

Refrigeration Temperature Controller

TF3 Series

USER MANUAL



TF3 Series

Thank you very much for selecting Autonics products.

For your safety, please read the following before using.

Preface

Thank you for purchasing Autonics product.

Please familiarize yourself with the information contained in the Safety Precautions section before using this product.





This user manual contains information about the product and its proper use, and should be kept in a place where it will be easy to access.

User Manual Guide

Please familiarize yourself with the information in this manual before using the product.


- This manual provides detailed information on the product's features. It does not offer any guarantee concerning matters beyond the scope of this manual.
- This manual may not be edited or reproduced in either part or whole without permission.
- A user manual is not provided as part of the product package. Visit our web site (www.autonics.com) to download a copy.
- The manual's content may vary depending on changes to the product's software and other unforeseen developments within Autonics, and is subject to change without prior notice. Upgrade notice is provided through out homepage.
- We contrived to describe this manual more easily and correctly. However, if there are any corrections or questions, please notify us these on our homepage.


User Manual Symbols

Symbol	Description
 Note	Supplementary information for a particular feature.
 Warning	Failure to follow instructions can result in serious injury or death.
 Caution	Failure to follow instructions can lead to a minor injury or product damage.
 Ex.	An example of the concerned feature's use.
※1	Annotation mark.

Safety Precautions

- Following these safety precautions will ensure the safe and proper use of the product and help prevent accidents, as well as minimizing possible hazards.
- Safety precautions are categorized as Warnings and Cautions, as defined below:

 Warning	Warning	Failure to follow these instructions may result in serious injury or death.
--	----------------	---

 Caution	Caution	Failure to follow these instructions may result in personal injury or product damage.
--	----------------	---

Warning

- Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)
Failure to follow this instruction may result in personal injury, fire, or economic loss.
- The unit must be installed on a device panel before use.
Failure to follow this instruction may result in electric shock.
- Do not connect, repair, or inspect the unit while connected to a power source.
Failure to follow this instruction may result in electric shock.
- Check the terminal numbers before connecting the power source.
Failure to follow this instruction may result in fire.
- Do not disassemble or modify the unit. Please contact us if necessary.
Failure to follow this instruction may result in electric shock or fire.

Caution

- Do not use the unit outdoors.
Failure to follow this instruction may result in shortening the life cycle of the unit, or electric shock.
- When connecting the power input and relay output cables, use AWG 12 to 28 cables. Make sure to tighten the relay output terminal screw bolt 0.4N·m and the others communication and power terminal screw bolt 0.5N·m. When connecting the sensor input cables, use AWG 14 to 30 cables and make sure to tighten the terminal screw bolt 0.2N·m. Failure to follow this instruction may result in fire due to contact failure.
- Use the unit within the rated specifications.
Failure to follow this instruction may result in shortening the life cycle of the unit, or fire.
- Do not use loads beyond the rated switching capacity of the relay contact.
Failure to follow this instruction may result in insulation failure, contact melt, contact failure, relay broken, or fire.
- Do not use water or oil-based detergent when cleaning the unit. Use dry cloth to clean the unit.
Failure to follow this instruction may result in electric shock or fire.

- Do not use the unit where flammable or explosive gas, humidity, direct sunlight, radiant heat, vibration, or impact may be present.
Failure to follow this instruction may result in fire or explosion.
- Keep dust and wire residue from flowing into the unit.
Failure to follow this instruction may result in fire or product damage.

The specifications and dimensions of this manual are subject to change and some models may be discontinued without notice.

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1 Product Overview

1.1 Features

- Standard installation size for refrigeration and air-cooling panels (W 70.3 × H 28.2 mm)
- Various compressor load current capacity: 5A, 16A, 20A
- Various user-friendly functions:
 - Defrost sync function: simultaneous defrost operation of multiple controllers (up to 6 units)
 - RTC (Real Time Clock) function: night mode operation and real-time defrost control
 - Built-in alarm function
- Remote monitoring of real-time temperature and output control (using TFD series remote display unit, sold separately)
- Communication output models available: RS485 (Modbus RTU)
- Parameter configuration via PC (RS485 communication)
 - DAQMaster software included (comprehensive device management software)
- IP65 protection structure (IEC standard): front panel only

1.2 Components and Accessories

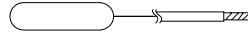
(1) Components



TF3 Series



Brackets



NTC Sensor



Instruction manual



Note

Make sure all of the above components are included with your product package before use. If a component is missing or damaged, please contact Autonics or your distributor.

(2) Sold separately

- Remote display unit (TFD)






Remote display unit (TFD) displays current temperature or output status of TF3 at remote place. TFD cable is TFD-3: 3m, TFD-5: 5m.

Connect the phone-jack of remote display unit (TFD) to the data loader port of TF3. This unit is dedicated for TF3 Series and it does not directly communicate with upper devices (PC, PLC, etc.)

If TFD communication with TF3 error occurs, TFD flashes display component for 1 sec. Check the connection with TF3.

When connecting TFD to the data loader port of TF3, you cannot connect Autonics SCM-US (USB to Serial converter, sold separately) for communication. Use SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately).

- Communication converter

SCM-38I (RS232C to RS485 converter)	SCM-US48I (USB to RS485 converter)	SCM-US (USB to Serial converter)
		



Note

Images of components and accessories may differ from actual products. For detailed information about any of the above products, please refer to the concerned product's user manual.

Visit our website (www.autonics.com) to download copies of the user manuals.

1.3 Ordering information

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Item	Description	
① Item	TF	Refrigeration Temperature Controller
② Digit	3	999 (3-digit)
③ Number of input channels	1	1CH input (NTC or RTD) [temperature+digital input (DI)]
	3	3 CH input (NTC) [inlet temperature+defrost temperature+ outlet temperature or digital input (DI)]
④ Output	1CH	1 Compressor output
	1CH,	2 Compressor+Defrost or Auxiliary (alarm/evaporator-fan) output
	3CH	3 Compressor+Defrost+Auxiliary (alarm/evaporator-fan) output
⑤ Power supply	1	24VAC 50/60Hz, 12-24VDC
	4	100-240VAC 50/60Hz
⑥ Compressor load capacity	G※1	Compressor 20A 1a contact
	A	Compressor 5A 1a contact
	H	Compressor 16A 1c contact
⑦ Option function※2	No-mark	No option
	S	Synchronize defrost
	T	RS485 communication
	R※3	RTC (real time clock)
	A※3	RS485 communication+RTC (real time clock)

※1. Only for 1CH input, compressor output model(TF31-1□G).

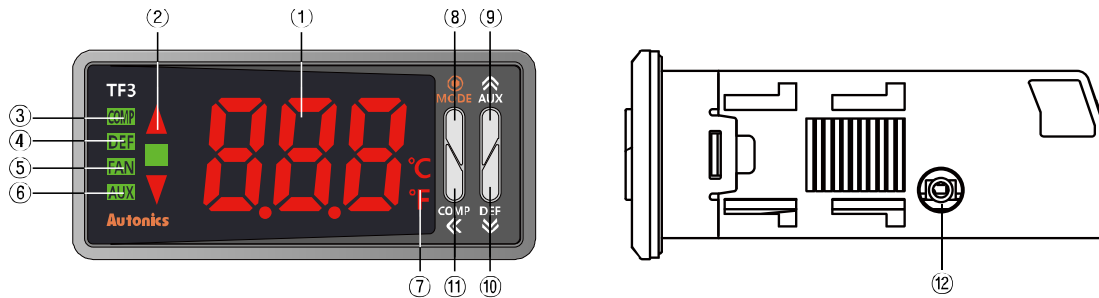
※2. Only for 3CH input model (TF33-□□□-□) . Option function is varied by compressor load capacity and contact.

Option function / Compressor load capacity & contact	Synchronize defrost function	RS485 communication	RTC function	RS485 communication +RTC function	No option
Compressor 5A 1a contact	● (TF33-□□A-S)	● (TF33-□□A-T)	-	● (TF33-3□A-A)	-
Compressor 16A 1c contact	-	-	● (TF33-3□H-R)	-	● (TF33-□□H)

※3. Except compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF33-2□□-□).

※Only for 3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF33-3□□-□) supports buzzer.

1.4 Part description



- ① Present value (PV) display component (red):
RUN mode: Displays present value (PV).
Setting mode: Displays parameter and setting value.
- ② Deviation indicator (■: green, ▼/▲: red):
Displays deviation of present value (PV) based on setting value (SV).

PV deviation temperature	Deviation display
More than 1.8°C	▲ indicator turns ON
Within $\pm 1.8^\circ\text{C}$	■ indicator turns ON
Less than -1.8°C	▼ indicator turns ON
- ③ Compressor (COMP) output indicator (green):
Turns ON for compressor output. In case of compressor protection operation and output does not turn ON, it flashes.
When operating compressor continuously, it turns ON for 2 sec, and turns OFF for 1 sec.
- ④ Defrost (DEF) output indicator (green):
Turns ON for defrost output. Flashes for defrost delay operation.
Turns ON for 2 sec and OFF for 1 sec for manual defrost or Power ON defrost.
- ⑤ Evaporator-fan (FAN) output indicator (green):
Turns ON for evaporator-fan output. Flashes for delay operation of evaporator-fan output.
- ⑥ Auxiliary (AUX) output indicator (green):
Turns ON for alarm output. Flashes for delay operation of alarm output.
- ⑦ Unit indicator (red):
Displays temperature unit set at temperature unit [Unit] of parameter 1 group.
- ⑧ (MODE) key: Used for entering parameter setting group, returning RUN mode, moving parameter or saving SV.
- ⑨ (AUX) key: Used for entering SV setting group or changing setting value.
Hold the key over 3 sec to select active/inactive auxiliary output in RUN mode.
- ⑩ (DEF) key: Used for entering SV setting group or changing setting value.
Hold the key over 3 sec to execute/stop manual defrost in RUN mode.
- ⑪ (COMP) key:
Used for entering SV setting group, changing setting value, moving digits.
Hold the key over 3 sec to active/inactive compressor output in RUN mode.
When Buzzer occurs, press the key once to stop the sound. (Only for 3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF33-3□□-□ supports buzzer. Buzzer [BUZ] of parameter 1 group is set as [ON])
- ⑫ Data loader port:
It is for displaying TF3 data at remote display unit (TFD) by connecting phone-jack. In other case, for connecting Autonics SCM-US (USB/Serial converter, sold separately), it is a PC loader port of serial communication for parameter setting or monitoring by PC.

**Note**

7-segment display characters

A	b	c	d	E	F	G	H	I	J	K	L	M
A	B	C	D	E	F	G	H	I	J	K	L	M




n	o	P	q	r	S	t	U	v	w	X	Y	Z
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

0	1	2	3	4	5	6	7	8	9	0	-1	/
0	1	2	3	4	5	6	7	8	9	0	-1	/

2 Specifications

(1) TF3 Series



Model		TF31-□□□	TF33-□□□-□
Number of channels		1CH	3CH
Power supply	AC power	100-240 VAC \sim 50/60Hz	
	AC/DC power	24VAC \sim 50/60Hz, 12-24VDC---	
Allowable voltage range		90 to 110% of rated voltage	
Power consumption	AC power	Max. 8VA (100-240VAC \sim 50/60Hz)	
	AC/DC power	Max. 5VA (24VAC \sim 50/60Hz), Max. 3W (12-24VDC---)	
Display method		7 Segment LED method (red)	
Character size (W×H)		9.4×19.3mm	
Input type	NTC	5k Ω /10k Ω	
	RTD	DPT100 Ω	-
Sampling period		500ms	
Display accuracy		- At room temp. (23°C \pm 5°C) : \pm 1°C \pm 1 digit - Out of room temp. range: \pm 2°C \pm 1 digit	
Control output	Compressor (COMP)	250VAC \sim 5A 1a, 16A 1c, 20A 1a	
	Defrost (DEF)	250VAC \sim 10A 1a	
	Auxiliary (AUX)	250VAC \sim 5A 1a	
Communication output		-	RS485 communication output (Modbus RTU)
Digital input		Contact input: ON Max. 1 k Ω , OFF Min. 100k Ω , No contact input: ON residual voltage: Max. 1V, OFF leakage current: Max. 1mA, outflow current: 4 μ A	
Control method		ON/OFF control	
Hysteresis		0.5 to 5.0°C, 2 to 10°F variable	
Relay life cycle	Compressor (COMP)	5A 1a	Mechanical: 5,000,000 operations, Electrical: 50,000 operations (250VAC 5A)
		16A 1c	Mechanical: 20,000,000 operations, Electrical: 30,000 operations (250VAC 16A)
		20A 1a	Mechanical: 10,000,000 operations, Electrical: 100,000 operations (250VAC 20A)
	Defrost (DEF)		Mechanical: 20,000,000 operations, Electrical: 100,000 operations (250VAC 10A)
	Auxiliary (AUX)		Mechanical: 5,000,000 operations, Electrical: 50,000 operations (250VAC 5A)
Memory retention		Approx. 10 years (non-volatile memory method)	
Insulation resistance		Min. 100M Ω (at 500VDC megger)	
Dielectric strength	AC power	3000VAC 50/60Hz for 1 min (between all terminals and case, power and input circuit)	
	AC/DC power	1000VAC 50/60Hz for 1 min	

		(between all terminals and case, power and input circuit)
Noise resistance		Square-wave noise by the noise simulator (pulse width: 1 μ s) \pm 2kV R-phase and S-phase
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Environment	Ambient temperature	-10 to 50°C, storage: -20 to 60°C
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Accessories		Bracket: 2, NTC sensor (5k Ω): 1
Protection structure		IP65 (front part)
Approval		  
Weight ^{*1}		Approx. 207g (approx. 105g)

※1. The weight includes packaging. The weight in parentheses is for unit only. The weight is varied by model option.

※ Environment resistance is rated at no freezing or condensation.

(2) Remote display unit [TFD, sold separately]

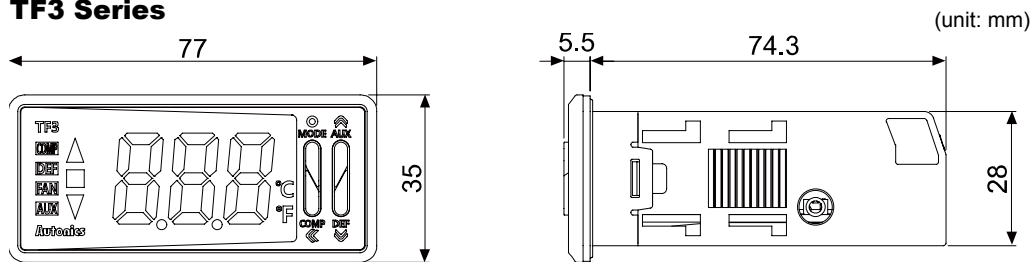
Model	TFD-3	TFD-5
Power supply	3.3VDC	
Power consumption	Max. 1W	
Display method	7 Segment LED method (red)	
Communication method	Serial (TTL Level), Half duplex	
Communication cycle	100ms	
Cable	Ø2.5mm, 3m	Ø2.5mm, 5m
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Environment	Ambient temperature	-10 to 50°C, storage: -20 to 60°C
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure	IP67	
Approval	 	
Weight ^{*1}	Approx. 77g (approx. 48g)	

※1. The weight includes packaging. The weight in parentheses is for unit only.

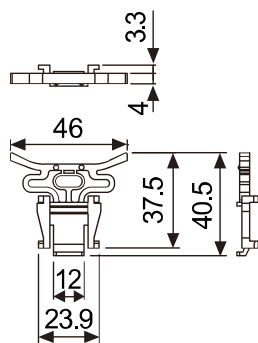
※ Environment resistance is rated at no freezing or condensation.

3 Dimensions

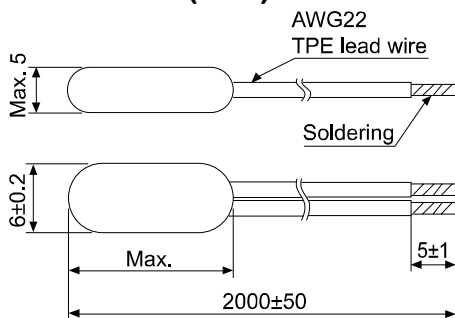
(1) TF3 Series



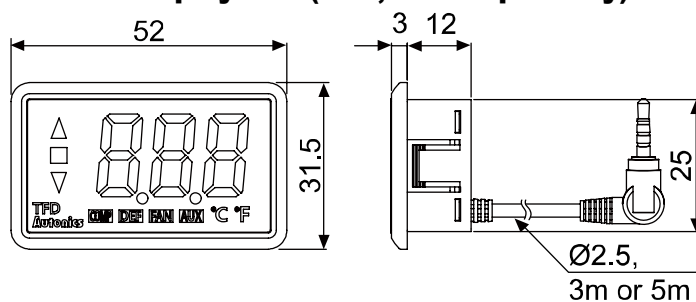
(2) Bracket



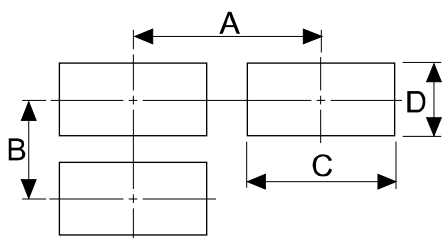
(3) NTC sensor (5kΩ)



(4) Remote display unit (TFD, sold separately)



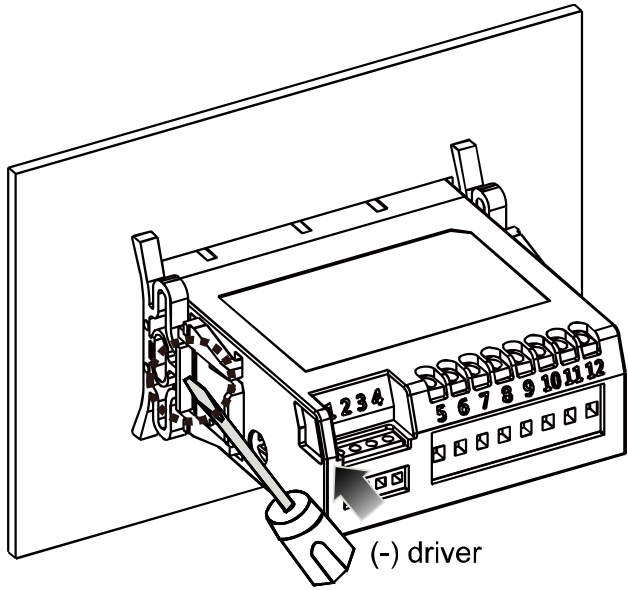
(5) Panel cut-out



Series	Size	A	B	C	D
TF3		Min. 100 ^{※1}	Min. 55	70.3 ^{+0.7} ₀	28.2 ^{+0.5} ₀
TFD		Min. 65	Min. 40	45.7 ^{+0.6} ₀	25.4 ^{+0.3} ₀

※1. When connecting remote display unit (TFD), or SCM-US, Min. 120

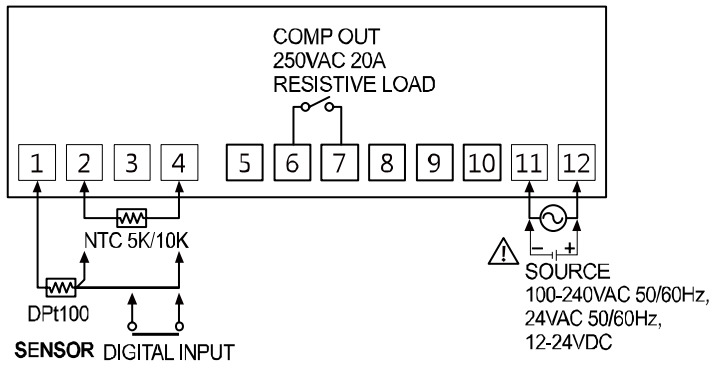
- Product mounting



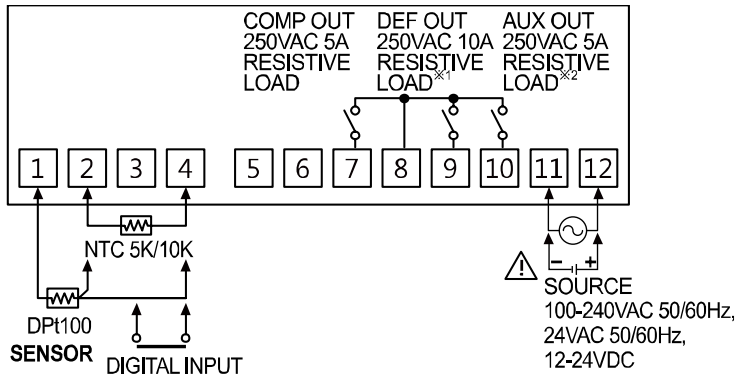
Insert the unit into a panel fasten the bracket by pushing with tools with a (-) driver.

4 Connections

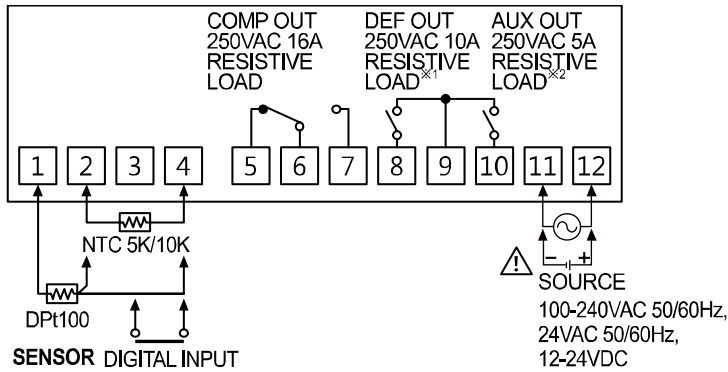
(1) TF31-1□G



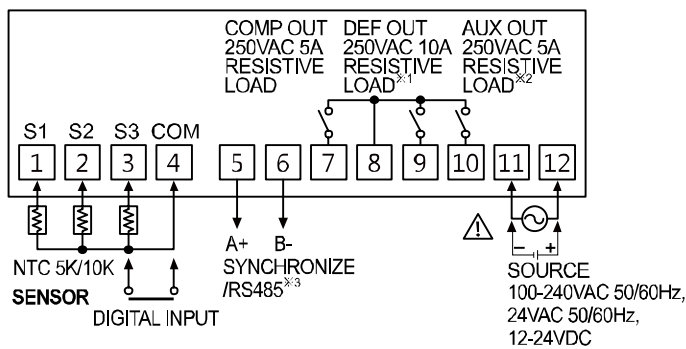
(2) TF31-□□A

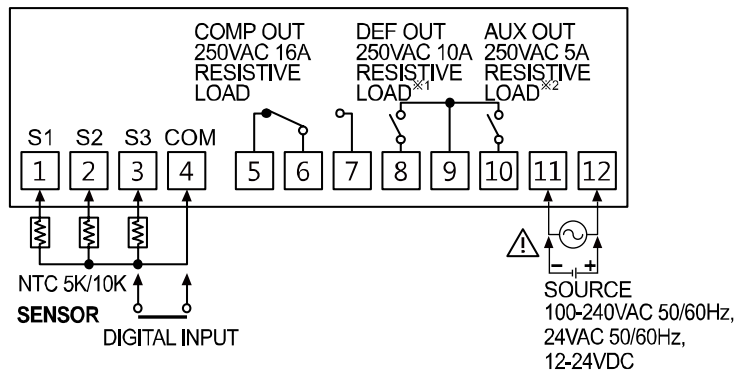


(3) TF31-□□H



(4) TF33-□□A-□



(5) TF33-3□□H-□

- ※1. Only for compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□), compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□).
- ※2. Only for compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□).
- ※3. Only for synchronize defrost function model (TF33-□□A-S) or RS485 communication model (TF33-□□A-T/A).

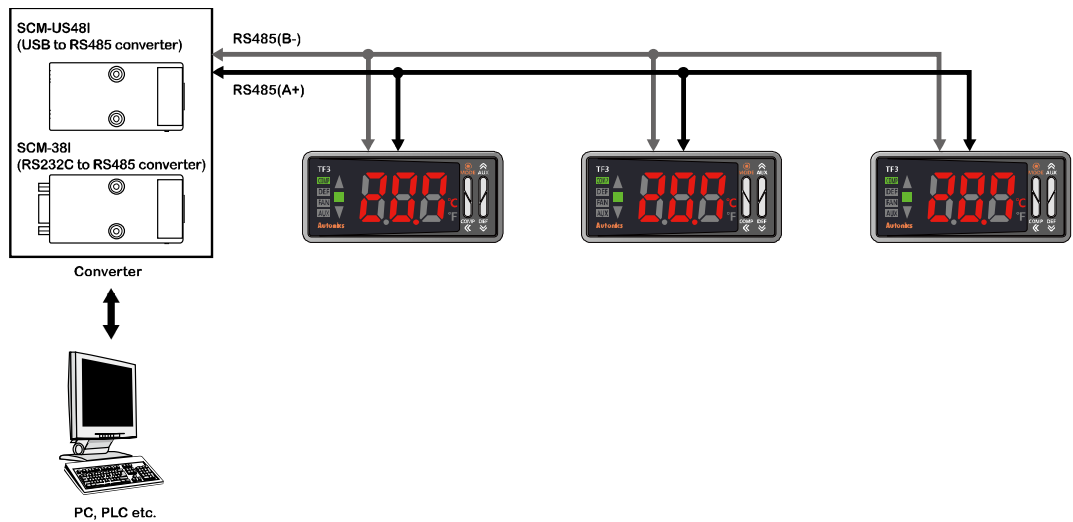
**Caution**

- When wiring input and output terminals, connect lines correctly.
- Use only supported sensors.
- Make sure to A, B direction of communication terminal.
- In case of AC/DC power model, make sure to +, - direction of power terminal.
- Do not tie together the sensor lines and the AC power lines.

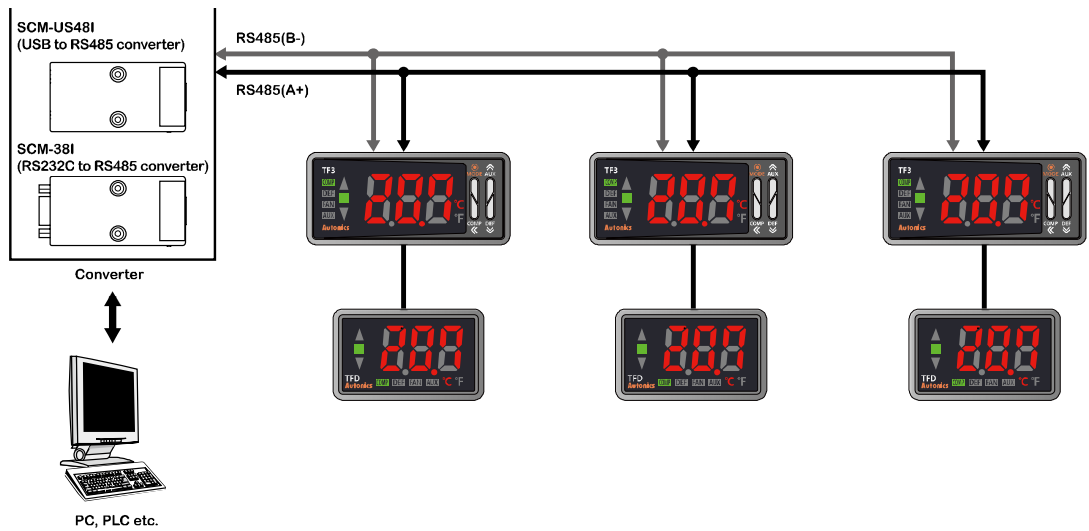
4.1.1 Communication connection

(1) Connection via RS485 communication terminal

Only for RS485 communication model (TF33-□□A-T/A). The connection is available between upper device and up to 31 TF3 units via RS485 communication terminal.

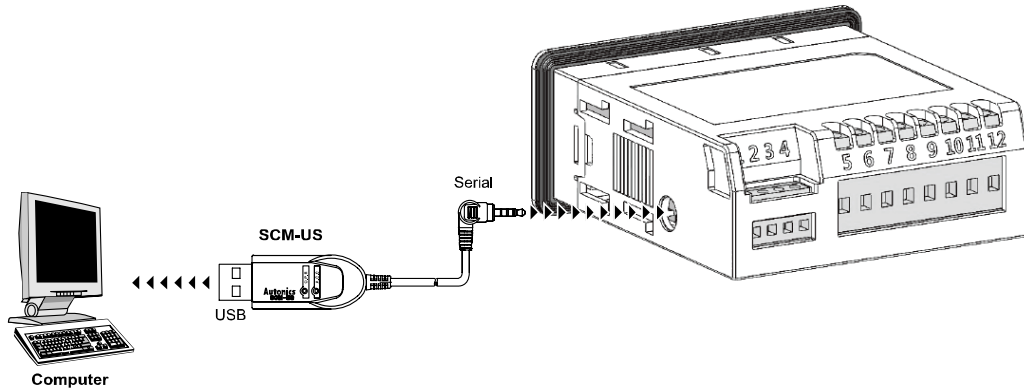


Connect a remote display unit (TFD) at the data loader port of the unit. One TF3 connects one remote display unit (TFD). When connecting remote display unit (TFD), the communication via RS485 communication terminal is available.



(2) Connection via data loader port

It is available to connect TF3 and PC by connecting communication converter, SCM-US (USB to Serial converter, sold separately) at the data loader port of the unit. (communication speed: 9600bps fixed)

**Note**

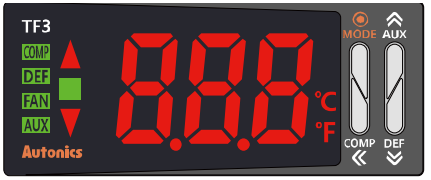





Do not communication lines and the AC power lines.
Use communication lines as twisted pair within up to 800m.
For more information about communication, refer to 6.11 Communication output.

5 Preparation and Start-up

5.1 Initial display when power ON

When power supplies to the unit, whole display part flashes approx. 1 sec. The display part displays model specification (no. of input CHs, output, power supply, compressor load capacity, option function), flashes input type twice and the unit returns to RUN mode to operate.

Model specification display is same as the unit model name. (E.g.: TF33-34A-A model)

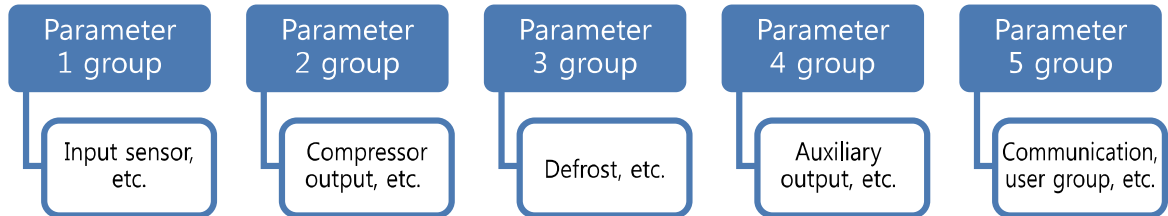
① Whole display part		
② Series		
③ No. of input CHs/Output/Power supply		
④ Compressor load capacity/Option function		
⑤ RUN mode		Sensor connection error
		Normal operation

5.2 Basic control method

5.2.1 Parameter group

The setting items are below by each group.

For more information about parameter group description, refer to 5.3 Parameter groups.










Note

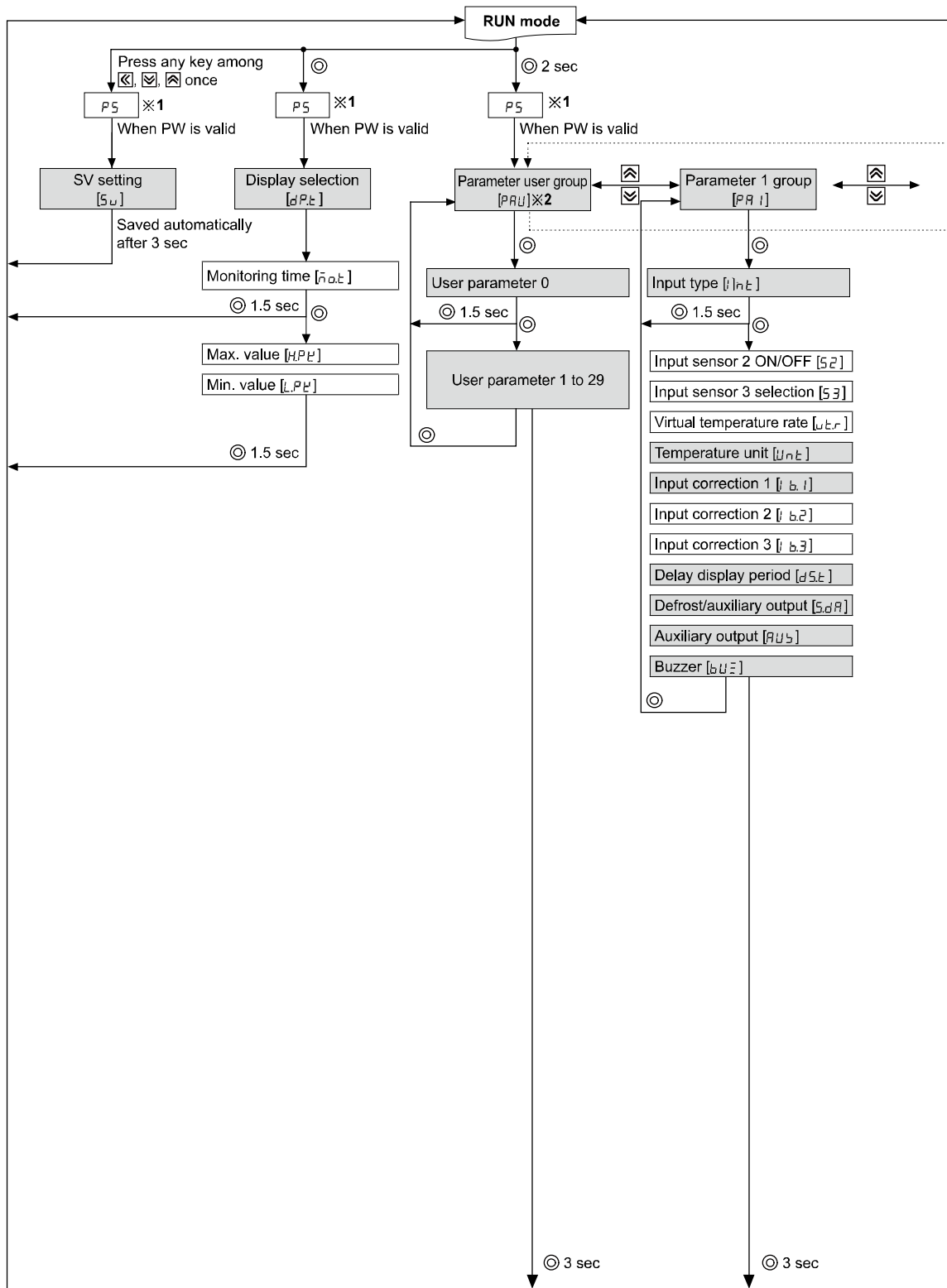
When changing parameter setting value, the related parameter setting value may be also reset. Must check the setting value of the related parameters.

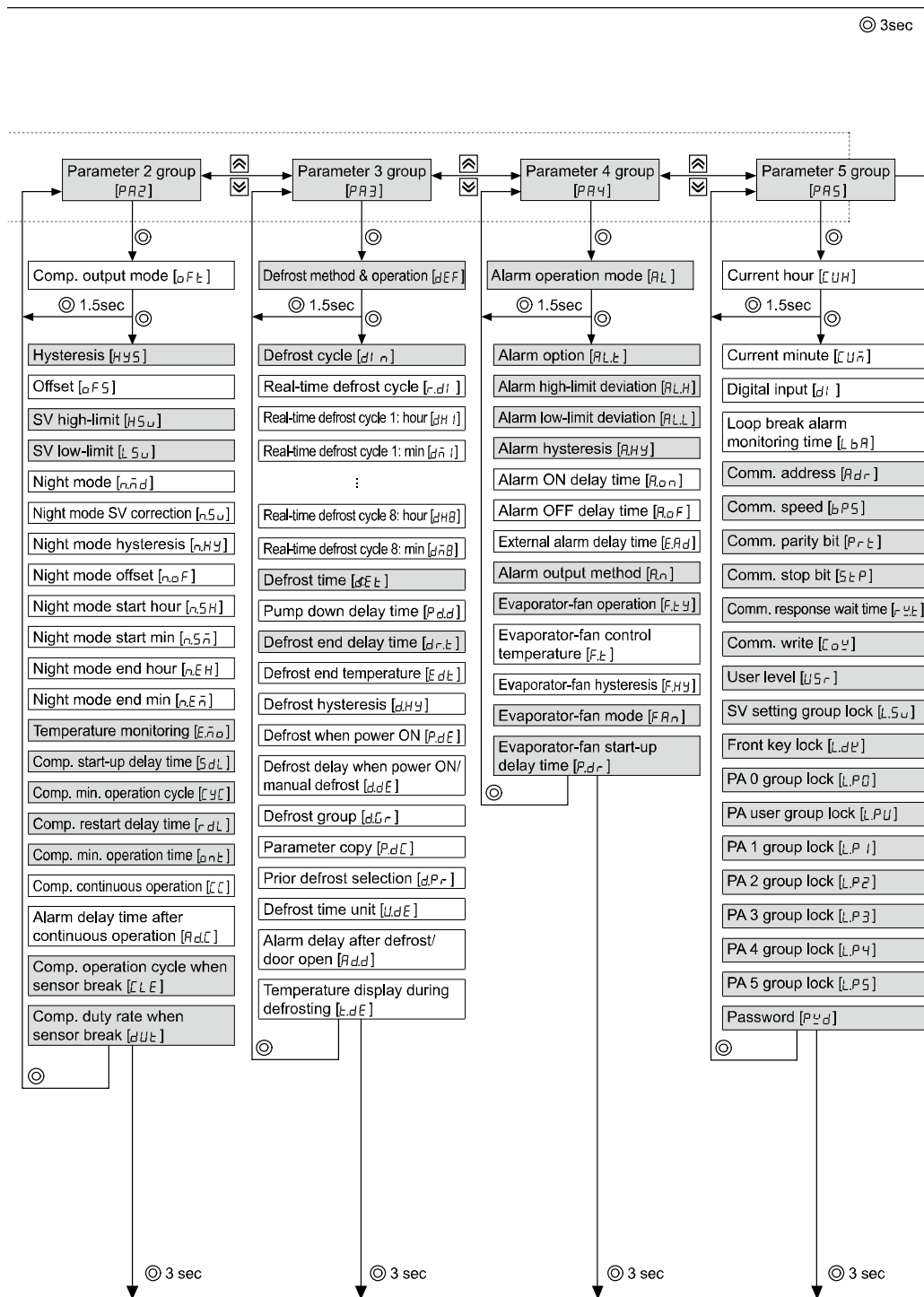
For more information, refer to 7.8 Reset parameters by changing parameter .

5.2.2 SV (setting value) setting







①		<p>Press any key among the , ,  key in RUN mode to enter into SV setting mode. Last digit (10^0 digit) on SV display part flashes.</p>
②		<p>Press the  key to move digit. ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$)</p>
③		<p>Press the ,  key to raise or lower the set value. (9→0)</p>
④		<p>Press the  (MODE) key to save the set value. (If there is no additional key operations in 3 sec, the changed SV is automatically saved.)</p>

5.3 Parameter groups



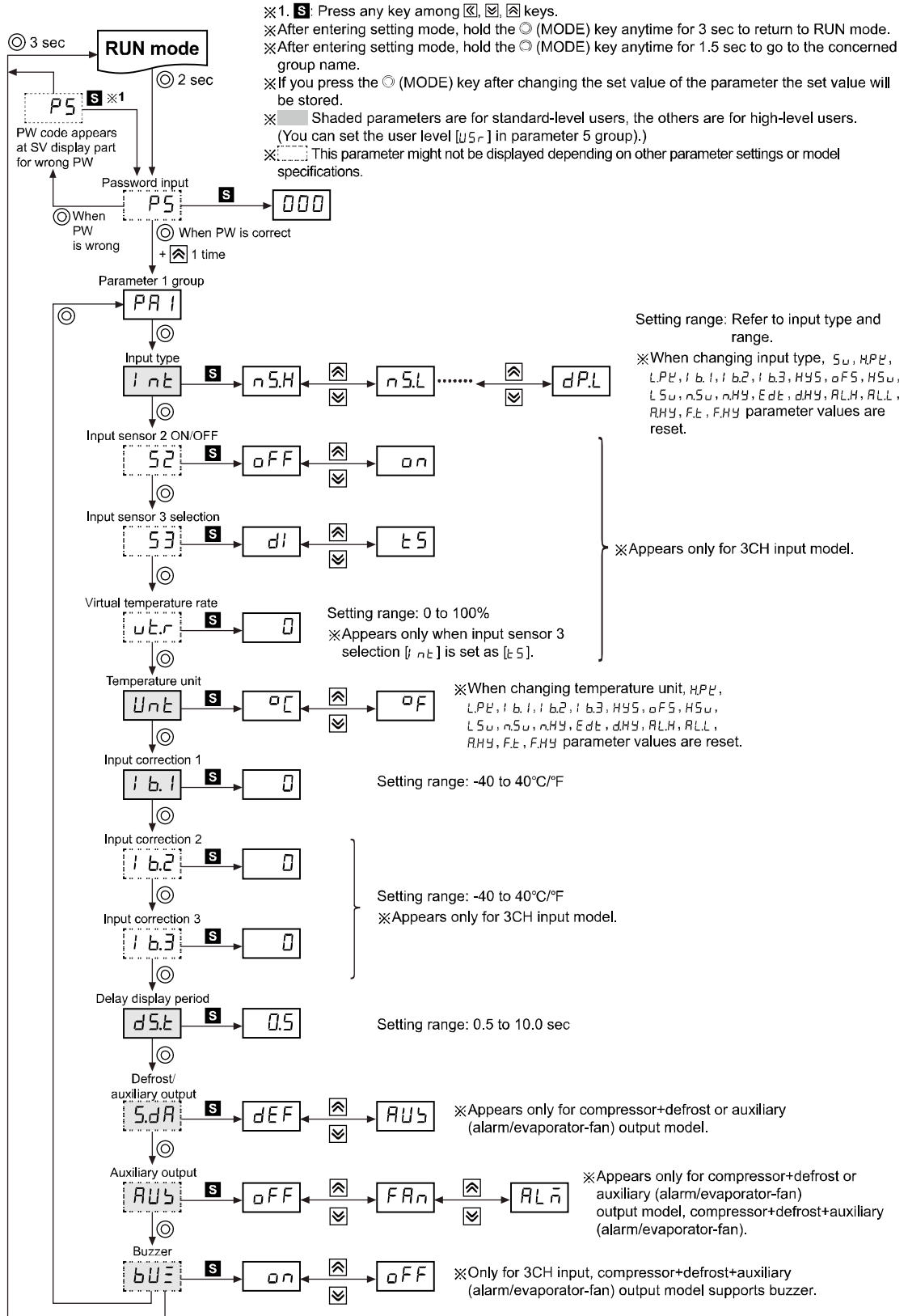


※1. [P5] parameter appears only when password is set.
 The default password is [000]. If password is not valid, the password code appears.
 Press any key among the \leftarrow , \rightarrow , \uparrow keys to return to password entering window. Press the \odot (MODE) key to return to RUN mode.
 If you forget password, contact Autonics after checking password code.

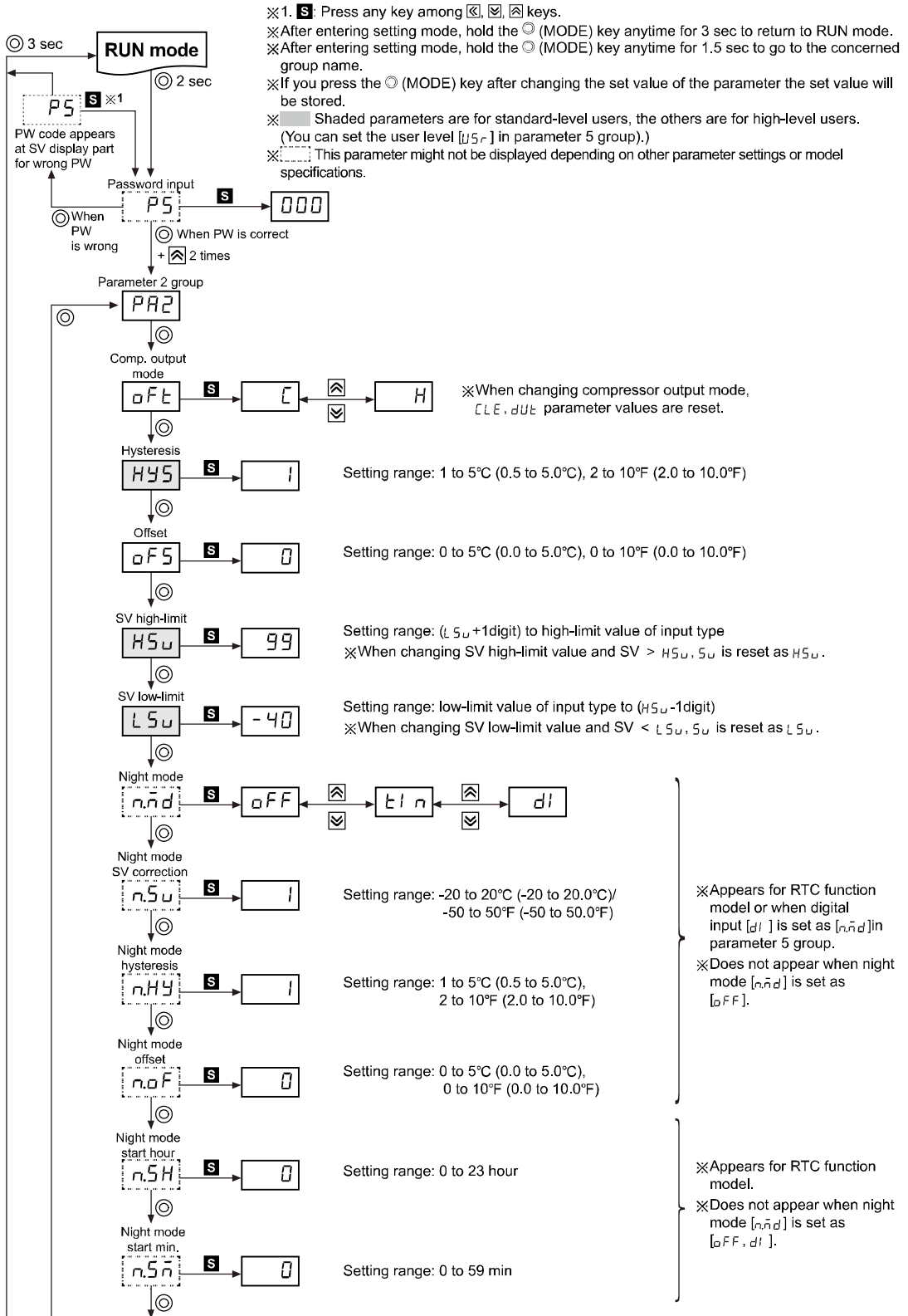
- ※2. It appears when setting user parameter group in the comprehensive device management program (DAQMaster).
- Press the  (MODE) key after changing the setting to save the SV.
 - Hold the  (MODE) key for 1.5 sec while in setting mode to move to the parameter group.
 - Hold the  (MODE) key for 3 sec while in setting mode to return RUN mode.
 - Press the  (MODE) at the last parameter of each parameter group, it moves to that parameter group name. You can move to other groups with ,  keys.
 - If there is no additional key operation within 30 sec after entering into setting mode, it will be automatically returned to RUN mode and previous setting value will be remained.
 - The shaded parameters are displayed when user level [U5r] of parameter 5 group is set as standard level [Std].

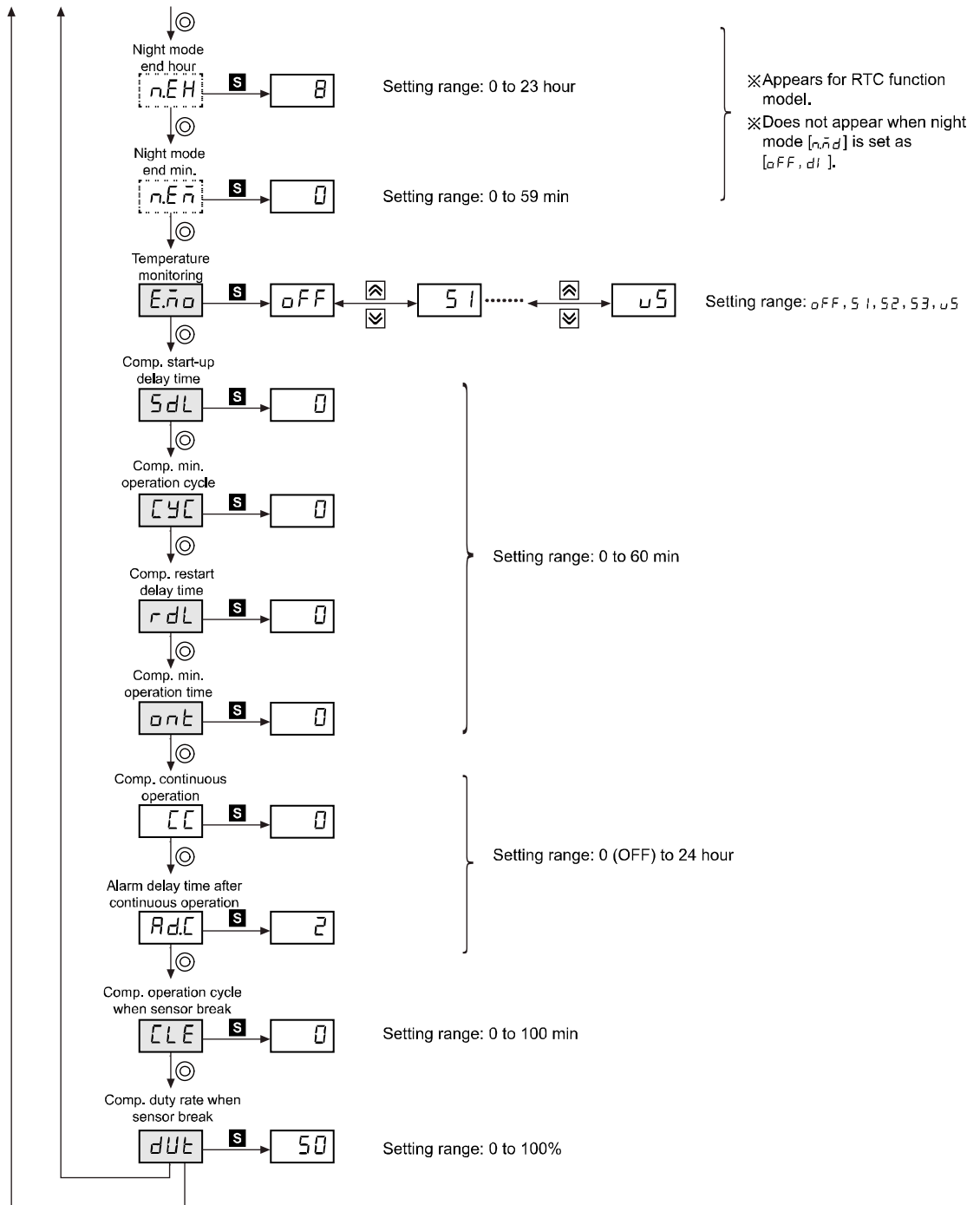
5.4 Parameter groups

5.4.1 Parameter 1 group [PA1]

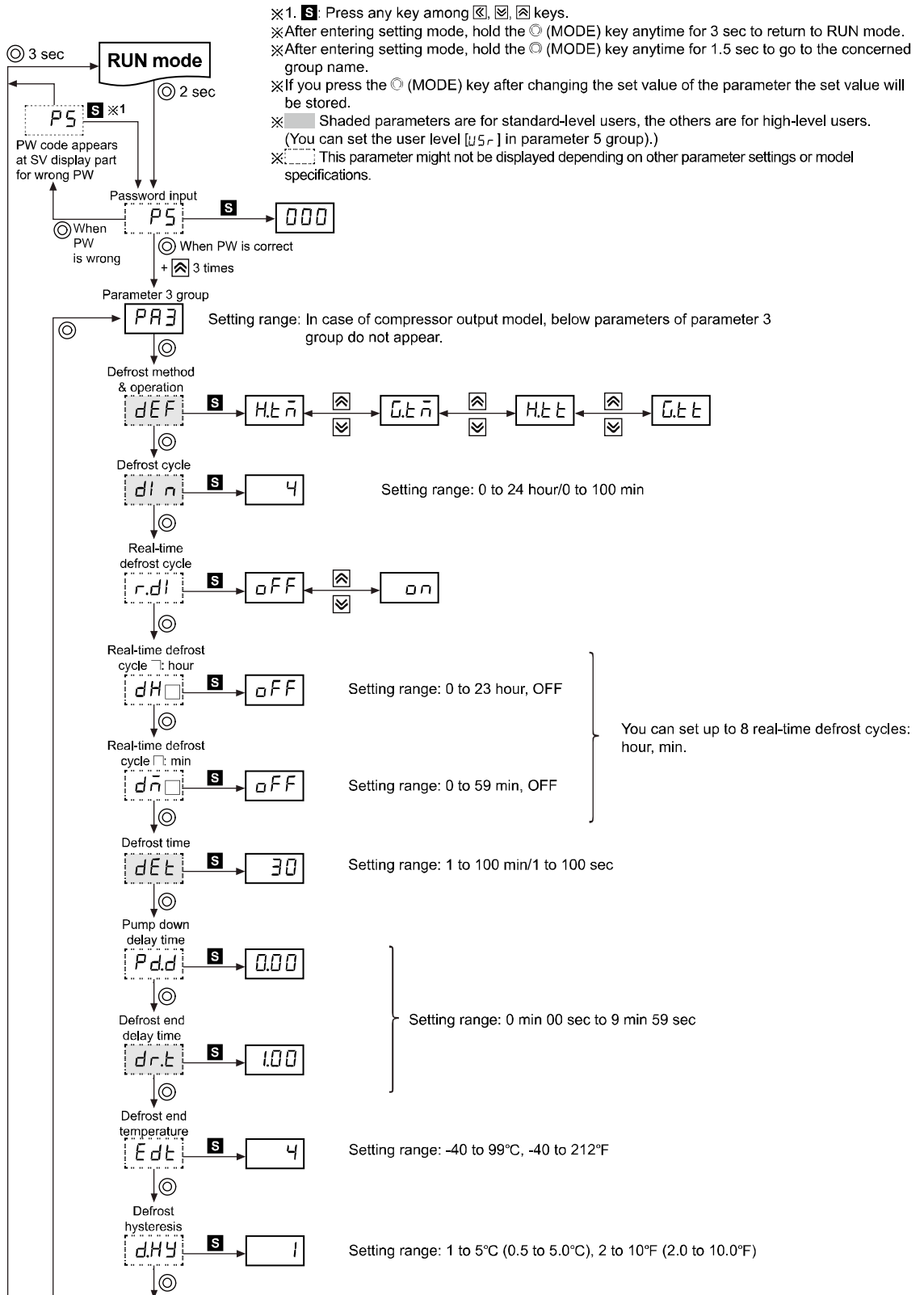


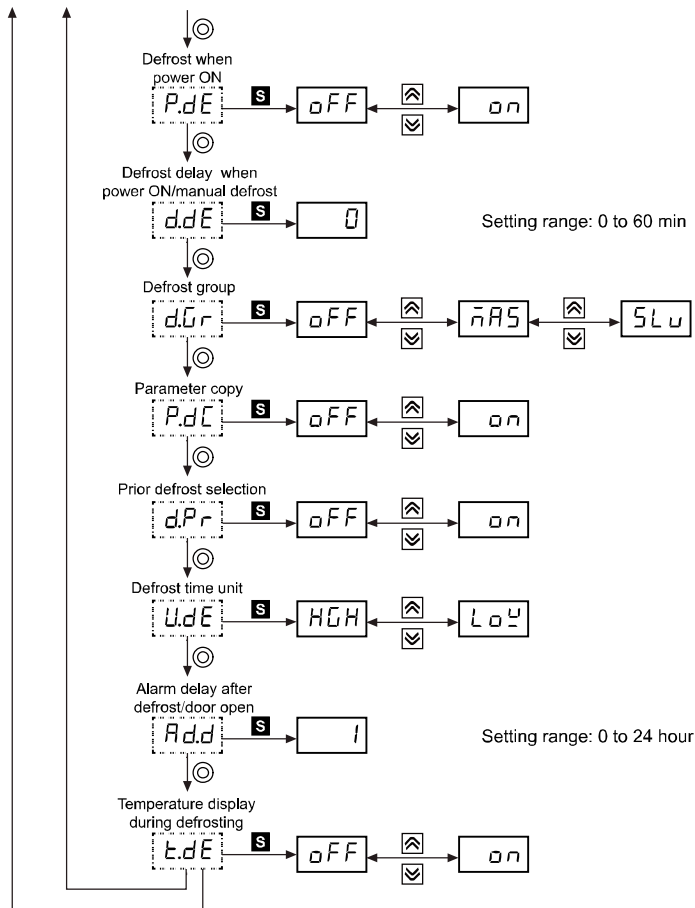
5.4.2 Parameter 2 group [PA2]





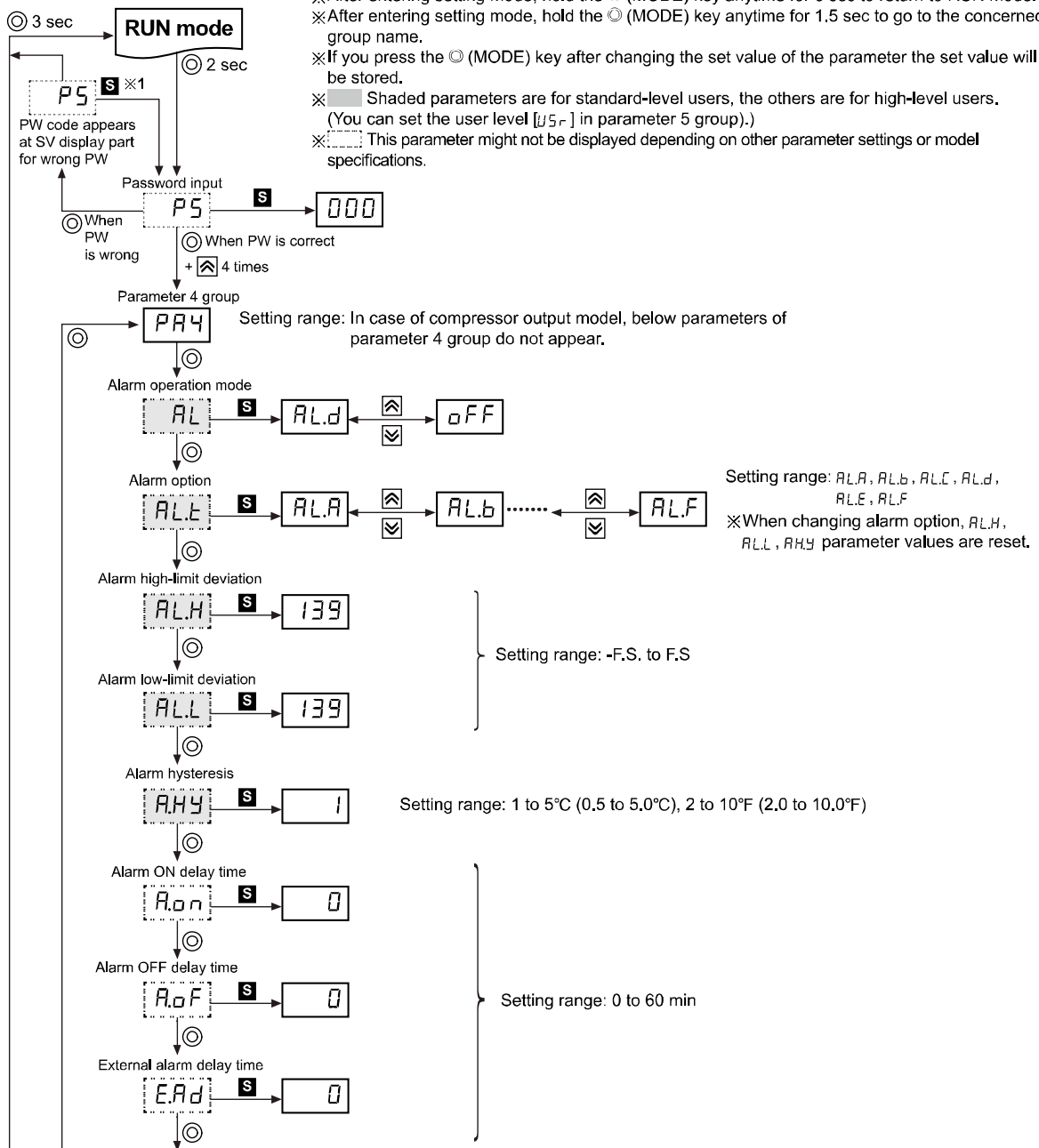
5.4.3 Parameter 3 group [PA3]

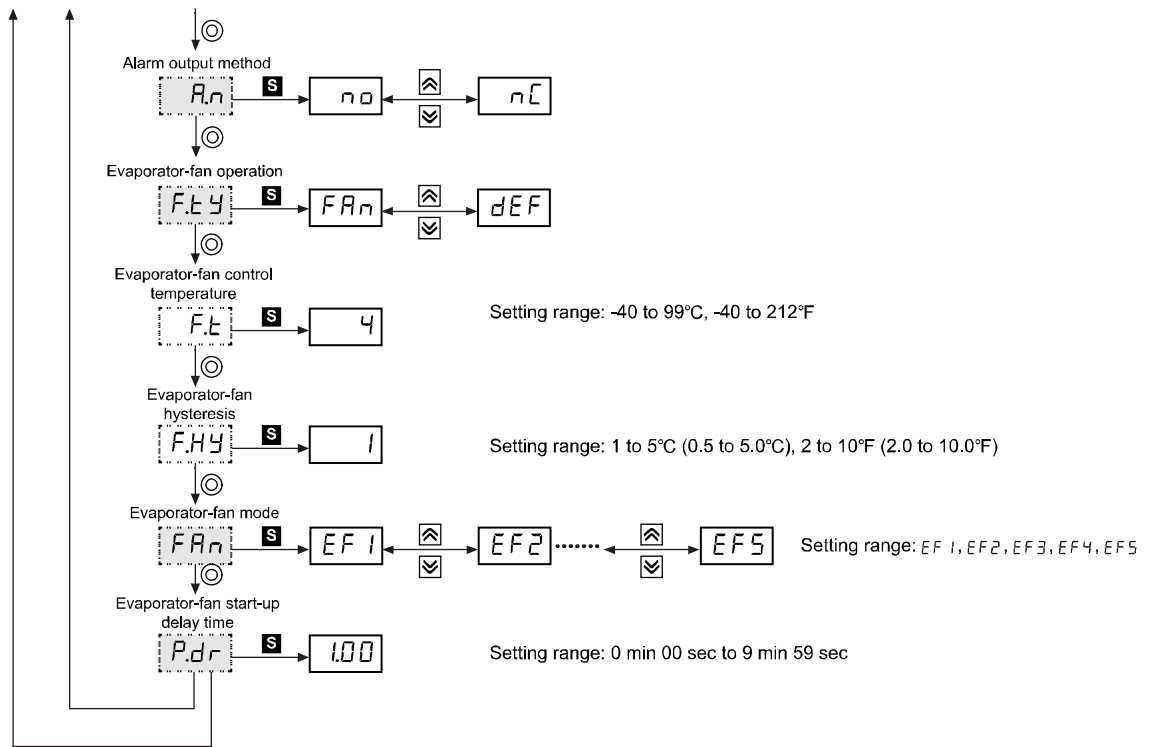




5.4.4 Parameter 4 group [PA4]

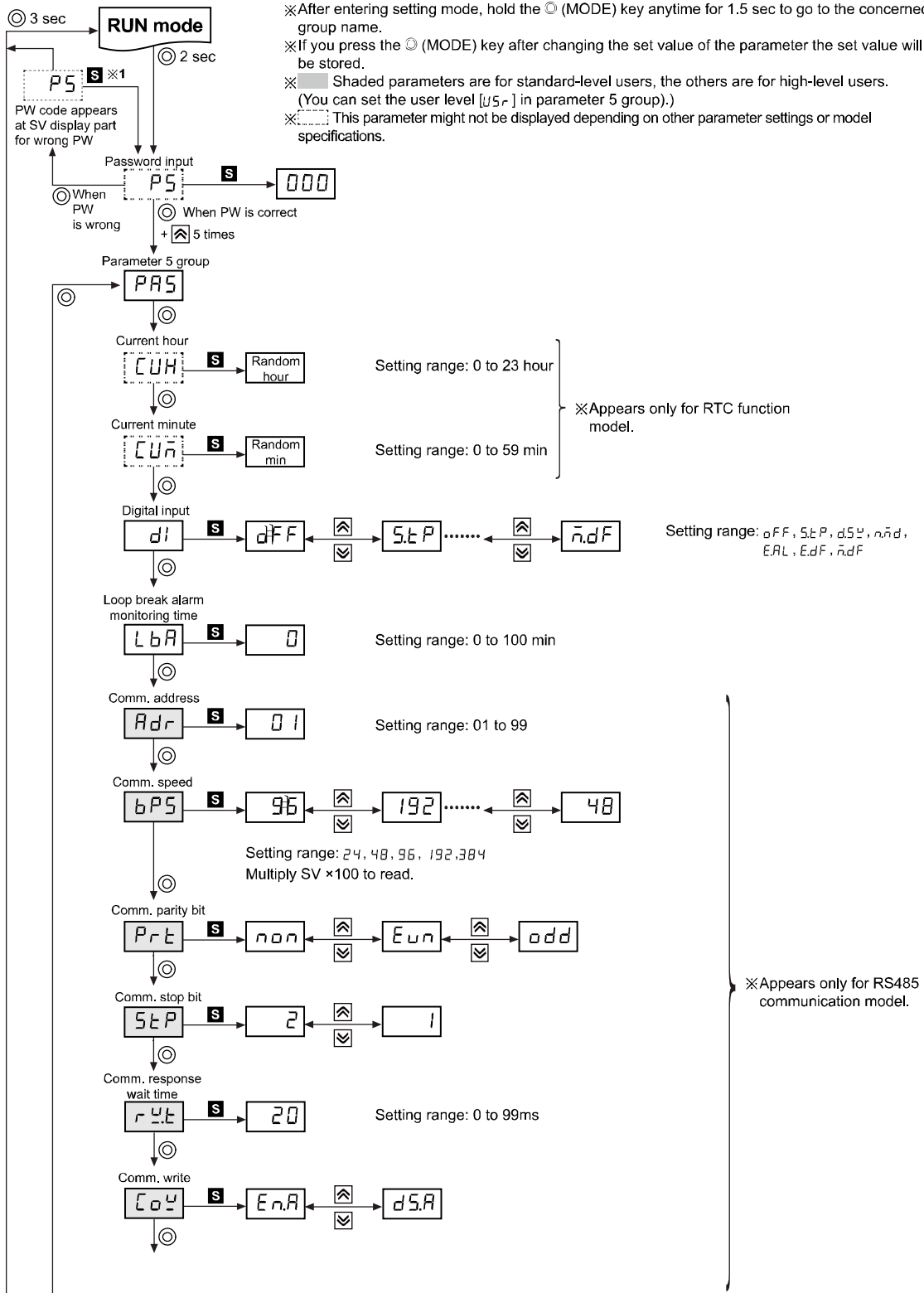
- ※1. **S**: Press any key among \square , \square , \square keys.
- ※After entering setting mode, hold the \odot (MODE) key anytime for 3 sec to return to RUN mode.
- ※After entering setting mode, hold the \odot (MODE) key anytime for 1.5 sec to go to the concerned group name.
- ※If you press the \odot (MODE) key after changing the set value of the parameter the set value will be stored.
- ※ Shaded parameters are for standard-level users, the others are for high-level users. (You can set the user level [U5r] in parameter 5 group.)
- ※ This parameter might not be displayed depending on other parameter settings or model specifications.

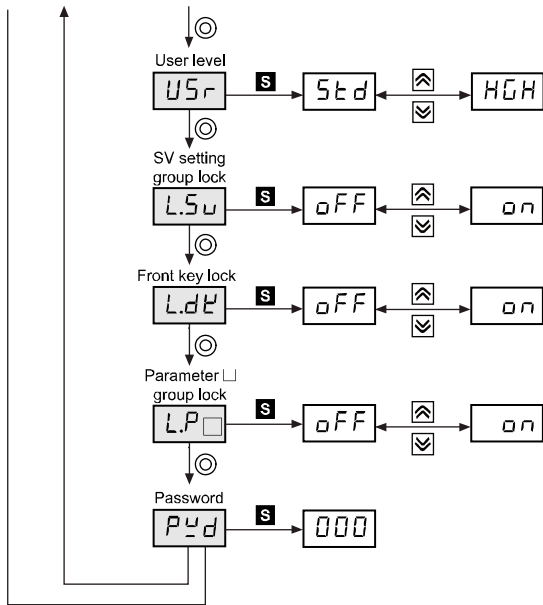




5.4.5 Parameter 5 group [P5]

- ※1. **S**: Press any key among \square , \square , \square keys.
- ※After entering setting mode, hold the \odot (MODE) key anytime for 3 sec to return to RUN mode.
- ※After entering setting mode, hold the \odot (MODE) key anytime for 1.5 sec to go to the concerned group name.
- ※If you press the \odot (MODE) key after changing the set value of the parameter the set value will be stored.
- ※ Shaded parameters are for standard-level users, the others are for high-level users. (You can set the user level [U5r] in parameter 5 group.)
- ※ This parameter might not be displayed depending on other parameter settings or model specifications.





6 Parameter Settings and Functions

6.1 Input

6.1.1 Input type and temperature range

Input type		Decimal point	Display	Temperature range(°C)	Temperature range (°F)
Thermistor (NTC)	NTC 5kΩ	1	n5.H	-40 to 99	-40 to 212
		0.1	n5.L	-40 to -20 -19.9 to 99.9	-40 to -20 -19.9 to 99.9 100 to 212
	NTC 10kΩ	1	n1.H	-40 to 99	-40 to 212
		0.1	n1.L	-40 to -20 -19.9 to 99.9	-40 to -20 -19.9 to 99.9 100 to 212
RTD ※1	DPt 100Ω	1	dP.H	-99 to 99	-148 to 212
		0.1	dP.L	-99 to -20 -19.9 to 99.9※2	-148 to 212

※ TF3 Series displays only 3 digits. If PV decimal number of shaded temperature range is out of 3 digit, TF3 does not display the numbers below decimal point. You can check it at the comprehensive device management program (DAQMaster) by communicating via PC.

※1. Only for 1CH input model (TF31-□□□).

※2. If PV with "-" sign is over 3 digits (e.g.: -99.9), the numbers below decimal point does not display. You can check it at the comprehensive device management program (DAQMaster) by communicating via PC.



Ex.

Display	TF3 Series	DAQMaster
Present value		
-30.3°C		
-10.3°C		

6.1.2 Input type [*PA1* → *Int*]

Select the desired input type (thermistor, RTD).

Refer to 6.1.1 Input type and temperature range.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA1</i>	<i>Int</i>	<i>n5.H, n5.L, ni.H, ni.L, dP.H</i> ※1, <i>dP.L</i> ※1	<i>n5.H</i>	-

※1. Only for 1CH input model (TF31-□□□) is available.



Note

When completing input type setting, control operation pauses and returns automatically. The related parameters are reset. For more information about the reset parameters, refer to 7.8 Reset parameters by changing parameter.

6.1.3 Input sensor 2 ON/OFF [*PA1* → *S2*]

Select input sensor 2 (defrost temperature) ON/OFF.

Only for 3CH input model (TF33-□□□-□) is available.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA1</i>	<i>S2</i>	<i>OFF, ON</i>	<i>OFF</i>	-

6.1.4 Input sensor 3 selection [*PA1* → *S3*]

Select input sensor 3 type.

Only for 3CH input model (TF33-□□□-□) is available.

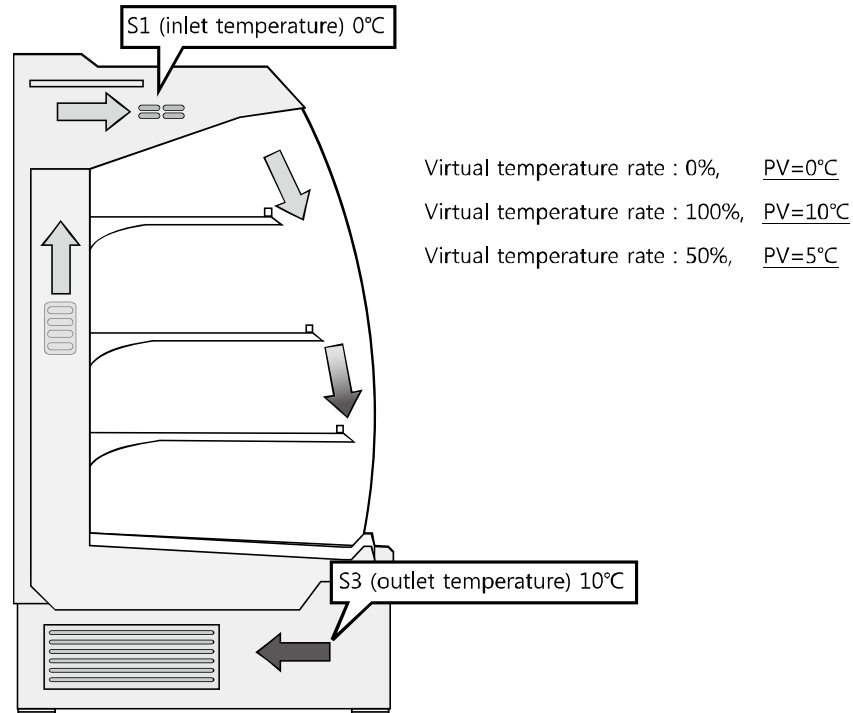
Setting group	Parameter	Setting range	Factory default	Unit
<i>PA1</i>	<i>S3</i>	<i>di, t5</i>	<i>di</i>	-

Setting value	Description
<i>t5</i>	Input sensor 3 is air outlet temperature.
<i>di</i>	Input sensor 3 is digital input.

6.1.5 Virtual temperature rate [P A 1 → u t . r]

If the temperature of inlet and outlet is significantly different at freezer, virtual temperature helps to control temperature efficiently.

When the unit is 3CH input model (TF33-□□□-□) and input sensor 3 selection [5 3] of parameter 1 group is set as [t 5]. You can set virtual temperature rate.



Setting group	Parameter	Setting range	Factory default	Unit
P A 1	u t . r	0 to 100	0	%

Virtual temperature is designated by the rate of input sensor 1 (inlet temperature) and input sensor 3 (outlet temperature).

There is virtual temperature calculation formula.

$$\text{Virtual temperature (PV)} = \frac{[(100 - \text{virtual temperature rate}) \times \text{input sensor 1 temperature}] + [\text{virtual temperature rate} \times \text{input sensor 3 temperature}]}{100}$$

If virtual temperature rate is set as [0], virtual temperature (PV) = input sensor 1,

If virtual temperature rate is set as [100], virtual temperature (PV) = input sensor 3



Ex.

If inlet temperature of input sensor 1 is 0°C, and outlet temperature of input sensor 3 is 10°C, set virtual temperature rate [u t . r] as [50] and virtual temperature is 5°C to control temperature.

$$5 = \frac{[(100 - 50) \times 0] + [50 \times 10]}{100}$$

6.1.6 Temperature unit [PA1 → Unit]

Set the desired temperature unit (°C/°F) to display.

The front unit indicator is displayed by the temperature unit setting.

Setting group	Parameter	Setting range	Factory default	Unit
PA1	Unit	°C, °F	°C	-

6.1.7 Input correction [PA1 → I b.□]

This feature is used to compensate for input correction produced by thermistor, RTDs, NOT by the controller itself.

The input correction function is mainly used when the sensor cannot be attached directly to controlled objects. It is also used to compensate for temperature variance between the sensor's installation point and the actual measuring point.

Set input correction value by each sensor.

(I b.1: input sensor 1 Input correction, I b.2: input sensor 2 Input correction, I b.3: input sensor 3 Input correction)

Setting group	Parameter	Setting range	Factory default	Unit
PA1	I b.1	-40 to 40	0	°C/°F
	I b.2 ^{※1}			
	I b.3 ^{※2}			

※1. When the unit is 3CH input model (TF33-□□□-□) and input sensor 2 ON/OFF[52] is set as [on], it is available.

※2. When the unit is 3CH input model (TF33-□□□-□) and input sensor 3 selection [53] is set as [t5], it is available.



Ex.

If the controller displays -2.0°C when the actual temperature is 0°C , set as 2 in order to adjust the controller's display temperature to 0.0°C . If present value after input correction is out of the input range by each input sensor, it displays 'HHH' or 'LLL'.



Note

Make sure that an accurate temperature variance measurement is taken before set values of input correction. An inaccurate initial measurement can lead to greater variance. Many of today's temperature sensors are graded by their sensitivity. Since higher accuracy usually comes at a higher cost, most people tend to choose sensors with medium sensitivity. Measuring each sensor's sensitivity correction for input correction feature in order to ensure higher accuracy in temperature reading.

6.1.8 Delay display period [*PR1* → *d5.t*]

To prevent shaken or repeatedly wobbled present value (PV) due to noise element, disturbance of input signal or unstable input signal, set the value to display temperature input value stably.

Calculated input values as average, the value becomes as filter of temperature input.

When delay display period setting value is lower, it is sensitive to disturbance and displays input sensor temperature change directly.

When the setting value is higher, display response is slow for input sensor temperature change. However if disturbance occurs, it displays effectively.

Set the value as user environment.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PR1</i>	<i>d5.t</i>	0.5 to 100	0.5	Sec

6.2 Display and Monitoring

6.2.1 Display selection [PA0 → dP.t]

Select the input sensor to display in RUN mode.

Only for 3CH input model (TF33-□□□-□) is available.

Setting group	Parameter	Setting range	Factory default	Unit
PA0	dP.t	51, 52, 53, u5	51	-

Setting value	Description
51	Displays present value of input sensor 1 (inlet temperature).
52 ^{*1}	Displays present value of input sensor 2 (defrost temperature).
53 ^{*2}	Displays present value of input sensor 3 (outlet temperature).
u5 ^{*3}	Displays virtual temperature.

※1. When input sensor 2 ON/OFF [52] is set as [on], it is available.

※2. When input sensor 3 selection [53] is set as [t5], it is available.

※3. When input sensor 3 selection [53] is set as [t5] and virtual temperature rate [u.t.r] is not set [0] or [100], it is available.

6.2.2 Monitoring

You can monitor the max./min. input value during the desired time.

Select the input sensor to be monitored at temperature monitoring [E.no] of parameter 2 group.

Set monitoring time [n.ot] of parameter 0 group and it starts monitoring max./min. input value.

You can also check the max./min. value at max./min. value [H.P.t/L.P.t] of parameter 0 group



Note

You can set the input sensor differently at display selection [dP.t] of parameter 0 group and temperature monitoring [E.no] of parameter 2 group.

You can monitor the max./min. value of the not displayed input.

6.2.2.1 Temperature monitoring [PR2 → E.no]

Select the input sensor to monitor max./min. value.

During monitoring, select [oFF] and it stops to monitor the value.

Setting group	Parameter	Setting range	Factory default	Unit
PR2	E.no	oFF, 51, 52, 53, u5	oFF	-

Setting value	Description
oFF	No monitoring.
51	Monitors input sensor 1 (inlet temperature).
52 ^{*1}	Monitors input sensor 2 (defrost temperature).
53 ^{*2}	Monitors input sensor 3 (outlet temperature).
u5 ^{*3}	Monitors virtual temperature.

※1. When input sensor 2 ON/OFF [52] is set as [on], it is available.

※2. When input sensor 3 selection [53] is set as [t5], it is available.

※3. When input sensor 3 selection [53] is set as [5] and virtual temperature rate [v.t.r] is not set [0] or [100], it is available.

6.2.2.2 Monitoring time [PA0 → n.o.t]

Set temperature monitoring time.

Monitoring is available up to 100 hours. After the set time, it stops to monitor the value.

When temperature monitoring [E.n.o] of parameter 2 group is set as [5 1/52/53/5], it is available.

Set it as [0] and time is not progress and no monitoring min./max. value.

Setting group	Parameter	Setting range	Factory default	Unit
PA0	n.o.t	0 to 100	0	Hour



Note

When re-supplying the power to the unit before reaching the set monitoring time, or changing the setting of monitoring time [n.o.t] or temperature monitoring [E.n.o], the progress time is reset and monitoring re-starts.

6.2.2.3 Max./Min. value [PA0 → H.P.V / L.P.V]

Check the max./min. value of input sensor during the set monitoring time (0 to 100 hours)

Press the [↩] key once at Max./ Min. value parameter [H.P.V/L.P.V] to reset max./min. value.

Setting group	Parameter	Setting range	Factory default	Unit
PA0	H.P.V	-	-	°C/°F
	L.P.V			

6.3 Temperature control

Temperature control of TF3 Series is based on compressor control output.

Regardless of display in RUN mode, in case of 1CH input model (TF31-□□□), it controls compressor by input sensor 1. In case of 3CH input model (TF33-□□□-□), it controls compressor by input sensor 1/3 or virtual temperature.

6.3.1 Compressor output mode [PR2 → OFt]

For control temperature, there are two methods; heating control, cooling control. Heating control and cooling control are mutually opposing operations with inverse outputs.

Setting group	Parameter	Setting range	Factory default	Unit
PR2	OFt	Ε, H	Ε	-

Setting value	Description
Ε (cooling control)	<p>When present value (PV) is higher than setting value (SV), the output (compressor control output) turns ON.</p> <p>Control output MV</p> <p>100%(ON)</p> <p>0%(OFF)</p> <p>SV</p> <p>Hysteresis</p> <p>Cooling</p> <p>PV</p> <p>Cooling control</p>
H (heating control)	<p>When present value (PV) is lower than setting value (SV), the output (compressor control output) turns ON.</p> <p>Control output MV</p> <p>100%(ON)</p> <p>0%(OFF)</p> <p>SV</p> <p>Hysteresis</p> <p>Heating</p> <p>PV</p> <p>Heating control</p>



Note

- Defrost operation is regardless of compressor output and it is heating operation.
- For user environment, set the compressor output mode.

6.3.2 ON/OFF control

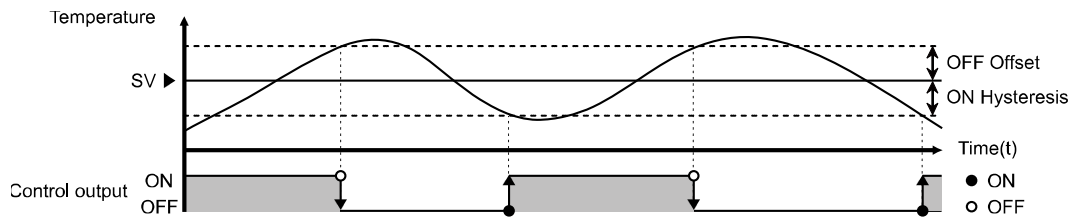
The output turns ON/OFF by comparing present value (PV) and setting value (SV) to control temperature.

6.3.3 Hysteresis, Offset [PR2 → HYS/OF5]

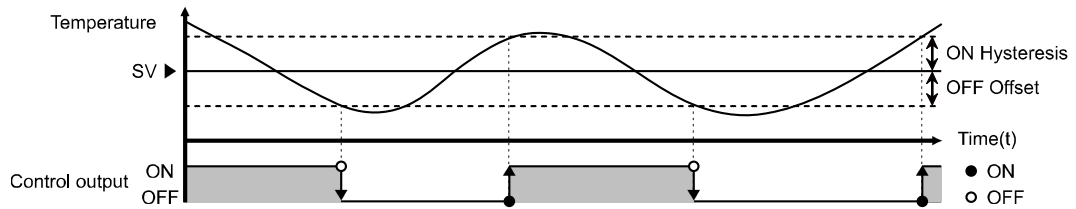
Hysteresis/Offset are to adjust control output ON/OFF point in ON/OFF control mode. ON hysteresis [HYS] sets the output on point and OFF offset [OF5] sets the off point. Setting hysteresis too low can result in hunting induced by disturbance (noise, chattering, etc.).

To minimize hunting, set ON hysteresis and OFF offset values with consideration to the heater or cooler's capacity and thermal characteristics, the control subject's response characteristics, the sensor's response characteristics and installation conditions, and other defining factors.

Setting group	Parameter	Setting range	Factory default	Unit
PR2	HYS	1 to 5 (0.5 to 5.0)	1	°C
		2 to 10 (2.0 to 10.0)		°F
	OF5	0 to 5 (0.0 to 5.0)	0	°C
		0 to 10 (0.0 to 10.0)		°F



< Heating control >

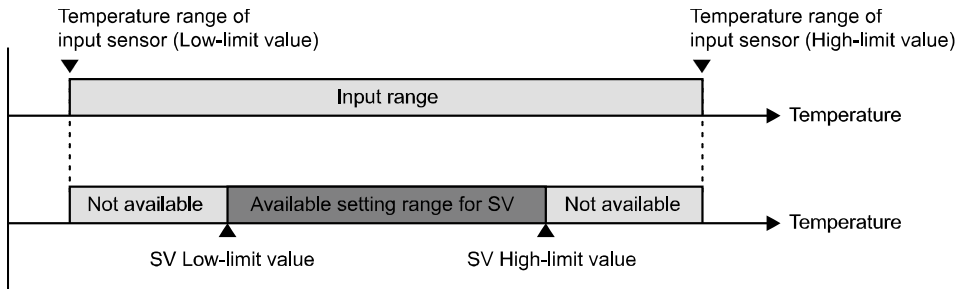


Cooling control

6.3.4 Setting value (SV) high/low-limit [$PR2 \rightarrow L5U / H5U$]

Set the high/low-limit of setting value (SV) within the input temperature range to limit the SV setting range.

Setting group	Parameter	Setting range	Factory default	Unit
PR2	H5U	(L5U + 1digit) to high-limit value of input type	99	°C/°F
	L5U	Low-limit value of input type to (H5U - 1digit)	-40	



Note

When changing input type [$i n t$] of parameter 1 group, SV high/low-limit [$H5U / L5U$] is also changed as max./min. value of the changed input type.

6.3.5 Night mode

For example, at the night time, a freezer door may not open frequently and it has better freezer efficiency than day time.

You can set night mode start/end time and night mode SV correction value and hysteresis/offset also.

Use RTC (real time clock) or digital input function, it controls temperature as night mode.

6.3.5.1 Night mode [PAR2 → n.nd]

Set night mode use or not.

Setting group	Parameter	Setting range	Factory default	Unit
PAR2	n.nd	OFF, t1 n, d1	OFF	—

Setting value	Description
OFF	Not using night mode.
t1 n ^{※1}	Uses night mode during the set time.
d1 ^{※2}	Uses night mode via digital input.

※1. Only RTC option model (TF33-3□H-R/TF33-3□A-A) is available.

※2. When input sensor 3 selection [53] of parameter 1 group is set as [d1] and digital input [d1] of parameter 5 group is set as [n.nd], it is available.

6.3.5.2 Night mode SV correction [PAR2 → n.Sv]

For night mode, it changes the existed setting value (SV) by adding the night mode SV correction value.

At night mode, night mode setting value (the existed setting value (SV)+night mode SV correction value) is applied and control is starts.

When night mode [n.nd] is set as [t1 n/d1], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PAR2	n.Sv	-20 to 20 (-20 to 20.0)	1	°C
		-50 to 50 (-50 to 50.0)		°F

6.3.5.3 Night mode hysteresis/offset [PAR2 → n.HY/n.OF]

At night mode, hysteresis/offset are to adjust control output ON/OFF point.

When night mode [n.nd] is set as [t1 n/d1], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PAR2	n.HY	1 to 5 (0.5 to 5.0)	1	°C
		2 to 10 (2.0 to 10.0)		°F
	n.OF	0 to 5 (0.0 to 5.0)	0	°C
		0 to 10 (0.0 to 10.0)		°F

6.3.5.4 Night mode start hour/min [PAR2 → n5H / n5n]

Set night mode start hour/min. When it is set time, it starts night mode.
When night mode [nnd] is set as [tln], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PAR2	n5H	0 to 23	0	Hour
	n5n	0 to 59	0	Min

6.3.5.5 Night mode end hour/min [PAR2 → nEH / nEn]

Set night mode end hour/min. When it is set time, it ends night mode.
When night mode [nnd] is set as [tln], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PAR2	nEH	0 to 23	0	Hour
	nEn	0 to 59	0	Min

6.4 Other output settings**6.4.1 Defrost/Auxiliary output [PA1 → SdA]**

In case of compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□),
select one between defrost output or auxiliary output.

Setting group	Parameter	Setting range	Factory default	Unit
PA1	SdA	dEF, AU5	dEF	-

Setting value	Description
dEF	Uses defrost output.
AU5	Uses auxiliary output.

6.4.2 Auxiliary output [PA1 → AU5]

Set the function of auxiliary output.

When the unit is compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□), it is available.

When the unit is compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□) and defrost/auxiliary output [SdA] of parameter 1 group is set as [AU5], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PA1	AU5	oFF, FRn, ALn	oFF	-

Setting value	Description
oFF	Not use auxiliary output.
FRn ^{*1}	Uses auxiliary output as evaporator-fan output.
ALn ^{*2}	Uses auxiliary output as alarm output.

6.4.3 Enable auxiliary output

Hold the \boxtimes key for 3 sec and [E.A] parameter appears to set auxiliary output use or not.

Set it as [OFF] and auxiliary output does not operate even though auxiliary output ON condition.

When the unit is compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□), and defrost/auxiliary output [S.dR] of parameter 1 group is set as [AUs], auxiliary output [AUs] is set as [FRn] or [RLn], it is available.

When the unit is compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□), and auxiliary output [AUs] is set as [FRn] or [RLn], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
-	E.A	OFF, ON	ON	-

6.4.4 Enable compressor output

Hold the \boxtimes key for 3 sec and [E.C] parameter appears to set compressor output use or not.

Set it as [OFF] and compressor output does not operate even though compressor output ON condition. It is regardless of setting values about compressor parameters.

Setting group	Parameter	Setting range	Factory default	Unit
-	E.C	OFF, ON	ON	-

6.5 Compressor protection

This function is for preventing compressor from life cycle shortening or malfunction by overload and frequent ON/OFF of compressor.

As compressor protection settings, when compressor output does not ON, the front compressor (COMP) output indicator (green) is flashing.

6.5.1 Compressor start-up delay time [PA2 → SdL]

If power turns ON instantly from break-down or power OFF, it delays start-up during the set time of compressor.

Due to this delay, it prevent from overload on the compressor, shortening compressor life cycle and repeated compressor operation.

During compressor start-up delay time, if it is compressor output condition, the output does not turn ON and the front compressor (COMP) output indicator flashes.

Setting group	Parameter	Setting range	Factory default	Unit
PA2	SdL	0 to 60	0	Min

6.5.2 Compressor min. operation cycle [PA2 → CYC]

To prevent frequent compressor ON/OFF, set min. operation cycle.

Set setting cycle by the compressor output ON time.

Setting group	Parameter	Setting range	Factory default	Unit
PA2	CYC	0 to 60	0	Min



Ex.

For 10 compressor operations in one hour, set compressor min. operation cycle [CYC] as [6].

6.5.3 Compressor restart delay time [PA2 → rDL]

To prevent frequent compressor ON/OFF, set compressor ON time after compressor turns OFF. This is for prevent repeat compressor operation.

During compressor restart delay time, if it is compressor output condition, the output does not turn ON and the front compressor (COMP) output indicator flashes.

Setting group	Parameter	Setting range	Factory default	Unit
PA2	rDL	0 to 60	0	Min

6.5.4 Compressor min. operation time [PA2 → onT]

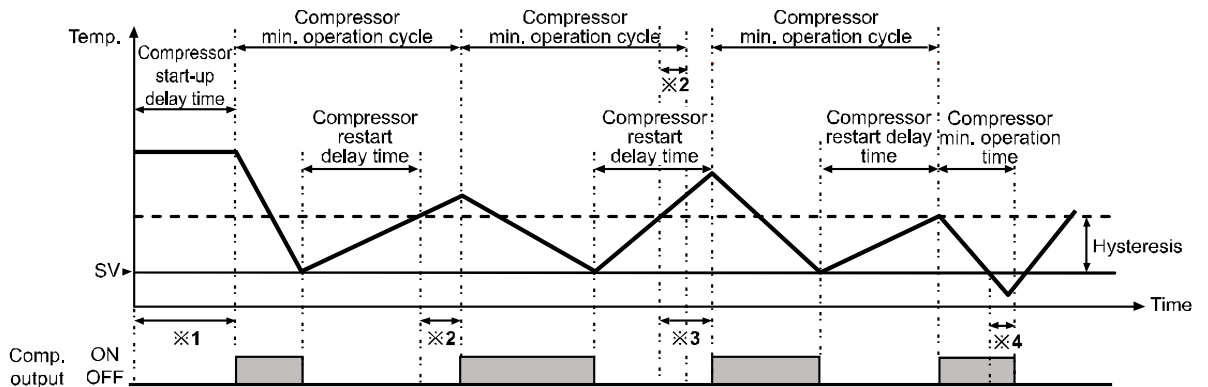
prevent frequent compressor ON/OFF, set min. operation time.

This is for prevent repeat compressor operation.

Even if present value (PV) is lower than hysteresis range, compressor output maintains ON during compressor min. operation time and the output turns OFF after the set time.

Setting group	Parameter	Setting range	Factory default	Unit
PA2	onT	0 to 60	0	Min

6.5.5 Example of compressor operation



- ※1. When starting compressor, if present value (PV) is out of hysteresis range, compressor output does not turn ON and the compressor (COMP) output indicator is flashing during compressor start-up delay time.
- ※2. When compressor delay is completed and it is within compressor min. operation cycle, compressor output does not turn ON and the compressor (COMP) output indicator is flashing. (The latest one has priority between compressor restart delay time and compressor min. operation cycle.)
- ※3. When present value (PV) is out of hysteresis, compressor output does not turn ON and the compressor (COMP) output indicator is flashing during compressor restart delay time.
- ※4. If present value (PV) is below the SV, compressor output maintains ON status during compressor min. operation time. After compressor min. operation time, it turns OFF.



Note

If compressor output does not turn ON due to compressor output condition or parameter settings for compressor protection, the compressor (COMP) output indicator is flashing.

6.5.6 Compressor continuous operation [PA2 → CC]

For lower present value (PV) than setting value (SV), you can set the compressor continuous operation. Set the continuous operation time and compressor continuous operation starts. The front compressor (COMP) output indicator flashes (2 sec ON, 1 sec OFF).

Setting group	Parameter	Setting range	Factory default	Unit
PA2	CC	0 (OFF) to 24	0 (OFF)	Hour

For below cases, it sets as [0] automatically.

- When compressor continuous operation time is end or present value is lower than alarm low-limit deviation value [ALL], and compressor continuous operation stops
- When power turns OFF and ON during continuous operation
- When the input sensor 1 or 3 disconnection error about compressor occurs



Note

- During compressor continuous operation, defrost function stops. During defrost operation (including hot-gas defrost), it stops defrost forcibly and operates compressor continuously.
- Even though normal control status after stopping compressor continuous operation, if compressor restart delay time [rdL] is set, the compressor operates after the set time.

- In case of no alarm setting, the compressor operation stops after the set time. Be sure that it may cause damage to the target object.

6.5.7 Alarm delay time after continuous operation [$PAR2 \rightarrow AdL$]

After compressor continuous operation, the temperature of freezer may be lower than alarm low-limit deviation value [$RL.L$].

Set alarm delay time to delay deviation low-limit alarm after compressor continuous operation setting time.

When the unit is compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□), defrost/auxiliary output [$S.dR$] of parameter 1 group is set as [$RU5$], auxiliary output [$RU5$] is set as [$RL.n$], alarm operation mode [RL] of parameter 4 group is set as [$RL.d$], it is available.

When the unit is compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□), auxiliary output [$RU5$] of parameter 1 group is set as [$RL.n$], alarm operation mode [RL] of parameter 4 group is set as [$RL.d$], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
$PAR2$	AdL	0 (OFF) to 24	2	Hour

6.5.8 Compressor operation when sensor break

If input sensor is break, compressor operation by temperature is disable.

Compressor output turns ON/OFF by the set operation cycle and duty rate to protect the target object.

Until sensor break error is cleared, operation cycle and duty ratio are applied repeatedly. When the error is cleared, the compressor operates after completing the currently applied operation cycle and compressor restart delay time.

During compressor control by input sensor 1, if input sensor 3 is break, it displays error but compressor operation cycle when sensor break is not applied.

For more information about error, refer to 오류! 참조 원본을 찾을 수 없습니다. Error displays 오류! 참조 원본을 찾을 수 없습니다..



Note

Compressor control by virtual temperature,
(when virtual temperature rate [$UL.R$] of parameter 1 group is set as among 1 to 99)

- If input sensor 1 (inlet temperature) and input sensor 3 (outlet temperature) are break or not connected, it operates compressor for error.
- If input sensor 1 (inlet temperature) is break or not connected, it operates compressor by input sensor 3 (outlet temperature) only.
If input sensor 3 (outlet temperature) is break or not connected, it operates compressor by input sensor 1 (inlet temperature) only.

If sensor break error occurs and compressor operates, defrost operation does not execute.

If input sensor 2 (defrost temperature) is break, defrost method is automatically changed as time and it does not effect on the compressor operation.

6.5.8.1 Compressor operation cycle when sensor break [$PA2 \rightarrow CLE$]

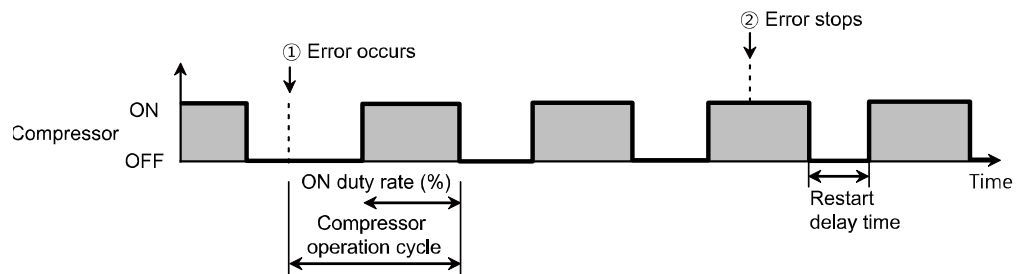
Set compressor operation cycle when sensor break.
Set it as [0] and compressor output turns OFF when sensor break.

Setting group	Parameter	Setting range	Factory default	Unit
$PA2$	CLE	0 to 100	0	Min

6.5.8.2 Compressor duty rate when sensor break [$PA2 \rightarrow dUt$]

Set compressor ON duty ratio when sensor break.
During operation cycle, it sets for compressor output ON rate.

Setting group	Parameter	Setting range	Factory default	Unit
$PA2$	dUt	0 to 100	50	%

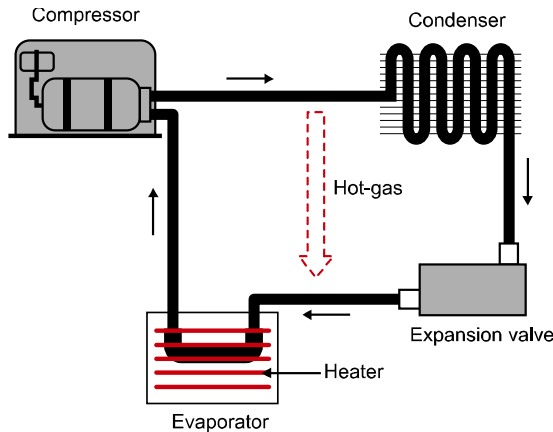


If input sensor is disconnected, the compressor operates by compressor operation cycle when sensor break [CLE], duty rate [dUt].

When the error is cleared, the compressor operates after completing the currently applied operation cycle when sensor break [CLE]. If compressor restart delay time [$r dL$] is set in normally operation, the compressor operates after the set time.

6.6 Defrost control

When compressor operates for a long time, an evaporator or freezer are frost and compressor's thermal efficiency is lower. Removing frost or ice of evaporator is defrost to higher thermal efficiency.



There are three defrost methods (natural, heater, hot-gas defrost).

When using heater/hot-gas defrost methods, TF3 Series operates automatic defrost by set defrost cycle, time, end temperature, hysteresis, etc.

During defrost, temperature may be higher and it is available to limit alarm.

- Natural defrost

This defrost method is for over 3°C of the freezer temperature.

When compressor stops, it circulates the air in the freezer.

- Heater defrost

This defrost method is installing a heater around an evaporator.

When compressor stops, the heater turns ON. The evaporator-fan operates (EF4/5) or stops (EF1/2/3) by the set operation mode.

- Hot-gas defrost

This defrost method uses high temperature and high pressure gas from compressor.

It is simple configuration which does not need to installing heater and the other drainage.

However, if there is lots of frost or ice, defrost may be difficult. Be sure that even though configuration occurs error, compressor operates continuously and it may cause whole refrigeration systems' problem.

When the unit is compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□), and defrost/auxiliary output [5.dR] is set as[dEF], defrost functions are available.

When the unit is compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□), defrost functions are available.

(1) No defrost output ON in defrost condition

- When compressor operates, (except when prior defrost selection [dPr] is set [on] and it is defrost condition, hot-gas defrost (compressor and defrost output operate at the same time)
- When it is pump down delay time and defrost end delay time.
- When it is compressor continuous operation and compressor error.
- When it is at hot-gas defrost, compressor restart delay time.

(2) Prior order for defrost operation

- When defrost and compressor start points are same, compressor operates.
- When defrost operation is overlap the next defrost, the next defrost is ignored.
- When it is defrost operation cycle/time during compressor operation, defrost operation waits until end of compressor operation. When compressor operation stops, it operates defrost. (only when defrost time is left)

**Note**

Defrost operates 6 times a day generally. Adjust the operation times depends on ice and frost. Defrost time be set over 30 to 40 min and it should be set within 15 to 20 minutes.

6.6.1 Defrost method & operation [$PA3 \rightarrow EF$]

TF3 Series supports heater/hot-gas defrost. Select defrost method and operation type.

Setting group	Parameter	Setting range	Factory default	Unit
$PA3$	dEF	$Ht\bar{n}$, $Gt\bar{n}$, $Ht\bar{t}$, $Gt\bar{t}$	$Ht\bar{n}$	-

Setting value	Defrost method	Defrost operation
$Ht\bar{n}$	Heater defrost	Operates during the set defrost cycle/time An additional defrost sensor does not required.
$Gt\bar{n}$	Hot-gas defrost	
$Ht\bar{t}$	Heater defrost	Operates when PV is lower than defrost end temperature during the set defrost cycle/time. (only for 3CH input model (TF33-□□□-□))
$Gt\bar{t}$	Hot-gas defrost	

6.6.2 Defrost cycle [$PA3 \rightarrow di n$]

Defrost executes by the set cycle. When defrost operates for the set time, defrost cycle is re-applied from the end point of defrost operation (including delay time).

Setting group	Parameter	Setting range	Factory default	Unit
PA3	di n	0 to 24/0 to 100	4	Hour/Min

When defrost time unit [UdE] of parameter 3 group is set as [HGH], defrost cycle unit is hour. Set it as [LoU], and the unit is minute.

Set it as [0] and manual defrost (front key or digital input) is only available.

For more information about manual defrost, refer to 6.6.15 Manual defrost.



Note

- When prior defrost selection [dPr] is set as [on], if it is defrost condition, defrost output turns ON ignoring compressor operation. However, compressor continuous operation and sensor error operation are prior to defrost operation.
- When executing defrost and the next defrost are overlapped, the next defrost is ignored.

6.6.3 Defrost time [$PA3 \rightarrow dEt$]

Set defrost operation time.

Defrost output turns ON for the set time and defrost operation executes.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	dEt	1 to 100	30	Min/Sec

When defrost time unit [UdE] of parameter 3 group is set as [HGH], defrost cycle unit is minute. Set it as [LoU], and the unit is second.



Note

If changing defrost time during executing defrost, defrost is stopped and the next defrost is applied the changed value.

6.6.4 Defrost time unit [$PA3 \rightarrow UdE$]

Select the unit of defrost cycle and defrost time.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	UdE	HGH, LoU	HGH	-

Setting value	Description
HGH	Defrost cycle (hour), Defrost time (min)
LoU ^{*1}	Defrost cycle (min), Defrost time (sec)

*1. It is useful to check defrost operation for defrost test in a short time.

6.6.5 Real-time defrost

6.6.5.1 Real-time defrost cycle [$PA3 \rightarrow r.dl$]

In case of RTC option model (TF33-3□H-R/TF33-3□A-A), set hour/min of defrost cycle to execute defrost in real-time.

Set real-time defrost cycle use or not.

Setting group	Parameter	Setting range	Factory default	Unit
$PA3$	$r.dl$	OFF, ON	OFF	-

6.6.5.2 Real-time defrost hour/min [$PA3 \rightarrow dH□ / d\bar{n}□$]

For using real-time defrost cycle, there are 8 real-times (hour/min) based on 24 hours per one day.

Defrost operates during the set time (hour/min).

For available cycle, set hour and minute both.

Set it as OFF and the defrost cycle is not available.

Parameter	Description
$dH□$	Set hour for real-time defrost cycle 1 to 8
$d\bar{n}□$	Set minute for real-time defrost cycle 1 to 8

Setting group	Parameter	Setting range	Factory default	Unit
$PA3$	$dH□$	$OFF / 0$ to 23	OFF	Hour
	$d\bar{n}□$	$OFF / 0$ to 59	OFF	Min



Note

- When prior defrost selection [dPr] is set as ON , if it is defrost condition, defrost output turns ON ignoring compressor operation.
- During compressor operation and in real-time defrost cycle, defrost operation waits until stopping compressor operation.
When compressor operation stops, defrost operates. (if defrost time is left)
- When defrost operation is overlap the next defrost, the next defrost is ignored.

6.6.6 Pump down delay time [*PA3* → *Pd.d*]

If defrost operates with refrigerant of evaporator, freezer efficiency may be decreased by evaporating refrigerant.

Set the time to exiting refrigerant of evaporator before operating defrost to prevent evaporating refrigerant.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA3</i>	<i>Pd.d</i>	0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)	0.00	Min.Sec

6.6.7 Defrost end delay time [*PA3* → *dr.t*]

During defrost operation, liquid may be caused at evaporator.

Set the time to drain liquid after stopping defrost to limit compressor and evaporator-fan operation.

After defrost end delay time, defrost operation stops and defrost cycle starts again.

Set it as [0.00], compressor operates right after stopping defrost.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA3</i>	<i>dr.t</i>	0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)	1.00	Min.Sec

6.6.8 Defrost end temperature [*PA3* → *Edt*]

Set defrost end temperature.

When defrost temperature which is measured by defrost sensor is arrived at the set defrost end temperature, defrost operation stops and liquid is drained.

If defrost sensor error occurs, defrost operates for the set defrost time [*dEt*] of parameter 3 group.

When the unit is 3CH input model (TF33-□□□-□), input sensor 2 ON/OFF [*S2*] of parameter 1 group is set as [01], defrost method & operation [*dEF*] of parameter 3 group is set as [*H.t.t / G.t.t*], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA3</i>	<i>Edt</i>	- 40 to 99	4	°C
		- 40 to 212		°F

6.6.9 Defrost hysteresis [PA3 → dHY]

When setting defrost end temperature, set defrost hysteresis to adjust defrost ON/OFF point.

When the unit is 3CH input model (TF33-□□□-□), input sensor 2 ON/OFF [52] of parameter 1 group is set as [ON], defrost method & operation [dEF] of parameter 3 group is set as [H.t.t / G.t.t], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	dHY	1 to 5 (0.5 to 5.0)	1	°C
		2 to 10 (2.0 to 10.0)		°F

6.6.10 Defrost when power ON

6.6.10.1 Defrost when power ON [PA3 → P.dE]

In case of defrost by the set cycle/time, set defrost when the unit power turns ON use or not.

Set it as [ON] and defrost time is progressing when the unit power turns ON.

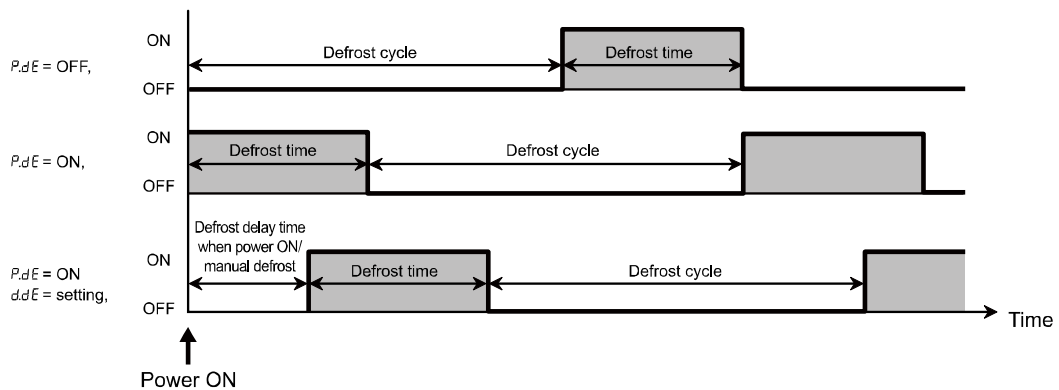
Set it as [OFF] and defrost time is progressing after defrost cycle when the unit power turns ON.

In case of real-time defrost, defrost operates when the unit power turns ON.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	P.dE	OFF, ON	OFF	-

6.6.10.2 Defrost delay when power ON/manual defrost [PA3 → d.dE]

Set defrost delay time for using defrost when power ON or manual defrost.



Setting group	Parameter	Setting range	Factory default	Unit
PA3	d.dE	0 to 60	0	Min

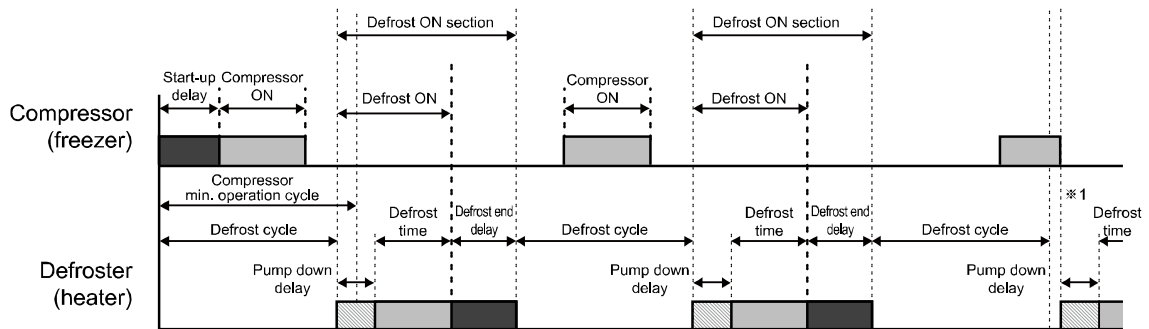


Note

Defrost when power ON setting is to prevent for not operating defrost due to repeating power ON / OFF every 4 hours in 6-hour of defrost cycle, for example.

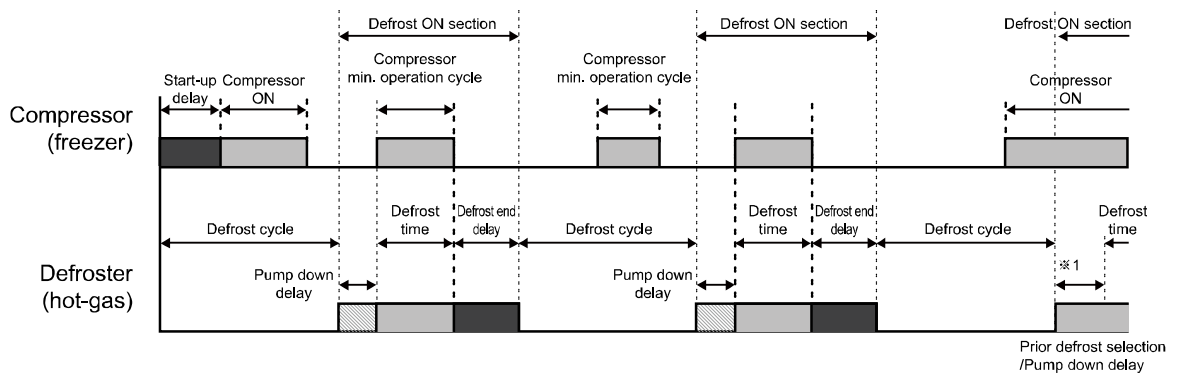
6.6.11 Example of defrost operation by defrost cycle/time

(1) Heater defrost by defrost cycle/time



- ※1. At defrost cycle during compressor operation, compressor operates continuously and defrost is stand-by. If compressor stops within defrost cycle, defrost operates. After defrost cycle, when completing compressor operation, defrost is ignored. However, prior defrost selection [$d.P_r$] is set as [$0n$], compressor operation is ignored and defrost operates.

(2) Hot-gas defrost by defrost cycle/time



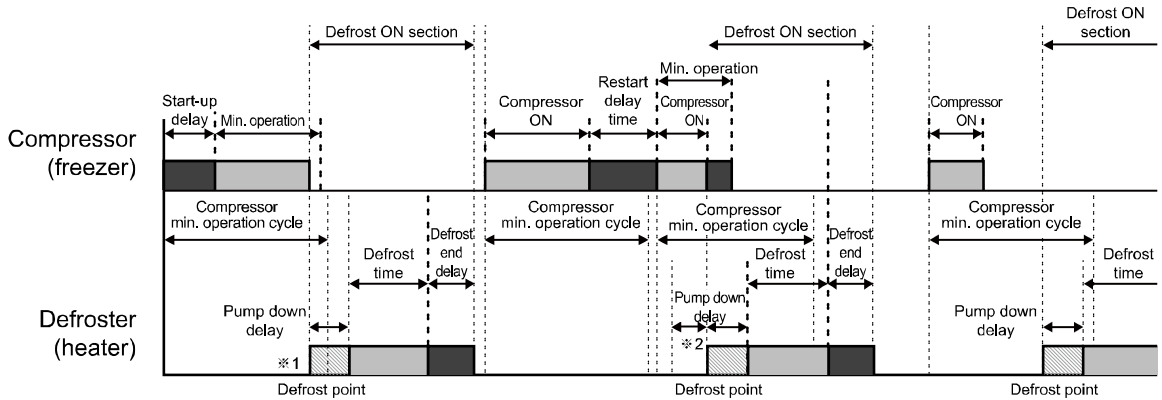
- ※1. Even though defrost condition, defrost does not operate during compressor operation. When prior defrost selection [$d.P_r$] is set as [$0n$] at ※1 point, compressor operation is ignored and defrost operates.
- ※ When pump down delay time [$P.d.d$] is set as [0], compressor operates continuously.
- ※ In case of hot-gas defrost, only compressor restart delay time [$r.d.L$] among compressor protection functions is applied.

6.6.12 Prior defrost selection [$PA3 \rightarrow dPr$]

Generally, compressor protection functions (compressor start-up delay time/ min. operation cycle/ restart delay time/ min. operation time) are prior to defrost operation.

Set it as $[0n]$, if compressor protection operation and defrost operation are same point, compressor protection operations are ignored and defrost operates.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	dPr	0FF, 0n	0FF	-



- ※1. Set it as $[0n]$, defrost is prior to compressor operation. Defrost operates ignoring compressor min. operation cycle.
- ※2. At defrost cycle during operating compressor, compressor operating is stopped and defrost operates. Compressor protection functions are ignored.



Note

- Compressor continuous operation and compressor operation when sensor break are prior to defrost.
- When defrost operation is overlap the next defrost, the next defrost is ignored..

6.6.13 Alarm delay after defrost/door open [$PA3 \rightarrow Add$]

During defrost operation, if it is alarm condition when increased object temperature is higher than alarm high-limit deviation value $[RLH]$, the deviation high-limit alarm can be delayed by the set alarm delay time.

When digital input $[dI]$ of parameter 5 group is set as $[d5d]$ and if it is alarm condition when increased object temperature is increased by freezer door open, the deviation high-limit alarm can be delayed by the set alarm delay time.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	Add	0 to 24	1	Hour

6.6.14 Temperature display during defrosting [*PA3* → *t.dE*]

Set present value (PV) temperature display ON/OFF during defrost operation.

Set this function to prevent confusion by increased present value (PV) during defrost operation.


When display selection [*d.Pt*] of parameter 0 group is set as [*52*], it does not available.

Set it as [*OFF*] and it displays the temperature which is previous defrost operation during defrost operation.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA3</i>	<i>t.dE</i>	<i>OFF, ON</i>	<i>OFF</i>	-

6.6.15 Manual defrost

Execute defrost manually ignoring the set defrost (real-time) cycle.

There are two methods for manual defrost.; Holding the  key for 3 sec. or when digital input [*dI*] of parameter 5 group is set as [*̄.n.dF*], turning ON digital input. The manual defrost operates by the set defrost method/operation for the set defrost time.

During manual defrost operation, the defrost (DEF) output indicator turns ON for 2 sec and OFF for 1 sec in turn.

During manual defrost operation, hold the  key for 3 sec or turn OFF the digital input to change auto defrost method.



Note

When defrost cycle [*dI n*] of parameter 3 group is set as [*0*], only manual defrost is available.

6.6.16 Defrost synchronization

When connecting more than 2 units TF3, you can synchronize defrost and compressor operation.

When the unit is defrost synchronization function model (TF33-□□A-S) or RS485 communication model (TF33-□□A-T/A), defrost synchronization is available.

One master unit execute synchronization function connecting with up to 5 slave unit(s).

(1) Setting order

- 1st Connect each other synchronize terminals or RS485 communication terminals of the units which are synchronized for defrost.
- 2nd Set defrost cycle [$d\bar{t}r$] of parameter 3 group as same as among the units.
(if error occurs, defrost cycle is the setting of each unit)
- 3rd Set defrost group [$d\bar{G}r$] of parameter 3 group as 1 master unit [$\bar{n}R5$] and slave unit(s) (up to 5 units) [$5LR$].
- 4th According to defrost operation of Master, the defrost operation of slave(s) executes. (when changing the defrost parameters of master, defrost operations of slave(s) are also changed forcibly as same as the defrost operation of master via connected terminals. The defrost parameters of slave(s) are not changed.)



Note

- During defrost synchronization, manual defrost function of slave unit is not available.
- Defrost operation by real-time defrost cycle is not synchronized. Defrost functions of a master unit are prior to compressor functions of slave unit(s).

(2) Defrost group setting [$PAR3 \rightarrow d\bar{G}r$]

Set master unit (1) and slave unit (up to 5) for defrost synchronization and parameter copy.

Setting group	Parameter	Setting range	Factory default	Unit
$PAR3$	$d\bar{G}r$	$OFF, \bar{n}R5, 5LR$	OFF	-

(3) Defrost synchronization error

If defrost synchronization error occurs, the below error message appear for 1 sec in turn.

The error unit operates defrost by each setting parameter value.

Display	Description
$E_{rr} \leftrightarrow d\bar{G}r$	Displays when master unit or slave unit are set wrong.
$E_{rr} \leftrightarrow 5LR (\bar{n}R5)$	Displays when communication error occurs with slave (master). (only when defrost synchronization via RS485 communication)

6.7 Evaporator-fan control

Evaporator-fan installed at evaporator operates for cold air circulation to higher freezer efficiency.

When the unit is compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□), defrost/auxiliary output [5.dR] of parameter 1 group is set as [RUS], auxiliary output [RUS] is set as [FRn], evaporator-fan control is available.

When the unit is compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□), auxiliary output [RUS] of parameter 1 group is set as [FRn], evaporator-fan control is available.

6.7.1 Evaporator-fan operation [PAR4 → FLY]

Set evaporator-fan control operation method.

Setting group	Parameter	Setting range	Factory default	Unit
PAR4	FLY	FRn, dEF	FRn	—

Setting value	Description
dEF	Controls evaporator-fan by measured temperature from input sensor 2 (defrost sensor).
FRn	Controls evaporator-fan by compressor/defrost operation.

6.7.2 Evaporator-fan control by defrost sensor temperature

6.7.2.1 Evaporator-fan control temperature [PAR4 → FL]

Set evaporator-fan control temperature.

When defrost operates and the temperature around evaporator is increased, if evaporator-fan operates, warm air may enter to system and effective control is difficult. To prevent this set evaporator-fan control temperature.

When input sensor 2 (defrost sensor) temperature is the set evaporator-fan control temperature value, evaporator-fan output turns OFF.

When evaporator-fan operation [FLY] of parameter 4 group is set as [dEF], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
PAR3	FL	-40 to 99	4	°C
		-40 to 212		°F



Note

When input sensor 2 (defrost sensor) error occurs, evaporator-fan operates at the same time of power ON until power OFF.

The error message of temperature sensor 2 (defrost sensor) is cleared for stopped defrost at the set temperature (when completing defrost normally).

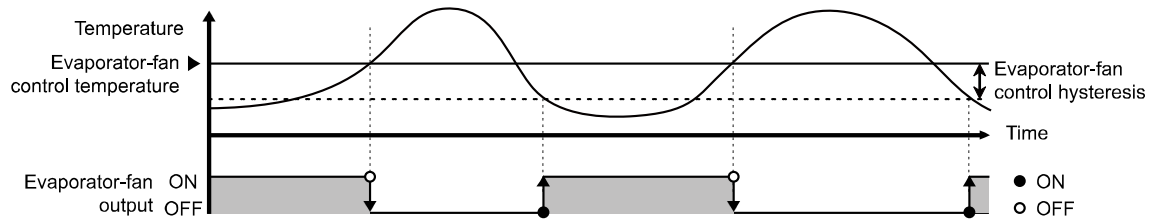
6.7.2.2 Evaporator-fan control hysteresis [*PA4* → *FHY*]

Set the evaporator-fan control output ON/OFF point.

When it is evaporator-fan operation [*FHY*] of parameter 4 group is set as [*DEF*], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PA4</i>	<i>FHY</i>	1 to 5 (0.5 to 5.0)	1	°C
		2 to 10 (2.0 to 10.0)		°F

6.7.2.3 Example of control via defrost sensor temperature



Evaporator-fan output turns ON/OFF by comparing present value (PV) and defrost temperature.

If input sensor 2 (defrost sensor) error occurs, evaporator-fan operates at the same time of power ON until power OFF. (same with EF5 of evaporator-fan operation mode)

6.7.3 Evaporator-fan control by compressor/defrost operation

6.7.3.1 Evaporator-fan mode [$PA4 \rightarrow FRn$]

When controlling evaporator-fan by compressor /defrost operation, you can selecte operation method.

When evaporator-fan operation [$F.t Y$] of parameter 4 group is set as [FRn], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	FRn	$EF1, EF2, EF3, EF4, EF5$	$EF1$	–

setting value	Description
$EF1$	When compressor operates, evaporator-fan also operates. When compressor operation is finished, evaporator-fan also operation turns OFF. (except compressor operation for hot gas defrost)
$EF2$	When compressor operates, evaporator-fan operates after the set evaporator-fan start-up delay time. When compressor operation is finished, evaporator-fan operation turns OFF. (regardless of defroster operation)
$EF3$	When power turns ON, evaporator-fan operates. When defroster operates, evaporator-fan stops. (regardless of compressor operation)
$EF4$	Evaporator-fan operates only when operating compressor or defrost. Evaporator-fan stops when compressor and defroster stops. (for above zero temperature control)
$EF5$	Evaporator-fan operates from power ON to power OFF. (regardless of defroster operation of freezer. When door is open (digital input [$d1$] is set as RUN/STOP [StP], or door switch [$d5H$]), evaporator-fan stops.

6.7.3.2 Evaporator-fan start-up delay time [$PA4 \rightarrow P.dr$]

When evaporator temperature is increased by defrost operation, warm air may enter to refrigeration systems during evaporator-fan operation.

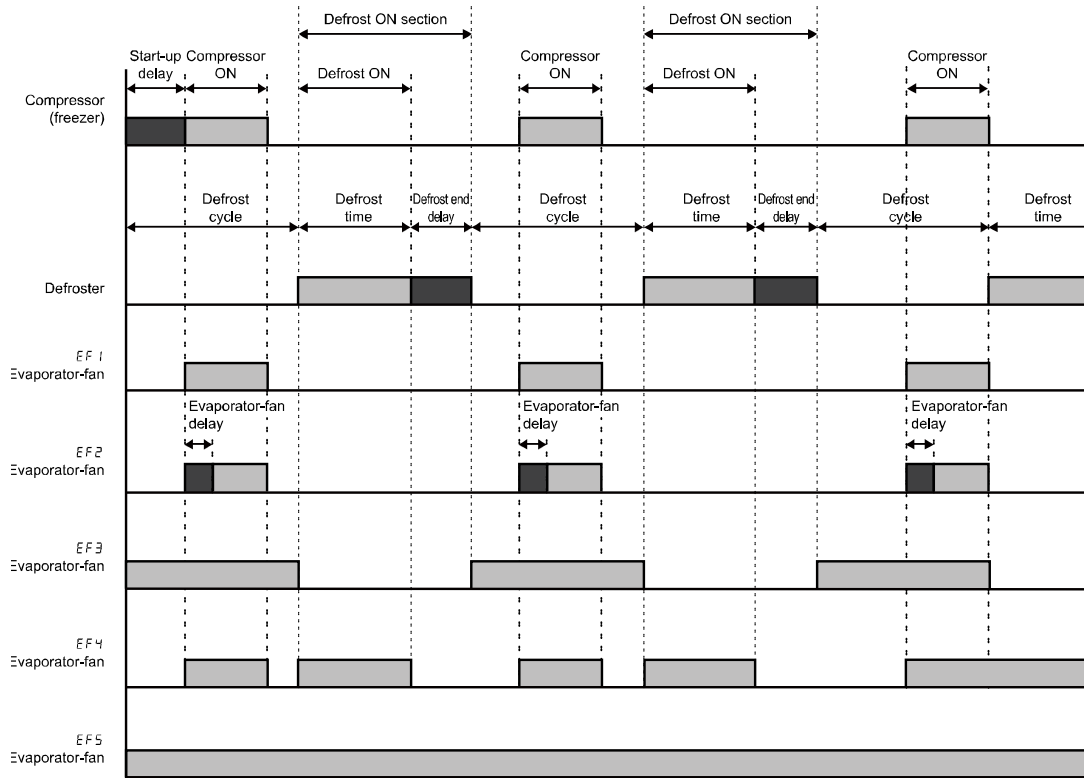
To prevent this, set evaporator-fan start-up delay time for freezer efficiency.

When evaporator-fan operation [$F.t Y$] of parameter 4 group is set as [FRn], it is available.

During start-up delay time, the front evaporator-fan (FAN) output indicator flashes.

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	$P.dr$	0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)	1.00	Min.Sec

6.7.3.3 Example of evaporator-fan control by compressor/defrost operation



※■: Output does not turn ON but the dedicated indicator flashes at the delay period (compressor, defrost, evaporator-fan).

6.8 Alarm output

Alarm output of TF3 Series is deviation high/low-limit alarm.

During temperature control, if it is alarm condition, alarm output turns ON.

When the unit is compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□-□), defrost/auxiliary output [5.dA] of parameter 1 group is set as [AUB], auxiliary output [AUB] is set as [AL \bar{n}], alarm output is available.

When the unit is compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3□-3□□-□), auxiliary output [AUB] of parameter 1 group is set as [AL \bar{n}], alarm output is available.

3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF33-3□□-□) supports buzzer. When buzzer [buz] of parameter 1 group is set as [on], buzzer operates at alarm output ON.

6.8.1 Alarm operation mode [PAR4 → AL]

Setting group	Parameter	Setting range	Factory default	Unit
PAR4	AL	OFF, AL.d	AL.d	-

Mode	Name	Operation	Description
OFF	-	-	No alarm output.
AL.d	Deviation high/low-limit alarm	<p>High-limit deviation: Set as 20°C Low-limit deviation: Set as 10°C</p>	<p>If deviation between present value (PV) and setting value (SV) is higher than high-limit or low-limit deviation SV, alarm output turns ON.</p> <p>Set high-limit deviation at [AL.H]. Set low-limit deviation at [AL.L].</p>

※ H: Alarm output hysteresis [A.HY]

6.8.2 Alarm option [$PA4 \rightarrow AL.E$]

You can set the desired alarm output option.

When alarm operation mode [AL] of parameter 4 group is set as [$AL.d$], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	$AL.E$	Refer to below table.	$AL.A$	—

Mode	Name	Operation description
$AL.A$	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
$AL.b$	Alarm latch ※ ¹	If it is an alarm condition, alarm output is ON and maintains ON status. (alarm output HOLD)
$AL.C$	Standby sequence ※ ²	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
$AL.d$	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
$AL.E$	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence※ ² and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.
$AL.F$	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence 1. It operates not only by power ON/OFF, but also alarm set value, or alarm option changing. When re-applied standby sequence※ ² and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

※¹. To clear alarm, turn OFF the power (also digital input [dI] is set as RUN/STOP [$SE.P$] and input is ON for pausing compressor output) or press the front \square keyonce. (press twice when buzzer is set)

※². Condition of re-applied standby sequence for standby sequence: Power ON, changing temperature, alarm settings, switching STOP mode to RUN mode (also digital input [dI] is set as RUN/STOP [$SE.P$] and input turns OFF from ON for operation mode by releasing pause compressor output)

6.8.3 Alarm high/low-limit deviation [$PA4 \rightarrow AL.H / AL.L$]

Set high/low-limit deviation of alarm.

When alarm operation mode [AL] of parameter 4 group is set as [$AL.d$], it is available.

High-limit alarm ON: $PV \geq SV + AL.H$, High-limit alarm OFF: $PV \leq SV + AL.H - AHY$

Low-limit alarm ON: $PV \leq SV - AL.L$, Low-limit alarm OFF: $PV \geq SV - AL.L + AHY$

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	$AL.H$	-F.S. to F.S	139	°C/°F
	$AL.L$			

6.8.4 Alarm output hysteresis [$PA4 \rightarrow R.HY$]

The “H” of alarm operation mode is alarm output hysteresis to set alarm output ON/OFF interval. When alarm operation mode [AL] of parameter 4 group is set as [$AL.d$], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	$R.HY$	1 to 5 (0.5 to 5.0)	1	°C
		2 to 10 (2.0 to 10.0)		°F

6.8.5 Alarm ON/OFF delay time [$PA4 \rightarrow R.ON/R.OF$]

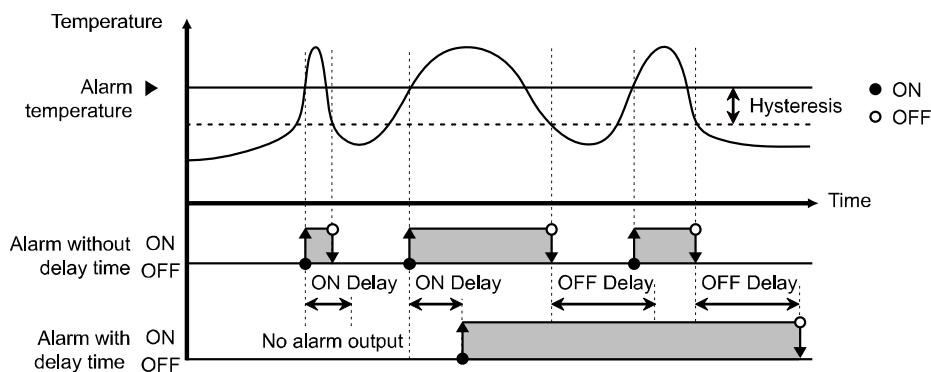
If alarm occurs by disturbance or noise, etc or it is alarm condition for a short time by door open by showcase, you can set the alarm delay time to prevent frequent alarm output ON/OFF.

When setting alarm output delay time, alarm output does not operate and the front auxiliary (AUX) output indicator flashes for 0.5 sec in turn during alarm output delay time.

When alarm operation mode [AL] of parameter 4 group is set as [$AL.d$], it is available.

Parameter	Description
$R.ON$	Alarm output ON delay time At the alarm output ON point, the alarm does not turn ON. After the set time and it is alarm output ON condition, alarm output turns ON.
$R.OF$	Alarm output OFF delay time At the alarm output OFF point, the alarm does not turn OFF. After the set time and it is alarm output OFF condition, alarm output turns OFF. (during OFF delay time, the auxiliary (AUX) output indicator flashes for 0.5 sec in turn.)

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	$R.ON$	0 to 60	0	Min
	$R.OF$			



6.8.6 External alarm delay time [$PA4 \rightarrow E.AD$]

When alarm output turns ON forcibly by digital input, you can set the alarm delay time.

When digital input [$d1$] of parameter 5 group is set as [$E.AL$] and alarm operation mode [AL] is set as [$AL.d$], it is available.

Setting group	Parameter	Setting range	Factory default	Unit
$PA4$	$E.AD$	0 to 60	0	Min

**Note**

When alarm output turns ON and the alarm by digital input is not operate. The set external alarm delay time is unavailable.

6.8.7 Alarm output method [PR4 → R.n]

Set the relay contact method at alarm output.

Setting group	Parameter	Setting range	Factory default	Unit
PR4	R.n	no, nL	no	-

Setting value	Description
no	Normally Open: It is open at normal status and close at occuring alarm.
nL	Normally Closed: It is close at normal status and open at occuring alarm

**Note**

Auxiliary (AUX) output indicator operation

Setting	Occuring alarm	Alarm output	Auxiliary (AUX) output indicator
no (Normally Open)	OFF	Open	<input type="checkbox"/> OFF
	ON	Close	<input checked="" type="checkbox"/> ON
nL (Normally Closed)	OFF	Close	<input type="checkbox"/> OFF
	ON	Open	<input checked="" type="checkbox"/> ON

6.8.8 Buzzer


3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF33-3□□-□) supports buzzer. When buzzer [bUΞ] of parameter 1 group is set as [on], buzzer operates at alarm output ON.

6.8.8.1 Buzzer [PA1 → bUΞ]

Set buzzer use or not.

Setting group	Parameter	Setting range	Factory default	Unit
PA1	bUΞ	off, on	on	—

6.8.8.2 Stop buzzer

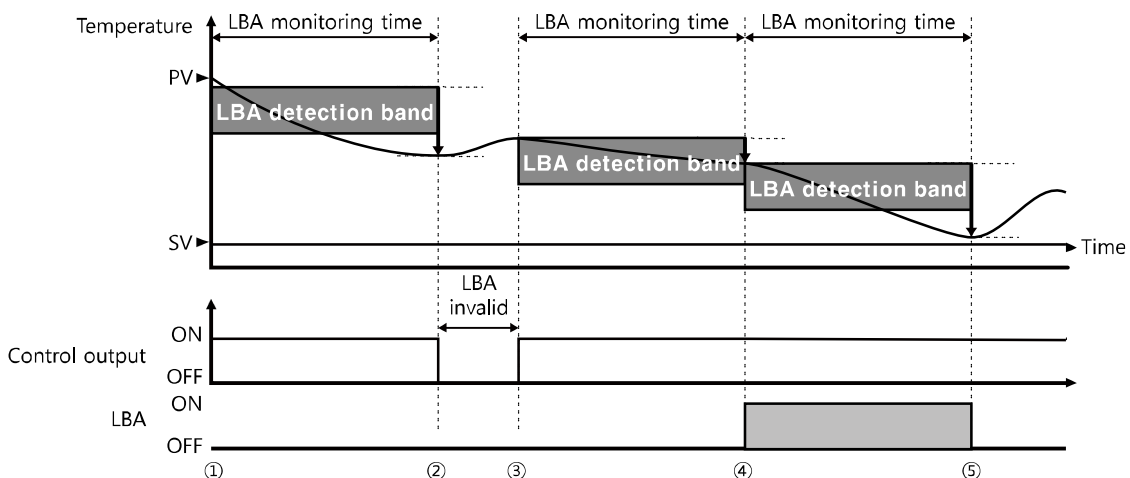
When buzzer [bUΞ] of parameter 1 group is set as [on], buzzer operates at alarm output ON. Press the  key to stop the buzzer sound.

6.8.9 Loop break alarm monitoring time [PAS → LbA]



This function is to check control loop by temperature change of target object and turn ON/OFF the alarm output.

When compressor control output turns ON and setting value (PV) is not changed over the LBA detection band [1.0°C (1.8°F)] during the set loop break alarm monitoring time [LbA], it considers compressor error.

Error [Err] and [LbA] appears in front display part for 0.5 sec in turn.



① to ②	When control output is ON and PV is decreased over than LBA detection band [1.0°C (1.8°F)] during LBA monitoring time [LbA].
② to ③	It is control output is OFF. (LBA monitoring time [LbA] is reset)
③ to ④	When control output is ON and PV is not decreased over than LBA detection band [1.0°C (1.8°F)] during LBA monitoring time [LbA]. The loop break alarm (LBA) turns ON after LBA monitoring time.
④ to ⑤	When control output is ON and PV is decreased over than LBA detection band [1.0°C (1.8°F)] during LBA monitoring time [LbA]. The loop break alarm (LBA) turns OFF after LBA monitoring time.

Check the compressor and hold the + keys for 3 sec and error display clear and it operates normally. When input is within the proper range, the input error display clear.

Setting group	Parameter	Setting range	Factory default	Unit
PAS	LbA	0 to 100	0	Min

Set it as [0] and loop break alarm (LBA) function does not operate.

In case of hot-gas defrost operation (compressor operation), loop break alarm (LBA) does not operate.

6.9 Time setting

When the unit is RTC option model (TF33-3□H-R/TF33-3□A-A), it is available to set current time (manual input) for night mode, real-time defrost functions.



Note

If not using the unit for a long time (over 1 week), you should set the time again. When supplying the power, [rEt] and [SEt] appear in turn to set the time. Set the current time. If holding the [K] key for 1 sec., it sets as 0:0 (hour:min). Time error may occur due to installation environment, set the time regularly.

6.9.1 Current hour/min [PAS → CUH/CUñ]

Set current hour/min manually.

Setting group	Parameter	Setting range	Factory default	Unit
PAS	CUH	0 to 23	Random hour	Hour
	CUñ	0 to 59	Random min	Min

6.10 Digital input

Set the function to be executed by external digital input.

When the unit is 3CH input model (TF33-□□□-□), and input sensor 3 selection [53] of parameter 1 group is set as digital input [*di*], it is available.

The set digital input function is regardless of parameter lock and password setting.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAR5</i>	<i>di</i>	<i>OFF, St.P, d.Sz, n.nd, E.AL, E.dF, n.dF</i>	<i>OFF</i>	—

Setting value		Description
<i>OFF</i>	OFF	No digital input.
<i>St.P</i>	RUN/STOP	Pauses compressor output. All output indicators turn OFF. When digital input is OFF, it controls normally after compressor restart delay time.
<i>d.Sz</i>	Door switch	By connecting freezer door switch and digital input contact, it controls compressor/defrost/ evaporator-fan according the door status. - Digital input ON (door open): Compressor, defrost, evaporator-fan output turns OFF. - Digital input OFF (door close): After 1 min, it returns the previous status of door open. (not applied compressor protection operations) Alarm occurs after the time of alarm delay after defrost/door open [<i>Rdd</i>] of parameter 3 group. When operating compressor continuously, compressor start-up time is extended as long as the door open time.
<i>n.nd</i>	Night mode ON/OFF	When digital input turns ON, night mode is active.
<i>E.AL</i>	External alarm	When digital input turns ON, alarm output turns ON forcibly. (except alarm is ON) When external alarm delay time [<i>EAd</i>] of parameter 4 group is set, alarm turns ON after the set time.
<i>E.dF</i>	Defrost ON/OFF	When digital input turns ON and it is defrost operation condition, defrost output turns ON. Even though it is defrost operation condition, if digital input turns OFF, defrost output turns OFF also.
<i>n.dF</i>	Manual defrost	When digital input turns ON, it executes manual defrost.

6.11 Communication output

This feature is used for external higher systems (PC, GP, etc.) to set the controller's parameters and to monitor the controller. It can also be used to transmit data to external devices.

When the unit is RS485 communication option model (TF33-□□A-T), the communication is available.

No redundant unit addresses may exist along the same communication line. The communication cable must be twisted pair that supports RS485 communication.

- Interface

Communication protocol	Modbus RTU
Connection type	RS485
Application standard	Compliance with EIA RS485
Max. connection	31 units (address: 01 to 99)
Communication synchronization method	Asynchronous
Communication type	2-wire half duplex
Communication distance	Max. 800m
Communication speed	2400, 4800, 9600, 19200, 38400 bps
Communication response time	5 to 99ms
Start bit	1-bit (fixed)
Data bit	8-bit (fixed)
Parity bit	None, Even, Odd
Stop bit	1, 2-bit



Note

Changing parameters during communication by front keys is available, however it may cause malfunction.

6.11.1 Communication address [*PAS* → *Adr*]

You can assign individual addresses to data units.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>Adr</i>	01 to 99	01	—

6.11.2 Communication speed [*PAS* → *bPS*]

You can set the rate of data transmission. Higher communication speed is faster transmission speed.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>bPS</i>	24 (2400), 48 (4800), 96 (9600), 192 (19200), 384 (38400)	96	bps

6.11.3 Communication parity bit [*PAS* → *Prb*]

Parity bit is a data communication method that adds an additional bit to each character in transmitted data as an indicator used to verify data loss and corruption. This parameter is used to enable or disable the parity bit option.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>Prb</i>	<i>non, EUn, odd</i>	<i>non</i>	—

Setting value	Description
<i>non</i>	No parity bit
<i>EUn</i>	Sets the total bits with signal signal value of 1 as even numbers.
<i>odd</i>	Sets the total bits with signal signal value of 1 as odd numbers.

6.11.4 Communication stop bit [*PAS* → *StP*]

You can set the number of bits to mark the end of a transmitted data string.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>StP</i>	<i>1, 2</i>	<i>2</i>	bit

Setting value	Description
<i>1</i>	Sets end of data string to 1-bit.
<i>2</i>	Sets end of data string to 2-bit.

6.11.5 Communication response wait time [*PAS* → *rUt*]

Set a standby time to mitigate communication errors when communicating with a slow master device (PC, PLC, etc.). Once a standby time is set, the controller will respond after the defined standby time.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>rUt</i>	<i>5 to 99</i>	<i>20</i>	ms



Note

Shorter standby times can cause communication errors in the master device.

6.11.6 Communication write [*PAS* → *CoW*]

This feature can change parameter settings stored in memory through communication with PC, GP, PLC, etc., in order to permit or prohibit writing.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>CoW</i>	<i>EnA, dSA</i>	<i>EnA</i>	—

Setting value	Description
<i>EnA</i>	Parameter set/change enable via communication.
<i>dSA</i>	Prohibit parameter setting or modification via communication.



Note

Reading parameter setting value is available even though not enables communication write.

6.11.7 User level [*PAR* → *USR*]

There are user level; standard level (*Std*) and high level (*HGH*) to limit parameter display.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAR</i>	<i>USR</i>	<i>Std, HGH</i>	<i>Std</i>	–

Setting value	Description
<i>Std</i>	Activated essential setting parameters.
<i>HGH</i>	Activated essential setting and applicable setting parameters.

The essential parameters for standard level [*Std*] is shaded parameters of 5.3 Parameter groups.

6.12 Lock

6.12.1 SV setting lock [*PAR* → *LSU*]

You can limit SV setting changes.

Set is as [on] not to change SV setting.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAR</i>	<i>LSU</i>	oFF, on	oFF	–

6.12.2 Front key lock [*PAR* → *LdL*]

You can limit front key functions (manual defrost, auxiliary output ON/OFF, compressor/auxiliary output ON/OFF, buzzer stop, parameter reset) by locking front keys (⏏, ⏏, ⏏).

However, Ⓞ (MODE) key input for entering parameter group is available.

Set is as [on] not to execute the functions by front keys

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAR</i>	<i>LdL</i>	oFF, on	oFF	–

6.12.3 Parameter group lock [*PAR* → *LP*

You can limit each parameter group PA0 (Parameter 0) to *PAR* (Parameter 5).

Set it as [on] not to change parameter groups setting.

Setting group	Parameter	Setting range	Factory default	Unit
<i>PAR</i>	<i>LP</i> <input type="checkbox"/>	oFF, on	oFF	–



Note

Even though parameter group is locked, parameter setting value is available to check. Except [*LP5*] of parameter 5 group [*PAR*] is available to change.


6.13 Password [*PAS* → *P₅d*]



You can limit SV setting (except digital input key function) and parameter 0 to 5 group parameters change. Only right password input is available to change the parameters.


Setting group	Parameter	Setting range	Factory default	Unit
<i>PAS</i>	<i>P₅d</i>	000: Password OFF 002 to 999: Password ON ^{※1}	000	—



※1. You can not set as [00 1] which is only for reading password. If entering parameter setting [*P₅d*] parameter with this reading password, it displays [- -].



- Setting method

1st Hold the  (MODE) key for 3 sec in RUN mode.

2nd Press the  key to enter parameter 5 group [*PAS*] and press the  (MODE) key.

3rd Press the  (MODE) key to enter password setting [*P₅d*] parameter.

4th Press the  key and press the  key to select the desired digit.

5th Press the  key and set password (002 to 999). Press the  (MODE) key to save.

6.13.1 Entering password

If setting password and entering SV setting parameter or parameter groups in RUN mode, the [*P5*] parameter appears to enter the set password.



If the input password is correct, it enters setting parameters.

If the input password is wrong, the coded password code and error message [Err] appear 1 sec in turn repeatedly.


- Entering method

1st Enter SV setting parameter or parameter group.

2nd [*P5*] parameter appears. Press the  key and press the  key to select the desired digit.

3rd Press the  key and enter the set password. Press the  (MODE) key.

4th If the input password is correct, it enters setting parameters.

If the input password is wrong, the coded password code and error message [Err] appear 1 sec in turn repeatedly. Press the  key and repeat 1st, 2nd orders to re-enter the right password.



Note

When password [*P₅d*] of parameter 5 group is set as [000], [*P5*] parameter does not appear. The password [00 1] is available only for reading parameter setting value.

6.13.2 Password recovery

When entering wrong password, the coded password and error message [E r r] appear for 1 sec in turn repeatedly.

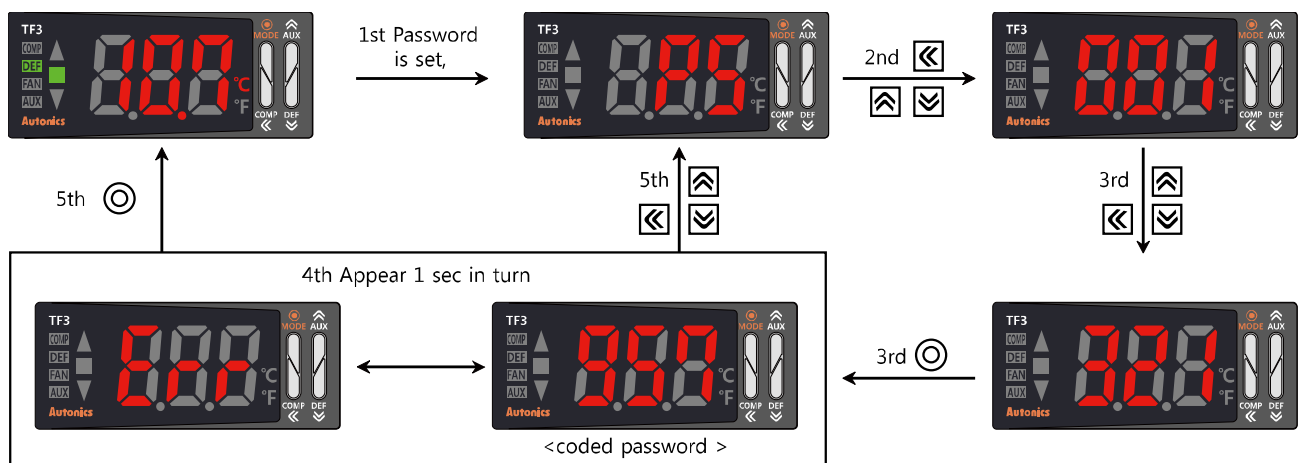
Contact Autonics with the coded password for recovering the set password.



Ex.

When entering wrong password: the set password is [123],

- 1st Enter SV setting parameter or parameter setting group.
- 2nd [P5] parameter appears. Press the $\leftarrow/\rightarrow/\uparrow/\downarrow$ key and press the \leftarrow key to select the desired digit.
- 3rd Press the \rightarrow/\uparrow key and enter [321] (wrong password) and press the \odot (MODE) key.
- 4th The coded password [957] and error message [E r r] appear for 1 sec in turn repeatedly.
- 5th During error displays, press the $\leftarrow/\rightarrow/\uparrow/\downarrow$ key, and password input parameter appears. During error displays, press the \odot (MODE) key, and it returns in RUN mode.



6.14 Parameter functions

6.14.1 Parameter copy [$PA3 \rightarrow PdC$]

You can copy Master unit setting via RS485 communication.

Parameter copy is available only for RS485 communication option and same specification model units.

Setting group	Parameter	Setting range	Factory default	Unit
PA3	PdC	OFF, ON	OFF	-

(1) Copied parameters

- All parameter setting values of parameter 0 group to 4 group
- CUH, CUn, dl, LbA parameter setting values of parameter 5 group

(2) Parameter copy method

- 1st Check the connected units are same specification mode.
Connect each other RS485 terminals of the units.
- 2nd Set defrost group [dUr] of parameter 3 group as 1 master unit [nAS] and slave unit(s) (up to 5 units) [SLA].
- 3rd Set communication address [Adr] of parameter 5 group of master and slave units differently.
- 4th In case of master unit, set parameter copy [PdC] of parameter 3 group as [ON].
- 5th The parameters of the master unit are copied to slave units sequentially by communication. During copying, the master unit displays the connected and copied slave unit number and the copied slave unit displays [PY].
- 6th After completing copy, parameter copy [PdC] of the master unit is automatically changes as [OFF]. The slave unit displays [OL] for 2 sec.
If copy error occurs, the slave unit displays [nG] for 2 sec.
The slave unit which copy is completed or occurs error, restarts.

(3) Message during parameter copy

- Master unit

Display	Description
5□□→OL	Displays the copied slave unit number and [OL] after completing the copy.
Err↔dUr	Displays when master unit or slave unit setting is wrong.
Err↔SLA	Displays when communication error occurs for master and slave units.
Err↔tln	Displays when time out error occurs during communicating slave unit.

- Slave unit

Display	Description
[PY] → OL	Displays when copy is complete normally.
[PY] → nG	Displays when error occurs during copying. The slave unit which has error operates the previous set parameter.

6.14.2 Parameter reset [i n l]

Resets all parameters as factory default.

Hold the $\text{[OK]} + \text{[F5]} + \text{[ENT]}$ keys for 5 sec to reset all parameters in memory to default value. Set [i n l] parameter to [YES] to reset all parameters.

Setting group	Parameter	Setting range	Factory default	Unit
-	i n l	YES, no	no	-



Note

In case password function is ON, it is required to enter valid password reset parameters.

Password is also reset.

6.15 Error displays

The controller diagnoses input signals for errors and displays messages accordingly. These messages inform the user of device problems.

When error occurs, [Er □] and the error message flashes for 0.5 sec in turn.

Flashing in turn	Description	Troubleshooting
Er □ ^{※1} ↔ oPn	When input sensor is break or sensor is disconnected.	Check input sensor status.
Er □ ↔ LLL	If the measured temperature of the dedicated sensor is lower than low-limit temperature among temperature setting range.	It clears when input is within the display range.
Er □ ↔ HHH	If the measured temperature of the dedicated sensor is higher than high-limit temperature among temperature setting range.	
Err ↔ LbR	Even though input sensor is normal, freezer temperature does not change over 1.0°C (1.8°F) during loop break alarm monitoring time [LbR].	Check the compressor and hold the $\text{[F5]} + \text{[ENT]}$ key at the same time for 3 sec. It clears when input is within the adequate range.


※1. □ indicates input sensor number of error display priority which occurs error.

Error display priority: Er 1 (input sensor 1) → Er 2 (input sensor 2) → Er 3 (input sensor 3)
→ Er u (virtual temperature) → Err

※2. Er u (virtual temperature) is not applicable.

7 Parameter Description by Setting Groups

7.1 SV setting group [50]

Parameter	Description		Setting range	Unit	Factory default
50	SV setting	Temperature setting value of controlled target	L50 to H50	°C/°F	0
ER	Enable auxiliary output	Using auxiliary output	OFF, ON	-	ON
EL	Enable comperssor output	Using compressor output	OFF, ON	-	ON
-	Manual buzzer OFF	Buzzer OFF	Press the  key	-	-
ini	Parameter reset	Parameters reset as factory default	no, YES	-	no

7.2 Parameter 0 group

Parameter	Description		Setting range	Unit	Factory default
dPt	Display type	Display selection	51, 52, 53, u5	-	51
nat	Monitoring time	Monitoring time	-	Hour	-
HPV	Max. value	Maximum value	-	°C/°F	-
LPV	Min. value	Minimum value	-	°C/°F	-

7.3 Parameter 1 group [PA1]

Parameter	Description		Setting range	Unit	Factory default
int	Input type	Input type	n5.H, n5.L, ni.H, ni.L, dP.H, dP.L	-	n5.H
52	Input sensor 2 ON/OFF	Input sensor 2 ON/OFF	OFF, ON	-	OFF
53	Input sensor 3 selection	Input sensor 3 selection	d1, t5	-	d1
utr	Virtual temperature rate	Virtual temperature rate	0 to 100	%	0
Unit	Temperature unit	Temperature unit	°C, °F	-	°C
ib.1	Input correction 1	Input correction 1	-40 to 40	°C/°F	0
ib.2	Input correction 2	Input correction 2			
ib.3	Input correction 3	Input correction 3			
d5t	Delay display period	Delay display period	0.5 to 10.0	Sec	0.5
5dR	Defrost/auxiliary output selection	Defrost/auxiliary output selection	dEF, AU5	-	dEF
AU5	Auxiliary output	Auxiliary output	OFF, FRn, ALn	-	OFF
bUΞ	Buzzer	Buzzer operation	OFF, ON	-	ON

7.4 Parameter 2 group [PAR2]

Parameter	Description		Setting range	Unit	Factory default
σFt	Compressor output mode	Compressor output operation mode	C, H	-	C
HYS	Hysteresis	ON hysteresis	1 to 5 (0.5 to 5.0)	°C	1
			2 to 10 (2.0 to 10.0)	°F	
σFS	Offset	OFF Offset	0 to 5 (0.0 to 5.0)	°C	0
			0 to 10 (0.0 to 10.0)	°F	
$H5u$	SV high-limit	SV high-limit	($L5u + 1$ digit) to high-limit value of input type	°C/°F	99
$L5u$	SV low-limit	SV low-limit	Low-limit value of input type to ($H5u - 1$ digit)	°C/°F	-40
$n\bar{n}d$	Night mode	Enable night mode	$\sigma FF, \epsilon 1 \bar{n}, d1$	°C/°F	σFF
$n5u$	Night mode SV correction	Night mode SV correction	-20 to 20 (-20 to 20.0)	°C	1
			-50 to 50 (-50 to 50.0)	°F	
nHY	Night mode hysteresis	Night mode hysteresis	1 to 5 (0.5 to 5.0)	°C	1
			2 to 10 (2.0 to 10.0)	°F	
$n\sigma F$	Night mode offset	Night mode offset	0 to 5 (0.0 to 5.0)	°C	0
			0 to 10 (0.0 to 10.0)	°F	
$n5H$	Night mode start hour	Night mode start hour	0 to 23	Hour	0
$n5\bar{n}$	Night mode start minute	Night mode start minute	0 to 59	Min	0
nEH	Night mode end hour	Night mode end hour	0 to 23	Hour	8
$nE\bar{n}$	Night mode end minute	Night mode end minute	0 to 59	Min	0
$E\bar{n}\sigma$	Temperature monitoring	Enable temperature monitoring	$\sigma FF, 51, 52, 53, u5$	-	σFF
$5dL$	Compressor start-up delay time	Compressor start-up delay time	0 to 60	Min	0
CYC	Compressor min. operation cycle	Compressor min. operation cycle	0 to 60	Min	0
$r dL$	Compressor restart	Compressor restart delay	0 to 60	Min	0

Parameter	Description		Setting range	Unit	Factory default
	delay time	time			
<i>o n t</i>	Compressor min. operation time	Compressor min. operation time	0 to 60	Min	0
<i>CC</i>	Compressor continuous operation	Compressor continuous operation	0 to 24	Hour	0
<i>AdC</i>	Alarm delay after continuous cycle	Alarm delay time after continuous operation	0 to 24	Hour	2
<i>CLE</i>	Compressor operation cycle when sensor break	Compressor operation cycle when sensor break	0 to 100	Min	0
<i>dUt</i>	Compressor duty rate when sensor break	Compressor duty rate when sensor break	0 to 100	%	50

7.5 Parameter 3 group [PAR3]

Parameter	Description		Setting range	Unit	Factory default
<i>dEF</i>	Defrost method & operation	Defrost method & operation	H.E.n, G.E.n, H.E.t, G.E.t	-	0
<i>dIn</i>	Defrost cycle	Defrost cycle	0 to 24/0 to 100	Hour/Min	4
<i>r.dI</i>	Real-time defrost cycle	Real-time defrost cycle	oFF, oN	-	oFF
<i>dH1</i>	Real-time defrost hour 1	Real-time defrost cycle 1 hour	0 to 23, oFF	Hour	oFF
<i>dñ1</i>	Real-time defrost min 1	Real-time defrost cycle 1 minute	0 to 59, oFF	Min	oFF
<i>dH2</i>	Real-time defrost hour 2	Real-time defrost cycle 2 hour	0 to 23, oFF	Hour	oFF
<i>dñ2</i>	Real-time defrost min 2	Real-time defrost cycle 2 minute	0 to 59, oFF	Min	oFF
<i>dH3</i>	Real-time defrost hour 3	Real-time defrost cycle 3 hour	0 to 23, oFF	Hour	oFF
<i>dñ3</i>	Real-time defrost min 3	Real-time defrost cycle 3 minute	0 to 59, oFF	Min	oFF
<i>dH4</i>	Real-time defrost hour 4	Real-time defrost cycle 4 hour	0 to 23, oFF	Hour	oFF
<i>dñ4</i>	Real-time defrost min 4	Real-time defrost cycle 4 minute	0 to 59, oFF	Min	oFF
<i>dH5</i>	Real-time defrost hour 5	Real-time defrost cycle 5 hour	0 to 23, oFF	Hour	oFF
<i>dñ5</i>	Real-time defrost min 5	Real-time defrost cycle 5 minute	0 to 59, oFF	Min	oFF
<i>dH6</i>	Real-time defrost hour 6	Real-time defrost cycle 6 hour	0 to 23, oFF	Hour	oFF
<i>dñ6</i>	Real-time defrost min 6	Real-time defrost cycle 6 minute	0 to 59, oFF	Min	oFF
<i>dH7</i>	Real-time defrost hour 7	Real-time defrost cycle 7 hour	0 to 23, oFF	Hour	oFF
<i>dñ7</i>	Real-time defrost min 7	Real-time defrost cycle 7 minute	0 to 59, oFF	Min	oFF
<i>dH8</i>	Real-time defrost hour 8	Real-time defrost cycle 8 hour	0 to 23, oFF	Hour	oFF
<i>dñ8</i>	Real-time defrost min 8	Real-time defrost cycle 8 minute	0 to 59, oFF	Min	oFF
<i>dEt</i>	Defrost time	Defrost time	1 to 100	Min/Sec	30
<i>P.d.d</i>	Pump down delay time	Pump down delay time	0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)	Min.Sec	0.00
<i>d.r.t</i>	Defrost end delay time	Defrost end delay time	0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)	Min.Sec	1.00

Parameter	Description		Setting range	Unit	Factory default
<i>E.d.t</i>	Defrost end temperature	Defrost end temperature	-40 to 99	°C	4
			-40 to 212	°F	
<i>d.H.Y</i>	Defrost hysteresis	Defrost hysteresis	1 to 5 (0.5 to 5.0)	°C	1
			2 to 10 (2.0 to 10.0)	°F	
<i>P.d.E</i>	Defrost when power ON	Defrost when power ON	oFF, oN	-	oFF
<i>d.d.E</i>	Defrost delay when power ON/manual defrost	Defrost delay when power ON/manual defrost	0 to 60	Min	0
<i>d.G.r</i>	Defrost group	Defrost group	oFF, nRS, SLu	-	oFF
<i>P.d.C</i>	Parameter copy	Parameter copy	oFF, oN	-	oFF
<i>d.P.r</i>	Prior defrost selection	Prior defrost selection	oFF, oN	-	oFF
<i>U.d.E</i>	Defrost time unit	Defrost time unit	HGH, LoY	-	HGH
<i>R.d.d</i>	Alarm delay after defrost/door open	Alarm delay after defrost/door open	0 to 24	Hour	1
<i>t.d.E</i>	Temperature display during defrost	Temperature display during defrost	oFF, oN	-	oFF

7.6 Parameter 4 group [PAR4]

Parameter	Description		Setting range	Unit	Factory default
<i>AL</i>	Alarm operation mode	Alarm operation mode	<i>OFF, AL.d</i>	-	<i>AL.d</i>
<i>AL.t</i>	Alarm option	Alarm option	<i>AL.A, AL.b, AL.C, AL.d, AL.E, AL.F</i>	-	<i>AL.A</i>
<i>AL.H</i>	Alarm high-limit deviation	Alarm high-limit deviation	-F.S. to F.S	°C/°F	139
<i>AL.L</i>	Alarm low-limit deviation	Alarm low-limit deviation	-F.S. to F.S	°C/°F	139
<i>AL.HY</i>	Alarm hysteresis	Alarm hysteresis	1 to 5 (0.5 to 5.0)	°C	1
			2 to 10 (2.0 to 10.0)	°F	
<i>AL.ON</i>	Alarm ON delay time	Alarm ON delay time	0 to 60	Min	0
<i>AL.OFF</i>	Alarm OFF delay time	Alarm OFF delay time	0 to 60	Min	0
<i>EA.d</i>	External alarm delay time	External alarm delay time	0 to 60	Min	0
<i>AL.n</i>	Alarm output method	Alarm output method	<i>no, nC</i>	-	<i>no</i>
<i>EF.tY</i>	Evaporator-fan operation	Evaporator-fan operation	<i>FR.n, dEF</i>	-	<i>FR.n</i>
<i>EF.t</i>	Evaporator-fan control temperature	Evaporator-fan control temperature	-40 to 99	°C	4
			-40 to 212	°F	
<i>EF.HY</i>	Evaporator-fan hysteresis	Evaporator-fan hysteresis	1 to 5 (0.5 to 5.0)	°C	1
			2 to 10 (2.0 to 10.0)	°F	
<i>FR.n</i>	Evaporator-fan mode	Evaporator-fan mode	<i>EF 1, EF2, EF3, EF4, EF5</i>	-	<i>EF 1</i>
<i>P.dr</i>	Evaporator-fan start-up delay time	Evaporator-fan start-up delay time	0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)	Min.Sec	1.00

7.7 Parameter 5 group [P_{AS}]

Parameter	Description		Setting range	Unit	Factory default
<i>CUH</i>	Current hour	Current hour	0 to 23	Hour	Random hour
<i>CU\bar{n}</i>	Current minute	Current minute	0 to 59	Min	Random minute
<i>dI</i>	Digital input	Digital input	<i>oFF, StP, dSt, n\bar{n}d, EAL, EdF, n\bar{d}F</i>	-	<i>oFF</i>
<i>LbA</i>	Loop break alarm monitoring time	Loop break alarm monitoring time	0 to 100	-	0
<i>Adr</i>	Communication address	Communication address	01 to 99	-	01
<i>bP5</i>	Communication speed	Communication speed	24, 48, 96, 192, 384	-	96
<i>Prt</i>	Communication parity bit	Communication parity bit	<i>non, E\bar{u}n, odd</i>	-	<i>non</i>
<i>StP</i>	Communication stop bit	Communication stop bit	1, 2	bit	2
<i>rt</i>	Communication response wait time	Communication response wait time	5 to 99	ms	20
<i>Co\bar{w}</i>	Communication write	Communication write	<i>E\bar{n}A, dS\bar{A}</i>	-	<i>E\bar{n}A</i>
<i>U5r</i>	User level	User level	<i>St\bar{d}, HGH</i>	-	<i>St\bar{d}</i>
<i>L5u</i>	SV setting group lock	SV setting group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>Ld\bar{t}</i>	Front key lock	Front key lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LP0</i>	Parameter 0 group lock	Parameter 0 group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LPu</i>	Parameter user group lock	Parameter user group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LP1</i>	Parameter 1 group lock	Parameter 1 group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LP2</i>	Parameter 2 group lock	Parameter 2 group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LP3</i>	Parameter 3 group lock	Parameter 3 group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LP4</i>	Parameter 4 group lock	Parameter 4 group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>LP5</i>	Parameter 5 group lock	Parameter 5 group lock	<i>oFF, on</i>	-	<i>oFF</i>
<i>P\bar{w}d</i>	Password	Password	000 (password OFF), 002 to 999 (password ON)	-	000

7.8 Reset parameters by changing parameter

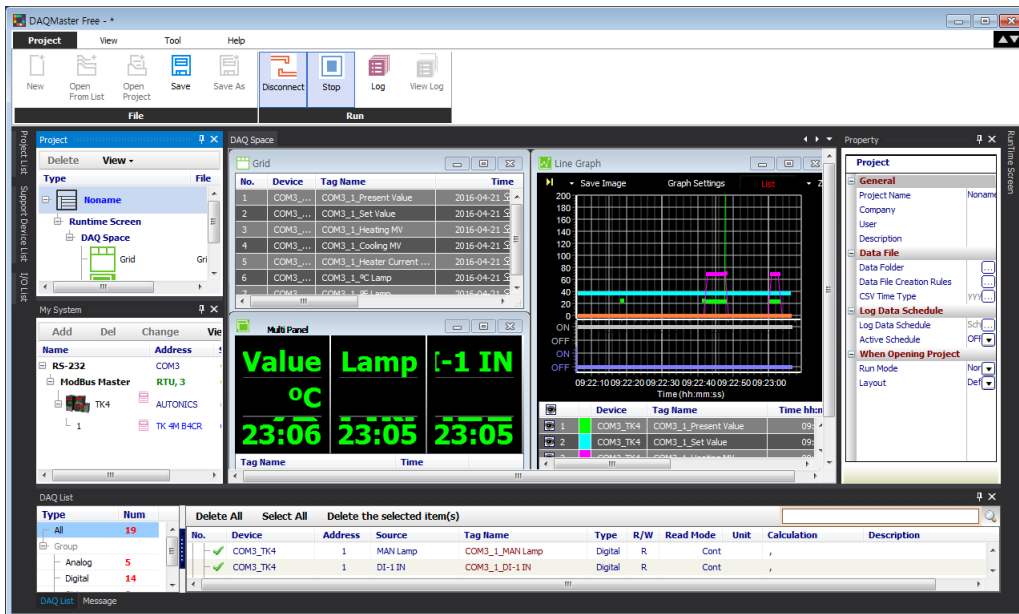
Changing parameter	Description	Reset parameters
<i>Int</i>	Input type	<i>Su, HPE, LPE, I b.1, I b.2, I b.3, HYS, oFS, HSu, L Su, nSu, nHY, Edt, dHY, ALH, ALL, AHY, Ft, FHY</i>
<i>Unit</i>	Temperature unit	<i>HPE, LPE, I b.1, I b.2, I b.3, HYS, oFS, HSu, L Su, nSu, nHY, Edt, dHY, ALH, ALL, AHY, Ft, FHY</i>
<i>oFt</i>	Compressor output mode	<i>[LE, dUt</i>
<i>HSu</i>	SV high-limit value	When $SV > HSu$, <i>Su</i> is reset as <i>HSu</i> .
<i>L Su</i>	SV low-limit value	When $SV < L Su$, <i>Su</i> is reset as <i>L Su</i> .
<i>ALt</i>	Alarm option	<i>ALH, ALL, AHY</i>

8 DAQMaster

8.1 Overview

DAQMaster is a comprehensive device management program that can be used with Autonics communication supporting products.

DAQMaster provides GUI control for easy and convenient management of parameters and multiple device data monitoring.



Note

For more information about DAQMaster, visit our web site (www.autonics.com) and download 'DAQMaster user manual'.

8.2 Major features

DAQMaster has the following features:

(1) Multiple Device Support

- Simultaneously monitor multiple devices and set parameters.
- Simultaneously connect units with different addresses in a single device.
- Multiple RS-233 ports are available for communications using Modbus remote terminal unit.

(2) Device Scan

In cases of multiple units (with different addresses) connected together, the unit scan function automatically searches for units.

(3) Convenient User Interface

Freely arrange windows for data monitoring, properties, and projects. Saving a project also saves the screen layout.

(4) Project Management

You can save added device information, data monitoring screen layouts, and I/O source selection as project files. Opens project files to load the saved settings. Provides a project list for simple and easy project file management.

(5) Monitoring Data Log

When monitoring, data log files can be saved as either DAQMaster data files (.ddf) or CSV (.csv) files. Open files saved in .csv format directly from Microsoft Excel. Define log data file naming/saving rules and destination folders to make file management convenient.

(6) Data Analysis

Performs grid and graph analyses of data files (.ddf) using DAQMaster's data analysis feature. Saves grid data as .rtf, .txt, .html, or .csv files in Data Grid.

(7) Print Modbus Map Table Report

Print address map reports of registered Modbus devices. Modbus map table reports can be saved as html (*.html) and pdf (*.pdf) formats.

(8) Multilingual Support

Supports Korean, English, Japanese, Simplified Chinese. To add a different language, modify the files in the Lang folder, rename, and save.

(9) Script Support

Uses the Lua Script language and deals with different I/O processes for individual devices.

8.3 Special feature for TF3 Series

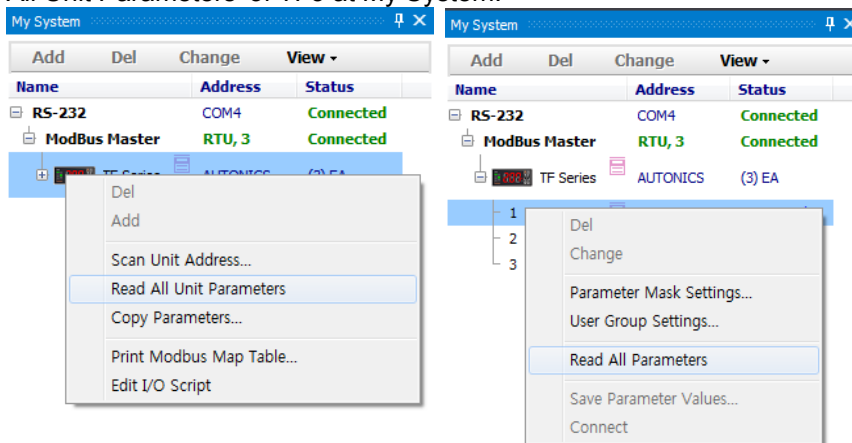
Parameter mask and user parameter group is available by DAQMaster. Visit our website (www.autonics.com) to download DAQMaster software and the manual.

8.3.1 Save parameter values

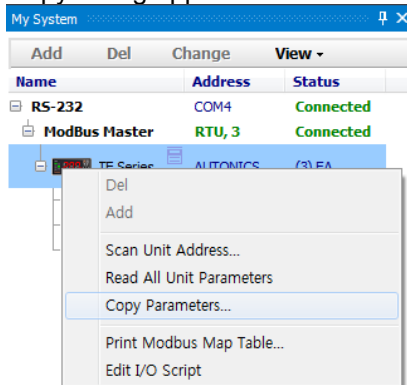
When several same model units cannot be connected to DAQMaster at once and parameter copy is not available, you can save the setting of the device as a file and utilize the file at a later.

1st Connect the TF3 device which parameters are saved.

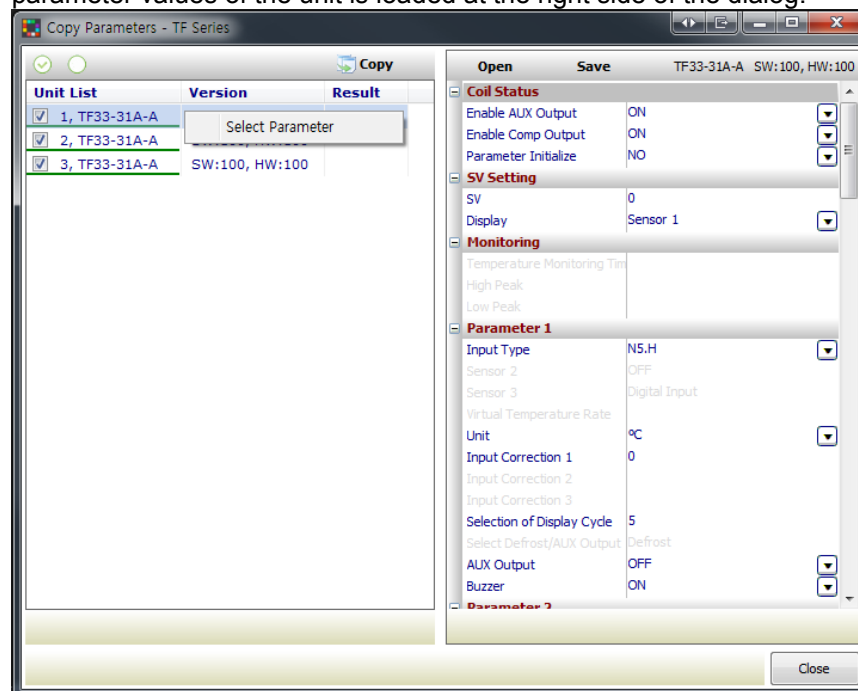
2nd Click 'Read All Parameters' of the unit device which parameters are saved or 'Read All Unit Parameters' of TF3 at My System.



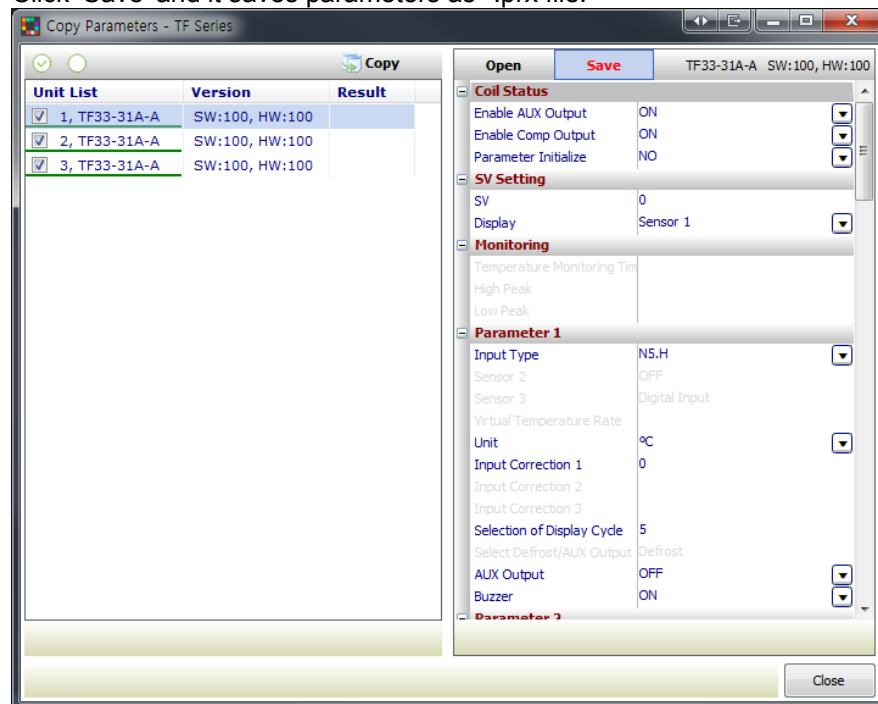
3rd Select TF3 at My System and right-click to select 'Copy Parameters' and Parameter Copy dialog appears.



- 4th Right-click the unit which parameters are saved and select 'Parameter Select'. The parameter values of the unit is loaded at the right side of the dialog.



- 5th Click 'Save' and it saves parameters as *.prx file.

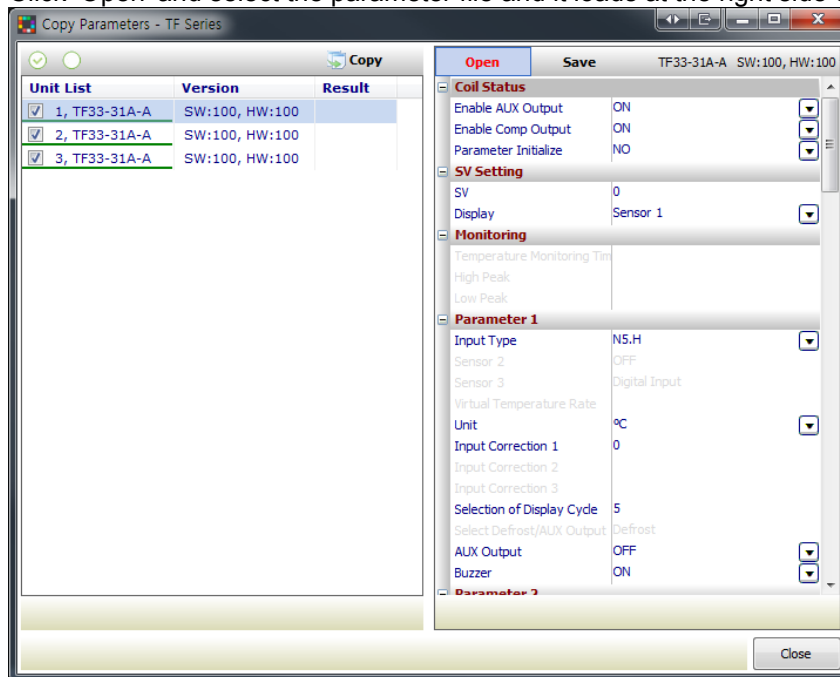


8.3.2 Copy parameters

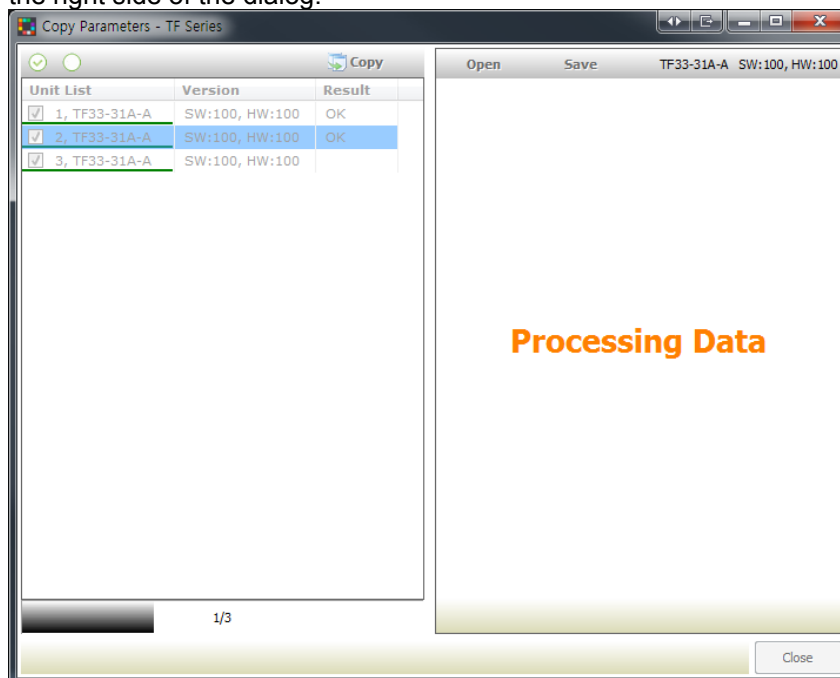
To connect the several same model units at once, you can copy the parameters. You can copy the saved parameter file or the parameter settings of the dedicated device(standard unit) to the other devices(target units).

(1) To copy the saved parameter file,

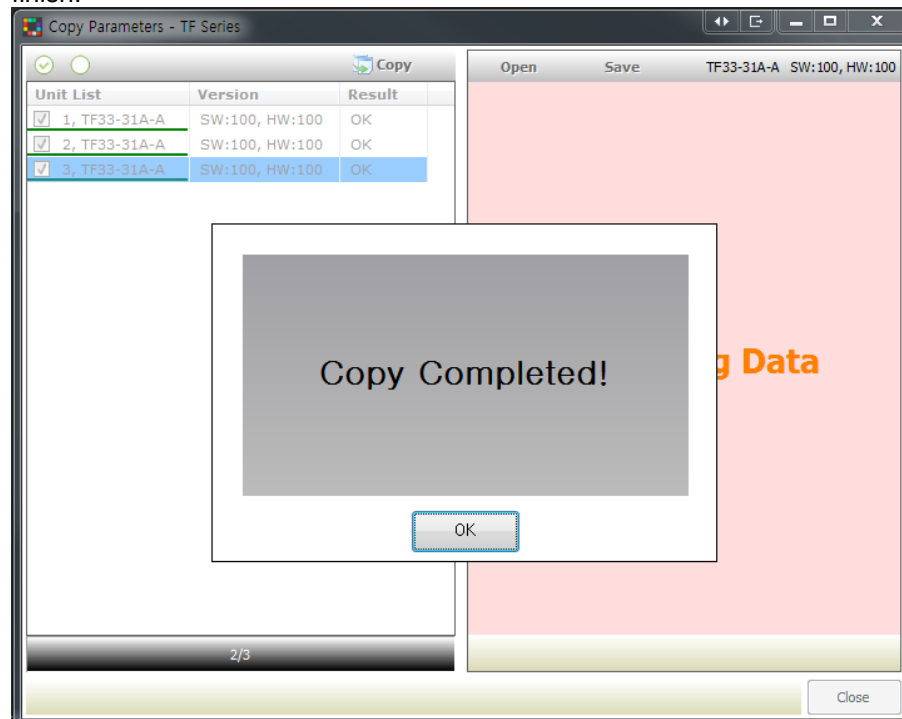
- 1st Same orders 1st to 3rd of the Save parameter values.
- 2nd Check the units to be copied at the check box of the left side of the dialog.
- 3rd Click 'Open' and select the parameter file and it loads at the right side of the dialog.



- 4th Click 'Copy' and copy is progressing. 'the Process of Copying data' text appears at the right side of the dialog.



5th After completing copy, 'Copy Complete!' dialog box appears. Click 'OK' and copy is finish.

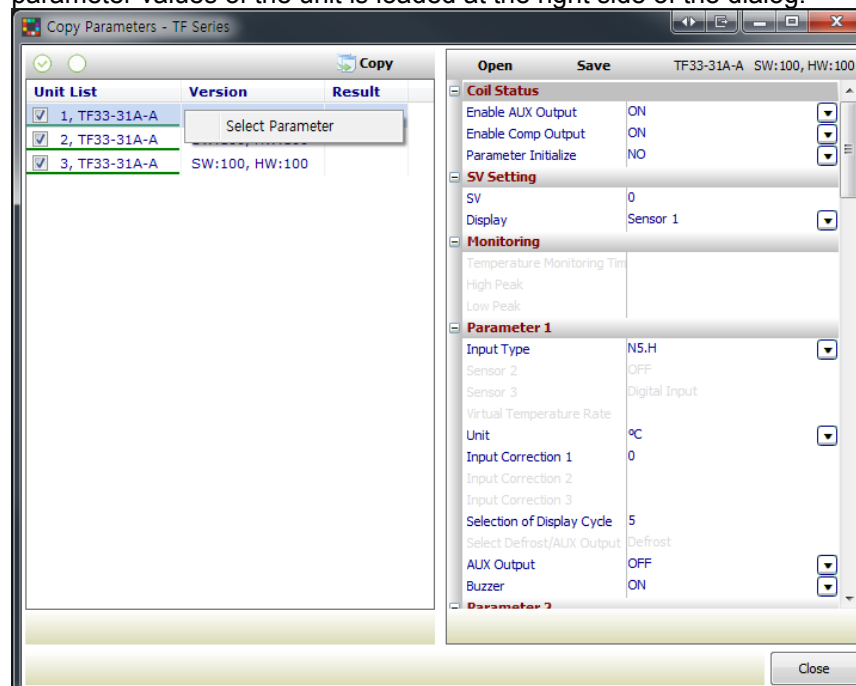


(2) To copy the parameter settings of the dedicated device(standard unit) to the other devices(target units),

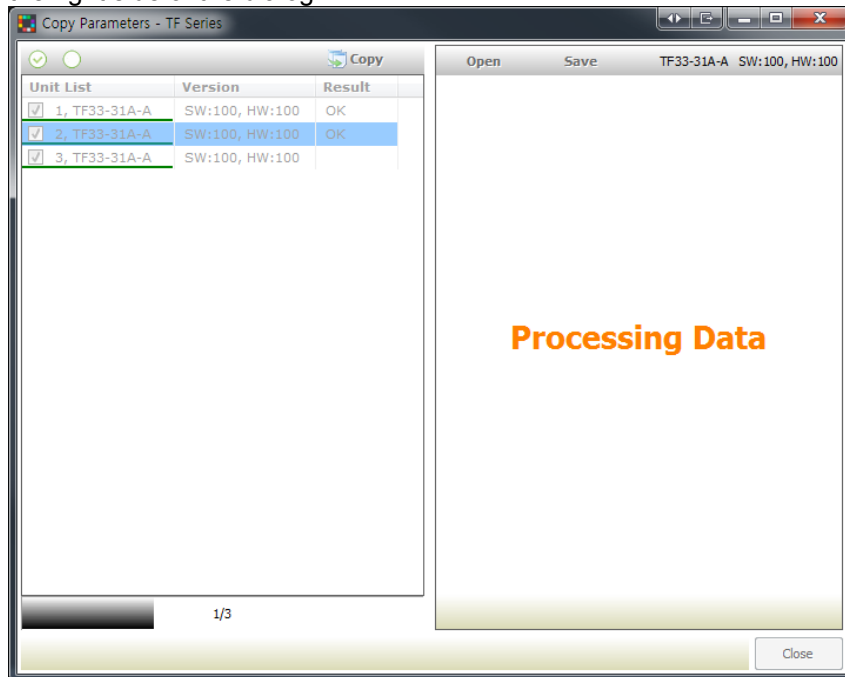
1st Same orders 1st to 3rd of the Save parameter values.

2nd Check the units to be copying (standard unit) and to be copied (target unit) at the check box of the left side of the dialog.

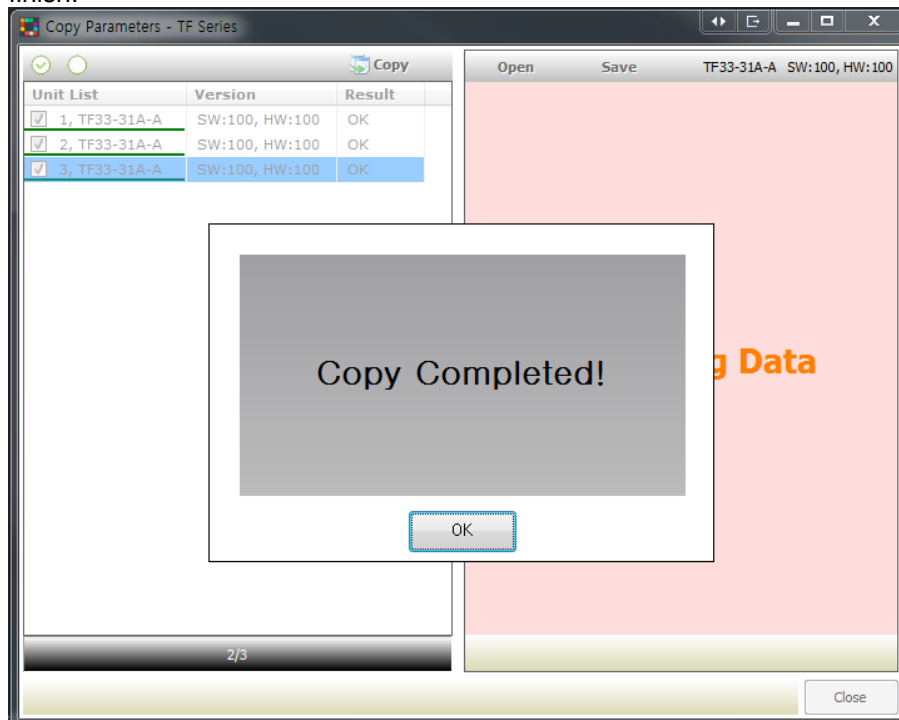
3rd Right-click the unit to be copying(standard unit) and select 'Parameter Select'. The parameter values of the unit is loaded at the right side of the dialog.



4th Click 'Copy' and copy is progressing. 'the Process of Copying data' text appears at the right side of the dialog.



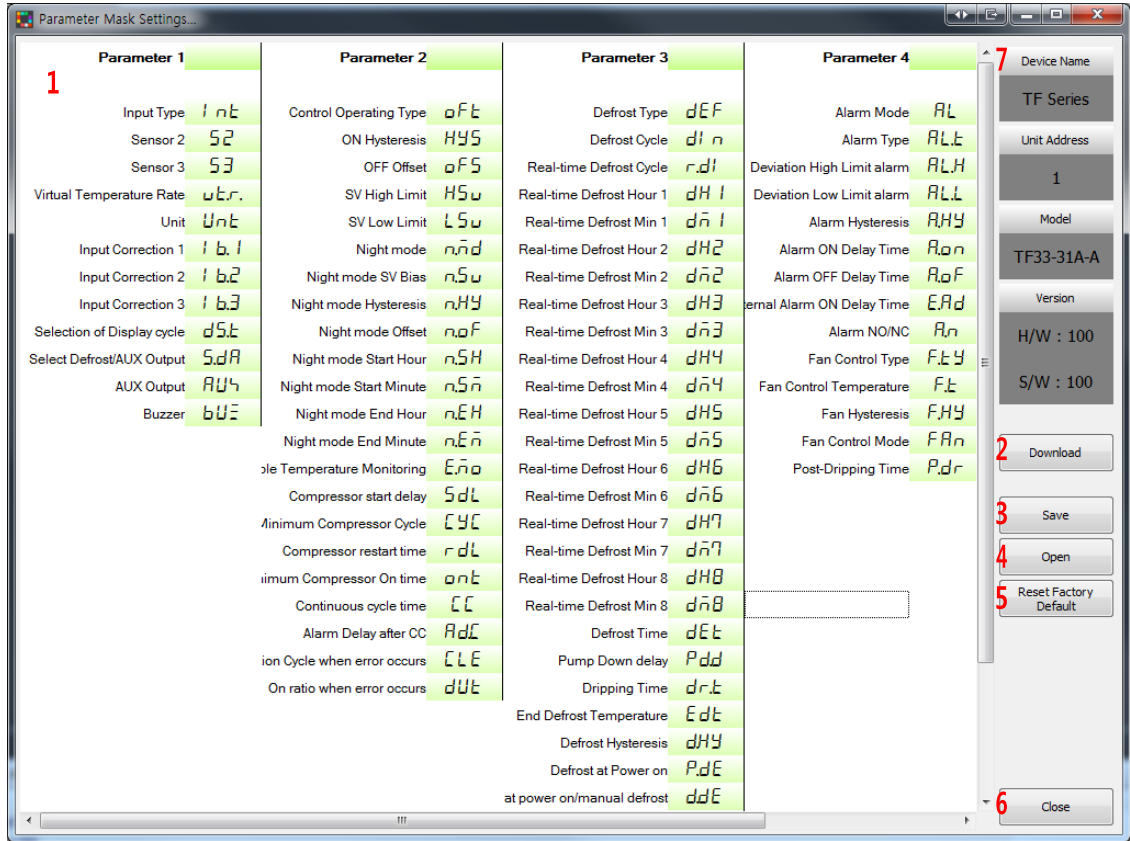
5th After completing copy, 'Copy Complete!' dialog box appears. Click 'OK' and copy is finish.



8.3.3 Parameter mask

This feature is able to hide unnecessary parameters to user environment or less frequently used parameters in parameter group.

Masked parameters are not only displayed. The set value of masked parameters are applied.



No	Item	Description
1	Parameter mask selection	Select the to-be masked parameters. Right-click the to-be masked parameters and they turn gray.
2	Download	Applies the set masked parameters to the device.
3	Save	Saves the set masked parameters as a mask information file.
4	Open	Opens the saved mask information file.
5	Initialize factory default	Clears the set for the masked parameters. Download this setting to apply it to the device.
6	Close	Closes the Parameter Mask Settings dialog.
7	Device information	Displays device name, unit address, model name, and version.



Ex.

Parameter Mask Settings...

Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Input Type <i>1 n t</i>	Control Operating Type <i>o F t</i>	Defrost Type <i>d E F</i>	Alarm Mode <i>AL</i>	Current Hour <i>C U H</i>
Sensor 2 <i>S 2</i>	ON Hysteresis <i>H Y S</i>	Defrost Cycle <i>d i n</i>	Alarm Type <i>AL t</i>	Current Minute <i>C U n</i>
Sensor 3 <i>S 3</i>	OFF Offset <i>o F S</i>	Real-time Defrost Cycle <i>r d i</i>	Deviation High Limit alarm <i>AL H</i>	Digital Input <i>d i</i>
Virtual Temperature Rate <i>w t r.</i>	SV High Limit <i>H S u</i>	Real-time Defrost Hour 1 <i>d H 1</i>	Deviation Low Limit alarm <i>AL L</i>	Loop break Alarm <i>L b A</i>
Unit <i>U n t</i>	SV Low Limit <i>L S u</i>	Real-time Defrost Min 1 <i>d n 1</i>	Alarm Hysteresis <i>A H Y</i>	Address <i>A d r</i>
Input Correction 1 <i>i b. 1</i>	Night mode <i>n n d</i>	Real-time Defrost Hour 2 <i>d H 2</i>	Alarm ON Delay Time <i>A o n</i>	Bit Per Second <i>b P S</i>
Input Correction 2 <i>i b. 2</i>	Night mode SV Bias <i>n S u</i>	Real-time Defrost Min 2 <i>d n 2</i>	Alarm OFF Delay Time <i>A o f</i>	Parity Bit <i>P r t</i>
Input Correction 3 <i>i b. 3</i>	Night mode Hysteresis <i>n H Y</i>	Real-time Defrost Hour 3 <i>d H 3</i>	Internal Alarm ON Delay Time <i>E A d</i>	Stop Bit <i>S t P</i>
Selection of Display cycle <i>d S t</i>	Night mode Offset <i>n o F</i>	Real-time Defrost Min 3 <i>d n 3</i>	Alarm NO/NC <i>A n</i>	Response Waiting Time <i>r W t</i>
Select Defrost/AUX Output <i>S d A</i>	Night mode Start Hour <i>n S H</i>	Real-time Defrost Hour 4 <i>d H 4</i>	Fan Control Type <i>F t Y</i>	Communication Write <i>C o Y</i>
AUX Output <i>A U Y</i>	Night mode Start Minute <i>n S n</i>	Real-time Defrost Min 4 <i>d n 4</i>	Fan Control Temperature <i>F t</i>	User Level Settings <i>U S r</i>
Buzzer <i>b U Z</i>	Night mode End Hour <i>n E H</i>	Real-time Defrost Hour 5 <i>d H 5</i>	Fan Hysteresis <i>F H Y</i>	Lock SV <i>L S u</i>
	Night mode End Minute <i>n E n</i>	Real-time Defrost Min 5 <i>d n 5</i>	Fan Control Mode <i>F A n</i>	Lock Digital Key <i>L d Y</i>
	Refrigerant Temperature Monitoring <i>E n o</i>	Real-time Defrost Hour 6 <i>d H 6</i>	Post-Dripping Time <i>P d r</i>	Lock Parameter 0 <i>L P 0</i>
	Compressor start delay <i>S d L</i>	Real-time Defrost Min 6 <i>d n 6</i>		Lock Parameter User <i>L P U</i>
	Minimum Compressor Cycle <i>C Y C</i>	Real-time Defrost Hour 7 <i>d H 7</i>		Lock Parameter 1 <i>L P 1</i>
	Compressor restart time <i>r d L</i>	Real-time Defrost Min 7 <i>d n 7</i>		Lock Parameter 2 <i>L P 2</i>
	Minimum Compressor On time <i>o n t</i>	Real-time Defrost Hour 8 <i>d H 8</i>		Lock Parameter 3 <i>L P 3</i>
	Continuous cycle time <i>C C</i>	Real-time Defrost Min 8 <i>d n 8</i>		Lock Parameter 4 <i>L P 4</i>
	Alarm Delay after CC <i>A d L</i>	Defrost Time <i>d E t</i>		Lock Parameter 5 <i>L P 5</i>
	Defrost Cycle when error occurs <i>C L E</i>	Pump Down delay <i>P d d</i>		PWD Password <i>P Y d</i>
	On ratio when error occurs <i>d U t</i>	Dripping Time <i>d r t</i>		
		End Defrost Temperature <i>E d t</i>		
		Defrost Hysteresis <i>d H Y</i>		
		Defrost at Power on <i>P d E</i>		
		Defrost at power on/manual defrost <i>d d E</i>		
		Defrost Group <i>d G r</i>		
		Parameter Data Copy <i>P d C</i>		
		Defrost Priority <i>d P r</i>		
		Defrost time unit <i>U d E</i>		
		Delay after Defrost/Door open <i>A d d</i>		
		Temperature display during Defrost <i>t d E</i>		

Device Name
TF Series

Unit Address
1

Model
TF33-31A-A

Version
H/W : 100
S/W : 100

Download

Save

Open

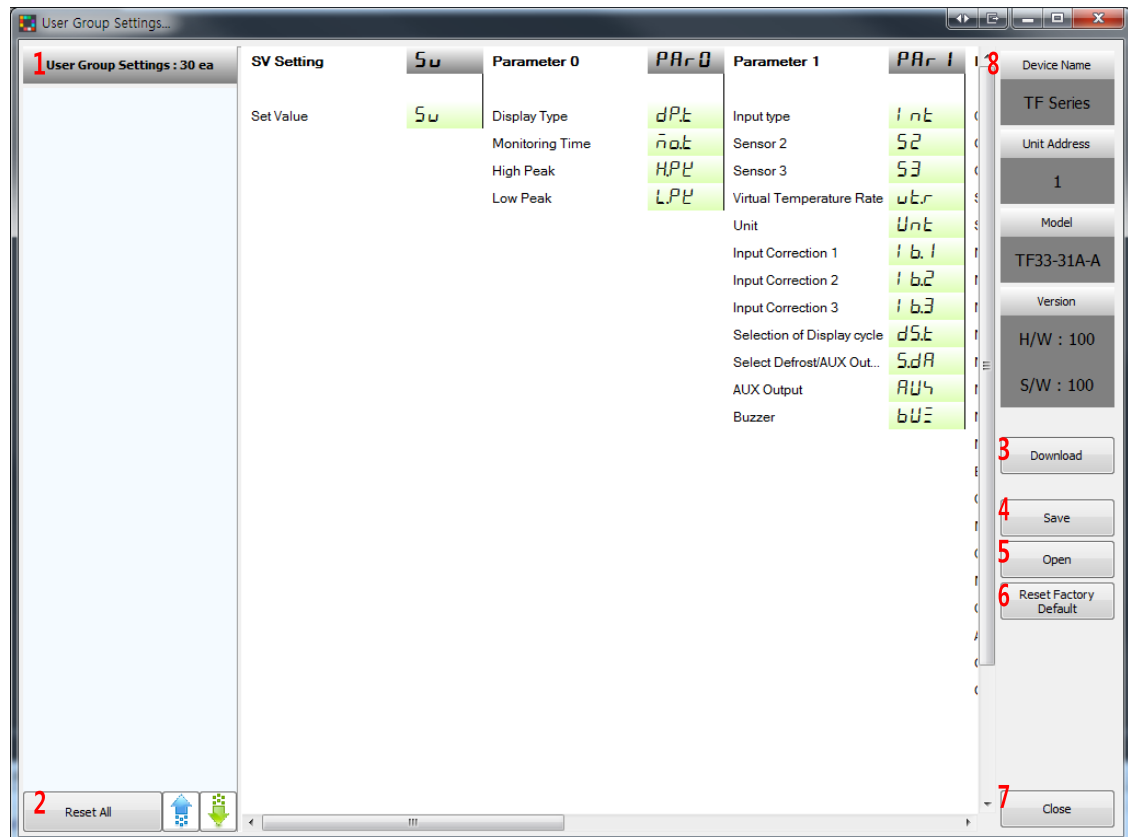
Reset Factory Default

Close

Example of masking delay display period, defrost/auxiliary output, auxiliary output, Buzzer of parameter1 group, and all of parameter4 group.

8.3.4 User parameter group

This feature is able to set the frequently used parameters to the user parameter group. You can quickly and easily set parameter settings. User parameter group can have up to 30 parameters.



No	Item	Description
1	User parameter group	Displays the selected parameters as user parameter group. Double-click the parameters for the user parameter group, and these parameters turn gray. To delete the parameters at the user parameter group, double-click the parameters.
2	User parameter group selection	- All initialize: Initializes the set user parameter group. - ↑,↓: Changes the selected parameter order up/down.
3	Download	Applies the set user parameter group to the device.
4	Save	Saves the set user group as user parameter group information file.
5	Open	Opens the saved user parameter group file.
6	Initialize factory default	Clears the set for the user parameter group. Download this setting to apply it to the device.
7	Close	Closes the User Parameter Group Settings dialog.
8	Device information	Displays device name, unit address, model name, and version.



Example of the set user parameter group with SV setting, display selection, monitoring time, input type, input sensor 2 ON/OFF, input sensor 3 selection, virtual temperature rate, temperature unit parameters, etc.

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■ Any proposal for a product improvement and development: Product@autonics.com

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