detection	0.0–0.6 V DC	0.0–0.2 V DC
	Flame voltage output	Recommended flame voltage	Stable 2.0 V DC min.	Stable 2.0 V DC min.
		Flame voltage output range	0.0–5.0 V DC	0.0–4.5 V DC
	Input		Start, interlock, contact reset Each input is a non-voltage contact input, with allowable contact resistance of 500 Ω max.	
	Service life		7 years or 100,000 relay operations (at 25 °C, room temperature, rated power)	
Operating conditions	Ambient temperature		Separately mounted unit: −20 to +60 °C Gang mounted units: −20 to +45 °C	
	Ambient humidity		10–90 % RH (without condensation)	
	Vibration resistance		0–3.2 m/s^2 (10–150 Hz, 1 octave/minute, 10 cycles, in each of XYZ directions)	
	Shock		0–9.8 m/s^2	
	Mounting angle		Reference plane ±10°	
	Dust		0.3 mg/m^3 max.	

Item		Description
General specifications	Protective structure	IP40: if sideboards (81447515-001) are attached to the sub-base (model BC-R05) IP10: sub-base (model BC-R05) only
	Overvoltage category	II
	Pollution degree	PD2
	Automatic action	Type 2.A.V (IEC 60730-1 / JIS C 09730 001)
	Software	Class C
	Case color	Black
	Case material	Denatured PPE resin (UL 94-V0 PTI materials group IIIa)
	Structure	Sub-base and main unit
	Mounting orientation	Vertical or horizontal For horizontal mounting, the 7-segment display must face upward (DIN rail mounting or direct mounting through screw holes in base)
	Standards compliance	JIS C 9730-2-5:2010 (Automatic Electrical Controls for Household and Similar Use — Part 2-5: Particular Requirements for Automatic Electrical Burner Control Systems) JIS C 9730-1:2010 (Automatic Electrical Controls for Household and Similar Use — Part 1: General Requirements)
	Dimensions	W95 x H105 x D110 mm
	Weight	Approximately 600 g (incl. sub-base)
Wiring types and max. wiring length		• Start, interlock Copper 600 V PVC-insulated cable (IEC 60227-3), 1.25 mm^2 Recommended length: 20 m or less, maximum length: 100 m • Contact reset Copper 600 V PVC-insulated cable (IEC 60227-3), 1.25 mm^2, maximum length: 10 m • AUD300C/500C (F, G, S1, S2) Copper 600 V PVC-insulated cable (IEC 60227-3), 1.25 mm^2, maximum length: 200 m • Flame rod (F, G) RG-11U (JAN standard: US DoD-compliant specification) or equivalent 5C2V, 7C2V (JIS standard) Recommended condition: 20 m or less, maximum length: 30 m • RS-485 communications (3-wire system) 0.2–1.5 mm^2 Shielded twisted pair cable (recommended), maximum length: 500 m • Flame voltage output signal Copper 600 V PVC-insulated cable (IEC 60227-3), 0.75 mm^2 min., maximum length 10 m • Event output JIS C 3306: 0.75 mm^2 min.

*1. Item in parentheses ( ) is for the case of direct ignition.

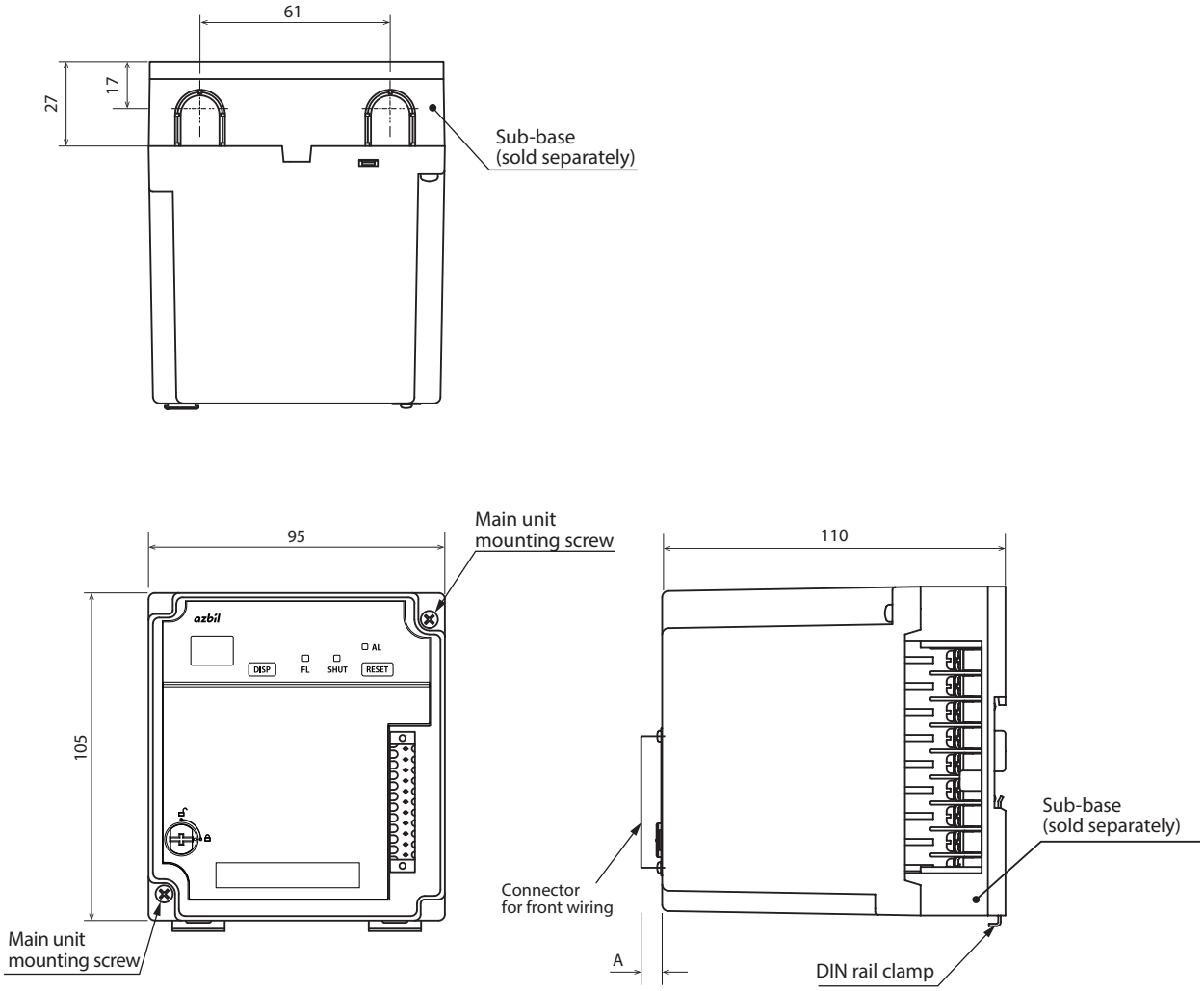
*2. If an inductive load is connected, connect a protective circuit such as an RC snubber in parallel with the load.

*3. For details on the contact reset input specifications, see ☞●Contact reset input (terminal 24) (Page 19).

■ External dimensions

● Main unit

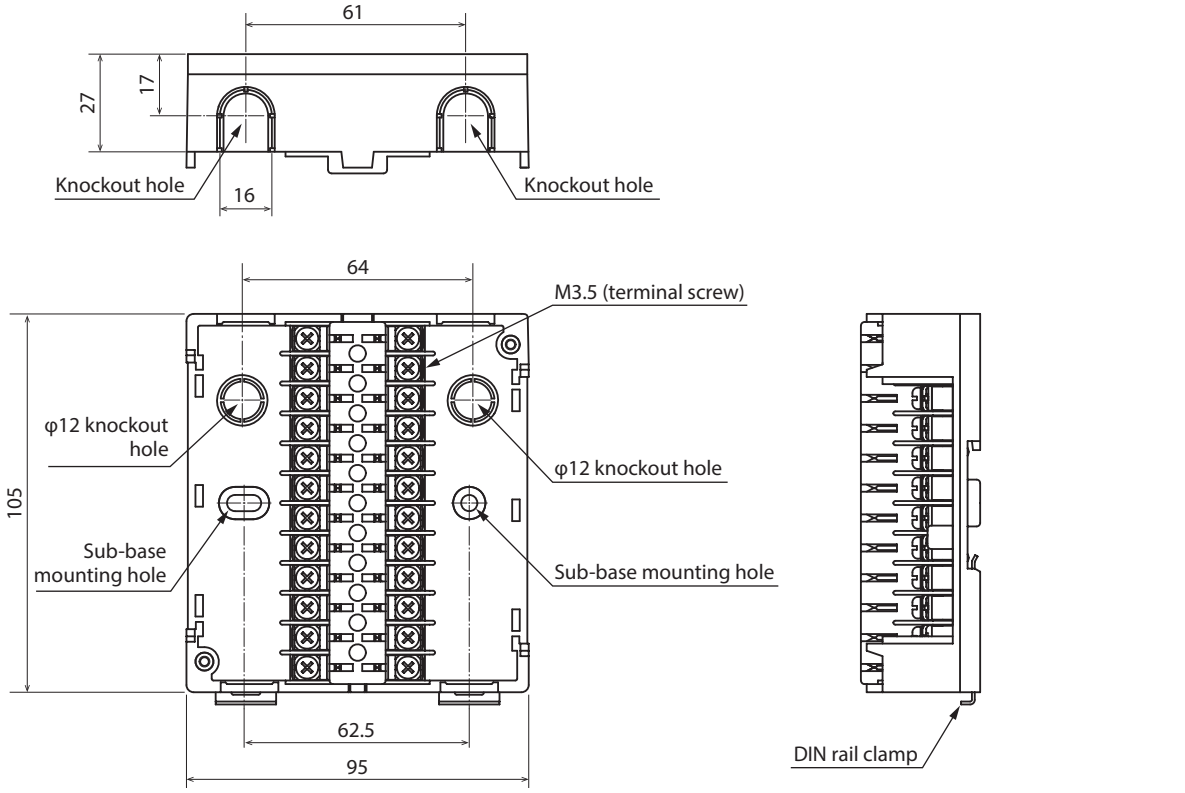
Unit: mm



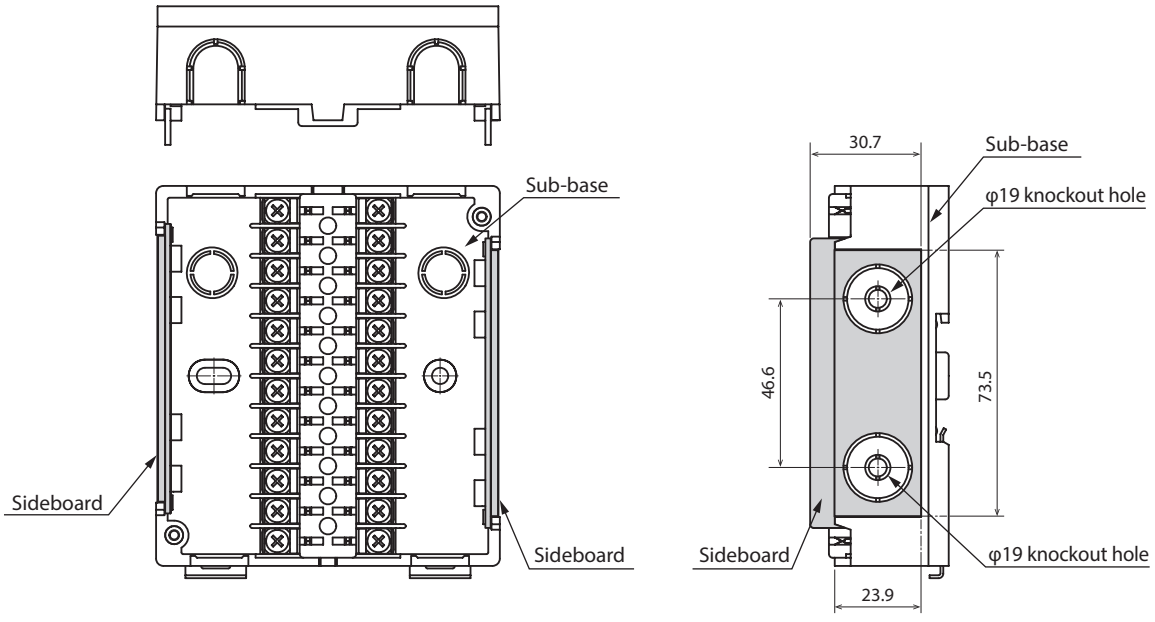
Model No. of connector for front wiring	A
81447514-001	10.6
81447514-002	14.6

● Sub-base model BC-R05A100 (sold separately)

Unit: mm



● Sideboard model 81447515-001 (sold separately)



Revision History of CP-SP-1439E

Date	Rev.	(New) Page No.	Description
Feb. 2021	1		

Terms and Conditions

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

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

1. Warranty period and warranty scope

   1.1 Warranty period

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

   1.2 Warranty scope

   In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

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

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

2. Ascertainment of suitability

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

   (1) Regulations and standards or laws that your Equipment is to comply with.
   (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
   (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
   Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

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

3. Precautions and restrictions on application

   3.1 Restrictions on application

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

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

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

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

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

   3.2 Precautions on application

   you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

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

4. Precautions against long-term use

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

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

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

6. Other precautions

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

7. Changes to specifications

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

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

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

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

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

azbil

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