Read all instructions thoroughly

INSTRUCTIONS

EEV Controller

Type **YNE**

SAGInoMIYA

Product Model: YNE-BB01-***

A-NE-71003

Introduction

Thank you for purchasing the YNE-type EEV Controller.
Before using the product, please read this instruction manual carefully and use the product correctly.
After reading, **be sure to keep the manual in a location** where it is easily accessible to all users.

These instruction manual and other related documents are available for download from our official website.
You can access them using the 2D code below.

Product Information
https://qr.saginomiya.co.jp/u/yne

Consent Related to Disclaimers

CONFIRMATION OF OPERATION

All customers using this Product (hereinafter referred to as “Customers”) are requested to, after properly installing this Product, test the operation of this Product to confirm that all the systems in connection with this Product fully function. In order to prevent the occurrence of bodily injury, fire accidents, serious damage, etc., in connection with the Customers’ machinery or equipment due to improper installation of this Product, Saginomiya kindly requests the Customers to take the necessary safety measures by preparing safe designs such as a fail-safe design (*1) and a fire spread prevention design, as well as to make the proper adjustments for product reliability necessary for fault-tolerance (*2).

(*1) Fail-safe design: Design to ensure safety in the event of any mechanical failure
(*2) Fault-tolerance: Utilization of redundancy technology

Periodic Inspection of this Product
Be sure to confirm the proper operation of this Product and keep records of such operation at least once a year.

Saginomiya shall be held harmless and be indemnified by the Customers from any damages incurred due to the Customers failing to conduct the above operational procedures, provided, however, that, this shall not apply if the damages which the Customers incurred due to the defect of this Product caused by Saginomiya.

RESTRICTIONS OF USE

This Product is designed and manufactured for the purpose of using them for cooling and heating and refrigerating appliances and air conditioning equipment or various industrial equipment, but is not designed and manufactured for the purpose of using this Product for any instrument or system related to human life or health purposes.
Therefore, the use of this Product in fields related to items (1) through (3) below is not intended whatsoever.
Saginomiya shall be held harmless and be indemnified from any and all damages incurred by use of this Product under item (3).

(1) In any field related to nuclear power and radiation;
(2) In any field related to space or seafloor equipment;
(3) In any equipment or device requiring a high degree of reliance on such equipment or device with respect to which it is reasonably foreseeable that failure or malfunction of the equipment or device would either directly or indirectly cause serious damage to human life, health or property;

Also, when using this Product under the fields related to items (1) through (10), (except for item (3), in relation to which this Product must never be used), please be sure to notify Saginomiya’s contact desk in charge of sales and obtain Saginomiya’s prior written approval for such use.

Saginomiya shall be held harmless and be indemnified from any and all damages incurred by use of this Product in relation to these fields if the Customers do not notify Saginomiya’s contact desk and obtain Saginomiya’s prior written approval.

(4) Heating, cooling and air conditioning equipment that uses flammable and/or toxic refrigerants, or various industrial equipment that uses flammable and/or toxic fluids;
(5) Transportation device (railroad, aviation, ship or vessel, vehicle equipment, etc.);
(6) Disaster-prevention or crime-prevention device;
(7) Facility or application directly related to medical equipment, burning appliances, electro thermal equipment, amusement rides and devices, facilities/applications associated directly with billing;
(8) Equipment requiring high reliance on supply systems such as electricity, gas, water, etc., in large-scale communication system, or in transportation or air traffic control system;
(9) Facilities that are to comply with regulations of governmental / public agencies or specific industries or
(10) Other machineries or equipment equivalent to those set forth in the above items (4) to (9) which require for high reliability and safety.

It is recommended to replace this Product within 5 to 10 years of delivery if no other duration of use is provided in the applicable specifications or instruction manual because the conditions and environment of use also have an impact on this Product.

SCOPE OF WARRANTY

SAGINOMIYA WILL PROVIDE THE CUSTOMERS WITH REPLACEMENT OR REPAIRED THIS PRODUCT DELIVERED, FREE OF COST, ONLY WITHIN ONE YEAR OF DELIVERY TO THE CUSTOMER, IF FAILURE OCCURS IN THE CUSTOMERS' EQUIPMENT USING THIS PRODUCT DUE TO A DEFECT OF THIS PRODUCT; PROVIDED, HOWEVER, THAT IN ANY EVENT THE RATIO OF THE AMOUNT THAT SAGINOMIYA BEARS FOR THE DAMAGES INCURRED BY THE FAILURE OF THIS PRODUCT OR CUSTOMERS' EQUIPMENT SHALL NOT EXCEED THE PRICE OF THIS PRODUCT WE DELIVERED. IN ADDITION, SAGINOMIYA SHALL BE HELD HARMLESS AND BE INDEMNIFIED FROM ANY AND ALL DAMAGES INCURRED WHEN THE FAILURE OF THE CUSTOMERS' EQUIPMENT OCCURRED DUE TO ANY CAUSE SET FORTH BELOW.

(1) WHEN CAUSED BY INAPPROPRIATE HANDLING OR USE OF THIS PRODUCT BY THE CUSTOMERS (SUCH AS NOT COMPLYING WITH THE CONDITIONS, ENVIRONMENTAL SPECIFICATIONS OR CAUTIONS INDICATED IN ANY APPLICABLE CATALOGUE, SPECIFICATIONS, INSTRUCTION MANUAL, ETC.);
(2) WHEN FAILURE OCCURRED DUE TO ANY REASON OTHER THAN THIS PRODUCT;
(3) WHEN CAUSED BY MODIFICATION OR REPAIR OF THIS PRODUCT MADE BY ANYONE OTHER THAN SAGINOMIYA OR DESIGNEE OF SAGINOMIYA;
(4) WHEN CAUSED BY THE USE OF THIS PRODUCT IN VIOLATION OF THE ABOVE "RESTRICTIONS OF USE" OR "CONFIRMATION OF OPERATION";
(5) WHEN SUCH FAILURE WAS NOT REASONABLY FORESEEABLE AT THE TIME OF SAGINOMIYA'S SHIPMENT; OR
(6) BY ANY OTHER CAUSE NOT ATTRIBUTABLE TO SAGINOMIYA, SUCH AS AN ACT OF GOD, DISASTER, OR ACT OF ANY THIRD PARTY.

PLEASE NOTE THAT THE CUSTOMERS WILL NOT BE ENTITLED TO ANY OF THE ABOVE WARRANTY IF THE CUSTOMERS PURCHASED THIS PRODUCT FROM INTERNET AUCTION, ETC.

Safety Precautions

Warning Labels

The precautions listed below contain important safety information. Please be sure to follow them strictly.

⚠**Warning**	Failure to follow instructions may result in serious injury(1) or death to the user.
⚠**Caution**	Failure to follow instructions may result in minor injury(2) to the user or property damage(3).

(1) **Serious injury** refers to conditions such as blindness, severe wounds, burns (high or low temperature), electric shock, bone fractures, or poisoning that may cause lasting aftereffects or require hospitalization or long-term outpatient treatment.
(2) **Minor injury** refers to conditions such as wounds, burns, or electric shock that do not require hospitalization or long-term outpatient treatment.
(3) **Property damage** refers to extensive damage involving buildings, household items, livestock, pets, etc.

Explanation of Symbols

Symbol Type		Meaning	Examples
Prohibited Action		Indicates actions that are prohibited when handling the product.	 General Prohibition  Disassembly Prohibition
Cautionary Notice		Alerts users to potential hazards such as electric shock when handling the product.	 General Caution  Electric Shock Caution
Mandatory Action		Indicates actions that must be followed when handling the product.	 General Instruction

Safety Warnings

⚠ Warnings	
	Always turn off the power before performing any wiring work. Failure to do so may result in electric shock or equipment malfunction.
	Do not touch the product with wet hands. This may cause electric shock or malfunction.
	Do not install the product in the following types of locations, as they may lead to electric shock, fire, malfunction, or failure: (1) Areas with high humidity (2) Areas exposed to water, oil, or where condensation may occur (3) Areas with excessive dust or dirt (4) Areas with corrosive gases (5) Areas subject to mechanical vibration or shock (6) Areas near equipment that generates strong high-frequency noise (7) Areas exposed to direct sunlight
	Do not install the product in locations where flammable refrigerant gases are present. This may cause explosion or fire.
	Do not use power supply voltages other than those specified. This may result in fire or malfunction.
	Do not disassemble, modify, or repair the product. This may cause fire, electric shock, or injury.
	Do not use this product for any purpose other than its intended use. This may result in fire or malfunction.

Safety Precautions

⚠ Cautions	
	Use the product only under the conditions specified in this manual. Failure to do so may result in malfunction.
	Use the designated DIN rail for installation. Improper installation may cause the product to fall, leading to malfunction or wire disconnection.
	Do not apply excessive stress that may bend the circuit board during installation. This may result in malfunction.
	Do not drop or subject the product to impact during storage or transportation. This may result in malfunction.

Wiring Warnings

⚠ Warnings	
	When wiring to screw-type terminal blocks, use crimp terminals and tighten to the specified torque. Failure to do so may cause electric leakage, electric shock, malfunction, or fire.
	After wiring to screw-type terminal blocks, always close the cover before use. This may prevent electric shock or fire.
	When wiring to screwless terminal blocks, use wires of the appropriate size and ensure they are securely connected without looseness or disconnection. Improper wiring may cause electric leakage, electric shock, malfunction, failure, or fire.
	Select wire size and type considering the allowable current for each wire. Failure to do so may result in electric shock, smoke generation, or fire.

Wiring Precautions

⚠ Cautions	
	Do not bundle or run wiring for this product in parallel with power lines carrying high current. This may cause malfunction or failure.
	Do not apply any voltage to the startup input or reference point input, as they are dry contacts. This includes surge, static electricity, or noise. Doing so may cause malfunction or failure.
	Do not apply any voltage to the maintenance communication port. This may cause malfunction or failure (including surge, static electricity, or noise).
	Be sure to ground the earth terminal properly. Improper grounding may cause malfunction or failure.
	Use twisted pair cables for communication lines and ground the shield wire at a single point. Improper grounding may cause malfunction.
	Wiring work must be performed by qualified professionals with appropriate knowledge and skills in instrumentation or electrical work. Improper wiring may result in failure or accidents.

Terminology

Term	Definition
Freezer Temperature	The internal temperature of a refrigerator, freezer, or other unit subject to temperature control.
Inlet Temperature	The temperature of the piping at the inlet side of the evaporator.
Evaporation Temperature	The temperature at which the refrigerant changes from liquid to gas inside the evaporator (converted from evaporation pressure).
Evaporation Pressure	The pressure at which the refrigerant changes from liquid to gas inside the evaporator.
Outlet Temperature	The temperature of the piping at the outlet side of the evaporator.
Superheat Optimization Sensor	A temperature sensor used for the automatic superheat optimization function to measure the reference temperature.
Reference Temperature	The temperature of the piping located several meters downstream from the outlet temperature measurement point, toward the compressor.
Liquid Back	A condition where the measured superheat is less than the preset superheat threshold for liquid back detection.
Temperature–Pressure Method	A method of calculating superheat by subtracting the evaporation temperature from the outlet temperature.
Temperature–Temperature Method	A method of calculating superheat by subtracting the inlet temperature from the outlet temperature.
YNE Internal Thermostat	A control method where the liquid solenoid valve is turned ON/OFF using the thermostat function built into the YNE controller.
External Thermostat	A control method where the liquid solenoid valve is turned ON/OFF using an external thermostat device.
Zero-Point Adjustment	An operation that excites the electronic expansion valve further in the closing direction from 0 pulses to reset the valve opening position to its origin.
Valve Opening	The opening level of the electronic expansion valve (0 pulses to 480 pulses).
Error	Refers mainly to abnormalities in the controller. An alarm is triggered, the electronic expansion valve control stops, and control will not resume until the error is cleared.
Abnormality	Refers mainly to system-related issues. An alarm is triggered, but the electronic expansion valve control continues.
Long Press	Pressing and holding a key on the operation panel for 3 seconds or longer.

Table of Contents

1. Product Overview

1.1. General Specifications

Item		Specification
Power Supply Voltage		AC85V - 250V (50Hz/60Hz)
Power Consumption		15W or less (including electronic expansion valve)
Dimensions (H × W × D)		96 × 105 × 51
Weight		Approx. 270g
Storage Ambient Temperature		-20 to +70°C
Operating Ambient Temperature		-10 to +50°C
Temperature Detection Range		-75 to +50°C
Pressure Detection Range		-0.1 to 2.0MPa
Installation Environment		Pollution Degree 2, Overvoltage Category II
Supported Refrigerants (as of Sep. 2025)		R410A, R404A, R134a, R22, R23, R448A, R449A, R463A (R463A-J), R32
Electronic Expansion Valve Control	Control Method	PI Control
	Superheat Setting Range	1.0 to 30.0K (in 0.5K steps)
	Valve Output	Saginomiya-Seisakusho: PKV and GKV type electronic expansion valves Coil Voltage: DC 12V, Coil Resistance: 46Ω
	Control Range	0 to 480 pulses
	Excitation Speed	Normal control: 31.3 pps, Zero-Point Adjustment: 83.4 pps
Thermostat Control	Control Method	ON/OFF control (OFF point setting)
	Temperature Setting Range	-70.0 to +10.0°C (in 0.5°C steps)
	Differential	0.5 to 10.0K (in 0.5K steps)
	Output	Voltage-free contact output (1a contact) × 1 AC 250V 2.0A (cosφ = 1.0), AC 250V 1.0A (cosφ = 0.4)
Alarm Monitoring	Alarm Types	Pressure sensor: Open/Short, Temperature sensor: Open/Short, EEV wiring: Open/Short, Freezer Temperature: Upper/Lower limit, Communication error, Liquid back
	Output	Voltage-free contact output (1a contact) × 1 AC 250V 2.0A (cosφ = 1.0), AC 250V 1.0A (cosφ = 0.4)
Inputs	Temperature Sensors	3 inputs Saginomiya-Seisakusho: AEK-23H or AEK-23K type temperature sensors Operating Temperature Range: -75 to +100°C
	Pressure Sensor	1 input Saginomiya-Seisakusho: NSK-AEA20 type pressure sensor Pressure Range: -0.1 to 2.0 MPa Operating Ambient Temperature: -40 to +100°C
	Startup Input	1 input (voltage-free contact input)
	Zero-Point Adjustment Input	1 input (voltage-free contact input)

1.2. Communication Specifications

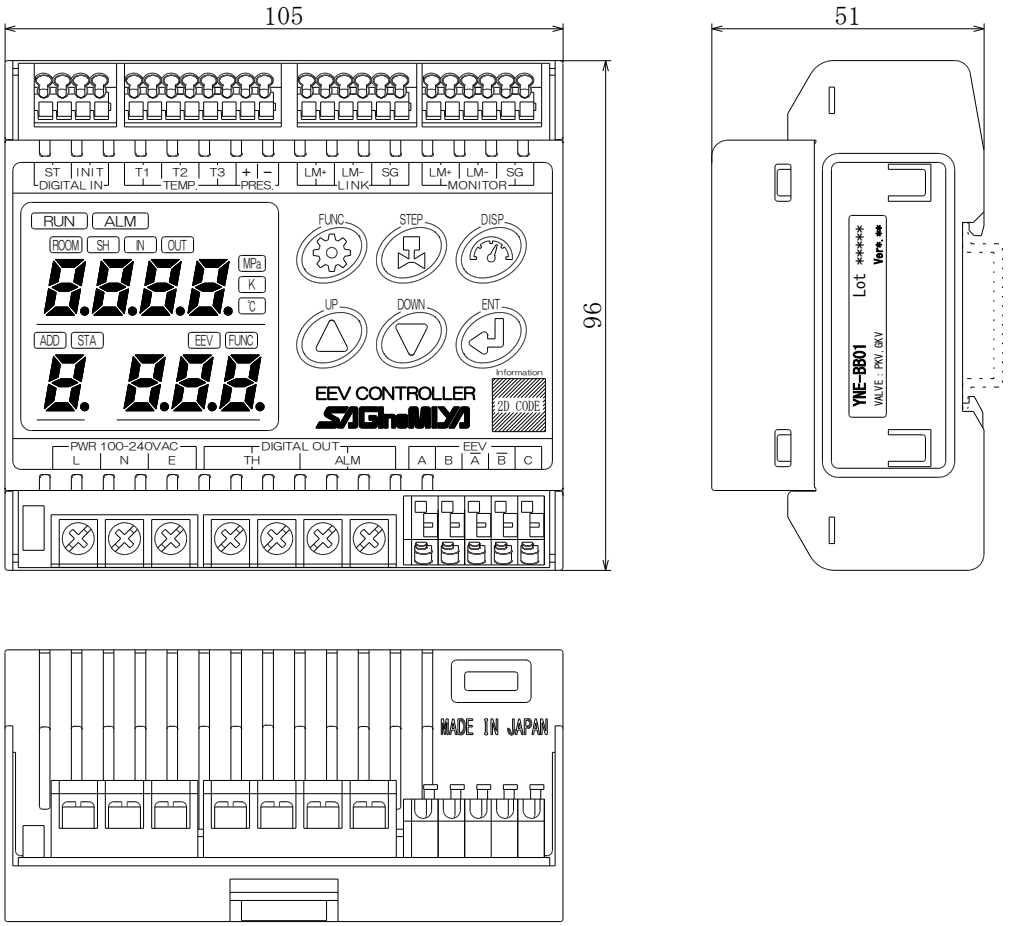
Item		Specification
Multi-Unit Communication	Interface	RS-485
	Protocol	YNE proprietary protocol
	Max connected units	4 (including the main unit)
Monitoring Communication	Interface	RS-485
	Protocol	Modbus RTU
Maintenance Communication	Interface	USB Type-C
	Protocol	USB2.0

2. Preparation

2.1. Package Contents

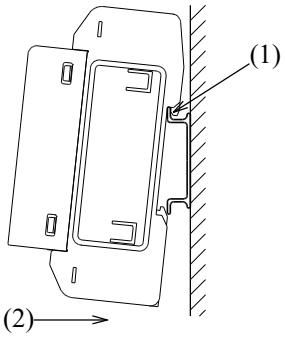
- EEV Controller
- Instruction Manual
- Easy Setup Sheet
- Termination Resistors × 2

2.2. External Dimensions



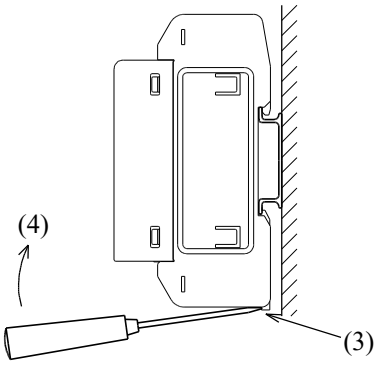
2.3. Installation Method

○ Mounting



Hook section (1) onto the DIN rail
and press the unit in direction of (2)

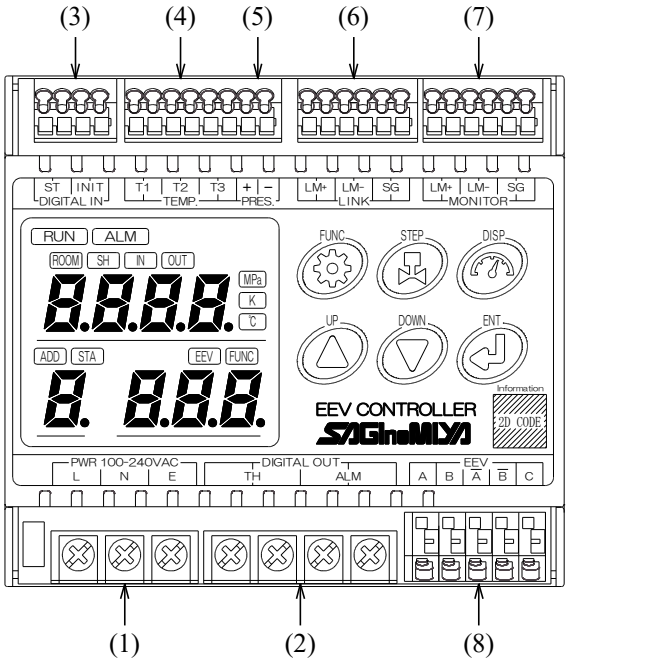
○ Removal

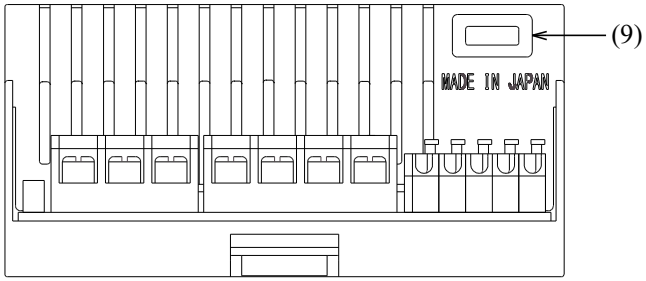


Insert a flathead screwdriver into section (3)
and lift in the direction of (4) to remove the unit.

2.4. Names of Components

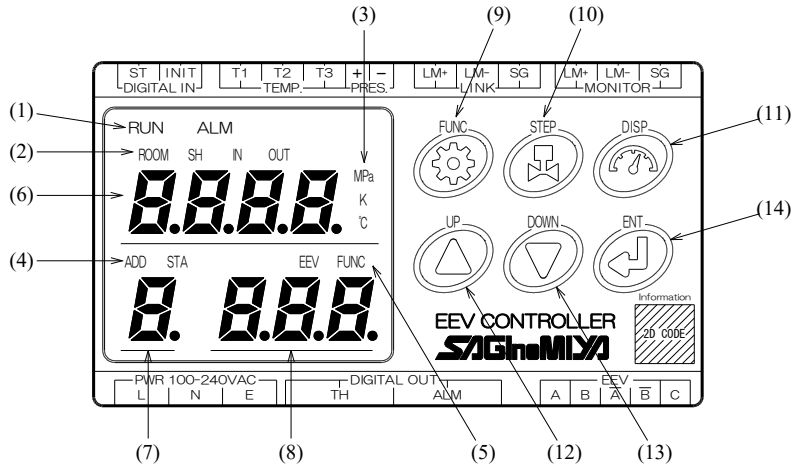
2.4.1. EEV Controller





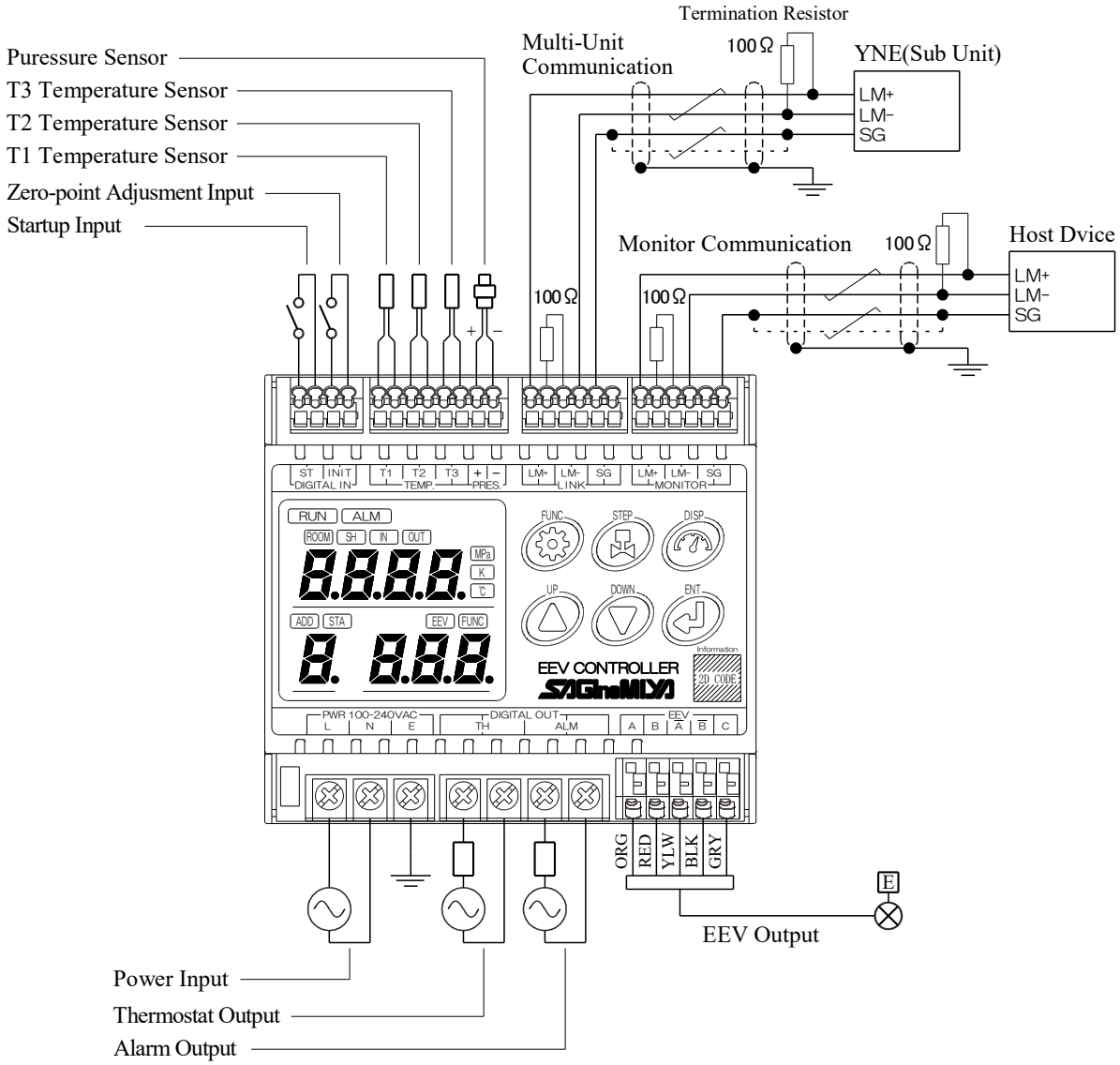
No.	Name	Wiring Label	Description
(1)	Power Input	PWR	L, N : Connect to 100-240VAC E : Connect to Ground
(2)	Contact Output	TH	Thermostat output terminal
		ALM	Alarm output terminal
(3)	Contact Input	ST	Startup input signal terminal
		INIT	Zero-Point Adjustment signal input terminal
(4)	Temperature Sensor Input	T1	Connect to inlet temperature sensor or freezer temperature sensor
		T2	Connect to outlet temperature sensor
		T3	Connect to superheat optimization sensor or freezer temperature sensor
(5)	Pressure Sensor Input	PRES	Connect to evaporator pressure sensor (Polarity sensitive)
(6)	Multi-Unit Communication Port	LINK	Connect communication lines for multi-unit communication with other YNE units
(7)	Monitoring Communication Port	MONITOR	Connect communication lines for RS-485 monitoring
(8)	Electronic Expansion Valve Output	EEV	Connect to electronic expansion valve
(9)	Maintenance Communication Port	-	Connect to PC via USB Type-C for software updates or monitoring

2.4.2. Display Panel



No.	Name	Indicator	Description
(1)	Operation Status Lamp	RUN	Lit: Startup input ON (EEV control active) Off: Startup input OFF (control stopped)
		ALM	Lit: Alarm active (alarm relay ON) Blinking: Alarm history present (alarm relay OFF) Off: No alarm
(2)	Temperature Display Lamp	ROOM	Lit when displaying freezer temperature
		SH	Lit when displaying superheat
		IN	Lit when displaying evaporator inlet temperature (evaporation temperature/pressure)
		OUT	Lit when displaying evaporator outlet temperature
(3)	Unit Display Lamp	MPa	Lit when displaying pressure
		K	Lit when displaying superheat or temperature difference
		℃	Lit when displaying temperature
(4)	Status Display Lamp	ADD	Lit when displaying multi-unit communication address
		STA	Lit when displaying system status
(5)	Item Display Lamp	EEV	Lit when displaying EEV opening level
		FUNC	Lit when displaying setting items
(6)	Upper 4-digit Display	-	Displays measured values (temperature, superheat, pressure) or setting values
(7)	Lower 1-digit Display	-	Displays multi-unit communication address or system status
(8)	Lower 3-digit Display	-	Displays EEV opening level or setting codes
(9)	FUNC key	-	Navigates to setting menu or save confirmation screen
(10)	STEP key	-	Manual operation of the electronic expansion valve
(11)	DISP key	-	Switches temperature display or returns to main display screen
(12)	UP key	-	Increases setting value or moves backward in setting items
(13)	DOWN key	-	Decreases setting value or moves forward in setting items
(14)	ENT key	-	Confirms setting value, clears errors, or resets alarm history

2.5. Basic Wiring



2.5.1. Wiring to Terminal Blocks

2.5.1.1. Screw-Type Terminal Blocks

Use crimp terminals compatible with M3.5 terminals for power input, thermostat output, and alarm output.
Also, set the tightening torque to 1.0 N·m.

[Recommended] Ring Terminal: RAA1.25-3.5 (or equivalent)

Note: When using bare crimp terminals, ensure proper insulation using tubing or other methods to prevent exposure of live parts.

2.5.1.2. Screwless Terminal Blocks

(1) EEV Output

Connection Method		Osada: OCN-050N
Wire Size	Solid	AWG28-14
	Stranded	AWG24-16
	Strip Length	9mm

(2)Startup Input, Zero-Point Adjustment Input, Sensor Inputs, Communication

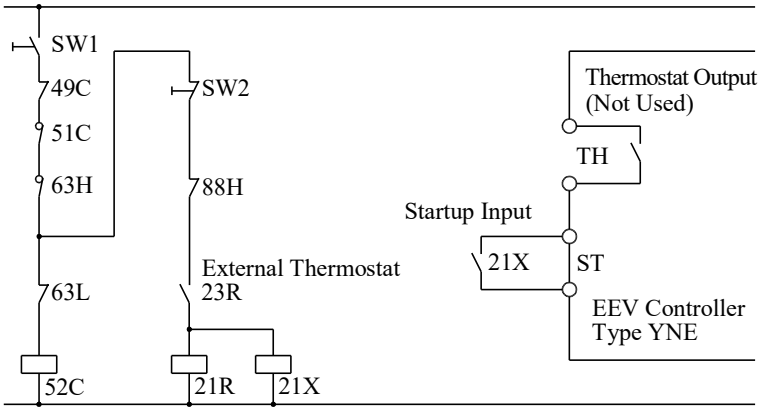
Connection Method		Phoenix: PTSA
Wire Size	Solid	AWG24-16
	Stranded	AWG24-16
	Strip Length	9mm

For stranded wires, press the button using a flathead screwdriver while inserting the wire.

2.5.2. Example Wiring for Startup Input and Thermostat Output

For the startup input, enter either the operation signal of the liquid supply solenoid valve or a signal linked to the start/stop of the refrigeration unit.
If electronic expansion valve control continues while refrigerant is not being supplied, the superheat cannot be measured correctly. This may cause the electronic expansion valve to open and close excessively, potentially resulting in abnormal system operation.

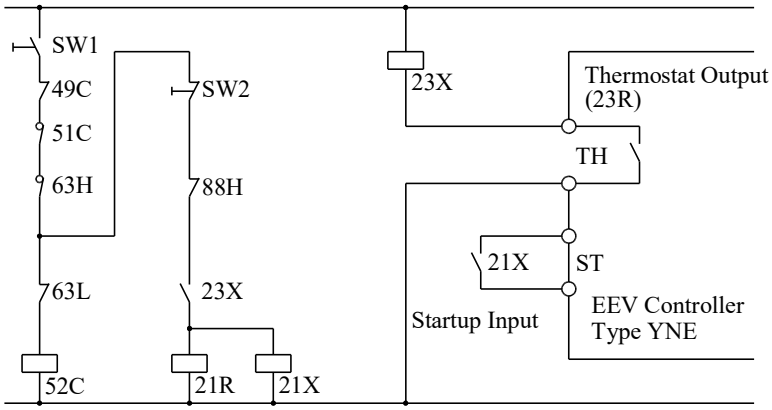
Example: Using External Thermostat



Symbols and Names

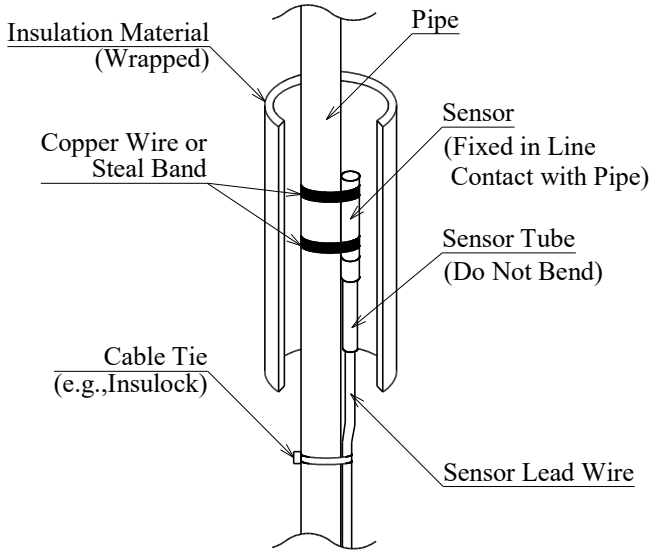
Symbol	Name
49C	Thermo Protect(Compressor)
51C	Overcurrent Relay(Compressor)
63H	High-Pressure Pressure Switch
63L	Low-Pressure Pressure Switch
52C	Electromagnetic Contactor (Compressor)
21R	Supply Solenoid Valve
21X	Auxiliary Relay (Supply Solenoid Valve)
23R	Temperature Controller (Thermostat)
23X	Auxiliary Relay (Temperature Controller)
SW1	Refrigeration Unit Operation Switch(Manual)
SW2	Pump Down Switch(Manual)
88H	Electromagnetic Contactor (Defrost Heater)

Example: Using YNE Internal Thermostat

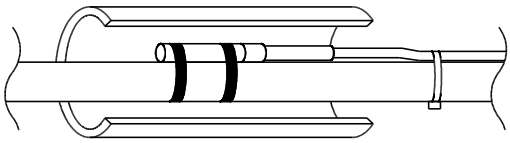


2.5.3. Temperature Sensor Installation

– To ensure good thermal conductivity, mount the sensor in line contact with the pipe. Clean any dirt or rust around the pipe and apply proper insulation and waterproofing.
– Do not bend the sensor tube.
– Secure the sensor lead wires using cable ties (e.g., Insulock).
Note: Do not pull the lead wires excessively during fixing, as this may cause damage.
– When installing on horizontal piping, whether to mount on the top or bottom depends on the measurement point.



Vertical Piping



Horizontal Piping (e.g., Evaporator)

2.5.3.1. Evaporator Inlet Temperature Sensor

– Install on piping between the distributor and evaporator inlet where liquid refrigerant is always present.
– For horizontal piping, mounting on the lower side (between 5 o'clock and 7 o'clock positions) is effective.

2.5.3.2. Evaporator Outlet Temperature Sensor

– Install near the evaporator outlet.
– For horizontal piping, mounting on the upper side (between 10 o'clock and 2 o'clock positions) is effective.

2.5.3.3. Superheat Optimization Sensor (Reference Temperature)

– Install at least 2 meters downstream from the evaporator outlet temperature sensor, toward the compressor.
It is used as the reference temperature for the automatic superheat optimization function.
If installed too close to the outlet sensor, the automatic target superheat control function may not operate effectively.
– For horizontal piping, mounting on the upper side (between 10 o'clock and 2 o'clock positions) is effective.

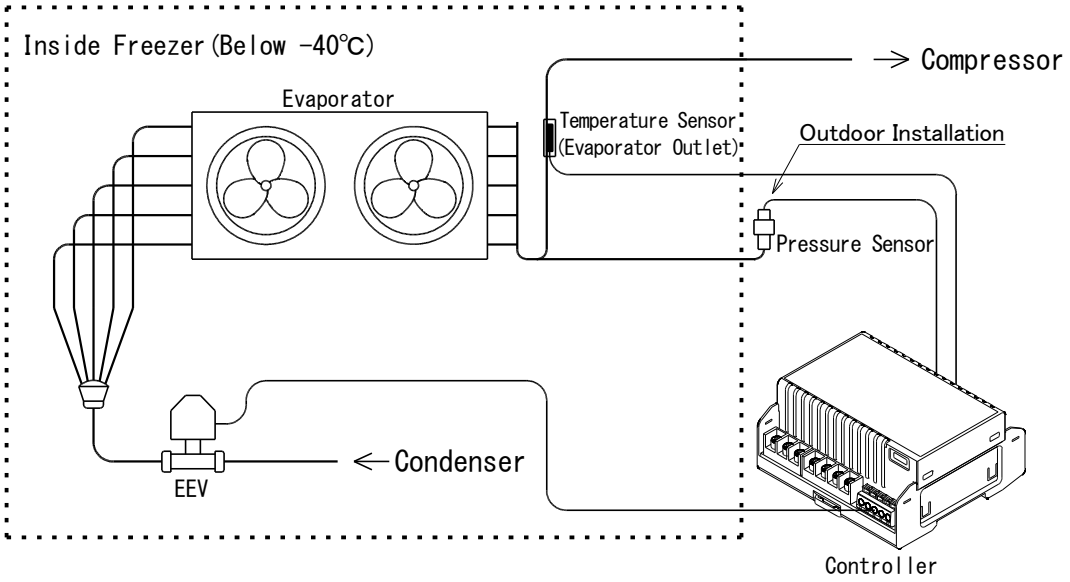
2.5.3.4. Freezer Temperature Sensor

– There are no restrictions on installation location. Install where representative freezer temperature can be reliably measured.
– Do not install in locations where the sensor may become buried in ice during long operation.

○ Advanced Usage
-6.6 To correct measured temperature and pressure values (e.g., when extending sensor cables) [P54]

2.5.4. Pressure Sensor Installation

– For specific installation procedures and conditions, refer to the instruction manual provided with the pressure sensor.
– Ensure that the pressure sensor body does not become subject to condensation, as this may lead to sensor failure.
– The pressure sensor must be used in a manner that prevents condensation on its body, as this may lead to malfunction.
– The pressure sensor should be installed at a location where the evaporating pressure can be accurately detected, taking into account the pressure loss within the evaporator. Installation near the evaporator outlet is recommended; however, the relative positioning with the evaporator outlet temperature sensor is not restricted.
– Do not install the pressure sensor in locations where the ambient temperature falls below the product's specified lower limit (-40°C).
If installation in such environments is unavoidable, extend the connection using a capillary tube or similar method and place the pressure sensor body outside the freezer.
When extending the connection, ensure that the piping design prevents any pressure loss.
When extending the piping, design it carefully to prevent any pressure loss.



3. Feature Overview

For details on each function, refer to the sections on basic usage and advanced usage.

●Electronic Expansion Valve Control

The degree of superheat is detected based on the evaporator outlet temperature and the evaporation temperature (either the temperature converted from evaporation pressure or the evaporator inlet temperature), and the electronic expansion valve is controlled using PI control to maintain the preset superheat level.

●Automatic Target Superheat Control

This is a powerful feature that enables the controller to automatically adjust the target superheat level according to the operating conditions of the evaporator, allowing the evaporator to be used efficiently without the user needing to be aware of the superheat setting.

●Thermostat Function

The freezer temperature is measured, and the thermostat output can be turned ON/OFF once the set temperature is reached. In addition to this, energy-saving operation is possible through the setback mode, which shifts the set temperature after pull-down operation, and the step-down mode, which gradually lowers the temperature over time to suppress sudden temperature changes.

●Alarm Monitoring Function

This function monitors alarms such as sensor open circuit / short circuit errors, electronic expansion valve open circuit short circuit errors, liquid back abnormalities, and freezer temperature abnormalities.
When an alarm is detected, the alarm relay is activated.

●Zero-Point Adjustment Function

The electronic expansion valve can be reset to its zero position at any desired timing.

●Software Update Function

Firmware updates, including refrigerant information, can be performed.

●Monitor Communication Function

Using the Modbus RTU protocol, it is possible to write various settings and read operating status.

●Multi-Unit Communication Function

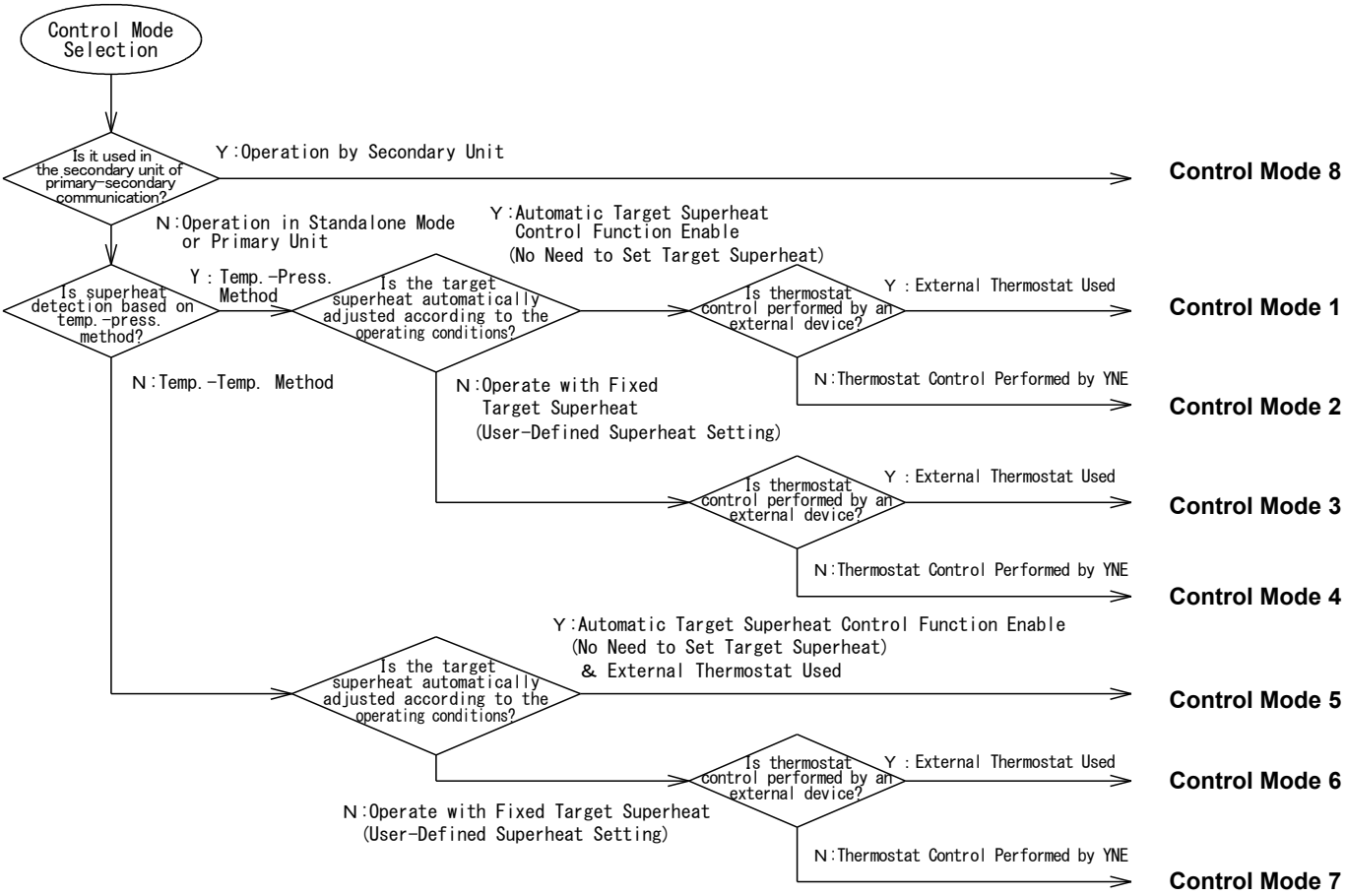
When multiple evaporators are connected to a single refrigeration unit, up to four YNE units can be linked via communication, allowing synchronization of the startup input signal between main and sub units. Additionally, when using a pressure sensor, the pressure measurement value from the main unit can be shared with the sub units.
It is also possible to operate in driver mode, where sensors are not connected to the sub units and the valve opening of the electronic expansion valve is synchronized with the main unit.
These features help reduce the number of sensors and wiring required in the system.

4. Basic Usage

4.1. Initial Setup (“F01”Setting)

The system configuration varies depending on the functions used. Select the appropriate control mode from the flowchart below.
In the case of the Temperature–Temperature method, the Automatic Target Superheat Control and the Thermostat Function cannot be used simultaneously.

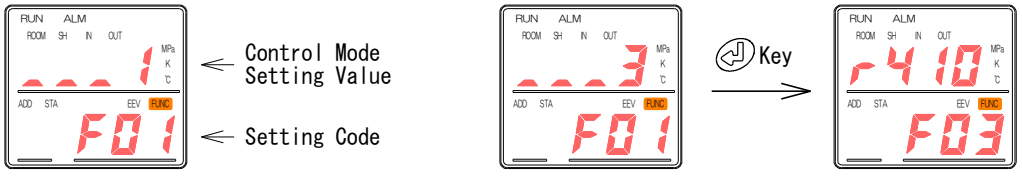
4.1.1. Control Mode Selection Flow



4.1.2. Control Mode Setup Procedure

When the power is turned on for the first time after purchase, initialization will be performed, and the following screen will appear.
Use the △ and ▽ keys to change the control mode, and press the ↵ key to confirm selection.

e.g. Control Mode 3



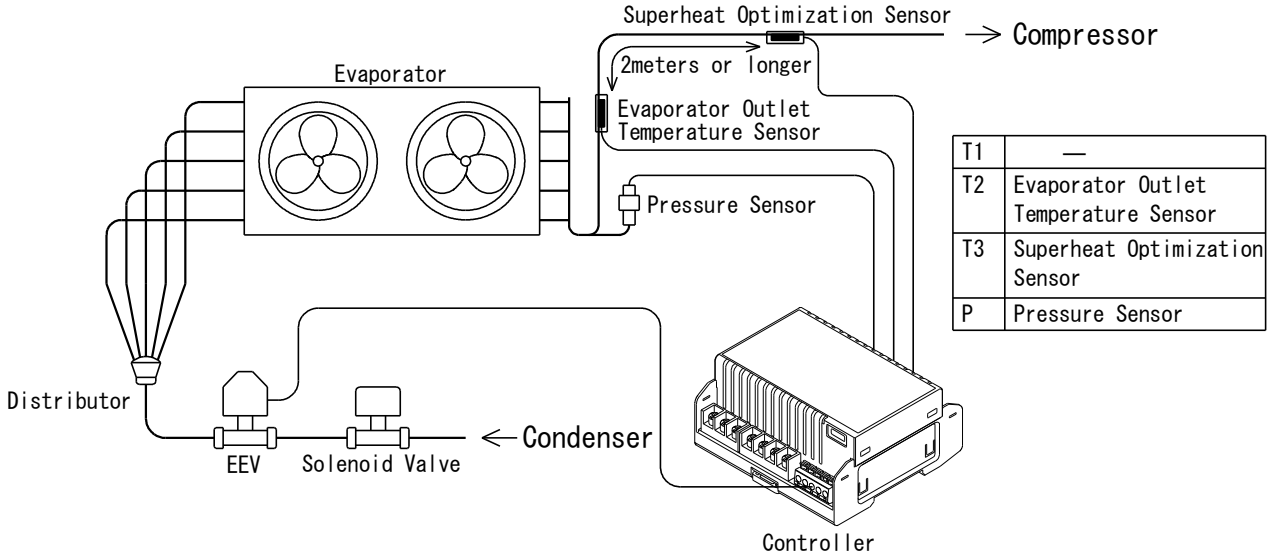
Control Mode Setting Screen (Refrigerant Selection Screen)

The subsequent setting screens will vary depending on the selected control mode, so refer to the items on the following pages.
Note: During initial setup, only the required settings for each control mode will be displayed.

When changing the control mode setting → Changing the System Configuration (“F01” Setting) [P55]

4.2. Control Mode 1

4.2.1. System Configuration Diagram (Temperature-Pressure Method / Superheat Auto / External Thermostat)

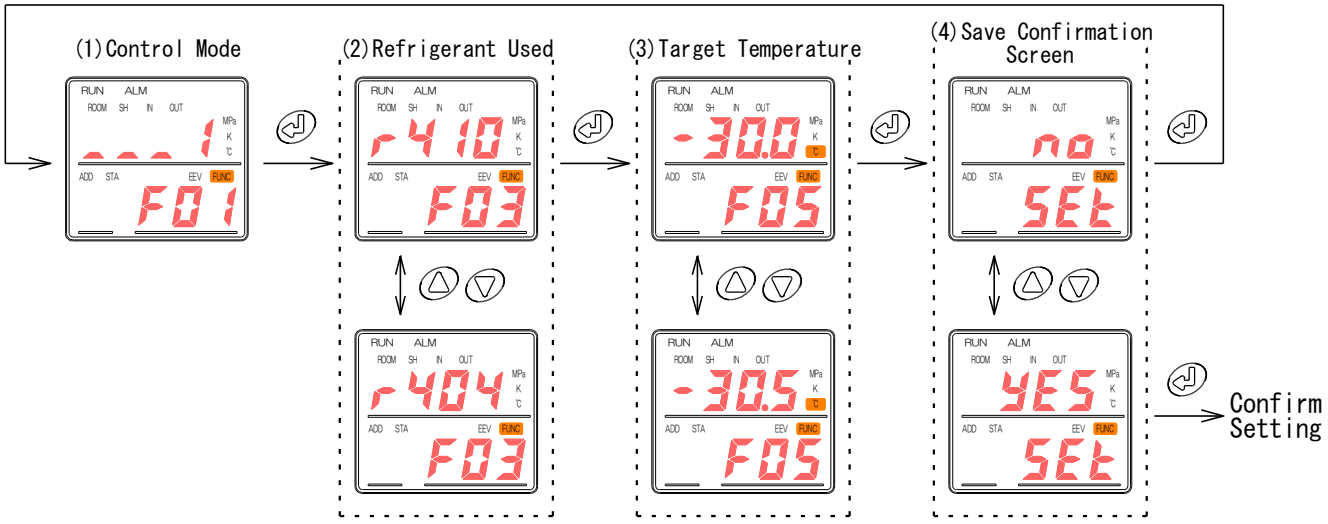


T1	—
T2	Evaporator Outlet Temperature Sensor
T3	Superheat Optimization Sensor
P	Pressure Sensor

4.2.2. Basic Setting Screen

Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.

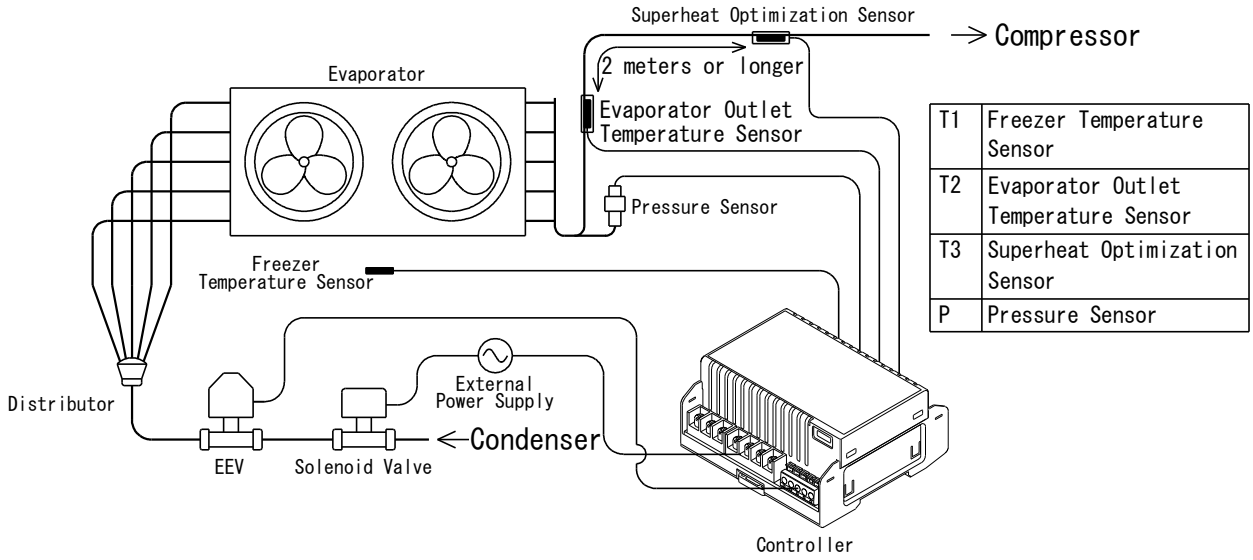
On the (4)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F03	Refrigerant Used	R410A, R404A, R134a, R22, R23, R448A, R449A, R463A(R463A-J), R32	Select the refrigerant used in the system.
F05	Target Temperature	-70.0°C to 10.0°C / in 0.5°C steps	**Set the system’s cooling target temperature.**

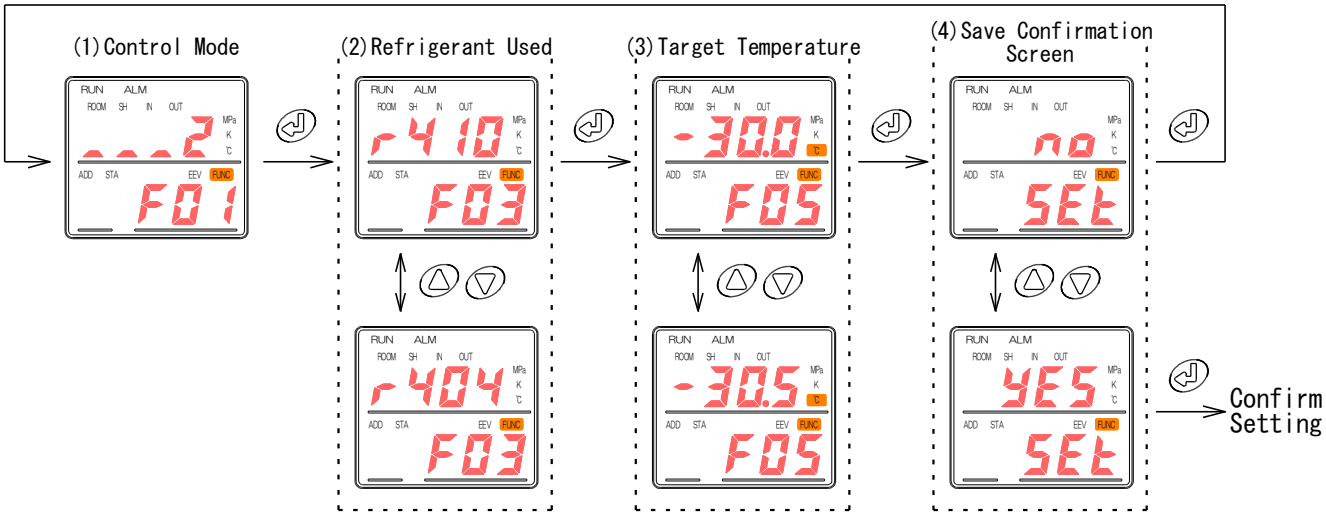
4.3. Control Mode 2

4.3.1. System Configuration Diagram (Temperature-Pressure Method / Superheat Auto / Internal Thermostat)



4.3.2. Basic Setting Screen

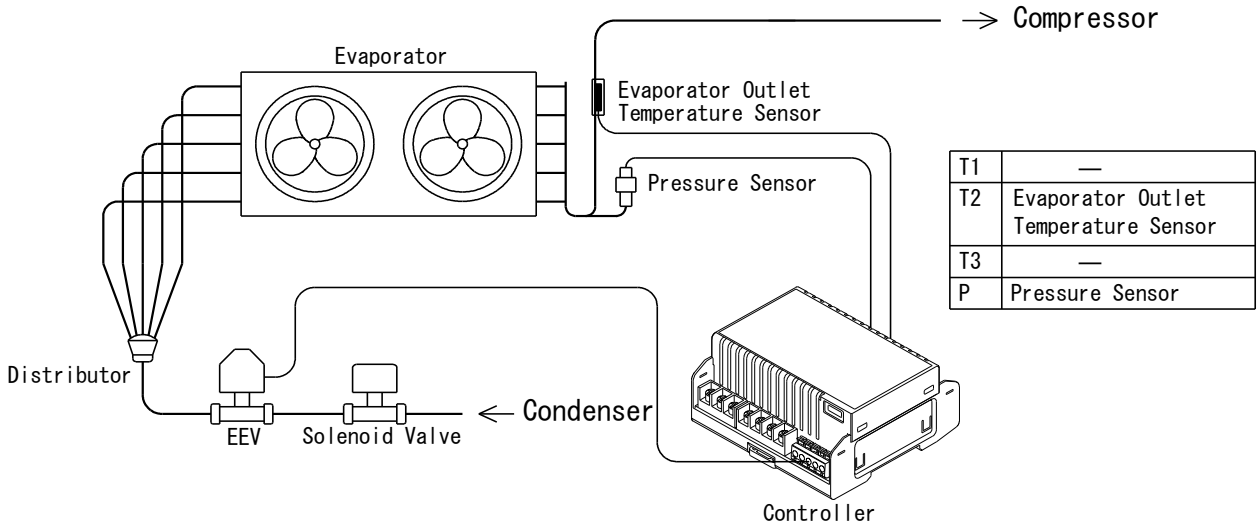
Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.
On the (4)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F03	Refrigerant Used	R410A, R404A, R134a, R22, R23, R448A, R449A, R463A(R463A-J), R32	Select the refrigerant used in the system.
F05	Target Temperature	-70.0℃ to 10.0℃ / in 0.5℃ steps	**Set the target freezer temperature.**

4.4. Control Mode 3

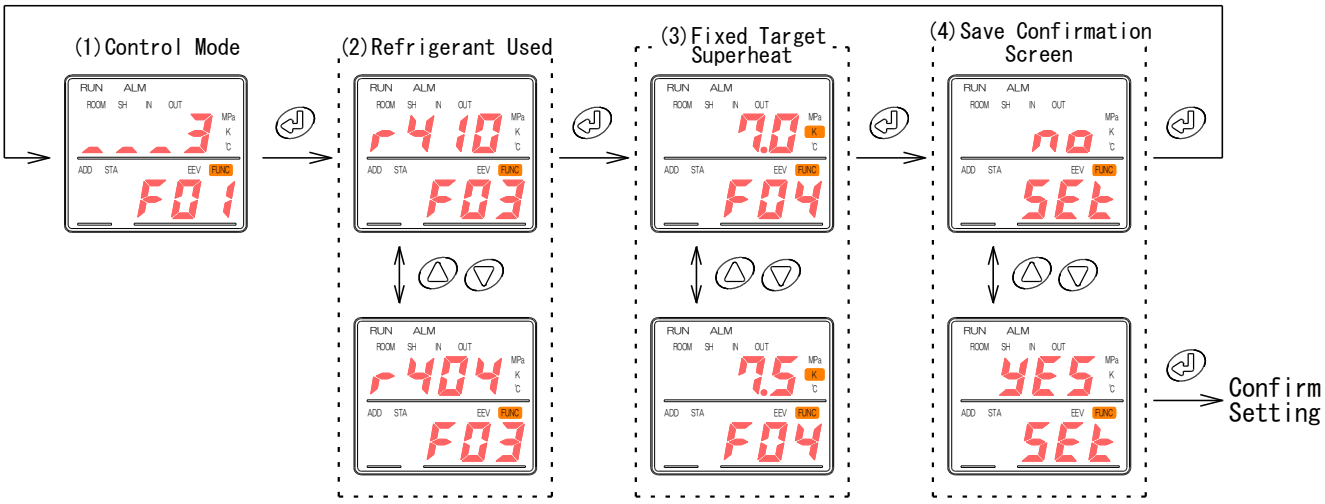
4.4.1. System Configuration Diagram (Temperature-Pressure Method / Fixed Superheat / External Thermostat)



T1	—
T2	Evaporator Outlet Temperature Sensor
T3	—
P	Pressure Sensor

4.4.2. Basic Setting Screen

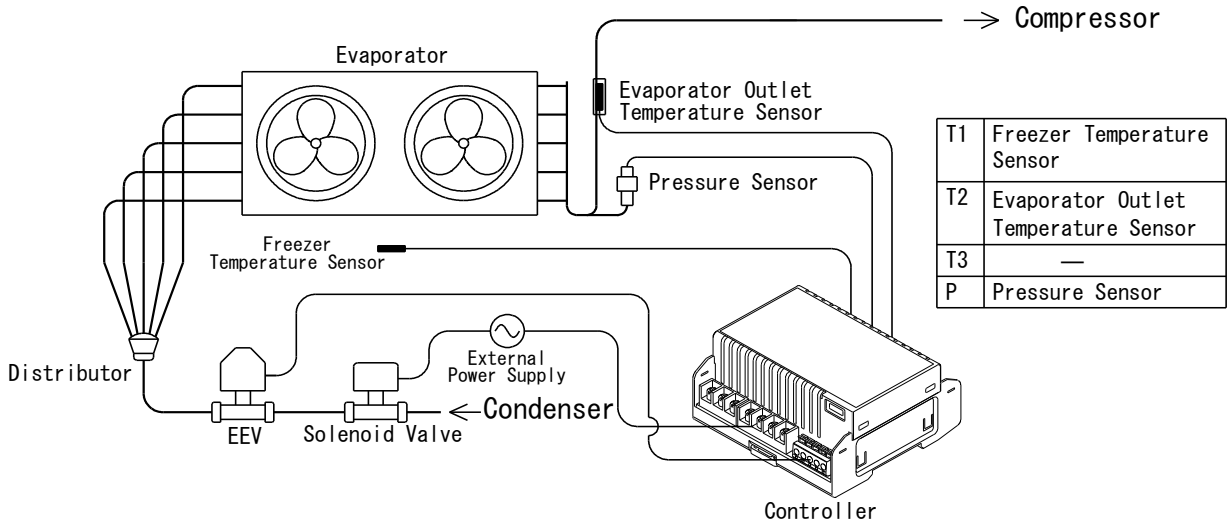
Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.
On the (4)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F03	Refrigerant Used	R410A, R404A, R134a, R22, R23, R448A, R449A, R463A(R463A-J), R32	Select the refrigerant used in the system.
F04	Fixed Target Superheat	1.0K to 30.0K / in 0.5K steps	Set the fixed target superheat value for the expansion valve.

4.5. Control Mode 4

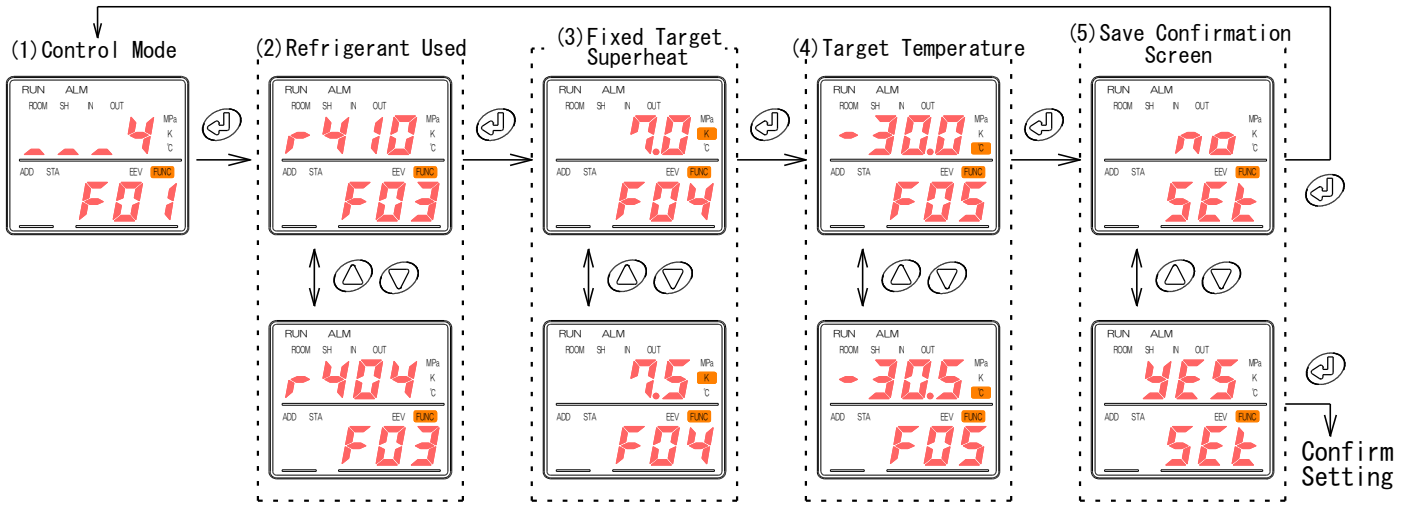
4.5.1. System Configuration Diagram (Temperature-Pressure Method / Fixed Superheat / Internal Thermostat)



4.5.2. Basic Setting Screen

Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.

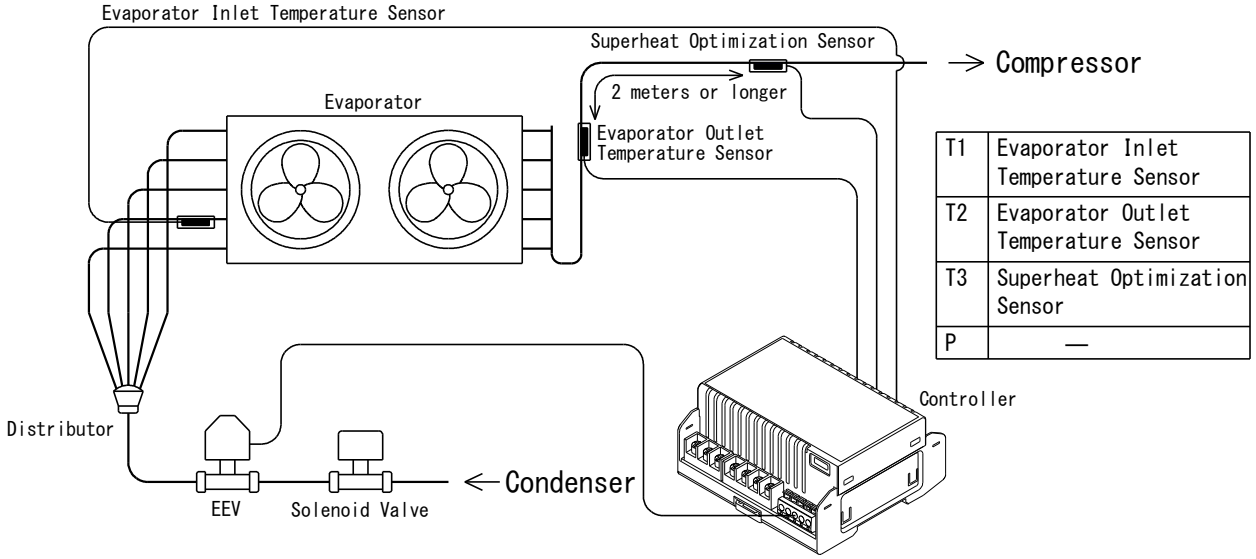
On the (5)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F03	Refrigerant Used	R410, R404, R134a, R22, R23, R448, R449, R463A(R463A-J), R32	Select the refrigerant used in the system.
F04	Fixed Target Superheat	1.0K to 30.0K / in 0.5K steps	Set the fixed target superheat value for the expansion valve.
F05	Target Temperature	-70.0℃ to 10.0℃ / in 0.5℃ steps	**Set the target freezer temperature.**

4.6. Control Mode 5

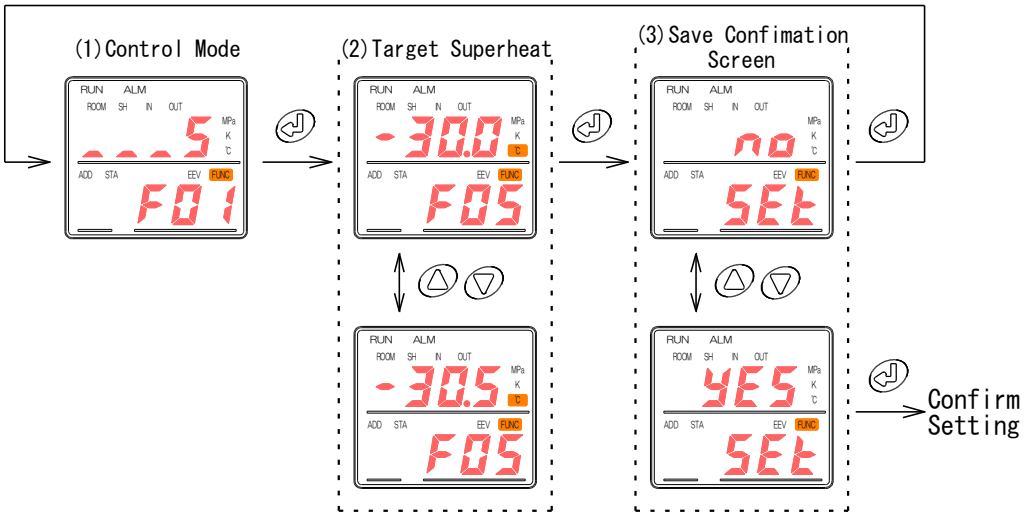
4.6.1. System Configuration Diagram (Temperature-Temperature Method / Superheat Auto / External Thermostat)



4.6.2. Basic Setting Screen

Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.

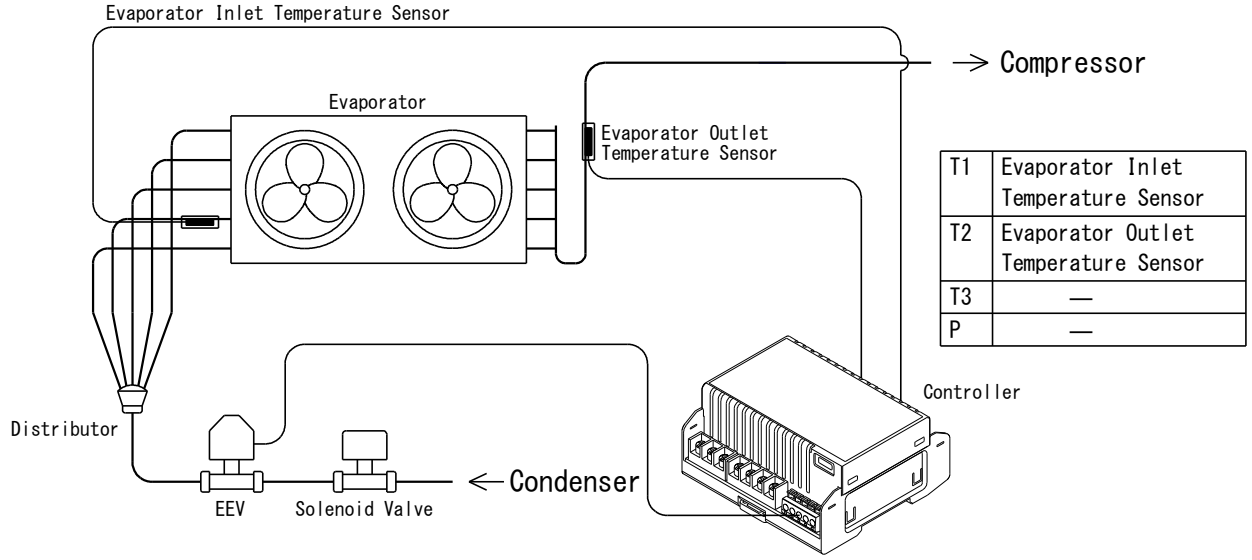
On the (3)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F05	Target Temperature	-70.0℃ to 10.0℃ / in 0.5℃ steps	**Set the system’s cooling target temperature.**

4.7. Control Mode 6

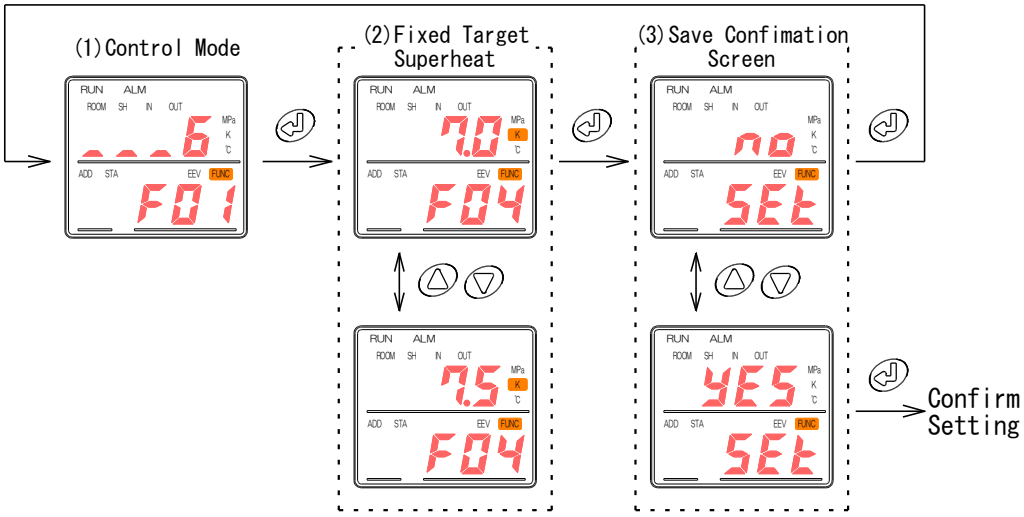
4.7.1. System Configuration Diagram (Temperature-Temperature Method / Fixed Superheat / External Thermostat)



T1	Evaporator Inlet Temperature Sensor
T2	Evaporator Outlet Temperature Sensor
T3	—
P	—

4.7.2. Basic Setting Screen

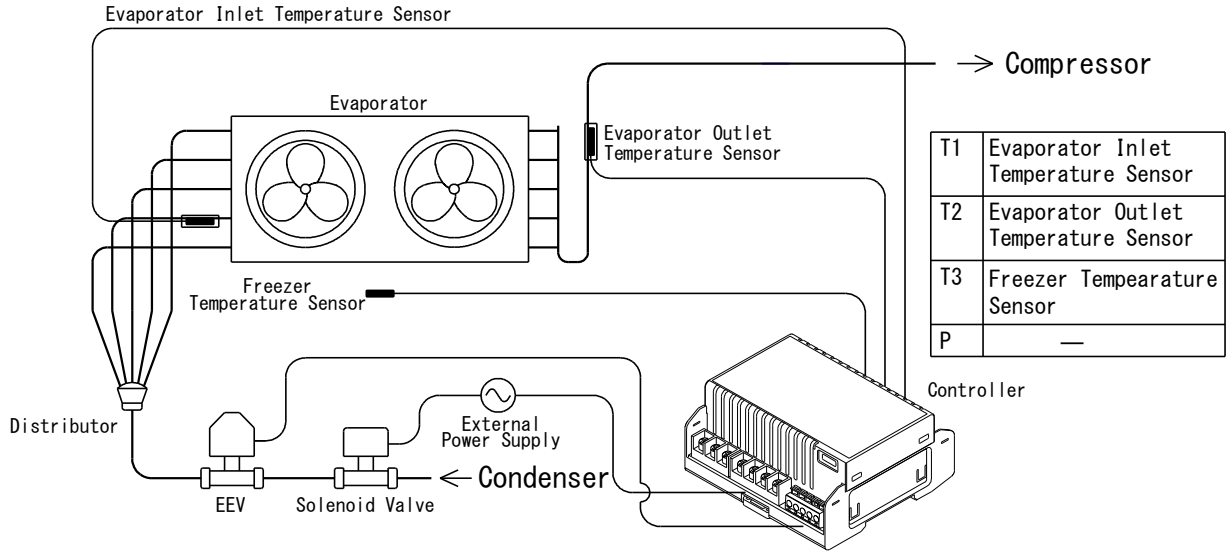
Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.
On the (3)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F04	Fixed Target Superheat	1.0K to 30.0K / in 0.5K steps	Set the fixed target superheat value for the expansion valve.

4.8. Control Mode 7

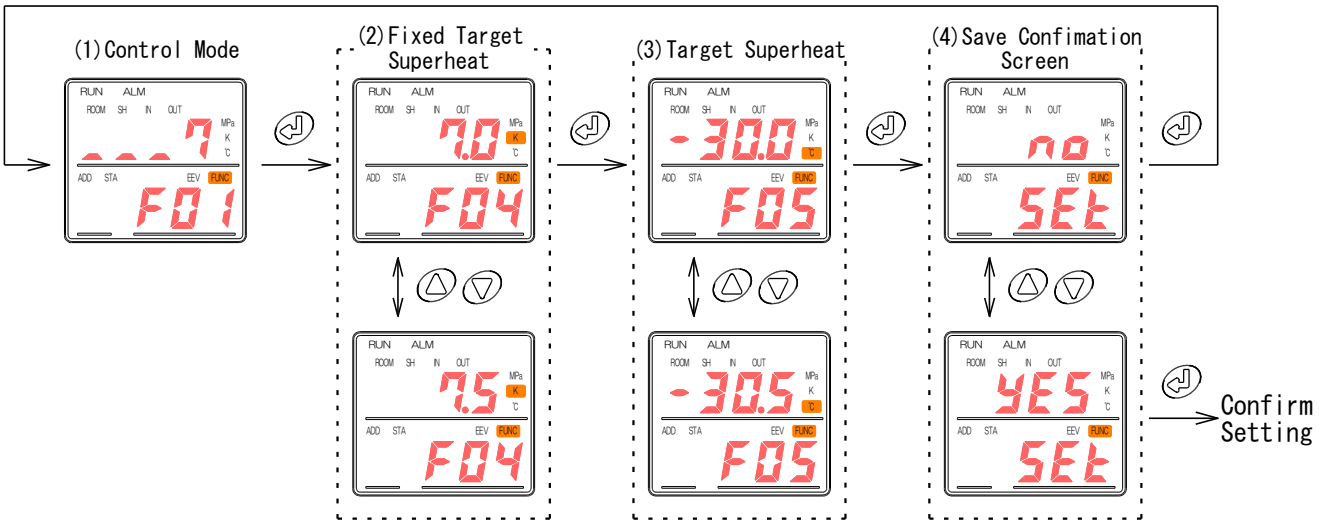
4.8.1. System Configuration Diagram (Temperature-Temperature Method / Fixed Superheat / Internal Thermostat)



T1	Evaporator Inlet Temperature Sensor
T2	Evaporator Outlet Temperature Sensor
T3	Freezer Tempearature Sensor
P	—

4.8.2. Basic Setting Screen

Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.
On the (4)Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.

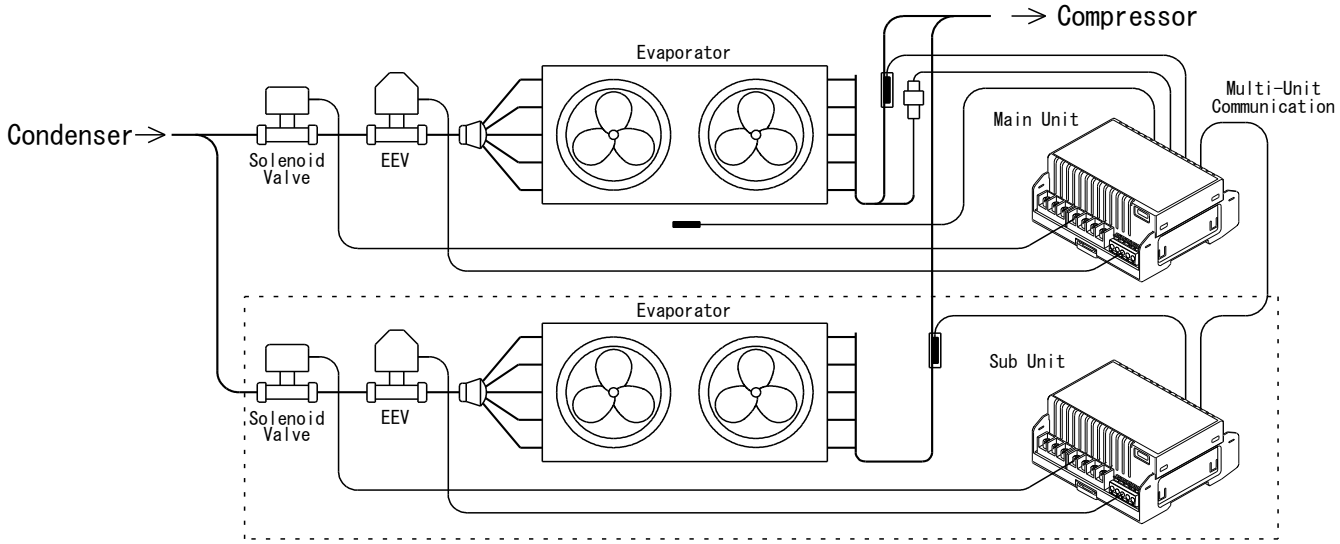


Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F04	Fixed Target Superheat	1.0K to 30.0K / in 0.5K steps	Set the fixed target superheat value for the expansion valve.
F05	Target Temperature	-70.0°C to 10.0°C / in 0.5°C steps	**Set the target freezer temperature.**

4.9. Control Mode 8

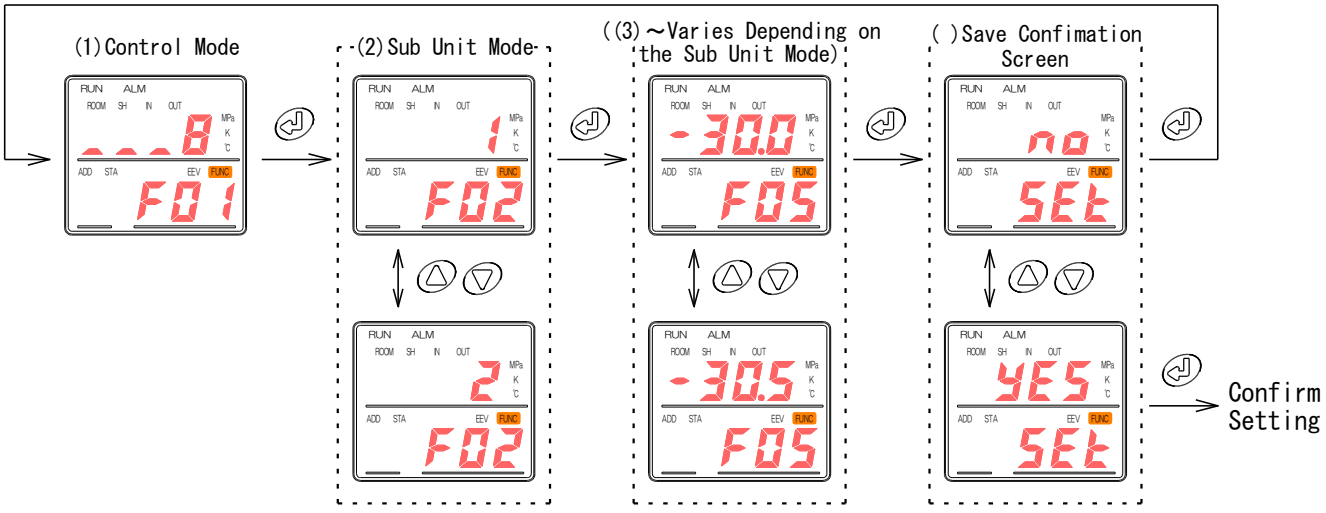
4.9.1. System Configuration Diagram (Sub Unit Mode)

Set this option when using the unit as a sub device in a multi-unit communication setup.
For details, refer to the Multi-Unit Communication Manual (S-NE-71003).



4.9.2. Basic Setting Screen

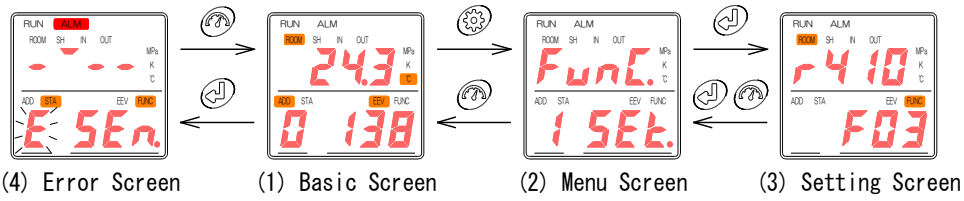
Common to All Setting Screens : Use the △ and ▽ keys to change the setting values, and press the ↵ key to proceed to the next screen.
On the ( )Save Confirmation Screen, selecting “YES” will confirm the selected values and start control operation.



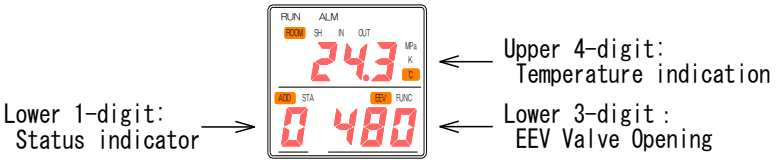
Code	Setting Item Name	Setting Range	Description
F01	Control Mode	1 to 8 / in 1 step	Select according to the functions to be use.
F02	Sub Unit Mode	1 to 7 / in 1step	Set According to System Configuration If the main unit is set to Control Mode 5, 6, or 7, and the sub unit is set to Sub Mode 1 or 3, an error will occur.
…	…	…	The subsequent setting items will vary depending on the selected sub mode.

4.10. Operation Method

After the initial setup is completed, the display switches to the Basic Screen, and electronic expansion valve control begins.
There are four types of display screens: **(1) Basic Screen, (2) Menu Screen, (3) Setting Screen, (4) Error Screen**



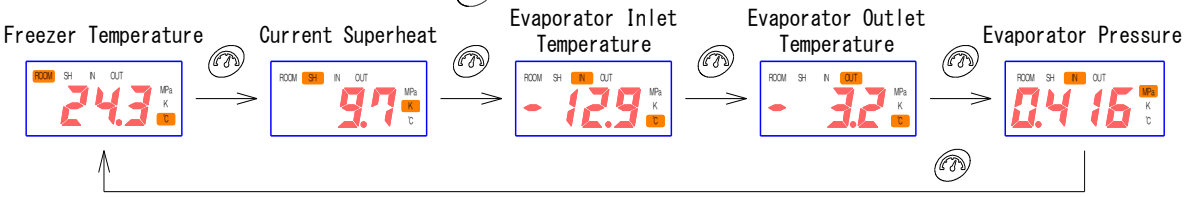
4.10.1. Basic Screen (1)



○ Upper 4-digit Display

–While the basic screen is displayed, the system shows the **temperature indication** of connected sensors, such as temperature or pressure.

–Depending on the control mode, even sensors that are not actively used will display their measured temperature if they are connected to the terminal block. Each time the key is pressed, the displayed sensor will switch.



○ Lower Leftmost 1-digit Display

-Under normal conditions, the ADD lamp lights up and display the **Multi-Unit Communication Address**.
Depending on the operating status, the display switches as shown in the table below:

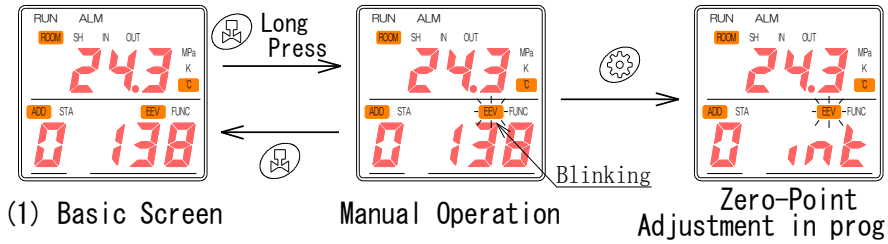
Priority	Lamp	Display	Meaning
High	"STA"	E Blinking	Error occurring (sensor error, EEV error, communication error with main unit)
↑	"STA"	b Blinking	Liquid back error occurring (ALM lamp also lit)
|	"STA"	d Lit	Multi-unit communication error occurring
|	"STA"	U Lit	Upper temperature limit error occurring
|	"STA"	L Lit	Lower temperature limit error occurring
|	"STA"	b Blinking	Liquid back condition (liquid back is being detected and the valve opening has reached the lower limit)
|	"STA"	b Lit	Liquid back detected (current superheat < liquid back detection threshold)
|	"STA"	- Lit	Valve opening has reached the upper limit (during normal operation)
↓	"STA"	_ Lit	Valve opening has reached the lower limit (during normal operation)
Low	"ADD"	0 to 4	Current multi-unit communication address setting (during normal operation)

○ Lower Rightmost 3-digits Display

-Displays the valve opening and operating status of the electronic expansion valve.

Display	Meaning
0 to 480	Displaying current valve opening (Unit:pulse)。 When the dot "." in the first digit is lit, power supply to the coil is temporarily limited to suppress coil temperature.
StP.	Operating at "Startup Valve Opening" after detecting startup input ON
StA.	Operating at "Startup Operation Time" after detecting startup input OFF
FAU.	Operating at "Error Opening" after detecting sensor error or multi-unit communication error
Int.	Performing zero-point adjustment
Con.	Checking connection status of the electronic expansion valve

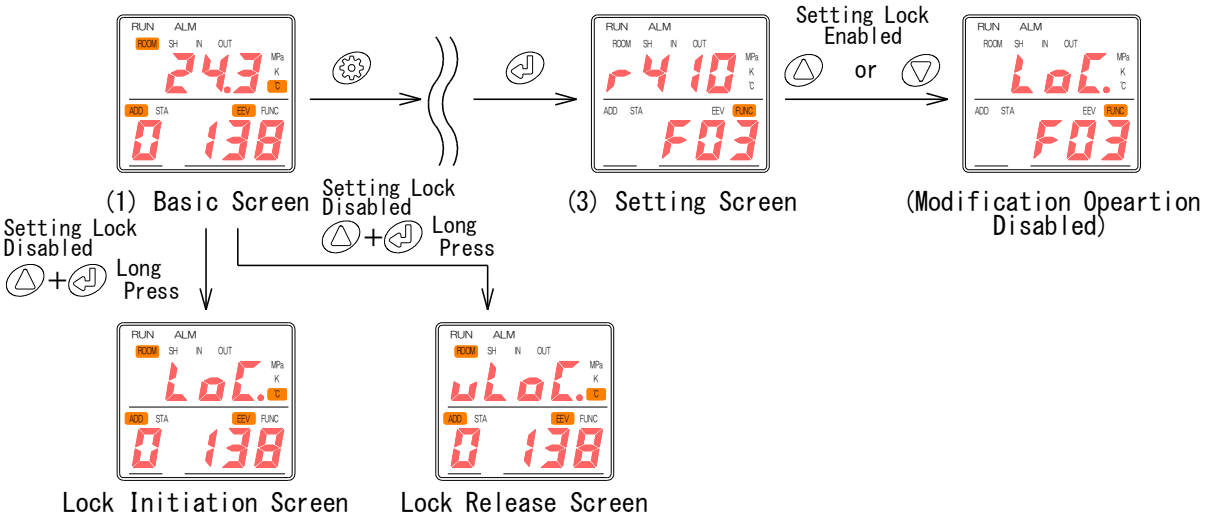
4.10.1.1. Manual Operation Mode



- While (1) Basic Screen is displayed, pressing and holding the key activates manual operation mode, indicated by the blinking [EEV] lamp.
- In manual operation mode, the valve opening of the electronic expansion valve can be adjusted in single-pulse increments using the and keys.
  Pressing the key initiates zero-point adjustment.
- Even during manual operation mode, pressing the key switches the temperature display.
- Pressing the key returns the [EEV] lamp to its lit state and exits manual operation mode.

*While in manual operation mode, liquid back recovery operation is not performed. Pay close attention to the system's refrigerant circulation volume. Excessive or insufficient refrigerant may cause system malfunction or shutdown. Use with caution.

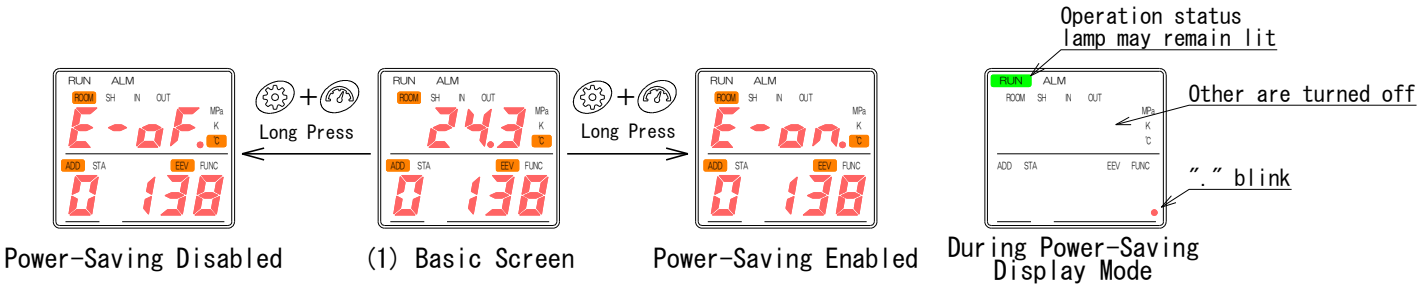
4.10.1.2. Setting Lock (Tamper Prevention)



- While (1) Basic Screen is displayed, pressing and holding the key and key simultaneously activates the setting lock.
- While the setting lock is active, changes to settings on the (3) setting screen are disabled. (This does not disable key operations themselves.)
  Additionally, if no key operation is performed for 3 seconds on the setting screen, the system automatically returns to the (2) Menu Screen.
- To deactivate the setting lock, press and hold the key and key simultaneously on the basic screen. The lock cannot be released while an error is occurring.
- The setting lock can only be activated or deactivated when no error is present. It can be operated during non-critical errors that do not stop control.

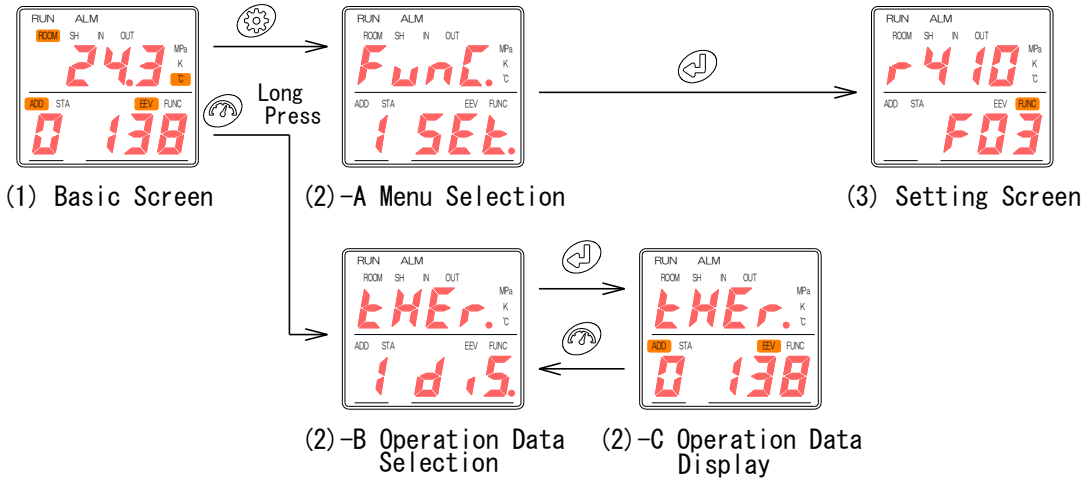
4.10.1.3. Display Power-Saving Mode

- While (1) Basic Screen is displayed, pressing and holding both the key and key toggles the display power-saving mode ON/OFF. (Default: OFF)
- When power-saving mode is enabled, if no key operation is performed for 1 minute, the display dims. If inactivity continues for 10 minutes, the display turns off. During display-off mode, the dot (".") in the lower display blink, and only the operation status lamps remain active. If an alarm is detected, the power-saving display mode is automatically canceled.
- Any key operation cancels the power-saving display mode and resets the inactivity timer.
- Standby power consumption can be reduced by enabling the display power-saving mode, such as disabling 7-segment display in the customer's system.



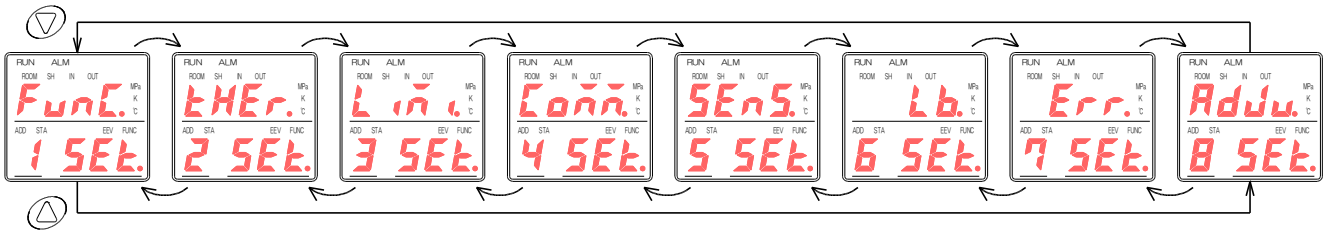
4.10.2. Menu Screen (2)

Common Operations:
Use the △ and ▽ keys to select a menu item, and press the ↵ key to proceed to the next level. Press the ⟲ key to return to the previous level.
Depending on the control mode, menus and operation data that are not used will not appear on the selection screen.



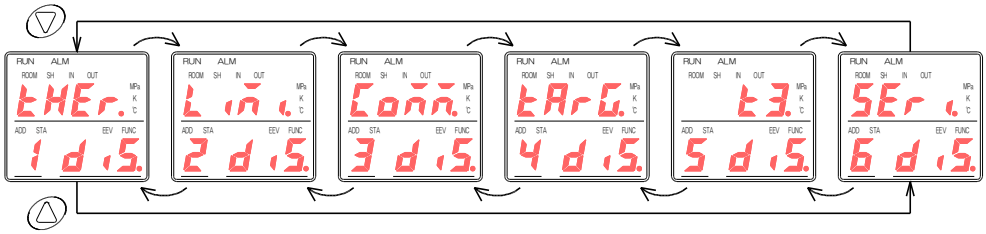
4.10.2.1. Menu Selection(2)-A)

Refer to the appendix for a list of setting menus and configuration values. → Settings List [P60]



Lower 1-digit display	Upper 4-digit display	Description	(3)Setting Screen	Remarks
1	“FunC.”	Basic settings for the EEV	“F**”	
2	“tHEr.”	Thermostat control settings	“t**”	Displayed only in control mode:2,4,7
3	“Limi.”	Upper/lower valve opening limit control settings	“L**”	
4	“Comm.”	Communication settings	“C**”	
5	“SEnS.”	Sensor measurement correction settings	“S**”	
6	“Lb.”	Liquid back prevention operation settings	“b**”	
7	“Err.”	Alarm response settings	“E**”	
8	“AdJu.”	Automatic Target Superheat Control settings	“A**”	Displayed only in control mode:1,2,5

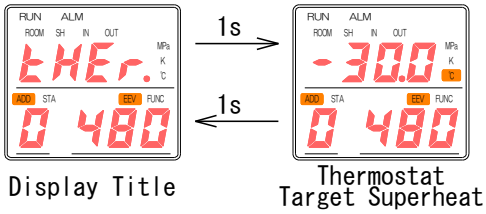
4.10.2.2. Operation Data Selection (2)-B



Lower 1-digit display	Upper 4-digit display	Description	Remarks
1	“tHEr.”	Display the currently applied target freezer temperature	Displayed only in control mode:2,4,7
2	“Limi.”	Display the valve opening limit values set by the upper / lower limit control function	
3	“Comm.”	Display the status of multi-unit communication	
4	“tArG.”	Display the currently applied target superheat	
5	“t3.”	Displays the detected temperature of the superheat optimization sensor	Displayed only in control mode:1,2,5
6	“Seri.”	Display the product’s serial number	

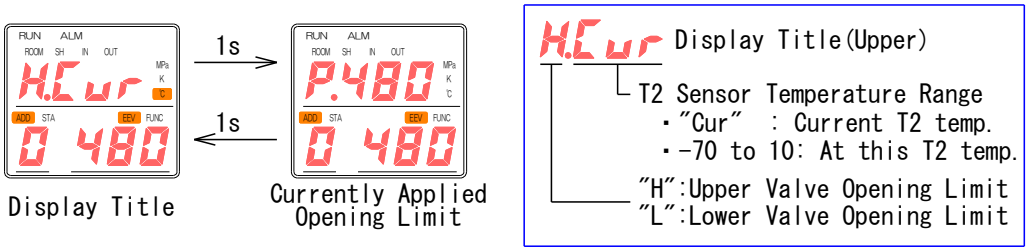
4.10.2.3. Operation Data Display (2)-C

(I) Current Target Freezer Temperature Display (”tHEr.”)



- The upper display shows the target temperature for thermostat control.
- During setback operation or step-down operation, the currently applied target temperature is displayed.

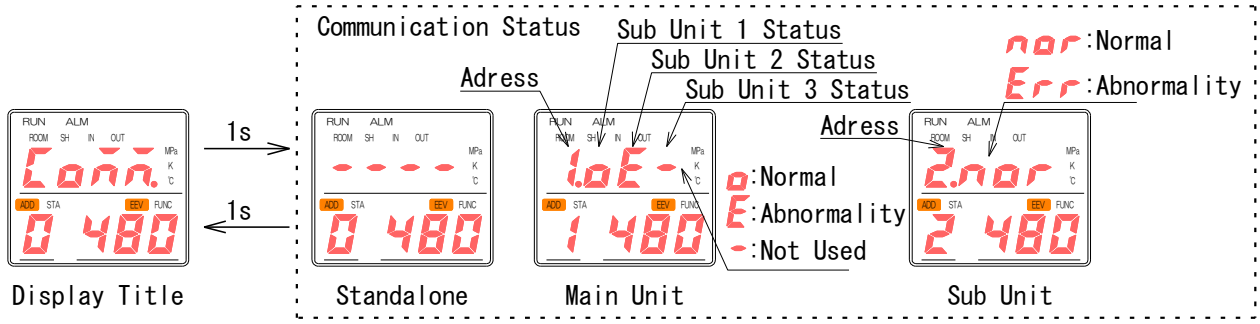
(II) Valve Opening Limit Value Display (“Limi.”)



- Displays the upper and lower valve opening limits applied by the Upper/Lower Limit Control Function for the electronic expansion valve.
- The display alternates between “T2 sensor temperature range + upper/lower limit”, and “Upper/lower valve opening at that temperature”
- Use the △ and ▽ keys to switch between limit values. “Cur” indicates the currently applied value based on the current T2 sensor temperature.
- If superheat control is not active, the “Cur” value will be 0.

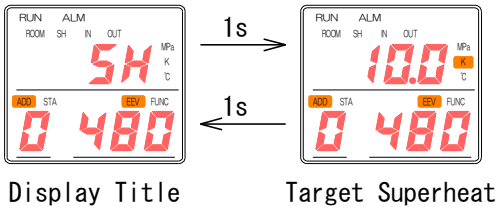
Display Example	Interpretation
H.Cur ⇔ P.480	Upper limit of the currently applied valve opening range is 480 pulses.
L.Cur ⇔ P.160	Lower limit of the currently applied valve opening range is 160 pulses.
H. 0 ⇔ P.480	When the outlet temperature is 0°C, the upper limit of the valve opening range is 480 pulses.
L.-45 ⇔ P.100	When the outlet temperature is -45°C, the upper limit of the valve opening range is 100 pulses.

(III) Multi-Unit Communication Status Display (”Comm.”)



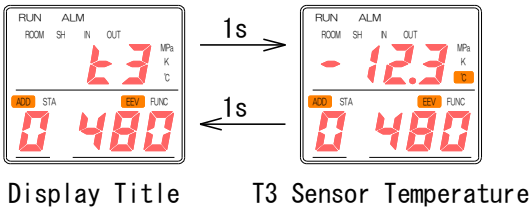
-The upper display shows the current communication status. The displayed content varies depending on the operation mode, standalone operation, main unit operation, or sub unit operation.

(IV) Current Target Superheat Display (”tArG.”)



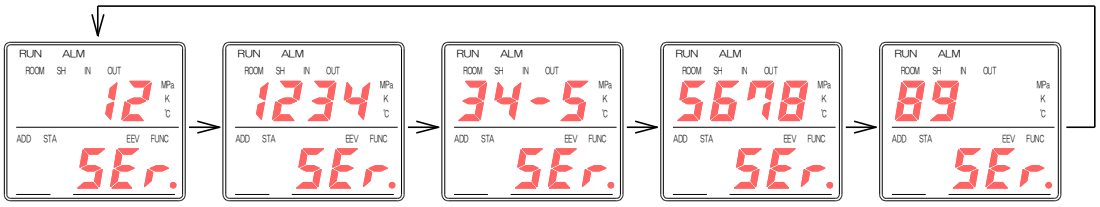
-The upper display shows the currently applied target superheat. If superheat control is not active, “----” will be displayed.

(V) Superheat Optimization Sensor Display (“t3.”)



-The upper display shows the temperature value from the T3 sensor.
-It is used as the reference temperature for the automatic superheat optimization function.

(VI) Serial Number Display (”Seri.”)



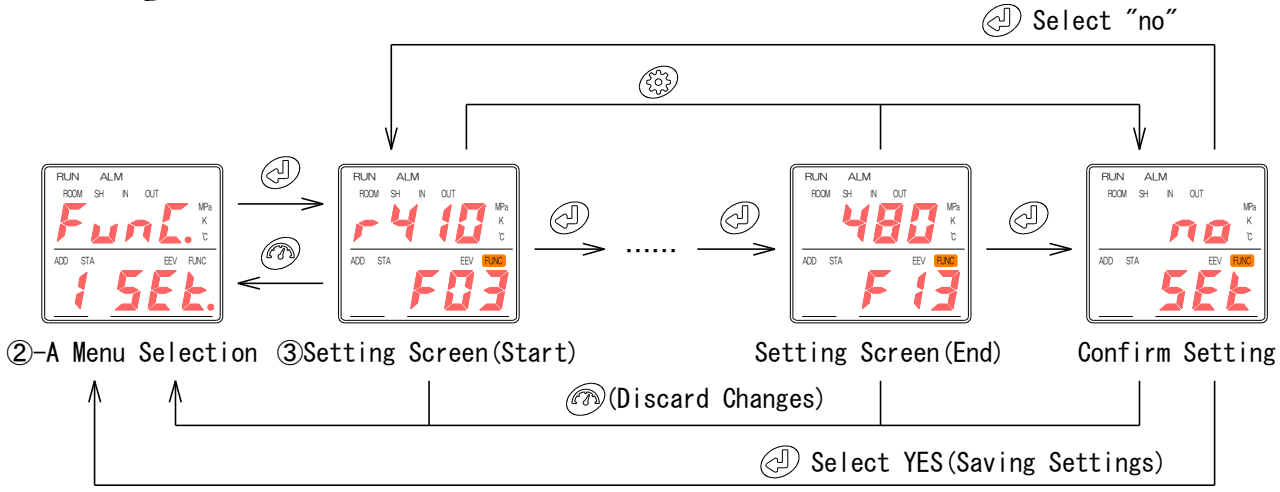
-The upper display scrolls to show the product’s serial number.

4.10.3. Setting Screen (3)

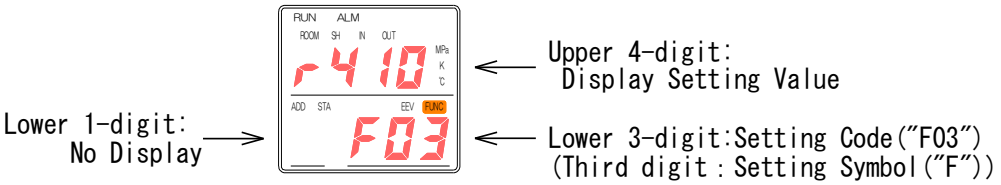
Common Operations:
Use the △ and ▽ keys to change the setting value, and press the ↵ key to proceed to the next item. Changes are not finalized at this stage. After reaching the final setting item, a **Save Confirmation Screen** will appear

- Selecting "YES" will save the setting values and return to the (2) Menu Screen.
- Selecting "NO" will discard the changes and return to the beginning of the (3) Setting Screen.

Even during the setting process, pressing the ⚙ key allows immediate transition to the Save Confirmation Screen.
Pressing the ↩ key on any setting screen will discard the selected setting value and return to the (2) Menu Screen.



○ Understanding the Settings Screen



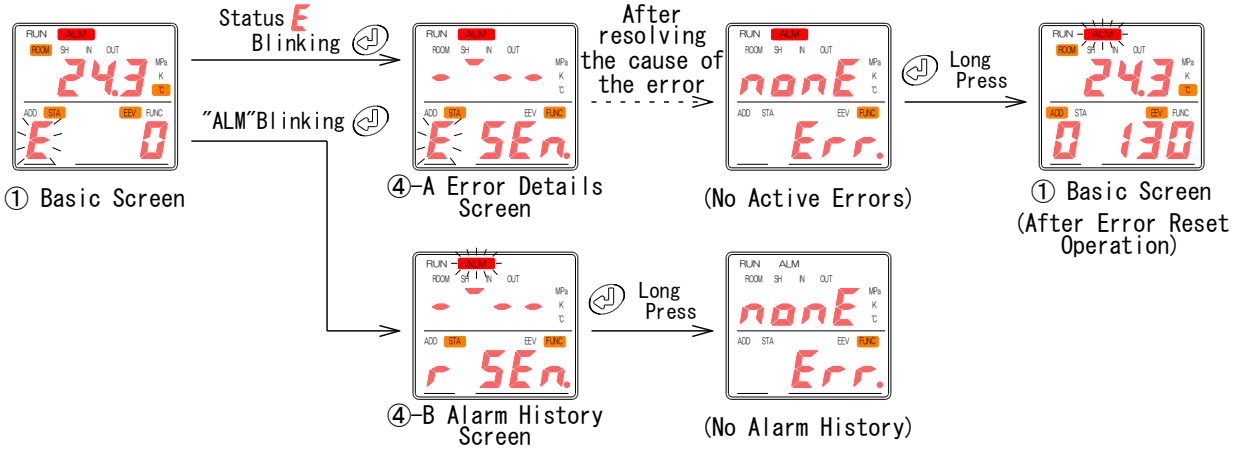
Refer to the appendix for the types of "Setting Screen" listed with their configuration values. → Settings List [P60]
Certain setting items may not be displayed depending on related settings such as control mode or multi-unit communication addresses.

4.10.4. Error Display (4)

Common Operations : When an error occurs, press the key to display the error details. Press the key to return to the basic screen.

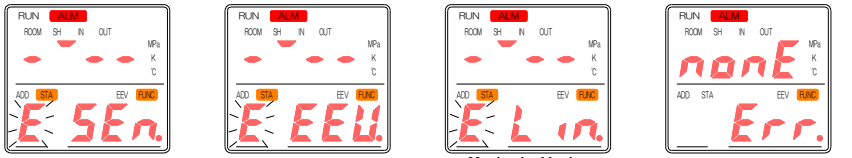
On the error screen, the lower 3 digits indicate the error type, and the upper 4 digits indicate the error location.

If multiple errors occur simultaneously, the error information will cycle every second, displaying one error at a time.



4.10.4.1. Error Details Screen (4)-A

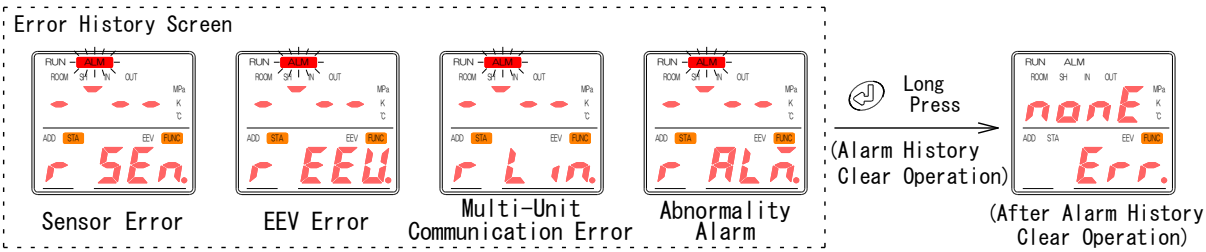
- While the basic screen is displayed, if the rightmost digit on the lower row is flashing "E", press the key to open the (4)-A **Error Details Screen**. The Error Details Screen shows the currently active errors.
- After resolving the cause of the error, press and hold the key when no errors are active to clear the error and resume control. (**Error Reset Operation**)
- Refer to the alarm function for details. → Alarm Function [P42]



Lamp	Display	Meaning	Display After Cause Removal
"STA"	SEn.	Sensor error occurring (temperature sensor, pressure sensor)	nonE
"STA"	EEU.	EEV error occurring (Phase A, B, a, b)	No change (EEU.)
"STA"	L in.	Multi-unit communication error occurring	nonE

4.10.4.2. Alarm History Screen (4)-B

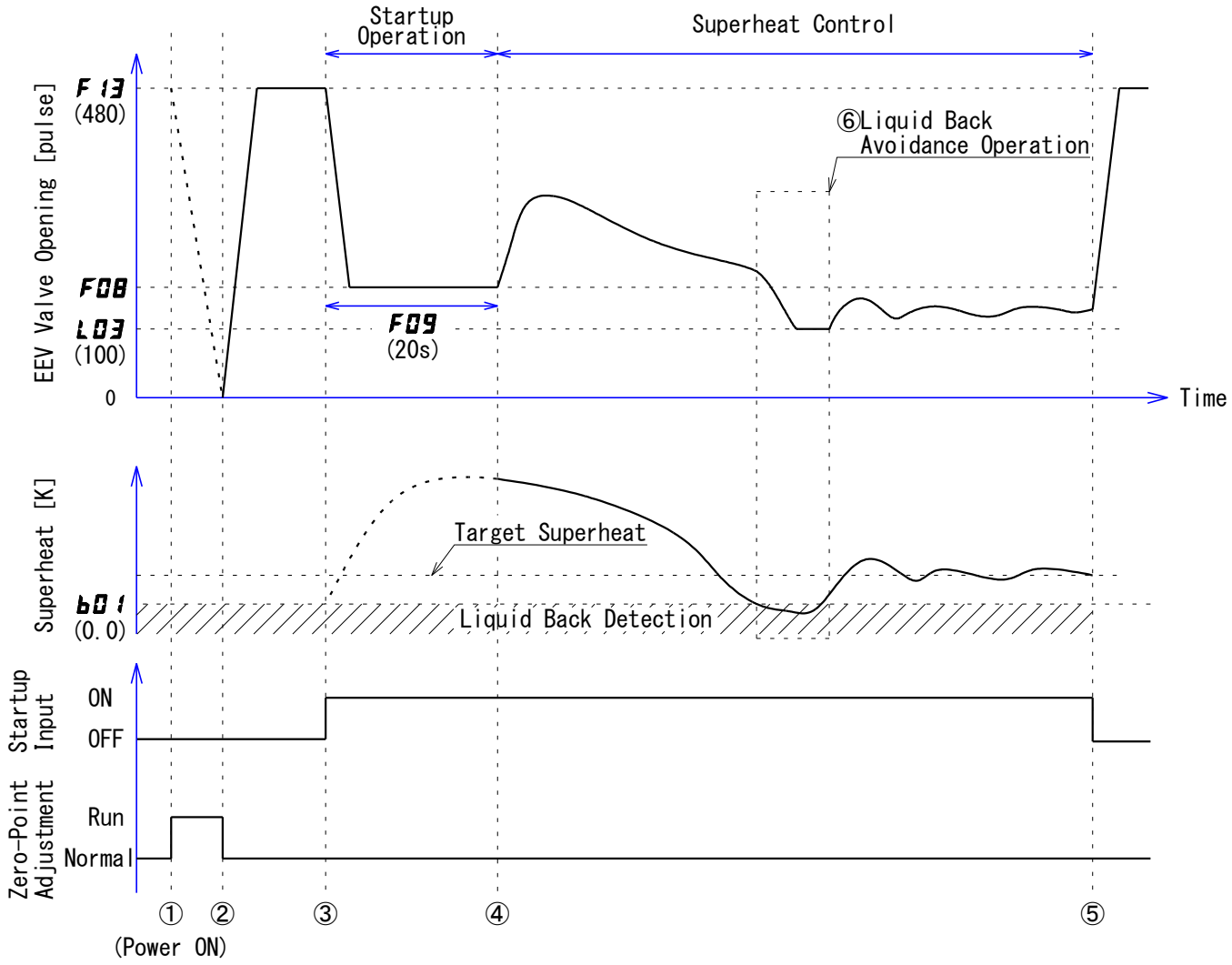
- (1)While the Basic Screen is displayed and the "ALM" lamp is flashing, press the key to open the (4)-B **Alarm History Screen**. The Alarm History Screen displays errors that occurred in the past.
- While the Alarm History Screen is displayed, press and hold the key to clear the alarm history and return to the (1) Basic Screen. (**Alarm History Clear Operation**) Note that the alarm history is retained even after the power is turned off and on, and will not be erased until the clear operation is performed.
- Refer to the alarm function for details. → Alarm Function [P42]



5. Basic Operation

In the diagrams following the Basic Operation section, any numerical values shown in parentheses next to setting codes indicate the factory default settings.

5.1. Electronic Expansion Valve Control



○ Related Parameter

Code	Name	Description
F08	Startup Valve Opening	Valve opening maintained during startup operation
F09	Startup Operation Time	Time period during which the startup opening is maintained
F13	Valve Opening During Stop	Valve opening maintained when the startup input is OFF
L03	Lower Alarm Temperature	Lower limit of the valve opening range during superheat control
b01	Liquid Back Detection Superheat	If the superheat value falls below this setting, liquid back is detected

5.1.1. Zero-Point Adjustment (1)

During zero-point adjustment, the electronic expansion valve is operated in the closing direction by a specified number of pulses to establish the reference valve opening position.
Zero-point adjustment begins when any of the following conditions are met:

- Power is supplied to the controller
- The "Zero-Point Adjustment Input" is short-circuited for more than 3 seconds but less than 15 seconds, then released
- The "Start Zero-Point Adjustment" command is executed from the display unit

Zero-point adjustment must be performed while the startup input is OFF. If executed while the startup input is ON, control will resume from the minimum valve opening position.

5.1.2. Start Control (2), (3), (5)

The control of the electronic expansion valve starts or stops depending on the status of the Startup Input.

- Startup Input: OFF (Open) : The valve is operated to the **Valve Opening During stop** (“F13” / default: 480 pulses), and control is stopped. ((2), (5))
- Startup Input: ON (Short-circuited) : Startup operation begins. ((3))

5.1.2.1. Startup Operation

The valve is operated to the **Startup Valve Opening** (“F08” / default: Auto*), and held at that position for the duration of the **Startup Operation Time** (“F09” / default: 20 seconds).
After the Startup Operation Time has elapsed, the system transitions to superheat control when either of the following conditions is met:

- The measured superheat is greater than or equal to the **Liquid Back Detection Superheat** (“b01” / default: 0.0K)
- 180 seconds have passed since the end of the Startup Operation Time

*When set to Auto, the controller automatically calculates the Startup Opening based on the currently applied upper and lower opening limits.

5.1.3. Superheat Control (4)

The electronic expansion valve opening is controlled so that the measured superheat reaches the Target Superheat set in the controller.

5.1.3.1. Automatic Target Superheat Control

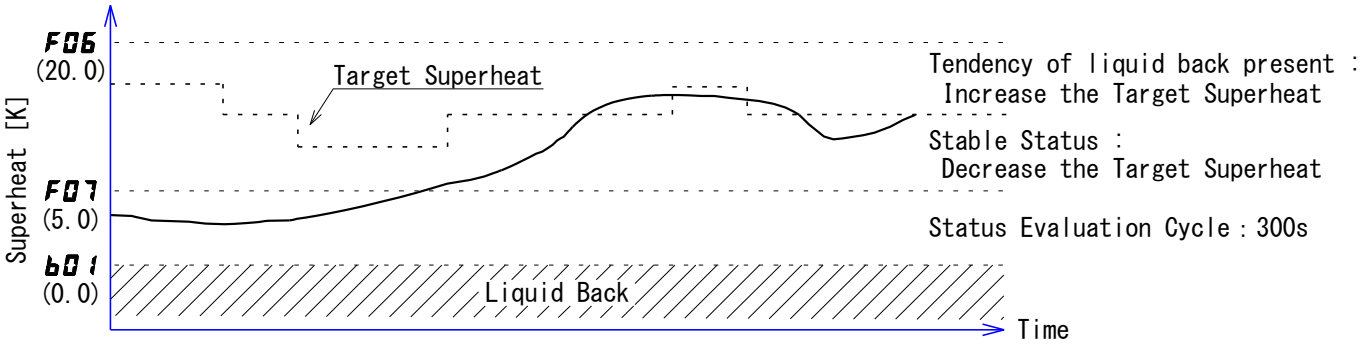
Depending on the operating condition of the evaporator, the controller automatically adjusts the Target Superheat. (This function is active when the control mode is set to 1, 2, or 5.)
The adjustment range for the Target Superheat is between the **Lower Limit of Target Superheat** (“F07” / default: 5.0K) and the **Upper Limit of Target Superheat** (“F06” / default: 20.0K).

Every **State Evaluation Cycle** (300 seconds), the refrigerant condition at the evaporator outlet is estimated based on the evaporator outlet temperature and the reference temperature.
- If the system determines “Tendency of liquid back present”, the Target Superheat is increased.
- If the system determines “Stable Condition”, the Target Superheat is decreased.

This allows the controller to dynamically optimize the Target Superheat according to system conditions.

How to check the currently applied Target Superheat → Operation Data Display (2)-C [P34]
(Refer to item (4) “tArG.”)

It is also possible to finely customize the setting values. For details on control settings, refer to the advanced usage section. When changing the settings for Automatic Target Superheat Control, make sure to perform the changes while the startup input is OFF.



○ Related Parameter

Code	Name	Description
F06	Upper Limit of Target Superheat	Upper Limit of Target Superheat Adjustment Range by Automatic Target Superheat Control
F07	Lower Limit of Target Superheat	Lower Limit of Target Superheat Adjustment Range by Automatic Target Superheat Control
b01	Liquid Back Detection Superheat	If the superheat value falls below this setting, liquid back is detected

○ Advanced Usage
-Customization of Automatic Target Superheat Control → Advanced Use of Automatic Target Superheat Control [P50]

5.1.3.2. Fixed Superheat Control

The system operates with a fixed target superheat, referred to as the **Fixed Target Superheat** (“F04” / default: 7.0K).
(This function is active when the control mode is set to 3, 4, 6, or 7.)
In systems using non-azeotropic refrigerants, consider the temperature glide and set the value slightly higher than usual (approximately +4 to +7 K) to reduce the likelihood of liquid back.

○ Related Parameter

Code	Name	Description
F04	Fixed Target Superheat	Target Superheat Value for Fixed Superheat Control

5.1.4. Liquid Back Prevention Operation (6)

When the measured superheat is less than the **Liquid Back Detection Superheat** (“b01” / default: 0.0K), the system initiates liquid back prevention operation.
During liquid back prevention operation, the valve is controlled further in the closing direction compared to normal operation.
For more details, refer to the section on Liquid Back Abnormality. → Liquid Back Abnormality [P44]

○ Related Parameter

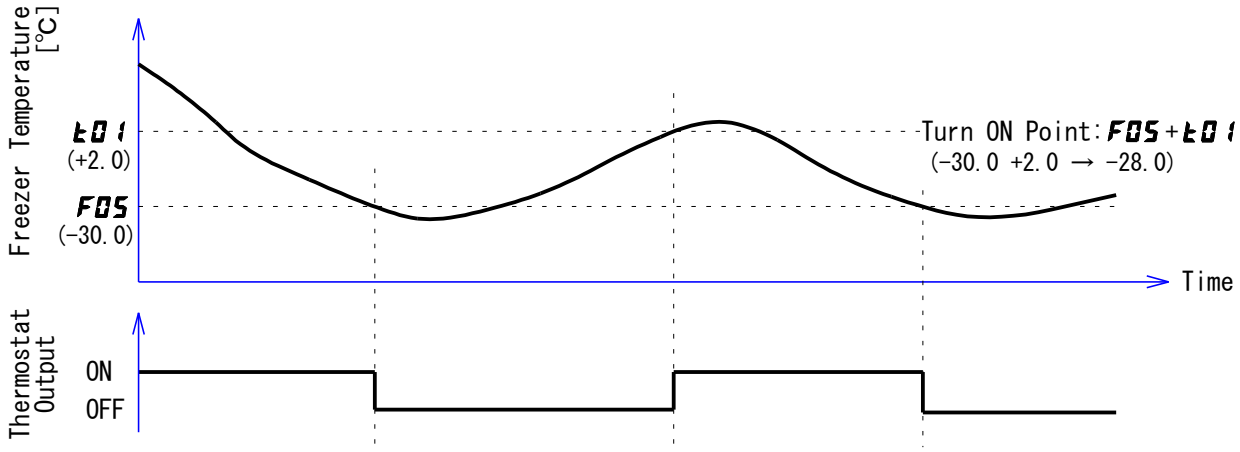
Code	Name	Description
b01	Liquid Back Detection Superheat	If the superheat value falls below this setting, liquid back is detected

○ Advanced Usage
-Customization of Liquid Back Prevention Operation → To suppress liquid back more effectively [P55]

5.2. Thermostat Control

When the control mode is set to 2, 4, or 7, the thermostat function becomes active.
The thermostat function turns the thermostat output ON/OFF based on the measured freezer temperature.

Output OFF Condition : Freezer temperature < **Target Temperature** (“F05” / default: -30.0°C)
Output ON Condition : Freezer temperature ≥ **Target Temperature** (“F05”) + **Differential** (“t01” / default: 2.0°C)



○ Related Parameter

Code	Name	Description
F05	Target Temperature	Target Temperature for Thermostat Control
t01	Differential	Temperature Difference for Thermostat Output Switching

○ Advanced Usage
-Setback Operation: Shift the set temperature after pull-down to save energy [P52]
-Step-Down Operation: Gradually cool down over time to avoid sudden temperature changes [P53]

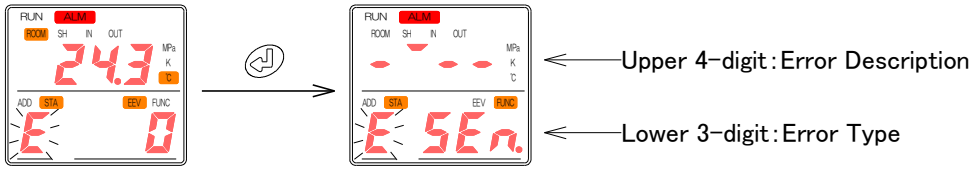
5.3. Alarm Function

Alarms are broadly categorized into two types: **Errors** and **Abnormality**.

- When an error is detected, the alarm relay is activated, and control of the electronic expansion valve is stopped. Recovery does not occur until an **error reset operation** is performed.
- When an abnormality is detected, the alarm relay is also activated; however, control of the electronic expansion valve continues.

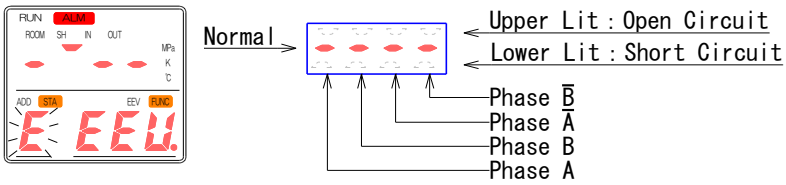
5.3.1. Alarm Item: Error

When an "E" is flashing on the basic screen, pressing the ⏎ key allows the user to check the alarm details.



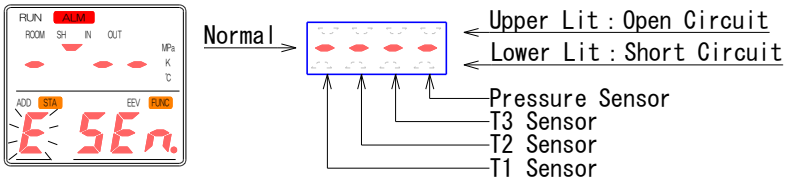
5.3.1.1. EEV Error (Open Circuit / Short Circuit)

- An error is determined when a open or short circuit is detected in the electronic expansion valve.
- At power-on or during origin positioning, all phases are monitored. During normal operation, only the phase that is periodically stopped is monitored.
- If a open or short circuit is detected, control of the electronic expansion valve is stopped, and monitoring is suspended until an error reset operation is performed.
- If a normal electronic expansion valve is connected and an error reset operation is executed, the error is cleared and origin positioning begins.



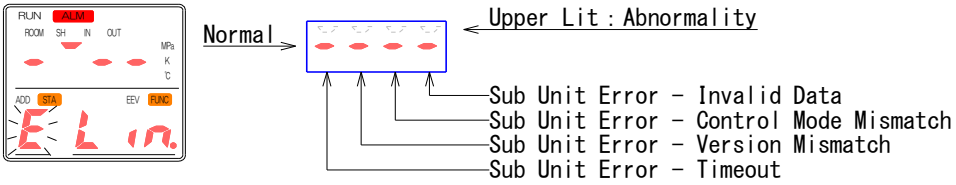
5.3.1.2. Sensor Error (Open Circuit / Short Circuit)

- An error is determined when a open or short circuit is detected in a temperature sensor or pressure sensor. Monitoring is performed continuously.
- If a open or short circuit is detected, the valve opening is set to the **Opening During Error** ("E01" / default: 0 pulses), and control is stopped. However, if the startup input is OFF, the valve is set to the **Valve Opening During Stop** ("F13" / default: 480 pulses).
- Sensors not used in the selected control mode are not monitored for sensor errors.



5.3.1.3. Sub Unit Error (Multi-Unit Communication)

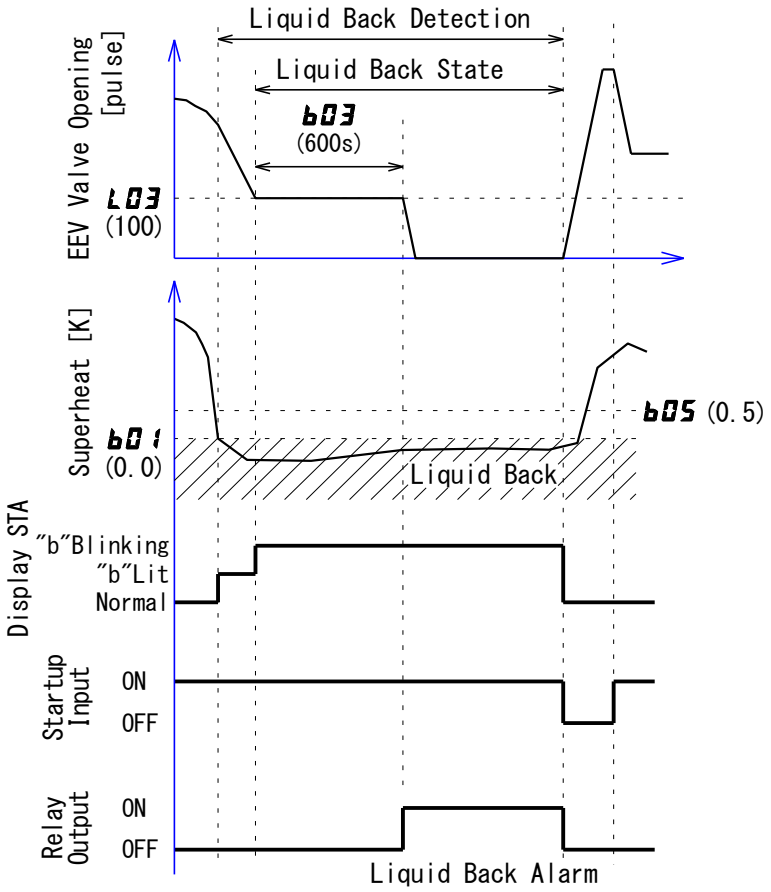
- When operating in sub unit mode using the multi-unit communication function, communication-related errors may be detected. There are four types of errors, as listed in the table below.
- If a multi-unit communication error is detected, the electronic expansion valve is set to the **Opening During Error** position, and control is stopped. However, if the startup input is OFF, the valve is set to the **Valve Opening During Stop** ("F13" / default: 480 pulses).



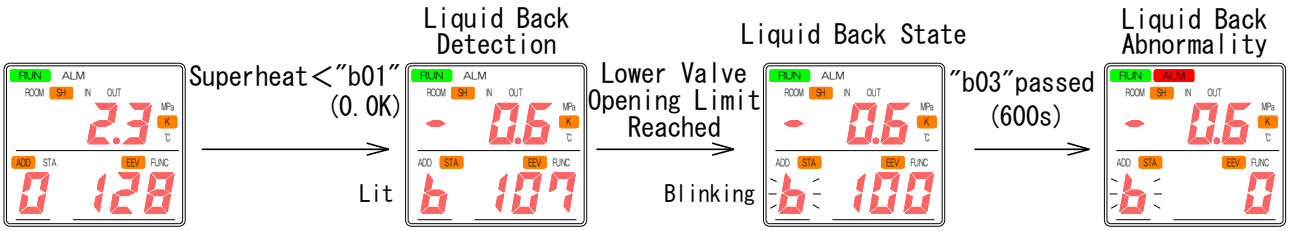
Error Type	Description
Sub Unit Error – Timeout	No message received from the main unit within a specified time.
Sub Unit Error – Version Mismatch	Software versions of the main and sub units do not match.
Sub Unit Error – Control Mode Mismatch	Control mode ("F01") of the main unit and sub unit mode ("F02") of the sub unit do not match.
Sub Unit Error – Invalid Data	Invalid message received from the main unit.

5.3.2. Alarm Item: Abnormality

5.3.2.1. Liquid Back Abnormality



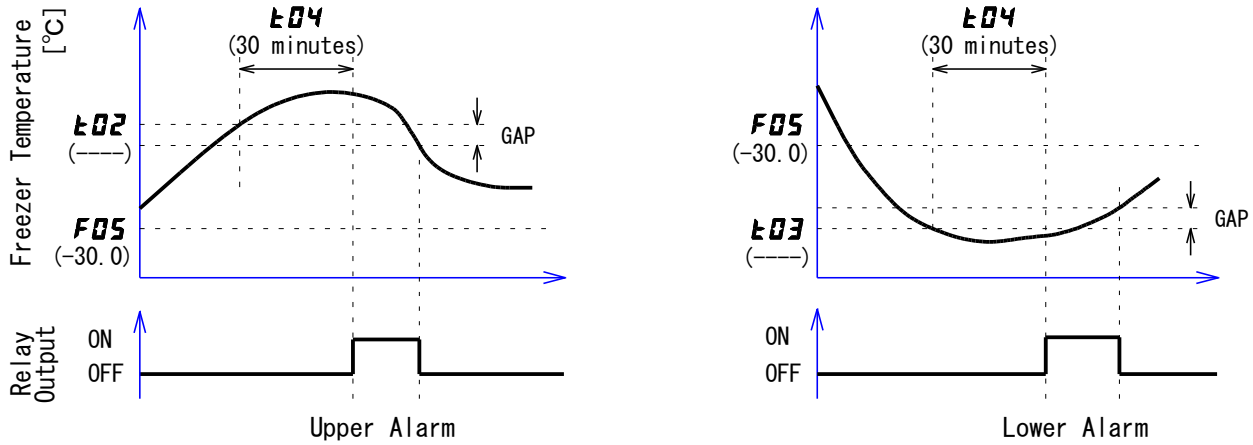
- A **liquid back detection** occurs when the measured superheat is less than the **Liquid Back Detection Superheat** ("b01" / default: 0.0K).(Lower 1-digit "b" lights up)
- If the measured superheat becomes equal to or greater than the **Liquid Back Recovery Superheat** ("b05" / default: 0.5K) during liquid back detection, the detection is cleared.
- If the valve opening of the electronic expansion valve reaches the **Lower Valve Opening Limit** ("L03" / default: 100 pulses) during liquid back detection, the system transitions to **liquid back state**. (Lower left of 7-segment display "b" blinks)
- If the liquid back state continues and the **Liquid Back Monitoring Duration** ("b03" / default: 600 seconds) elapses, a liquid back abnormality is detected.
- Upon detection of a liquid back abnormality, the valve opening is set to 0 pulses, and control is stopped.
  *If the outlet temperature is below -50°C, refrigerant is fed using the equivalent valve opening of the Auto startup opening setting, for the duration of the **No Liquid Detection Duration** ("b04" / default: 15 seconds). If the superheat still does not exceed the "Liquid Back Recovery Superheat" ("b05"), a liquid back abnormality is determined.
- A liquid back abnormality will not be cleared until the startup input is turned OFF. To resume control, turn the startup input OFF → ON.



○ Related Parameter

Code	Name	Description
L03	Lower Valve Opening Limit	Lower Limit of Valve Opening Range During Superheat Control
b01	Liquid Back Detection Superheat	If the superheat value falls below this setting, liquid back is detected
b03	Liquid Back Monitoring Duration	Monitoring Time Until Liquid Back Abnormality Is Detected
b04	No Liquid Detection Duration	Control Time for No-Liquid Determination
b05	Liquid Back Recovery Superheat	Superheat Value to Clear Liquid Back Detection

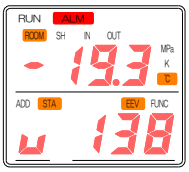
5.3.2.2. Temperature Abnormality (Upper/Lower Temperature Limits)



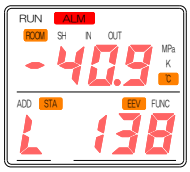
- When the thermostat function is active (Control Modes: 2, 4, 7), the system monitors for freezer temperature abnormalities.
- An alarm is triggered if the freezer temperature continuously exceeds the **Alarm Detection Temperature** (Upper Alarm Temperature: "t02" / default: "----", Lower Alarm Temperature: "t03" / default: "----") for the duration of the **Alarm Monitoring Time** ("t04" / default: 30 minutes).
  If the Alarm Detection Temperature is set to "----" , the corresponding alarm will not be detected.
- After an alarm is detected, it will be cleared and the alarm relay will turn OFF when the freezer temperature falls below (or rises above) the **Alarm Reset Temperature Gap (GAP)**.

Alarm Reset Temperature Gap (GAP)
Upper Alarm : (t02 − F05) ÷ 5
Lower Alarm : (F05 − t03) ÷ 5
However GAP ≧ 0.5℃

- Even if an alarm occurs, control of the electronic expansion valve continues.



Freezer Temperature Abnormality (Upper Limit)



Freezer Temperature Abnormality (Lower Limit)

○ Related Parameter

Code	Name	Description
F05	Target Temperature	Set Temperature for Thermostat Control
t02	Upper Alarm Temperature	Freezer Temperature for Detecting High-Temperature Alarm
t03	Lower Alarm Temperature	Freezer Temperature for Detecting Low-Temperature Alarm
t04	Alarm Monitoring Time	Monitoring Time Until Temperature Alarm Is Triggered

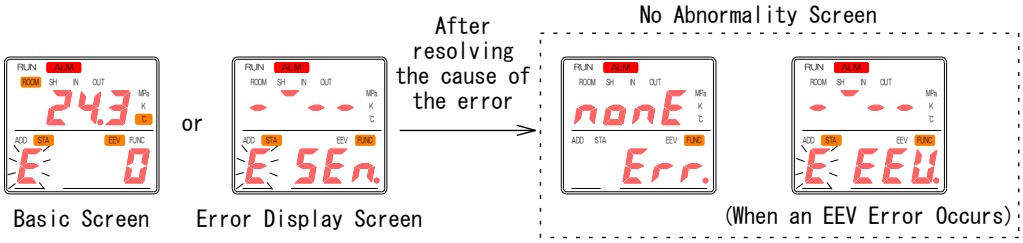
5.3.2.3. Multi-Unit Communication Abnormality (Detected During Main Unit Operation)

- When operating in main mode using the multi-unit communication function, a communication abnormality is detected if the main unit fails to communicate with the sub unit or detects an error from the sub unit.
- The alarm is cleared when the sub unit confirms the alarm details (i.e. when the sub unit is displaying the error screen).
- Even if an alarm occurs, the main unit continues control of the electronic expansion valve.

5.3.3. Error Reset Operation

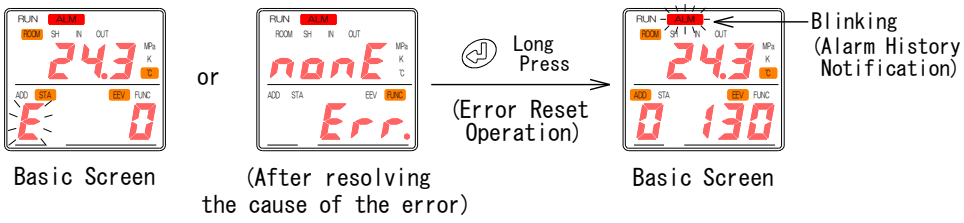
When the cause of a sensor error or sub unit communication error is resolved, the error screen transitions to the **No Abnormality screen.**
In the case of an electronic expansion valve error, even if the cause is resolved, the error screen remains active and does not automatically switch to the “No Abnormality” screen.

- In this state, an **Error Reset Operation** can be performed. After the reset, the alarm relay turns OFF and control of the electronic expansion valve resumes. There are two types of **error reset operations**: **Manual Reset** and **Automatic Reset** (default: Manual Reset).



5.3.3.1. Manual Reset

- When the error cause has been resolved, pressing and holding the ⏎ key on either the “No Abnormality” screen or the “Basic Screen” will clear the error.
- After the error is cleared, the ALM lamp flashes to indicate that an alarm history is present.



5.3.3.2. Automatic Reset

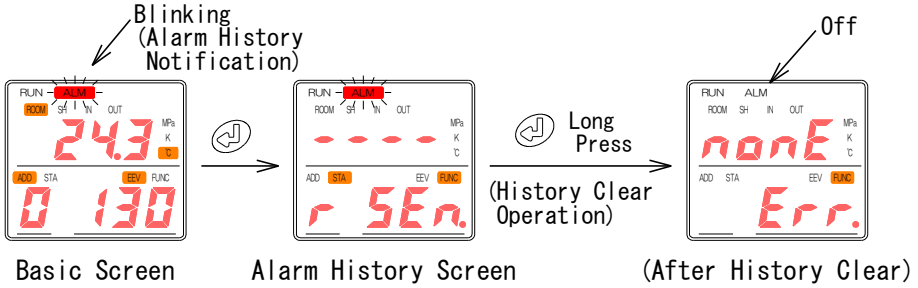
- If the **Error Reset Operation** (“E02” / default: Manual Reset “mAnu”) is set to “Auto”, automatic error recovery becomes active. Even when set to automatic reset, manual reset operation remains available.
- In automatic reset mode, the system attempts to clear the error after the **Automatic Recovery Start Time** (“E03” / default: 60 seconds) has elapsed following error detection. If the cause has been resolved, the error is cleared. If the error cannot be cleared, the system will retry every 60 seconds until the **Automatic Recovery Valid Time** (“E04” / default: 600 seconds) has elapsed.

○ Related Parameter

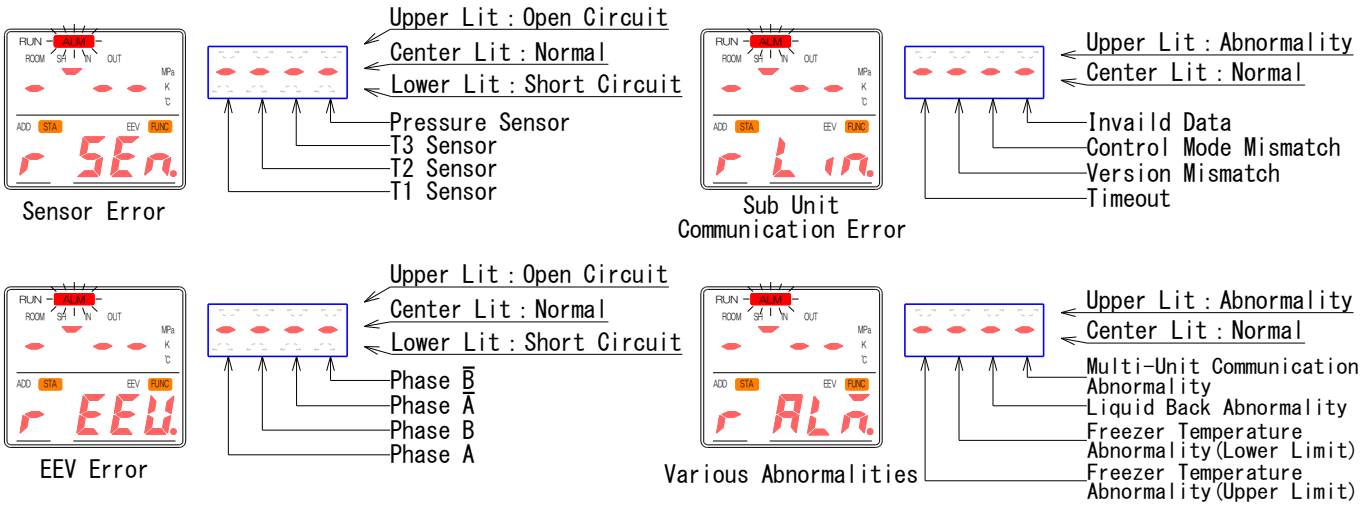
Code	Name	Description
E02	Error Reset Operation	Select Error Recovery Method: Manual or Automatic
E03	Automatic Recovery Start Time	Time to Start Automatic Recovery After Error Occurrence
E04	Automatic Recovery Valid Time	Maximum Duration to Attempt Automatic Recovery After Error Occurrence

5.3.4. Alarm History

- When the “ALM” lamp is flashing, it indicates that there are unconfirmed alarm history records. Pressing the ⏎ key at this time will display the Alarm History Screen. The Alarm History Screen shows a summary of all errors and abnormalities that have occurred since the last history clear operation.
- Alarm history is retained even after the power is turned OFF and ON, and will not be cleared until a **History Clear Operation** is performed.
- To perform a History Clear Operation, press and hold the ⏎ key while the Alarm History Screen is displayed.
- After the history is cleared, the “ALM” lamp turns OFF.



○ Contents Displayed on the Alarm History Screen



6. Advanced Usage

6.1. How to Suppress Output Hunting (Control Rank and Opening Limit Functions)

-Hunting in the electronic expansion valve opening tends to occur when the sensor used to measure superheat shows rapid or large fluctuations in its readings.
-The main cause is often liquid back, so first try increasing the target superheat and observe the system behavior.
When Automatic Target Superheat Control is enabled: Increase the **Lower Limit of Target Superheat** (“F07”).
When Automatic Target Superheat Control is disabled: Increase the **Fixed Target Superheat** (“F04”).
*Depending on the system configuration, if superheat sensing is properly performed, the system typically stabilizes with a target superheat setting of approximately 5K to 10K. If the system remains unstable even after increasing the target superheat, check the sensor installation and mounting location.

-Hunting in the electronic expansion valve can be suppressed by lowering the control sensitivity.
PID Control Rank (“F10” / default: Rank 3): Sets the calculation sensitivity.
FUZZY Control Rank (“F11” / default: Rank 1): Sets the output sensitivity.

-By enabling the **Upper/Lower Opening Limit Function**, the system can prevent excessive valve opening in response to sudden load fluctuations.

○ Related Parameter

Code	Name	Description
F04	Fixed Target Superheat	Target Superheat When Automatic Target Superheat Control Is Not Used
F07	Lower Limit of Target Superheat	Lower Limit of Target Superheat Adjustment Range in Automatic Target Superheat Control
F10	PID Control Rank	Calculation Sensitivity Setting
F11	Fuzzy Control Rank	Output Sensitivity Setting

6.1.1. PID Rank

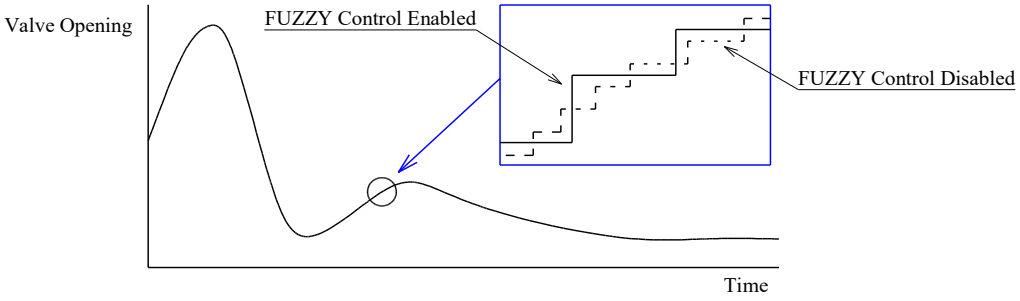
This parameter sets the calculation sensitivity for electronic expansion valve control. The default setting is Rank 3.
Rank 5 has the highest calculation sensitivity and responds with large valve opening adjustments to changes in measured values. Rank 1 has the lowest sensitivity.
Lowering the rank to Rank 1 or Rank 2 is expected to help suppress hunting.

Rank 0 allows control using manually configured PID calculation parameters.
*To use Rank 0, contact our sales representative.

6.1.2. FUZZY Rank

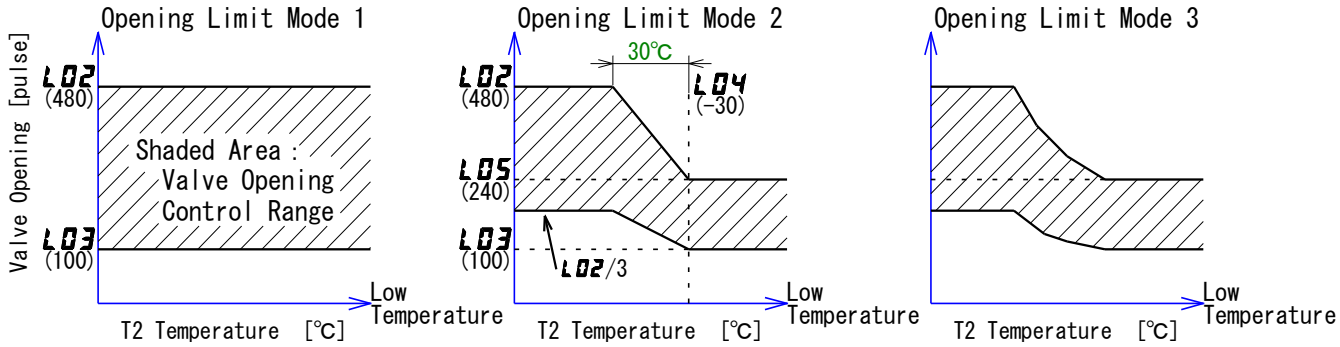
This parameter sets the output sensitivity for electronic expansion valve control. The default setting is Rank 1.
Rank 1 has the highest output sensitivity and output control results every second.
Rank 5 has the lowest output sensitivity and output control results in batches at longer intervals.
Increasing the rank to Rank 2–5 results in larger individual control actions but fewer adjustments overall, which may contribute to system stability.

Rank 0 allows operation using manually configured FUZZY control parameters.
*To use Rank 0, contact our sales representative.



6.1.3. Upper/Lower Opening Limit Function

- The Upper/Lower Opening Limit Function is designed to suppress excessive electronic expansion valve operations caused by sudden temperature changes, thereby improving system stability. The function operates in three selectable modes via the **Opening Limit Mode** (“L01” / default: Mode 1).
- It is recommended to first verify system compatibility using Opening Limit Mode 1.
  If adjustment of the opening range based on the evaporator outlet temperature (T2 sensor) is desired, Mode 2 or Mode 3 may be used.



6.1.3.1. Opening Limit Mode 1

- Operates within a fixed valve opening range, regardless of the evaporator outlet temperature.
- The valve opening is controlled within the range of **Lower Valve Opening Limit** (“L03” / default: 100 pulses) to **Upper Valve Opening Limit** (“L02” / default: 480 pulses)
  Upper Valve Opening Limit (“L02”): Set based on the system’s high-temperature capacity and the capacity of the electronic expansion valve, with a suitable margin.
  Lower Valve Opening Limit (“L03”): Set to a low value that prevents low-pressure cut-off in the system.

6.1.3.2. Opening Limit Mode 2

- By configuring the **Target Temperature at Evaporator Outlet** (“L04” / default: -30.0°C) and the **Upper Valve Opening Limit at Target Temperature** (“L05” / default: 240 pulses), the valve opening control range can be dynamically adjusted based on the evaporator outlet temperature (T2 sensor).
- When the evaporator outlet temperature is 30°C higher than the target temperature, the valve operates within the range of Upper Limit Opening ÷ 3 to **Upper Valve Opening Limit** (“L02” / default: 480 pulses).
  When the evaporator outlet temperature equals the target temperature, the valve operates within the range of **Lower Valve Opening Limit** (“L03” / default: 100 pulses) to **Upper Valve Opening Limit at Target Temperature** (“L05” / default: 240 pulses).
  This allows the system to dynamically adjust the valve opening control range in response to the evaporator outlet temperature.

6.1.3.3. Opening Limit Mode 3

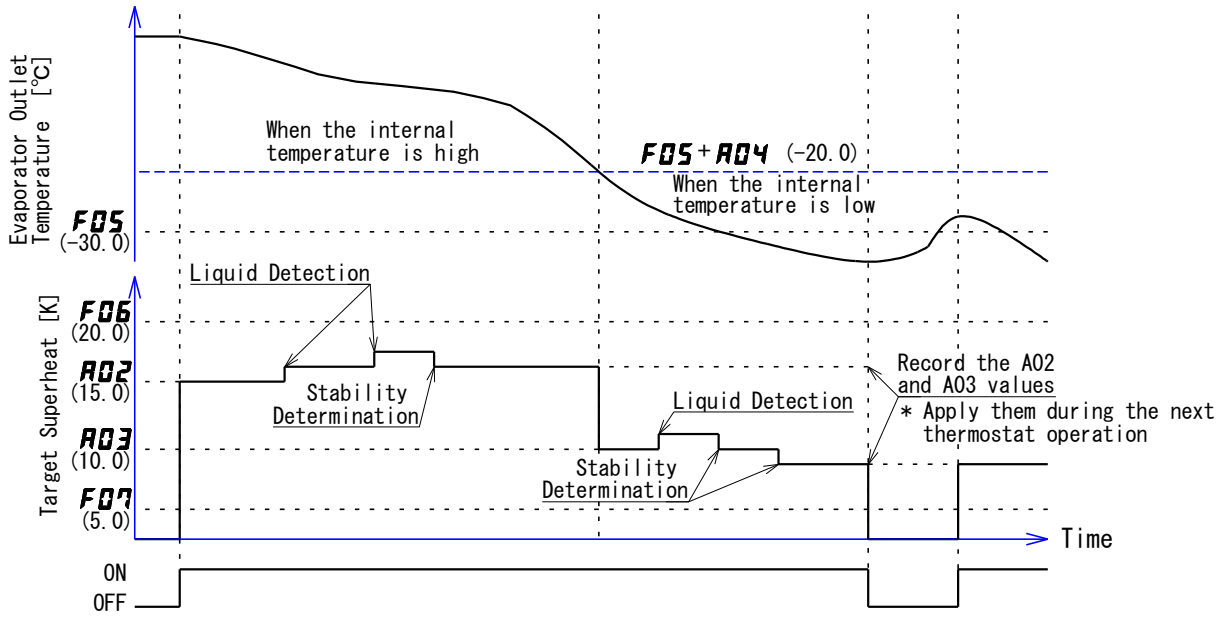
-By entering the following system information, the controller calculates the system capacity based on the evaporation temperature and determines the appropriate valve opening control range:

Refrigerant Used (“F03”): Select the refrigerant used in the system.
EEV Diameter (“L06”): Select the orifice size of the electronic expansion valve in use.
Representative Evaporation Temperature (“L07”): Set the evaporation temperature used in the system.
Representative Freezing Capacity (“L08”): Set the refrigeration capacity of the unit at the evaporation temperature specified in “L07”.
Subcooling Degree (“L09”): For two-stage systems, enter the representative value; for single-stage systems, enter 0.
Condensing Temperature (“L10”): Set the typical condensation temperature of the refrigeration unit in use.

○ Related Parameter

Code	Name	Description	Applicable Mode
L01	Valve Opening Limit Mode	Operating Mode for Upper/Lower Limit Restriction Function	1, 2, 3
L02	Upper Valve Opening Limit	Upper Limit of Valve Opening Range During Superheat Control	1, 2
L03	Lower Valve Opening Limit	Lower Limit of Valve Opening Range During Superheat Control	1, 2
L04	Target Temperature at Evaporator Outlet	Target Temperature for Evaporator Outlet	2
L05	Upper Valve Opening Limit at Target Temperature	Maximum Valve Opening When T2 Temperature Equals L04	2
F03	Refrigerant Used	Enter the Refrigerant Used in the System	3
L06	EEV Diameter	Select the Orifice Size of the EEV Used	3
L07	Representative Evaporation Temperature	Set the Evaporating Temperature to Be Used	3
L08	Representative Freezing Capacity	Refrigeration Capacity of the Unit When Evaporating Temperature Equals L07	3
L09	Subcooling Degree	Representative Value for Two-Stage Systems; Set to 0 for Single-Stage Systems	3
L10	Condensing Temperature	Typical Condensing Temperature of the Refrigeration Unit Used	3

6.2. Advanced Use of Automatic Target Superheat Control



- There are two types of initial target superheat values used for optimization **Target Superheat in High Temperature Zone** (“A02” / default: 15.0K), **Target Superheat at Low Temperature Zone** (“A03” / default: 10.0K)
  The controller switches between high-temperature and low-temperature target settings based on the freezer temperature (evaporator outlet temperature).
- When the **Measured Temperature** is greater than or equal to the **Switching Temperature**, the system determines that the internal compartment is in a high-temperature state. When the Measured Temperature is lower than the Switching Temperature, the system determines that the internal compartment is in a low-temperature state.
  *Measured Temperature: Freezer Temperature (Control Mode = 2), or Evaporator Outlet Temperature (Control Mode = 1 or 5)
  *Switching Temperature: **Target Temperature** (“F05” / Initial Value: -30.0°C) + **Temperature Difference for Zone Switching** (“A04” / Initial Value: 10.0K)
  *[High-temperature → Low-temperature]: Measured Temperature < Switching Temperature
  [Low-temperature → High-temperature]: Measured Temperature ≥ Switching Temperature + 10°C (with differential applied)
  *To check the currently applied target superheat → Operation Data Display (2)-C [P34] (see item (4) “tArG.”)
- When changing the settings for Automatic Target Superheat Control, make sure to perform the operation while the startup input is turned OFF.

○ Related Parameter

Code	Name	Description
F05	Target Temperature	Set temperature for Evaporator Outlet Temperature / Thermostat Control
A01	Optimization Mode	Operating mode of Automatic Target Superheat Control
A02	Target Superheat in High Temperature Zone	Target Temperature at the start of optimization during high freezer temperature conditions
A03	Target Superheat at Low Temperature Zone	Target Temperature at the start of optimization during low freezer temperature conditions
A04	Temperature Difference for Zone Switching	Offset value for the switching point between high and low freezer temperature conditions

6.2.1. Optimization Mode 1

- Target superheat optimization is performed in both high and low freezer temperature conditions.
- When using Automatic Target Superheat Control for the first time, start with this mode to verify compatibility with the system.

6.2.2. Optimization Mode 2

- Target superheat optimization is not performed during high freezer temperature conditions; it is performed only during low freezer temperature conditions.
  This mode is suitable when the system is intended to operate with slight liquid back during high freezer temperature conditions to accelerate pull-down.
- During high freezer temperature conditions, the target superheat is fixed to the Target Superheat in High Temperature Zone (“A02”).
- During low freezer temperature conditions, the target superheat is set to the Target Superheat at Low Temperature Zone (“A03”), and optimization is performed.

6.2.3. Optimization Mode 3

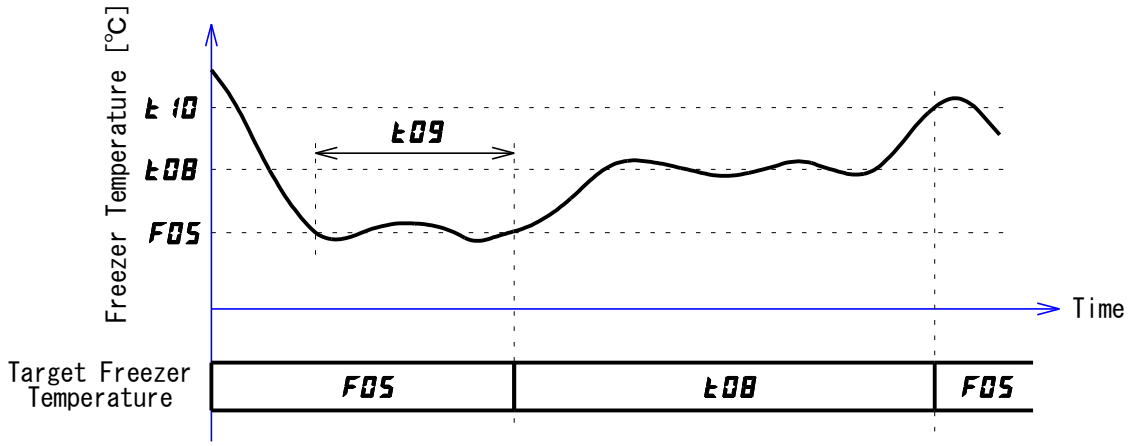
- Target superheat optimization is not performed. The system operates with two fixed target superheat values depending on the temperature range.
  Use this mode when operating with fixed target superheat values while switching between them based on the temperature range.
- During high freezer temperature conditions, the target superheat is fixed to the Target Superheat in High Temperature Zone (“A02”).
- During low freezer temperature conditions, the target superheat is fixed to the Target Superheat at Low Temperature Zone (“A03”).

6.3. Setback Operation: Shift the set temperature after pull-down to save energy

- When Thermostat Control is enabled, setting the **Setback Temperature** (“t08”) allows the system to perform setback operation.
- In setback operation, when the specified conditions are met, the Target Freezer Temperature is changed to the Setback Temperature (“t08”) and controlled via thermostat.
- If the Freezer Temperature rises and reaches the **Setback Exit Temperature** (“t10”), the system reverts to the original **Target Temperature** (“F05”).
- The **Differential** (“t01”) remains common regardless of whether setback operation is active.
- If a value is entered in **Step Temperature** (“t05”), the Step-Down Operation described later becomes active, and the settings related to setback operation (“t08” to “t10”) will be hidden. To use setback operation, set Step Temperature (“t05”) to “----”.

○ Start Condition: Setback operation begins after the Freezer Temperature falls below the Target Temperature (“F05”) and the **Setback Start Time** (“t09”) has elapsed.

○ Cancel Condition: Setback operation is canceled when the Freezer Temperature rises to or above the Setback Exit Temperature (“t10”).

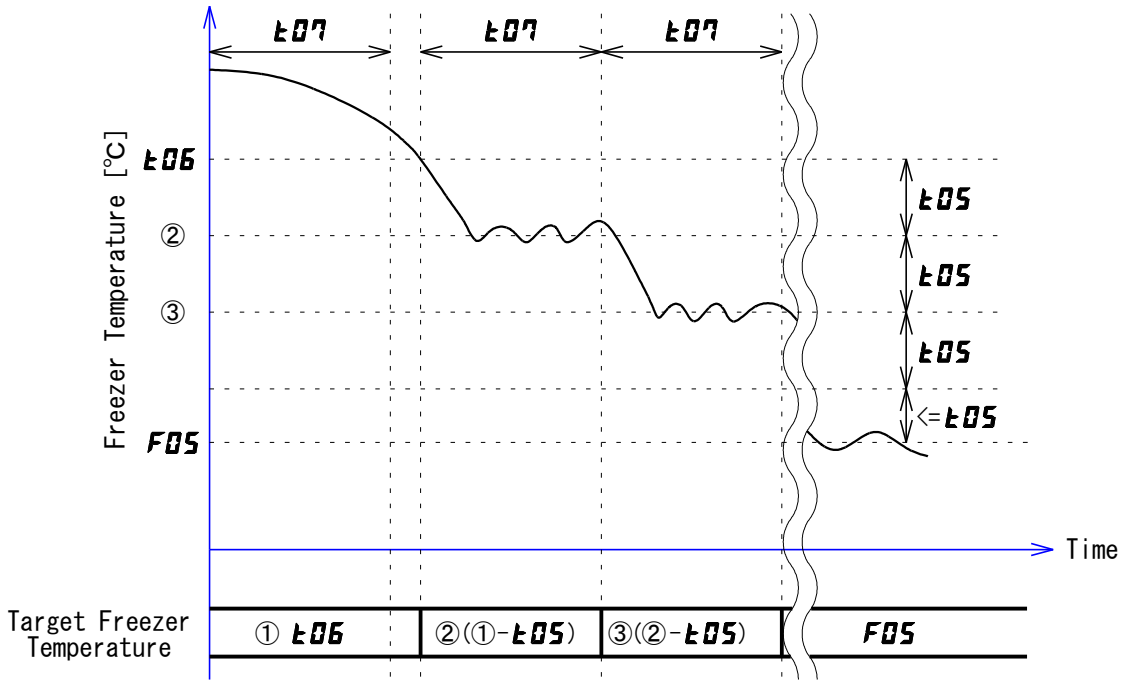


○ Related Parameter

Code	Name	Description
F05	Target Temperature	Set temperature for Thermostat Control
t01	Differential	ON/OFF temperature differential for Thermostat Output
t05	Step Temperature	To use Setback Operation, set Step Temperature (“t05”) to “----”
t08	Setback Temperature	Target Freezer Temperature during setback operation
t09	Setback Start Time	Time delay before starting setback operation after reaching the target freezer temperature
t10	Setback Exit Temperature	Freezer temperature threshold for canceling setback operation

6.4. Step-Down Operation: Gradually cool down over time to avoid sudden temperature changes

- When Thermostat Control is enabled, entering a value in **Step Temperature** (“t05”) activates Step-Down Operation.
- In Step-Down Operation, the Target Freezer Temperature is gradually lowered from the **Step-Down Start Temperature** (“t06”). These intermediate target temperatures are referred to as **Step Target Temperatures**, and thermostat control is performed using the Step Target Temperature and the **Differential** (“t01”).
- When the Step Target Temperature is updated, the system begins measuring the Step Time (“t07”).
  If the thermostat turns OFF within the Step Time (“t07”), the Step Target Temperature is updated when the time elapses.
  If the thermostat does not turn OFF within the Step Time (“t07”), the current Step Target Temperature is maintained until the thermostat turns OFF.
  This process is repeated until the **Target Temperature** (“F05”) is reached. After reaching the Target Temperature, normal thermostat control resumes.
- If power supply is interrupted during Step-Down Operation, the Step Target Temperature will be re-initialized upon power restoration, and the elapsed Step Time will be reset.
  If the Freezer Temperature is lower than the Step-Down Start Temperature at the time of power restoration, the nearest lower Step Target Temperature will be selected.



○ Related Parameter

Code	Name	Description
F05	Target Temperature	Set temperature for Thermostat Control
t01	Differential	ON/OFF temperature differential for Thermostat Output
t05	Step Temperature	To use Setback Operation, set Step Temperature (“t05”) to “----”
t06	Step-down Start Temperature	Initial value of the Step Target Temperature
t07	Step Time	Minimum duration to maintain the Step Target Temperature

6.5. Desire to extend the electronic expansion valve cable

-This product allows the connection cable to the electronic expansion valve to be extended.
The following table shows the approximate distances that can be extended for typical wire sizes.
Note: Distances are approximate and may vary depending on actual operating conditions. After extension, always perform an operation check.

Wire Size (AWG)	Cross-sectional Distance (mm^2)	Extension Distance (Approximate)
AWG16	1.25	Approx. 45m
AWG18	0.75	Approx. 28m
AWG20	0.5	Approx. 18m
AWG22	0.3	Approx. 11m

○ Precautions when processing cables
-Do not make connections inside the freezer. If unavoidable, apply waterproofing to prevent moisture ingress at the extension point. (Perform soldering and completely coat the lead wire connection with silicone or similar material.)
-Pay attention to poor contact of crimp terminals or connectors.
-For outdoor extensions, use weather-resistant wires and apply waterproof and dustproof treatment.

6.6. To correct measured temperature and pressure values (e.g., when extending sensor cables)

-It is possible to set offset values for the measured temperature, pressure, and the calculated superheat.
Correction may be effective in the following cases, so apply as needed:
(1) When installation position or mounting conditions of the sensor cause pressure loss errors or discrepancies between measured temperature and actual refrigerant temperature.
(2) When extending the temperature sensor cable affects sensor resistance (*).

*The temperature sensor used in this product has a characteristic of 0.117°C/Ω.
Measure the resistance of the extended cable or calculate it based on the cable specifications and length and determine the appropriate correction value.
*When extending the sensor cable, be sure to review the precautions for temperature sensors before proceeding.

Table: Measurement Error When Extending Lead Wires
(Tinned Soft Copper Stranded Wire at 20°C)

L	Nominal Cross-Sectional Area of Extension Cable			
	0.3 ㎟	0.5 ㎟	0.75 ㎟	1.25 ㎟
5m	+0.08℃	+0.05℃	+0.03℃	+0.02℃
10m	+0.16℃	+0.10℃	+0.06℃	+0.04℃
50m	+0.80℃	+0.48℃	+0.32℃	+0.19℃
100m	+1.60℃	+0.97℃	+0.64℃	+0.39℃

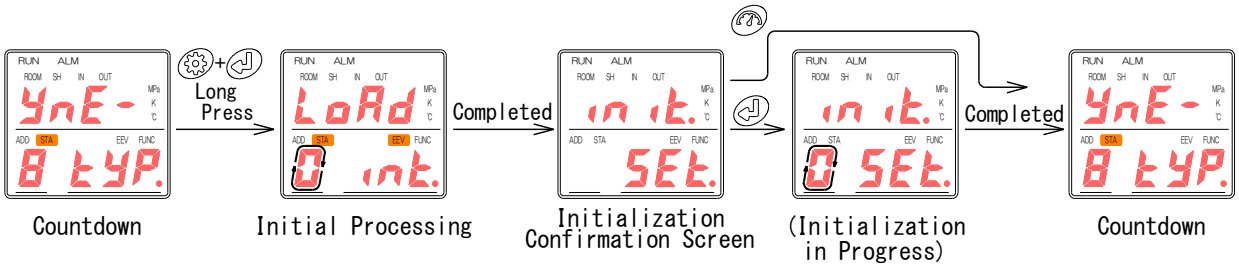
○ Precautions When Extending Lead Wires
-Cut the wire just above the Y-terminal before extending.
-Do not make wire connections inside the freezer compartment. If unavoidable, ensure waterproofing is applied to prevent moisture ingress at the extended section.
(Perform soldering and completely coat the lead wire connection with silicone or equivalent material.)
-For outdoor extensions, use weather-resistant wires and apply waterproof and dustproof treatment.
-During wiring, cover the extended lead wire section with a plastic bag or similar to prevent moisture from adhering.

○ Related Parameter

Code	Name	Description
F12	Superheat Offset Value	The calculated superheat is handled with an added offset value.
S01	T1 Measured Temperature Offset	The measured T1 temperature is handled with an added offset value.
S02	T2 Measured Temperature Offset	The measured T2 temperature is handled with an added offset value.
S03	T3 Measured Temperature Offset	The measured T3 temperature is handled with an added offset value.
S04	Measured Pressure Offset	The measured pressure is handled with an added offset value.

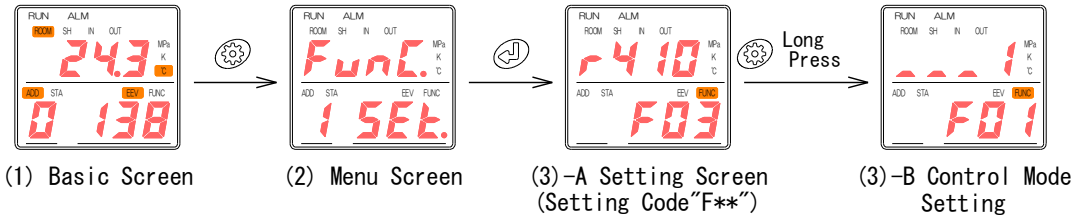
6.7. Initializing Settings

- When power is supplied to the controller, a countdown begins as the startup preparation screen is displayed.
- If the key and key are pressed simultaneously before the countdown reaches zero, the countdown will pause while the keys are held down.
  If the keys continue to be held, the countdown will resume. Once the countdown resumes, the keys may be released.
- After the initial process is completed, the **Initialization Confirmation Screen** will appear. Pressing the key will execute the initialization of the settings.
- Upon completion of initialization, the system will automatically restart and the countdown will begin again. Proceed with the initial setup thereafter.
- If the and keys are released before 3 seconds have elapsed, or if the key is pressed on the Initialization Confirmation Screen, initialization will not be performed.



6.8. Changing the System Configuration (“F01” Setting)

- To change the system configuration (superheat control method, sensor type, thermostat control availability), modify the **Control Mode** (“F01”).
- The setting screen for Control Mode is not displayed in the standard menu, so a specific operation is required to access it.
  [Step 1] (1)Basic Screen → (2)Menu Screen → Open(3)-A **Basic Settings for Electronic Expansion Valve Control** (Setting Code “F**”).
  [Step 2] While the Basic Settings screen (“F**”) is displayed, press and hold the key to open (3)-B “Control Mode Settings” (“F01”).
  [Step 3] Change the “F01” setting using the standard setting procedure and save the value from the Save Confirmation screen.



6.9. To suppress liquid back more effectively

- During Liquid Back Detection, the system performs Liquid Back Avoidance Control by adding the **Additional Valve Adjustment on Liquid Back Detection** (“b02” / Initial Value: -1 pulse) to the normal valve control pulse.
- Increasing the negative value of the Additional Control Pulse causes the valve to close more aggressively during avoidance control, promoting a faster rise in superheat.
- Raising the setting of **Liquid Back Detection Superheat** (“b01”) allows the system to initiate avoidance control earlier.

○ Related Parameter

Code	Name	Description
b01	Liquid Back Detection Superheat	If the superheat value falls below this setting, liquid back is detected
b02	Additional Valve Adjustment on Liquid Back Detection	The additional control pulse applied during Liquid Back Detection.
b05	Liquid Back Recovery Superheat	The superheat threshold for canceling Liquid Back Detection.

6.10. To operate a system with a tendency toward liquid back

- Since the correction process of Automatic Target Superheat Control may interfere with system behavior, it is recommended to use Fixed Superheat Control. Try setting the **Control Mode** (“F01”) to 3, 4, 6, or 7, and configure a relatively low value for **Fixed Target Superheat** (“F04”).
- Since Liquid Back Avoidance Control is activated when the current superheat falls below the **Liquid Back Detection Superheat** (“b01”), lowering the value of “b01” allows for more stable control even when operating with a low target superheat.
- Increasing the **Liquid Back Monitoring Duration** (“b03”) makes it less likely for the system to detect liquid back as an abnormal condition.
- Ensure that the system operates properly under these settings before applying them.

○ Related Parameter

Code	Name	Description
F01	Control Mode	Select according to the functions to be use.
F04	Fixed Target Superheat	Set the target superheat value for the expansion valve accordingly.
b01	Liquid Back Detection Superheat	If the superheat value falls below this setting, liquid back is detected
b03	Liquid Back Monitoring Duration	Monitoring Time Until Liquid Back Abnormality Is Detected

6.11. To continue operation during error conditions (Emergency Operation)

- During sensor errors, sub unit communication errors, or liquid back abnormalities, control of the electronic expansion valve is stopped. If emergency operation is required, the system can continue operating with a fixed valve opening using the methods below. Emergency operation is not available in the case of an electronic expansion valve error.
  *During fixed opening operation, Liquid Back Avoidance Control is not performed. Ensure that the refrigerant circulation volume in the system is appropriate.

(1)**Manual Operation Mode**

The valve opening can be manually controlled via key operation. This mode is available during sensor errors, sub unit errors, or liquid back abnormalities.

For details, refer to Manual Operation Mode → Manual Operation Mode [P31]

(2)**Valve Opening Degree During Error**

If a sensor error or sub unit error occurs while the startup input is ON, the valve is controlled using the **Valve Opening Degree During Error** (“E01” / Initial Value: 0 pulses).

If the startup input is OFF, the valve is controlled using the **Valve Opening During Stop** (“F13” / Initial Value: 480 pulses).

The Valve opening degree during error setting allows configuration of the valve opening during emergency operation under error conditions.

In the case of a liquid back abnormality, the valve is not controlled using the Valve Opening Degree During Error. Use (1) Manual Operation Mode.

○ Related Parameter

Code	Name	Description
E01	Valve opening degree during error	EEV Opening During Sensor Error or Multi-Unit Communication Error

6.12. Using the System in Configurations with Multiple Evaporators per Refrigeration Unit (Multi-Unit Communication Function)

- In systems where multiple evaporators (up to 4 units) are installed within the same refrigeration/freezing system and each is controlled by an electronic expansion valve, the Multi-Unit Communication Function enables the following configuration capabilities:

(1)**Shared Startup Signal Function**

The startup input signal from the main unit is shared with the sub units. This allows synchronization of operating timing across all evaporators.

(2)**Shared Pressure Sensor Data Function**

The pressure sensor data (evaporating pressure) from the main unit is shared with the sub units. This reduces the number of pressure sensors required in the system.

(3)**Driver Mode Function**

The valve opening of the main unit's electronic expansion valve is shared with the sub units. This eliminates the need for sensors on the sub units, thereby reducing the total number of sensors used.

- For details, refer to the Multi-Unit Communication Manual (S-NE-71001).

6.13. Monitoring Operating Status via Control Panel (Monitor Communication Function)

- By using the Monitor Communication Function, various internal data from this product can be read from the customer's equipment.
- For details, refer to the Monitor Communication Manual (S-NE-71002).

6.14. Setting Parameters from a PC During Test Operation (Maintenance Communication Function)

- Using the Maintenance Communication Port, parameter values can be written from a PC.
- Download the dedicated PC application from SAGINOMIYA official website.
- In addition to writing parameter values, the dedicated PC application also allows monitoring of operating status.

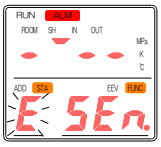
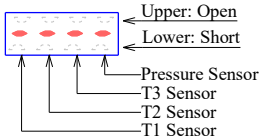
6.15. Updating Refrigerant Information (Software Update Function)

- Using the Maintenance Communication Port, the firmware of this product can be updated from a PC.
- Download the dedicated PC application from SAGINOMIYA official website.

7. Troubleshooting

If the controller does not operate normally, please check the following items before contacting us.
If the issue still persists, contact our sales office.

Timing	Observed Issue	Possible Cause	Checkpoints	Page
During Initial Setup	The target superheat setting item is not displayed	Selected a mode that uses automatic superheat optimization.	When the automatic superheat optimization function is active, the target superheat is automatically adjusted and does not require manual setting. If you want to set the target superheat to a fixed value, select control mode 3, 4, 6, or 7.	4.1
During Normal Operation	The control mode item is not displayed	After the initial setup, the control mode becomes hidden.	This is not a product malfunction. Perform the operation to display the control mode setting item.	6.8
	Control does not start (RUN lamp does not light)	The startup input is not wired.	If the RUN lamp is off, check the wiring of the startup input.	2.5.2
		The startup input is OFF	Check whether the operation signal of the liquid supply solenoid valve is present.	2.5.2
		A high-voltage wire was connected to the startup input	The internal circuit may have failed. Please replace this product.	---
	Control has stopped	A liquid back abnormality has occurred.	To restore from a liquid back abnormality, turn the startup input OFF once, then ON again.	5.3.2.1
		An error has occurred	After removing the cause of the error, perform the error reset operation.	5.3.1
	Control does not stop while the thermostat output is OFF	The startup input has not been turned OFF.	The YNE thermostat output and electronic expansion valve control are not interlocked. Regardless of whether the YNE thermostat control function is used, always link the solenoid valve and the startup input on the wiring side.	2.5.2
	Zero-point Adjustment is not executed	The short-circuit duration of the Zero-point Adjustment input is too short or too long.	If the input short-circuit duration is less than 3 seconds or more than 15 seconds, the input will be ignored.	5.1.1
		The Zero-point Adjustment input has not been released after short-circuiting.	Zero-point Adjustment starts when the input is released after being short-circuited for 3 seconds or more and less than 15 seconds.	5.1.1
	Unable to communicate (Multi-Unit communication, Monitor communication)	System configuration, device wiring, or communication settings are incorrect.	Please refer to the Multi-Unit Communication Manual and Monitor Communication Manual available on our website.	---
	The compressor is performing a low-pressure cut-off.	The electronic expansion valve is jammed with foreign matter.	Remove the foreign matter. If necessary, install a strainer.	---
		The piping or strainer is clogged.	Remove the foreign matter.	---
		The refrigerant charge is insufficient.	Check whether the flow rate is adequate and confirm that there is no refrigerant leakage.	---
		The lower valve opening limit is too high.	Set the lower valve opening limit within a range that prevents low-pressure cut-off. It is also possible to make the lower valve opening limit variable according to the cooling condition.	6.1.3
	The freezer is not cooling properly.	Incorrect wiring of the electronic expansion valve.	Wiring errors between phases cannot be detected. Review the wiring on the terminal block.	2.5
		Frost has accumulated on the evaporator.	Frost accumulation reduces heat exchange efficiency. Check the frost condition.	---
		The refrigerant charge is insufficient.	Check whether the flow rate is adequate and confirm that there is no refrigerant leakage.	---
		The Fixed Target Superheat setting is inappropriate.	If it is excessively high, cooling will be delayed. Lower the Fixed Target Superheat setting.	5.1.3.2

Timing	Observed Issue	Possible Cause	Checkpoints	Page
During Normal Operation	The freezer is not cooling properly. (Continued from previous page)	The upper valve opening limit setting is too low.	Increase the upper limit opening setting. It is also possible to make the upper limit opening variable according to the cooling condition.	6.1.3
		Temperature is not being detected correctly.	Review the installation position (inlet, outlet, freezer) and the mounting condition of the temperature sensor.	2.5.3
	Liquid back occurs frequently.	The electronic expansion valve has an oversized orifice.	Check whether the orifice size of the electronic expansion valve is appropriate.	---
		Startup operation is insufficient.	Set the initial opening to Auto or a smaller value and extend the startup time.	5.1.2.1
		Automatic target superheat control function is not functioning properly.	If the outlet temperature sensor and the superheat optimization sensor are positioned too close to each other, proper operation may not be achieved. Review the sensor installation positions. If the issue persists, switch to Fixed Target Superheat Control.	2.5.3.3 6.8
		The Fixed Target Superheat setting is inappropriate.	If the setting is excessively low, liquid back is likely to occur. Increase the Fixed Target Superheat setting.	5.1.3.2
		Temperature glide caused by non-azeotropic refrigerant (temperature deviation).	When using Fixed Target Superheat Control, take temperature glide into account and set the target superheat approximately 4–7 K higher than usual.	5.1.3.2
		Frost has accumulated on the evaporator.	Frost accumulation reduces heat exchange efficiency. Check the condition of frost buildup on the evaporator.	---
		Low ambient temperature.	Since the high-pressure side pressure decreases, liquid back is likely to occur. Set the target superheat to a higher value.	5.1.3.2
		The lower limit opening setting is too high relative to the orifice size of the expansion valve.	Set the lower valve opening limit within a range that prevents low-pressure cut-off. It is also possible to make the upper/lower valve opening limit variable according to the cooling condition.	6.1.3
During Alarm Activation	The ALM lamp is illuminated (the error has not been cleared).	An alarm has occurred.	This product has detected an alarm. Check the alarm details and eliminate the cause.	5.3
		Error reset operation has not been performed.	For various errors, after removing the cause, an error reset operation is required.	5.3.3
	The ALM lamp is flashing.	There is an uncleared alarm history.	When flashing, no alarm is currently active. Perform the error log clear operation.	5.3.4
	A sensor error has occurred. (Display Example)  (Display Information)  	The sensor wiring is open or short circuited.	Turn off the power to the product and measure the resistance between the sensor wires. If the approximate resistance value is not within the range of 1.2 kΩ to 2.5 kΩ, a fault is suspected. Replace the sensor.	---
		Moisture has entered, and electrical continuity has changed due to freezing.	Replace the sensor. After replacement, apply proper thermal insulation treatment.	2.5.3
		The heater's heat is being detected.	Check that the heater is not affecting the measurement. Also, apply proper thermal insulation treatment.	2.5.3
		Poor contact at the terminal block.	Verify the crimping condition of the wires and ensure that the wires are fully inserted into the terminal block.	2.5.1
		Product failure.	Swap with another temperature sensor and check whether the error is reproduced. If the same location still detects an error after replacement, the internal circuit of this product is likely faulty. If the error location changes after replacement, check the sensor for open or short circuits.	---
	The Display does not show "No Error" even after replacing the EEV.	The error reset operation has not been performed.	The EEV error will not automatically switch to "No Error" display. Perform the error reset operation while the error screen remains displayed. After confirming the connection of the EEV, the error will be cleared if the connection is normal.	5.3.1.1

8. Settings List

Refer to page P33, sections “Menu Screen (2)“ and “Menu Selection(2)-A)“ for instructions on how to access the settings list and the settings screen.

8.1. ［Symbol: F］Basic Settings for EEV Control

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
F01	Control Mode	—	1	8	1	
F02	Sub Unit Mode	—	1	7	1	
F03	Refrigerant Used	—	—	—	—	
F04	Fixed Target Superheat [K]	7.0	1.0	30.0	0.5	
F05	Target Temperature [℃]	-30.0	-70.0	10.0	0.5	
F06	Upper Limit of Target Superheat [K]	20.0	-10.0	50.0	0.5	
F07	Lower Limit of Target Superheat [K]	5.0	-10.0	50.0	0.5	
F08	Startup Valve Opening [pulse]	Auto	0	480	1	Auto：Auto selection
F09	Startup Operation Time [s]	20	0	1200	5	
F10	PID Control Rank	3	0	5	1	
F11	Fuzzy Control Rank	1	0	5	1	
F12	Superheat Offset Value [K]	0.0	-30.0	+30.0	0.1	
F13	Valve Opening During Stop [pulse]	480	0	480	1	

8.2. ［Symbol: t］Thermostat Control Setting

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
F05	Target Temperature [℃]	-30.0	-70.0	10.0	0.5	Same as basic settings
t01	Differential [K]	2.0	0.5	10.0	0.5	
t02	Upper Alarm Temperature [℃]	----	F05+0.5	20.0	0.5	----：Alarm disabled
t03	Lower Alarm Temperature [℃]	----	-75.0	F05-0.5	0.5	----：Alarm disabled
t04	Alarm Monitoring Time [minute]	30	0	600	10	0 ：Immediate output disabled
t05	Step Temperature [K]	----	0.1	10.0	0.1	----：Disabled setting
t06	Step-down Start Temperature [℃]	0.0	F05+0.5	20.0	0.5	
t07	Step Time [minute]	120	30	1440	30	
t08	Setback Temperature [℃]	----	-65.0	20.0	0.5	----：Disabled setting
t09	Setback Start Time [minute]	120	30	1440	30	
t10	Setback Exit Temperature [℃]	0.0	t08+5.0	40.0	0.5	

8.3. ［Symbol: L］Settings for Valve Opening Limit Function

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
L01	Valve Opening Limit Mode	1	1	3	1	
L02	Upper Valve Opening Limit [pulse]	480	1	480	1	Automatic adjustment to ensure L02 > L03
L03	Lower Valve Opening Limit [pulse]	100	0	479	1	
L04	Target Temperature at Evaporator Outlet [℃]	-30.0	-70.0	30.0	5.0	
L05	Upper Valve Opening Limit at Target Temperature [pulse]	240	1	480	1	
F03	Refrigerant Used	—	—	—	—	Same as basic settings
L06	EEV Diameter	14D	14D	60D	—	
L07	Representative Evaporation Temperature [℃]	-40	-70	10	5	
L08	Representative Freezing Capacity [kW]	10.0	0.5	100.0	0.1	
L09	Subcooling Degree [K]	0	0	60	5	Settings between 5K and 15K are not allowed
L10	Condensing Temperature [℃]	35	25	60	5	
L11	Upper Valve Opening Offset [pulse]	0	-100	100	1	
L12	Lower Valve Opening Offset [pulse]	0	-100	100	1	

8.4. ［Symbol: C］Communication Settings

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
C01	Multi-Unit Communication Address	Add.0	Add.0	Add.4	1	Add.2 to Add.4 can be set only when F01 = 8
C02	Multi-Unit Communication: Register Sub Unit 1	oFF	oFF	on	—	Displayed only when C01 = Add.1
C03	Multi-Unit Communication: Register Sub Unit 2	oFF	oFF	on	—	Displayed only when C01 = Add.1
C04	Multi-Unit Communication: Register Sub Unit 3	oFF	oFF	on	—	Displayed only when C01 = Add.1
C05	Monitor Communication: Slave ID (*)	1	1	247	1	
C06	Monitor Communication: Baud Rate [×10 bps]	1920	480	3840	—	4800,9600,19200,38400
C07	Monitor Communication: Communication Parity	EVEn	—	—	—	EVEn / odd / non

* “Slave ID” is a standard term used in the Modbus RTU protocol to identify individual devices. While the term originates from legacy terminology, it is retained here for consistency with the official Modbus specification.

8.5. ［Symbol: S］Sensor Offset Adjustment Settings

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
S01	T1 Measured Temperature Offset [K]	0.0	-10.0	10.0	0.1	
S02	T2 Measured Temperature Offset [K]	0.0	-10.0	10.0	0.1	
S03	T3 Measured Temperature Offset [K]	0.0	-10.0	10.0	0.1	
S04	Measured Pressure Offset [MPa]	0.000	-0.200	0.200	0.001	

8.6. ［Symbol: b］Liquid Back Avoidance Operation Settings

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
b01	Liquid Back Detection Superheat [K]	0.0	-10.0	10.0	0.1	
b02	Additional Valve Adjustment on Liquid Back Detection [pulse]	-1	-10	0	1	
b03	Liquid Back Monitoring Duration [s]	600	0	1200	1	
b04	No Liquid Detection Duration [s]	15	0	120	5	
b05	Liquid Back Recovery Superheat [K]	0.5	b01	10.0	0.1	

8.7. ［Symbol: E］Alarm Operation Settings

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
E01	Valve opening degree during error [pulse]	0	0	480	1	
E02	Error reset operation	mAnu	mAnu	Auto	—	mAnu: Manual reset Auto: Automatic reset
E03	Automatic Recovery Start Time [s]	60	10	600	10	
E04	Automatic Recovery Valid Time [s]	600	0	4200	600	

8.8. ［Symbol: A］Automatic Target Superheat Control Settings

Code	Name	Default Value	Lower Limit	Upper Limit	Step	Remarks
A01	Optimization Mode	1	1	3	1	
A02	Target Superheat in High Temperature Zone [K]	15.0	F07	F06	0.5	
A03	Target Superheat at Low Temperature Zone [K]	10.0	F07	F06	0.5	
A04	Temperature Difference for Zone Switching [K]	10.0	-20.0	50.0	0.5	

9. Revision History

Revision Date	Manual Number	Revision Details
Oct. 2025	A-NE-71003	Initial Release

The contents of this instruction manual are current as of the time of publication. Note that specifications may be changed or improved without prior notice.

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