



CONTROLLER BOARD

**IM-100A
IM-130A
IM-220AA
IM-220AWA**

SERVICE MANUAL

This service manual provides information on the controller board used for Hoshizaki IM-220AA/AWA, IM-100A, and IM-130A cubers. Please also refer to the applicable service manual for each model. If any information contained herein is inconsistent with the instruction or installation manual, follow the latter manual.

M028-861 (070221)

CONTENTS

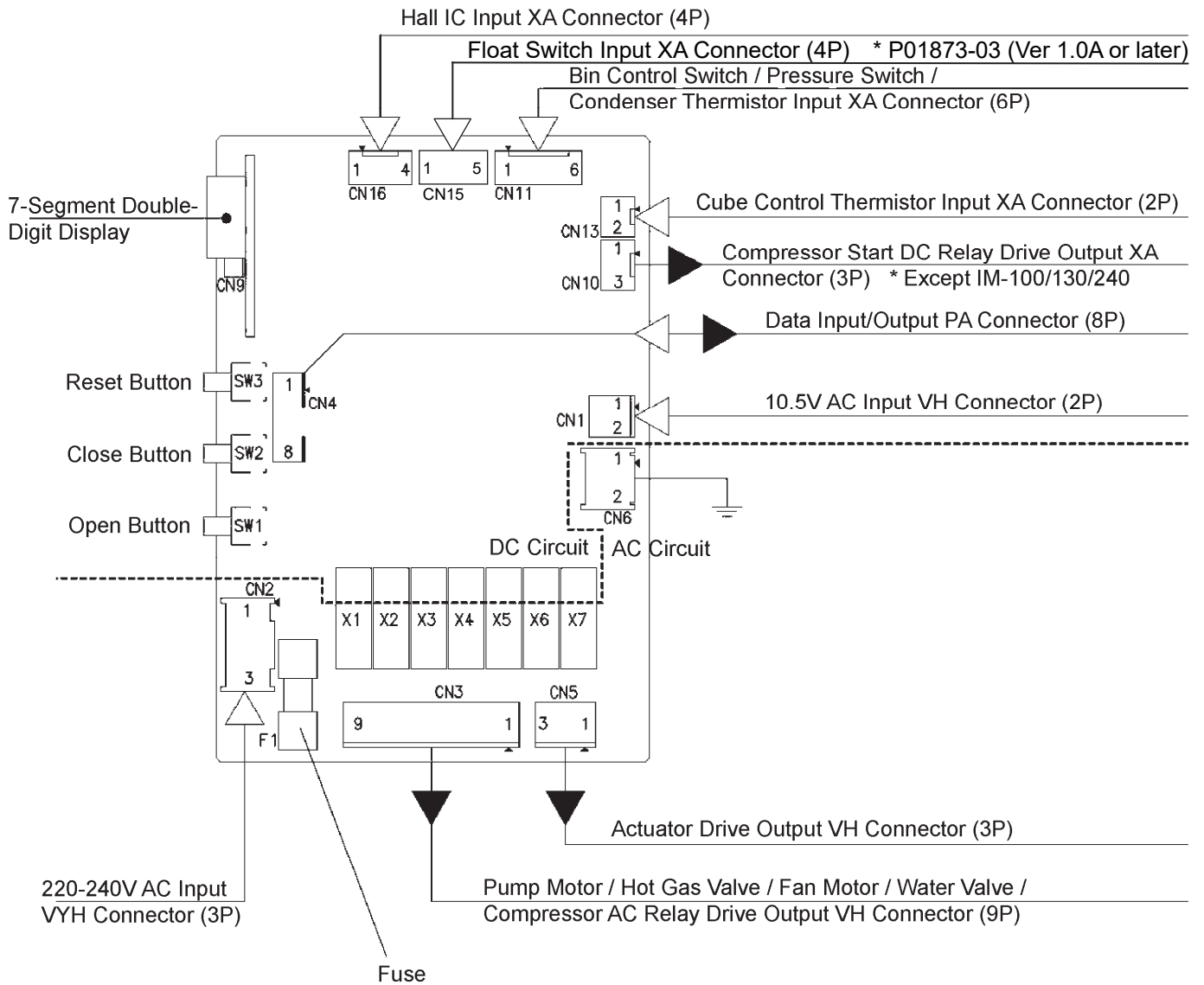
PAGE

1. CONFIGURATION -----	1
[a] INPUT/OUTPUT LAYOUT -----	1
[b] INPUT/OUTPUT CIRCUIT -----	2
[c] BOARD CONFIGURATION -----	3
[d] SWITCH OPERATION -----	4
[e] VERSION COMPARISON -----	6
2. OPERATION -----	7
[a] SOFT START -----	7
[b] WATER PAN OPENS -----	7
[c] DEFROST CYCLE -----	8
[d] WATER PAN CLOSES -----	8
[e] FREEZE CYCLE -----	8
[f] FREEZE COMPLETION CONTROL -----	10
[g] WATER SUPPLY CONTROL -----	12
[h] AMBIENT TEMPERATURE CORRECTION -----	13
[i] DIMPLE DIAMETER SETTING -----	13
[j] BIN CONTROL CYCLE -----	14
[k] RESET SWITCH -----	14
[l] 7-SEGMENT LED -----	15
3. MODE SETTING -----	15
[a] WATER CIRCUIT FLUSH MODE -----	15
[b] SELF-CLEANING MODE (for M028-C106 and M028-C207) -----	16
[c] MAINTENANCE MODE -----	17
[d] DISPLAY MODE (LOG CLEARING) -----	30
[e] MODEL CODE SETTING MODE -----	31
4. 7-SEGMENT DISPLAY -----	33
[a] NORMAL MODE -----	33
[b] MAINTENANCE MODE -----	33
[c] DISPLAY MODE -----	35
[d] SELF-CLEANING MODE (for M028-C106 and M028-C207) -----	36
5. ERROR CODES -----	36
[a] ERROR CODES, CAUTION CODES -----	36
[b] SERVICE DIAGNOSIS -----	38
6. TROUBLESHOOTING -----	39
[a] INSTRUCTIONS FOR SERVICE ENGINEER -----	39
[b] CHECKING CONTROLLER BOARD -----	39

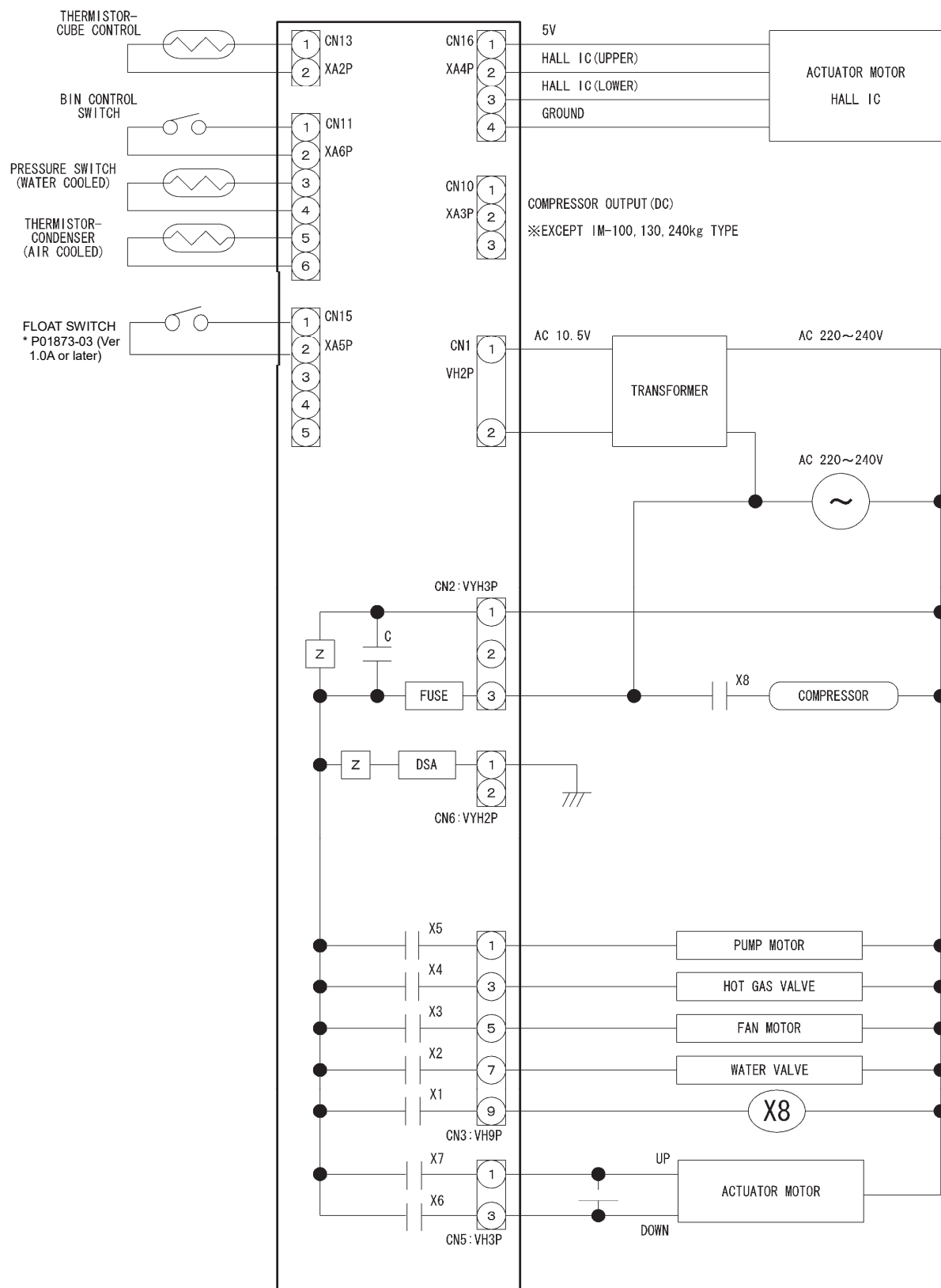
7. REMOVAL AND REPLACEMENT	40
8. TIMING CHART	42

1. CONFIGURATION

[a] INPUT/OUTPUT LAYOUT

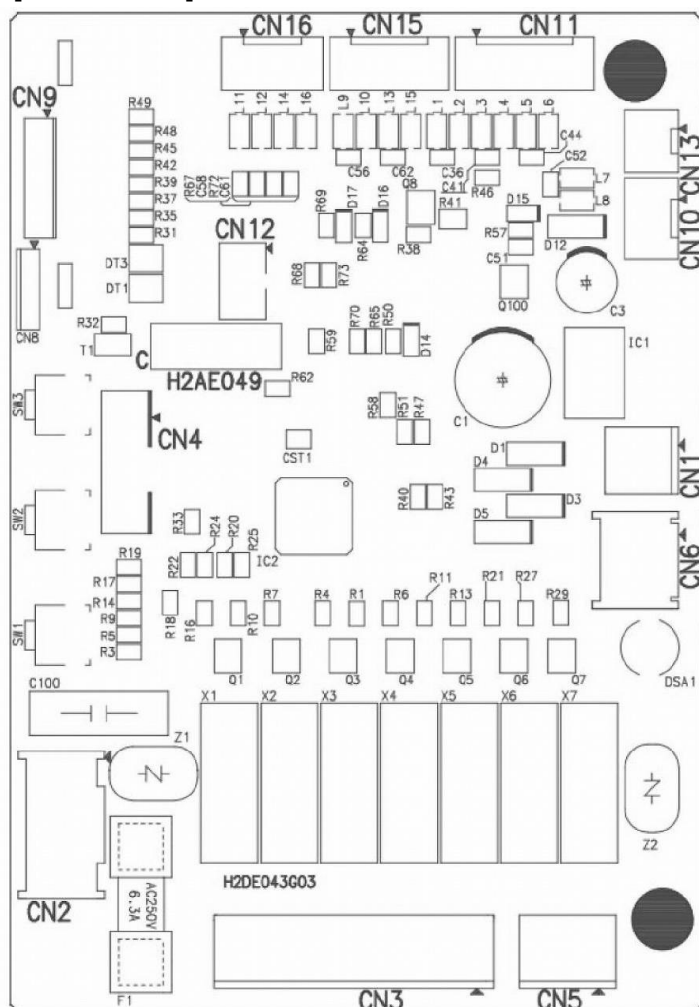


[b] INPUT/OUTPUT CIRCUIT

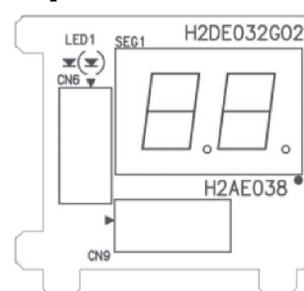


[c] BOARD CONFIGURATION

[Main Board]

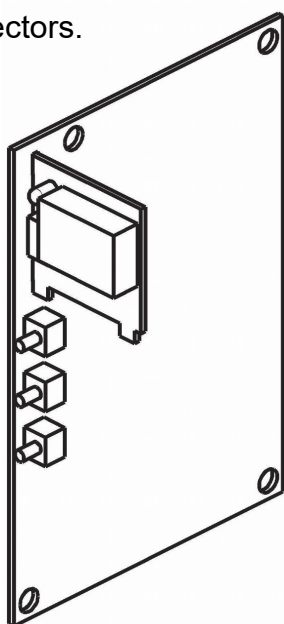


[Sub Board]

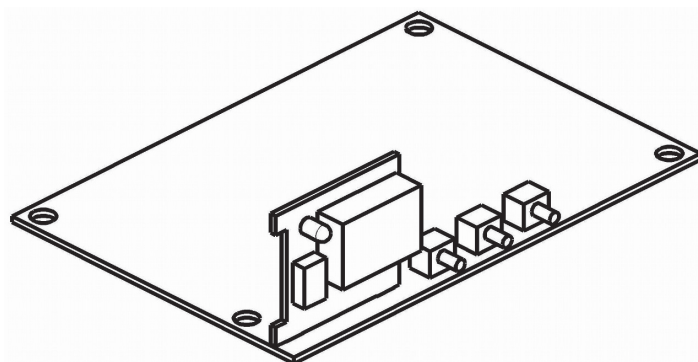


7-segment display board

The direction to install the sub board depends on models and is easily changeable by connectors.



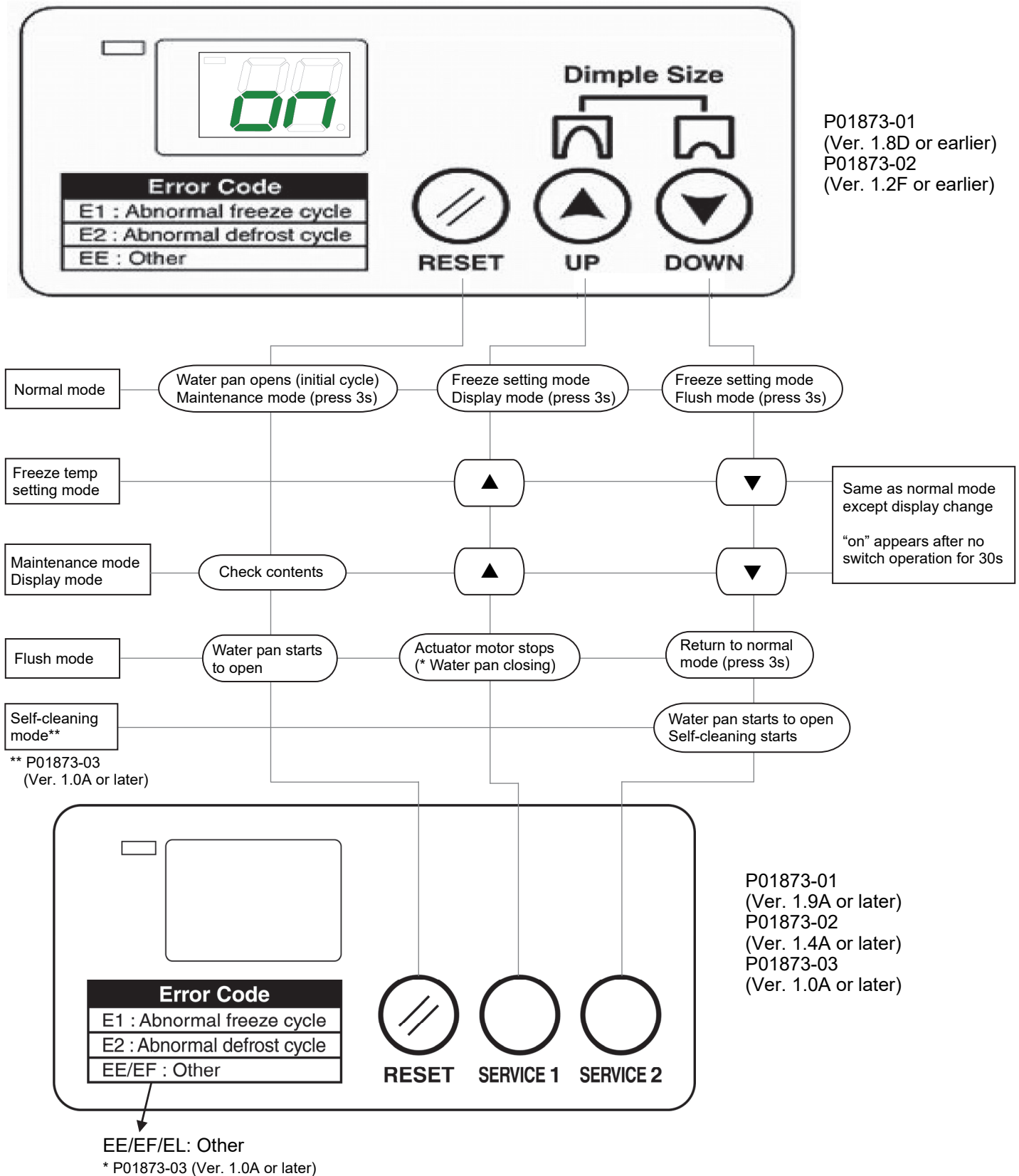
Vertical installation into control box



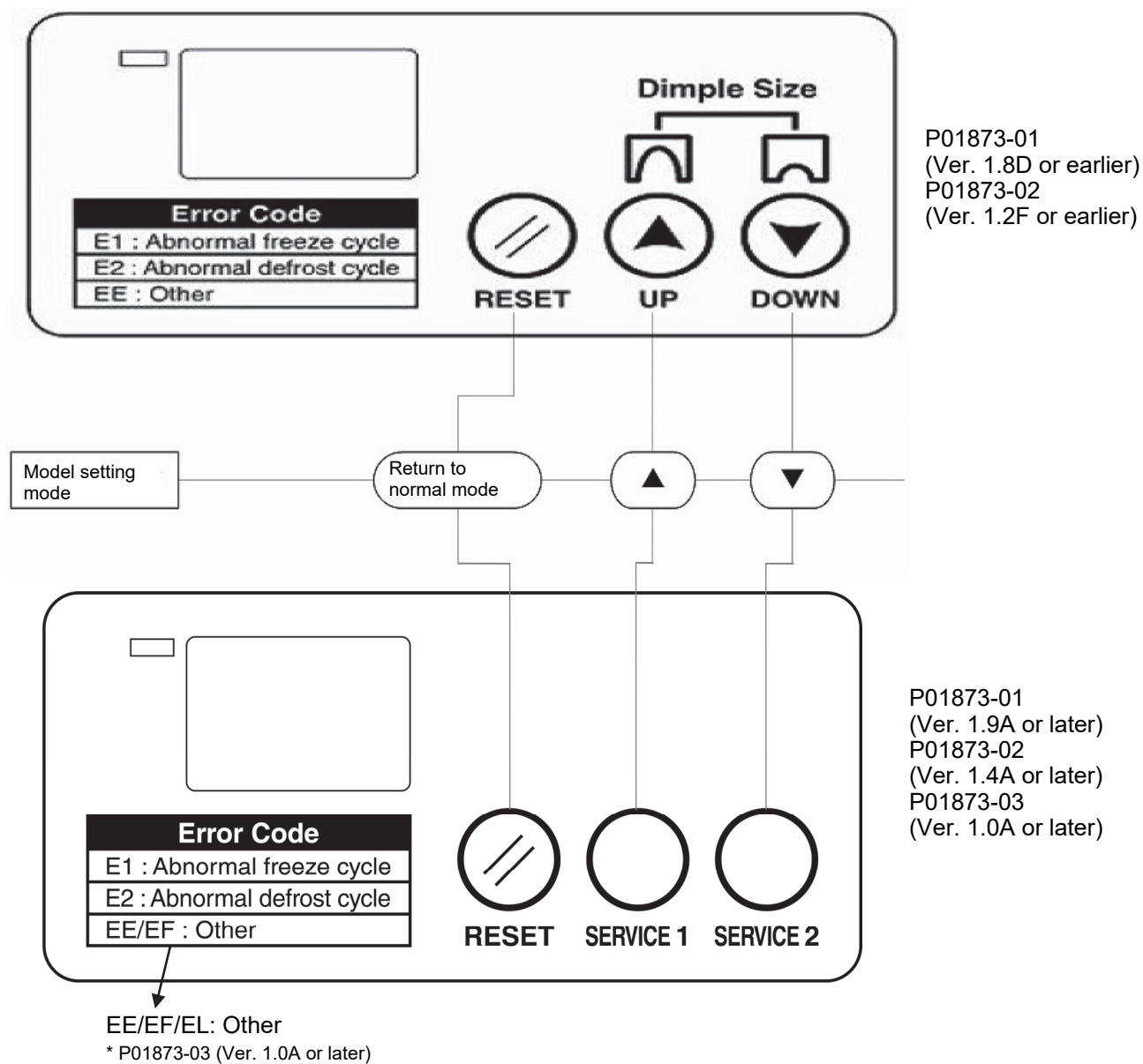
Horizontal installation into control box

[d] SWITCH OPERATION

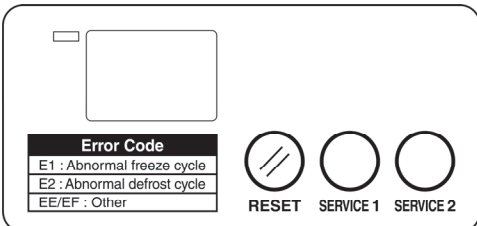
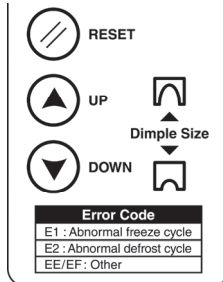
- 1) The following is the switch operation flow in different modes. When pressed and released, the switch detects the operation by its pressing duration.



- 2) To clear the current model code information and enter the model setting mode, press the up and down switches together for 15 seconds while the model code is indicated in the display mode (see “3. [c] DISPLAY MODE”).



[e] VERSION COMPARISON

Operator	P01873-01 (Ver. 1.9A or later), P01873-02 (Ver. 1.4A or later), P01873-03 (Ver. 1.0A or later)	P01873-01 (Ver. 1.8D or earlier), P01873-02 (Ver. 1.2F or earlier)
End-user	- Control mode: Normal - No. 2: Target integrated freeze completion temperature cannot be changed. - Target integrated freeze completion temperature cannot be changed by pressing "SERVICE 1" or "SERVICE 2" button on control panel * Control label has been changed. 	- Control mode: Normal - No. 2: Target integrated freeze completion temperature can be changed. - Target integrated freeze completion temperature can be changed every 0.5°C by pressing "▲UP" or "▼DOWN" button on control panel. - Change range: -5°C to -40°C 
Service engineer	- Control mode: Maintenance mode - Press and hold "RESET" button for more than 3 seconds to show setting number "1". - Select desired number with "SERVICE 1(▲)" or "SERVICE 2(▼)". - Press "RESET" button to flash set value on display. - Change set value with "1(▲)" or "2(▼)". - Press "RESET" button to memorize set value and return to setting number. - Leave buttons untouched for 30 sec to shift to normal mode. - All settings are adjustable. - Adjustable range: Nos. 2 and 3 have additional setting ranges. - No. 2: Target integrated freeze completion temperature Factory setting ± 3°C * every 0.5°C - No. 3: Target integrated freeze completion time Factory setting ± 2 min * every 1 min * Factory settings cannot be changed, but set values can be changed within the above setting ranges.	- Control mode: Maintenance mode - Press and hold "RESET" button for more than 3 seconds to show setting number "1". - Select desired number with "▲" or "▼". - Press "RESET" button to flash set value on display. - Change set value with "▲" or "▼". - Press "RESET" button to memorize set value and show setting number. - Leave buttons untouched for 30 sec to shift to normal mode. - All settings are adjustable. - Adjustable range: e.g. Nos. 2 and 3 - No. 2: Target integrated freeze completion temperature -5 to -40°C * every 0.5 °C - No. 3: Target integrated freeze completion time 5 to 90 min * every 1 min * Factory settings can be changed.

Setting number	P01873-01 (Ver. 1.9A or later), P01873-02 (Ver. 1.4A or later), P01873-03 (Ver. 1.0A or later)	P01873-01 (Ver. 1.8D or earlier), P01873-02 (Ver. 1.2F or earlier)
No. 71 Hot gas valve ON time to prevent ice stuck	Setting range: 0 to 10 sec * every 1 sec	Setting range: 0 to 20 sec * every 1 sec
No. 72 Hot gas valve OFF time to prevent ice stuck	Not adjustable OFF time = 30 sec – No. 71 set value (sec)	Setting range: 0 to 60 sec * every 1 sec

2. OPERATION

This service manual specifies the basic operation of the controller board “P01873-03 (Ver. 1.0A or later)”.

[a] SOFT START

- 1) When the power supply is turned on, the 7-segment LED shows “on” and the hot gas valve opens. After 30 seconds, the defrost cycle starts.
 - * If the reset switch is pressed during the 30-second standby time, the unit resets soft start and immediately starts operation.

[b] WATER PAN OPENS

- 1) The hot gas valve opens, the actuator motor starts, and the water pan starts to open.
- 2) After 20 seconds, the water valve opens to supply defrosting water (water pan cleaning water) for a specific time.
 - * The defrosting water supply time varies between the water temperatures above and below 13°C.
 - * In the initial cycle, the water temperature is not detected and assumed to be below 13°C, resulting in a longer defrosting water supply time.
 - * The defrosting water supply time is adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 3) The opening backup timer starts counting when the water pan starts to open. If the hall IC does not turn on within 3 minutes, the display shows “EE” and the unit stops for 60 minutes. If the error recurs after the unit resumes operation, the display shows “EE” and the unit shuts down (recorded as “E3” in error history).

[c] DEFROST CYCLE

- 1) After the water pan opens, the hot gas valve opens until the defrost completion temperature is reached.
- 2) If the defrost completion temperature is not reached even when the defrost backup timer counts up (30 minutes after water pan starts to open), the display shows "E2" and the unit stops.

If the hot gas valve fails to open, the unit may stop with the "E2" error.

- * The defrost completion temperature is adjustable in the maintenance mode (see "3. [b] MAINTENANCE MODE").

[d] WATER PAN CLOSES

- 1) When the cube control thermistor senses the evaporator temperature above the defrost completion temperature, the hot gas valve closes, the fan motor starts, and the water pan starts to close.
- 2) The closing backup timer starts counting when the water pan starts to close. If the hall IC does not detect the water pan closes within 50 seconds and after a retry, the display shows "EE" and the unit stops for 60 minutes (recorded as "E4" in error history). If the error recurs after the unit resumes operation, the display shows "EE" and the unit shuts down (recorded as "E4" in error history).

- * In the initial cycle or when the water temperature is below 13°C, the water valve opens to supply defrosting water for 10 seconds after the water pan starts to close.

[e] FREEZE CYCLE

- 1) When the water pan closes and the hall IC turns on, the water valve opens to supply icemaking water for a specific time. The icemaking water supply time varies between startup, reset, and the end of bin control cycle and between partial drain flush and full drain flush (see note below).

- * The icemaking water supply time and additional water supply time are adjustable in the maintenance mode (see "3. [b] MAINTENANCE MODE").

Note:

Full drain flush - After a freeze cycle ends, the unit drains all the remaining water in the tank and refills the tank in the next freeze cycle.

Partial drain flush (default setting) - After a freeze cycle ends, the unit leaves the remaining water in the tank and adds some water to fill the tank in the next freeze cycle.

- 2) After icemaking water has been supplied, the pump motor starts.
- 3) After 30 seconds, the cube control thermistor senses the temperature that will be added with a predetermined offset value and used as the water temperature in the freeze cycle, water pan opening cycle, defrost cycle, and water pan closing cycle.
 - * The offset value for the cube control thermistor temperature is adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 4) The freeze cycle is considered to be 100% complete when the predetermined target integrated values are reached.
 - * The target integrated values (temperature and time) for the freeze completion are adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 5) To reduce ice forming on the water pan when the freeze completion rate reaches 100% at an ambient temperature below 30°C, the hot gas valve opens and closes two times (depending on models) for a specific time to raise the water pan temperature. Then, the actuator motor starts to open the water pan.

While the hot gas valve opens and closes, the freeze cycle is not considered to be complete and the pump motor and fan motor keep running.

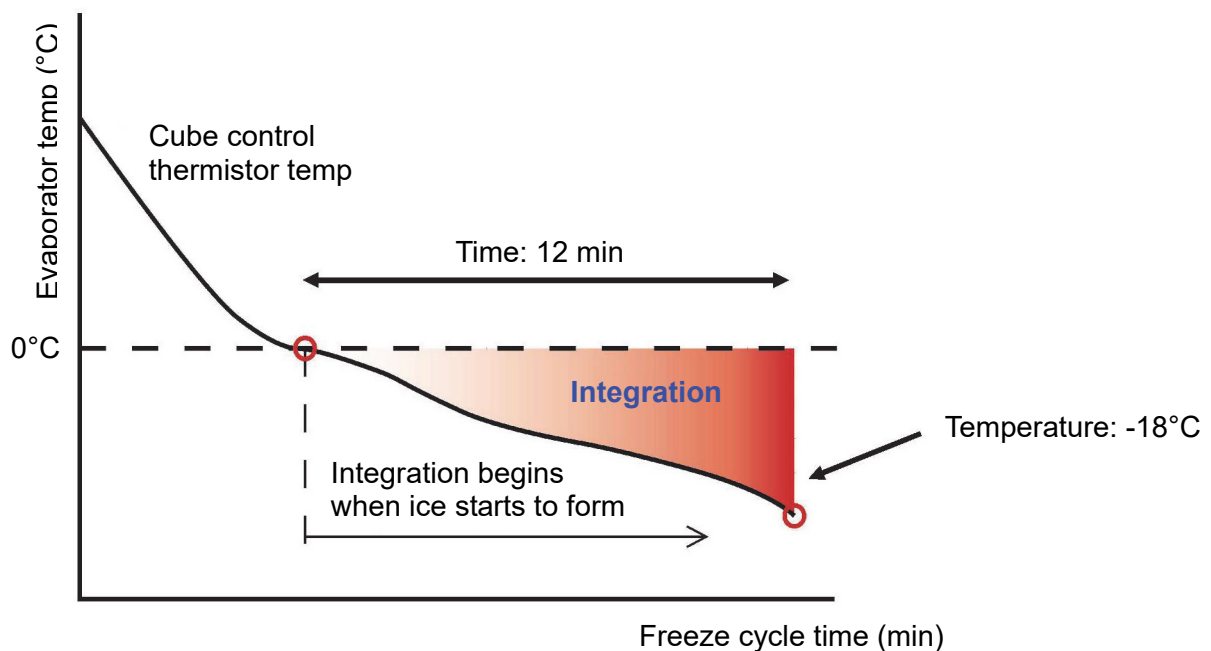
 - * The ambient temperature setting and hot gas valve opening/closing time are adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 6) Even if the freeze backup timer counts up (45 - 90 minutes after water pan starts to close), the unit stops with the “E1” error when the evaporator temperature is above 0°C.

If the hot gas valve fails to close, the unit may stop with the “E1” error.

 - * The backup timer setting is adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).

[f] FREEZE COMPLETION CONTROL

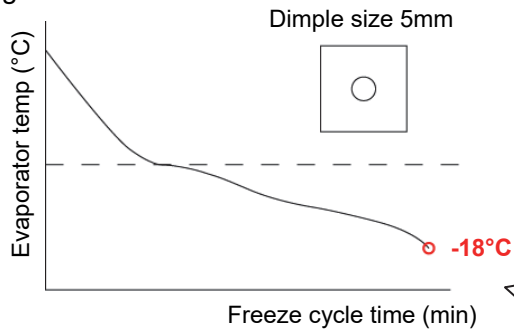
- 1) The target integrated values (cube control thermistor temperature and freeze cycle time) are set for freeze completion.
 - * The target integrated freeze completion temperature and time are adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 2) After the cube control thermistor senses a temperature below 0°C, the cube control thermistor temperature and freeze cycle time are integrated every second.
- 3) When the integrated values reach the target, the freeze cycle completes.



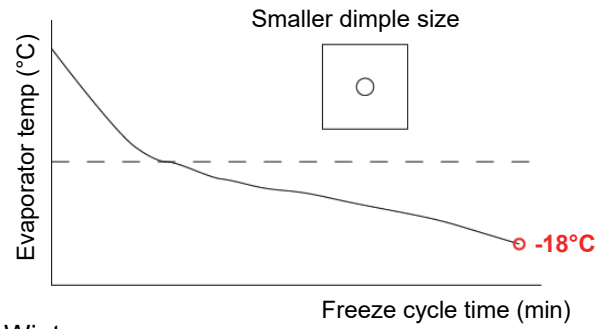
As the previous freeze completion control depended on the freeze completion temperature only, the dimple size varied in 1) spring/fall, 2) summer, and 3) winter even at the same freeze completion temperature.

For example, when the freeze completion temperature is -18°C and the dimple size is 5 mm, the freeze cycle time becomes longer and dimple size smaller in summer, and the freeze cycle time becomes shorter and dimple size larger in winter.

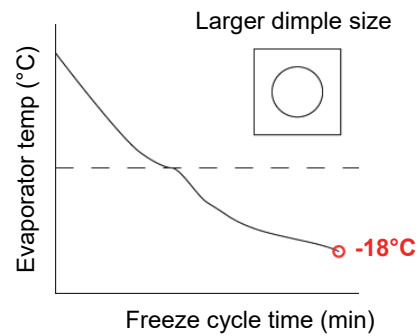
1) Spring/fall



2) Summer

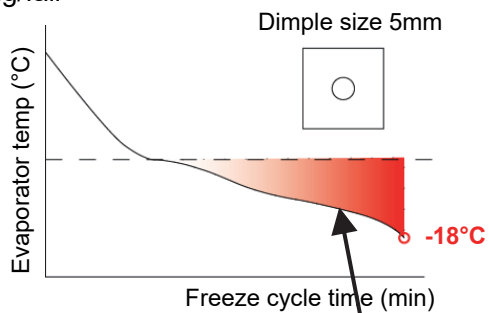


3) Winter

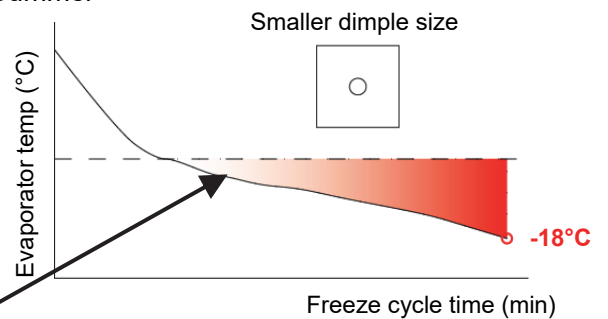


Comparison of the evaporator temperature curves finds that the red-colored area varies in different seasons.

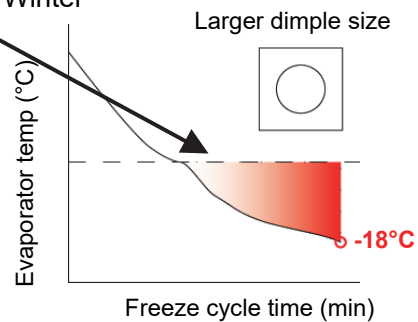
1) Spring/fall



2) Summer



3) Winter



This area varies

This area corresponds to the energy on ice. Making these different areas into one can equalize the dimple size.

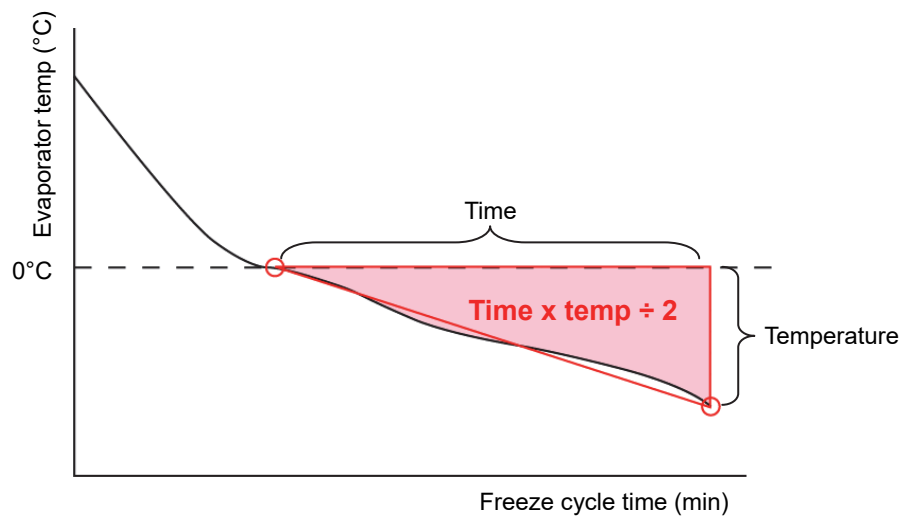
To calculate the energy required for ice production, the actual ice production area under 0°C in the evaporator temperature curve is approximated into a triangle.

This area can be calculated by

$$\text{Time} \times \text{temperature} \div 2$$

Therefore,

$$\text{Energy required for ice production} = \text{time} \times \text{temperature} \div 2$$



Providing the calculated energy to icemaking water can produce ice with fixed dimple size not affected by ambient conditions.

Actually, after the evaporator temperature becomes 0°C, the icemaker adds thermistor sensed temperature every second and continues ice production until the energy value calculated above (target freeze completion value) is reached.

To have stable ice production, it is necessary to calculate icemaking energy internally with the microprocessor. This energy calculation requires not just temperature but also time as shown in the above graph.

For this reason, both temperature and time are used to determine freeze completion.

[g] WATER SUPPLY CONTROL

- 1) When the water pan closes and the hall IC turns on, the water valve opens to supply icemaking water for a specific time. The icemaking water supply time varies between startup, reset, and the end of bin control cycle and between

partial drain flush and full drain flush.

- * The icemaking water supply time and additional water supply time are adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 2) After the water pan starts to open, the water valve opens in 20 seconds to supply defrosting water (water pan cleaning water) for a specific time. The defrosting water supply time varies between the water temperatures above and below 13°C. If the water temperature is below 13°C, the water valve opens for 10 seconds after the water pan starts to close.
 - * The defrosting water supply time is adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).
- 3) The water temperature is determined by a predetermined offset value plus the cube control thermistor temperature after icemaking water is supplied as mentioned in 1) and the pump motor runs for 30 seconds.
 - * The water temperature offset value is adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).

[h] AMBIENT TEMPERATURE CORRECTION

- 1) At low ambient temperatures, the dimple diameter of ice cubes is increased by a predetermined rate between the ambient temperature and target integrated freeze completion value to prevent reduction in the evaporator temperature leading to excessive ice production.
 - * The rate between the ambient temperature and integrated value is adjustable in the maintenance mode (see “3. [b] MAINTENANCE MODE”).

[i] DIMPLE DIAMETER SETTING

- 1) When the up or down switch is pressed, the current set point temperature (maintenance mode No. 2) is displayed (see “3. [b] MAINTENANCE MODE”).
 - 2) When the up or down switch is pressed again, the set point temperature goes up or down in 0.5°C increments.
 - 3) When the switches are not pressed for 30 seconds, the set point temperature is determined with “on” in the display.
- * For the controller boards of P01873-01 (Ver. 1.9A or later), P01873-02 (Ver. 1.4A or later) and P01873-03 (Ver. 1.0A or later), the setting cannot be changed except in maintenance mode.

[j] BIN CONTROL CYCLE

- 1) When the bin control switch stays on for more than 10 seconds, the bin control cycle starts and the icemaker stops. After the bin control switch stays off for more than 80 seconds, the bin control cycle ends and the icemaker restarts. (The hot gas valve opens 30 seconds before the icemaker restarts.)
- 2) After the bin control cycle ends (or when the power supply is turned on), the water pan starts to open (if the icemaker stopped while the water pan was closing).
- 3) If the bin control switch turns on while the water pan is opening after the power supply is turned on (or after the reset switch is pressed), the bin control cycle does not start. When the water pan opens and the hall IC turns on, the bin control cycle starts after 10 seconds and the icemaker stops.

[k] RESET SWITCH

- 1) When the reset switch is pressed and released after the power supply is turned on, the soft start is reset within 3 seconds and the water pan starts to open in the initial cycle.
- 2) When the reset switch is pressed and released during operation (water pan opening or closing, defrost or freeze cycle), the icemaker returns to the initial cycle within 3 seconds and the water pan starts to open.
 - * The above control is available because the water pan position is detected by the hall IC not by a change switch.
- 3) When the reset switch is pressed and released while the icemaker is off in the bin control cycle, the icemaker returns to the initial cycle within 3 seconds, the bin control cycle ends and the water pan starts to open.
- 4) When the reset switch is pressed and released while the icemaker is off with an error, the icemaker returns to the initial cycle within 3 seconds, the error is reset and the water pan starts to open.
 - * When the icemaker returns to the initial cycle by the reset switch operation, the water temperature is assumed to be below 13°C, the freeze back up timer is extended, the icemaking water supply time including additional water supply with the water pan closed doubles and the number of freeze cycles becomes 0.

[I] 7-SEGMENT LED

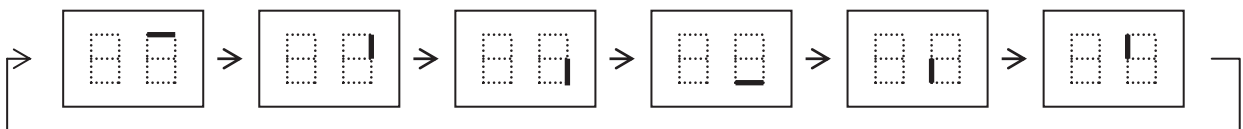
- 1) When the power supply is turned on, the display shows “on” and the automatic icemaking process starts.
- 2) When the up or down switch is pressed, the display shows the current setting. When the switch is pressed again, the setting becomes adjustable. When the switches are not pressed for 30 seconds, the adjusted setting is determined with “on” in the display.
- 3) When an error occurs, the display flashes the applicable error code.
- 4) In the maintenance mode, the display shows various settings.
- 5) In the display mode, the display shows various values and the error history.
- 6) In the water circuit flush mode, the segments of the ones digit light up in rotation.

* See “4. 7-SEGMENT DISPLAY” for further details.

3. MODE SETTING

[a] WATER CIRCUIT FLUSH MODE

- 1) When the down switch is pressed for 3 seconds during operation, the water circuit flush mode starts. The ones digit in the LED display lights up as follows.



- 2) There is no 30-second standby time after the power supply is turned on. While the compressor stays off, the actuator motor starts to open the water pan. After the water pan closes, the water valve opens to supply water. Then, the pump motor starts.
- 3) When the reset switch is pressed during the flush process, the water pan opens to drain the water pan and water tank. Then, the water pan closes again, the water valve opens to supply water, and the pump motor starts.
- 4) Repeat the above step 3) as required.
 - * Manually press the reset switch to open the water pan to drain water. If the icemaker keeps running in the flush mode with the water pan closed, the freeze backup timer operates and the display shows “E1”.
 - * If the cube control thermistor senses a temperature below the defrost completion temperature, the water pan keeps open, the defrost backup timer

operates and the display shows “E1”.

To reset, press the down switch for 3 seconds.

Note:

1. The freeze backup timer and defrost backup timer are available in the water circuit flush mode. As the compressor is off in the flush mode, these timers operate to stop the icemaker in case the freeze or defrost cycle does not complete.
2. As the compressor is off in the flush mode, be sure to drop all ice cubes in the defrost cycle before starting the flush mode. If any ice cube is left on the evaporator, the defrost backup timer operates to stop the icemaker.
3. After the flush mode is reset, the icemaker resumes operation from the defrost cycle.
 - * If the up switch is pressed while the water pan is closing in the flush mode, the actuator motor stops and icemaking water is supplied for a specific time. Then, the pump motor starts to spray water. This allows for checking whether the spray holes are clogged or not.

[b] SELF-CLEANING MODE (for M028-C106 and M028-C207)

- 1) When the down switch is pressed for 3 seconds, the self-cleaning mode starts.
- 2) When the power supply is turned off while the display shows “Pr” in the self-cleaning mode, the unit starts operation from the preset process (step 1 in the timing chart) after the power supply is turned on. When the power supply is turned off while the display shows some other code than “Pr”, the unit starts operation from the evaporator draining process (step 9 in the timing chart) after the power supply is turned on.
 - * The latest cleaning state is memorized when 1) the self-cleaning mode starts, 2) the display stops showing “Pr” or 3) the self-cleaning mode ends. When the power supply is turned on, the latest cleaning state is read in and resumed.
- 3) When the down switch is pressed for 3 seconds while the display shows “Pr” in the self-cleaning mode, the unit stops self-cleaning mode. When the down switch is pressed and held while the display shows some other code than “Pr” in the self-cleaning mode, the unit starts operation from evaporator draining process (step 9 in the timing chart).
- 4) The unit shuts down if the defrost error (E2), water pan opening error (E3), water pan closing error (E4) or cube control thermistor error (EC) occurs while the

display shows “Pr” in the self-cleaning mode. When the reset switch is pressed, the unit starts operation from the preset process (step 1 in the timing chart). The unit shuts down if the water pan opening error (E3) or water pan closing error (E4) occurs while the display shows some other code than “Pr”. When the reset switch is pressed, the unit starts operation from the evaporator draining process (step 9 in the timing chart).

- 5) In the self-cleaning mode, the water pan opening error (E3) or water pan closing error (E4) is detected without retry (If the applicable hall IC is not turned on within 3 minutes after the water pan starts to open/close).
- 6) In the self-cleaning mode, the controller board detects only the defrost error (E2), water pan opening error (E3), water pan closing error (E4) or cube control thermistor error (EC) in the self-cleaning mode. The cube control thermistor error (EC) is not detected when and after the defrost cycle ends in the self-cleaning mode. The cube control thermistor error (EC) is not automatically reset in the self-cleaning mode.
- 7) The actuator motor down energizes in 2 seconds or more after the actuator motor up de-energizes.
- 8) The self-cleaning mode can be shifted to the maintenance mode or display mode by pressing switch in the self-cleaning mode. But the cleaning cycle is not stopped by pressing the down switch.

[c] MAINTENANCE MODE

When the reset switch is pressed for more than 3 seconds, the maintenance mode starts to allow various set values to be checked or adjusted.

- 1) Press the reset switch for more than 3 seconds while the unit is running. The display shows “1”.
- 2) Press the up switch to increase the number and the down switch to decrease the number.
- 3) Press the reset switch to select the desired number. The current set value flashes in the display.
- 4) Press the up switch to increase the set value and the down switch to decrease the set value.
- 5) Press the reset switch to select the desired value. The display shows the number again.

To reset, leave the switches untouched for 30 seconds.

Maintenance Mode List

	No	Item	Range	Step
Basic	1	Defrost completion temp	2 to 20°C	1
	2	Integrated constant 1 (temp)	-5 to -40°C	0.5
	3	Integrated constant 2 (time)	5 to 90 min	1
	4	Ambient temp correction operating temp for integrated value	10 to 50°C	1
	5	Ambient temp correction rate for integrated value	10 to 100% (00 = 100)	1
	6	Freeze backup timer	45 to 90 min	5
Water supply	10	Defrosting water supply time, water temp less than 13°C	1 to 99 sec, 99 = continuous	1
	11	Defrosting water supply time, water temp 13°C or more	1 to 99 sec	↑
	12	Icemaking water supply time, normal	0 to 90 sec	1
	13	Water temp measurement correction value	+0 to +20K	1
	14	Full / partial drain flush selection	0: full / 1: partial	1
	15	Additional icemaking water supply time	0 to 90 sec	1
	17	Defrosting water control (*1)	0: normal control 1: segmented control	1
	18	Defrost completion temp correction (*1)	+0 to +20K	1
Other	21	Double stack bin control	0: No / 1: Yes	1
	22	Refrigeration unit operation in bin control cycle	0: No / 1: Yes	1
	24	Cleaning cycle time (*2)	0: cancel self-cleaning mode 1 to 99 min	1
	25	Rinse cycle number (*2)	1 to 99 cycles	1
	26	Rinse cycle time (*2)	1 to 99 min	1
	27	Evaporator draining time	2 to 99 min	1
	28	Tank draining time	2 to 99 min	1
Model	30	Type	0: water-cooled 1: small 2: medium / large 3: separate	1
Defrost cycle low temp control	34	Operating temp	40 to 70°C	1
Water regulator	36	Water regulator error detecting temp	0 to 50°C, 0: cancel	1
Compressor	37	Compressor output selection	0: X8 (DC relay) on 1: X1 (AC relay) on	1
Slush ice	50	Pump off time	0 to 90 sec, 0: no control	1
	51	Water supply time	0 to 5 sec	1
Hard water	60	Operating condition	10 to 100% (00 = 100)	1
	61	Water supply time	0 to 90 sec	1
Ice left in water pan	70	Operating temp	10 to 60°C	1
	71	Hot gas valve on time (*3)	0 to 20 sec	1
	72	Hot gas valve off time (*4)	0 to 60 sec	1

Ice bridge	73	Hot gas valve off time	0 to 30 sec	1
Low temp in defrost cycle	74	Operating temp	0 to 40°C	1
High pressure	80	Sensed temp	55 to 70°C	1

For the controller board of P01873-03 (Ver. 1.0A or later):

(*1) To prevent possible failure, do not change Nos. 17 and 18 settings.

(*2) The settings can be changed.

For the controller boards of P01873-01 (Ver. 1.9A or later), P01873-02 (Ver. 1.4A or later) and P01873-03 (Ver. 1.0A or later):

(*3) No. 71 setting range is 0 to 10 sec.

(*4) No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting".

Maintenance Mode Descriptions

	No	Item	Description
Basic	1	Defrost completion temp	Temperature to complete defrost cycle (detected by cube control thermistor).
	2	Integrated constant 1 (temp)	Target integrated value inside controller board is determined by constants 1 and 2. Temperature in freeze cycle is integrated, and freeze cycle continues until target integrated value is reached. Basically, the smaller constant 1 gets, the bigger integrated value and the smaller dimple diameter become.
	3	Integrated constant 2 (time)	Target integrated value inside controller board is determined by constants 1 and 2. Time in freeze cycle is integrated, and freeze cycle continues until target integrated value is reached. Basically, the smaller constant 2 gets, the smaller integrated value and the bigger dimple diameter become.
	4	Ambient temp correction operating temp for integrated value	Upper temperature limit to trip control to ensure minimum dimple size in low temp conditions like at 1°C / wt 5°C.
	5	Ambient temp correction rate for integrated value	Percentage of integrated value in low temp conditions against target integrated value to ensure minimum dimple size in low temp conditions like at 1°C / wt 5°C based on integrated value inside controller board determined by constants 1 and 2.
	6	Freeze backup timer	Timer setting to forcibly complete freeze cycle if cube control thermistor cannot sense freeze completion temp.
Water supply	10	Defrosting water supply time, water temp less than 13°C	Time to supply defrosting water to melt ice on water pan at water supply temp less than 13°C. Adjustable between 1 and 99 sec. When set to "99", defrosting water keeps running until cube control thermistor senses defrost completion temp.
	11	Defrosting water supply time, water temp 13°C or more	Time to supply defrosting water to melt ice on water pan at water supply temp of 13°C or more. Adjustable between 1 and 99 sec. When set to "99", defrosting water keeps running until cube control thermistor senses defrost completion temp.
	12	Icemaking water supply time, normal	Time to supply icemaking water depending on partial or full drain flush.
	13	Water temp measurement correction value	Setting to correct difference between water temp measured by cube control thermistor and actual water supply temp.
	14	Full / partial drain flush selection	Selection between full and partial drain flush of icemaking water tank in case of cloudy ice production even after hard water control. Icemaking water supply time and water tank overflow pipe direction need to be changed.
	15	Additional icemaking water supply time	Time to supply additional icemaking water required after pump motor starts following normal icemaking water supply time.
Water supply	17	Defrosting water control	Selection of defrosting water control. When set to "0", normal control as described for No. 11 above. When set to "1", control timing is segmented into two.
	18	Defrost completion temp correction	Set defrost completion temp correction value when defrosting water control setting is changed.

Other	21	Double stack bin control	Selection of bin control in case of double stack application.
	22	Refrigeration unit operation in bin control cycle	Selection of control to prevent ice in storage bin from melting in bin control cycle (by operating refrigeration unit).
	24	Cleaning cycle time	Time to clean water circuit with cleaning solution.
	25	Rinse cycle number	Number of rinse cycles after flush cycle.
	26	Rinse cycle time	Time to rinse water circuit.
	27	Evaporator draining time	Time to wait until dripping from evaporator stops with water pan closed.
	28	Tank draining time	Time to wait until tank is drained with water pan opened.
Model	30	Type	Selection of fan motor type. When set to "0", unit operates as water-cooled model.
Defrost cycle low temp control	34	Operating temp	Set temp for continuous fan motor operation in defrost cycle to lower temp inside control box if ambient temp at the beginning of defrost cycle exceeds set point.
Water regulator	36	Water regulator error detecting temp	Thermistor temp (water regulator outlet) in case of water regulator error and cooling water failure for water-cooled model.
Compressor	37	Compressor output selection	Selection between AC supply and DC supply (normal setting = AC supply). Transformer voltage drop is too large to input both.
Slush ice	50	Pump off time	Pump off time for slush ice control to stop pump after 2 min at evaporator temp of 3 to 4°C, quickly refrigerate evaporator before icemaking water supercools, and form ice core. When set to "0", there is no slush ice control.
	51	Water supply time	Time to supply water while pump is off for slush ice control. If slush ice is too much and cannot be prevented solely by pump off in No. 50, water is supplied while pump is off to slightly raise tank water temp.
Hard water	60	Operating condition	Condition to operate cloudy ice control in hard water application indicated in percentage against target integrated value. After icemaking water supply starts, ice begins to form and freeze cycle integrated value reaches a certain level. Then, additional water is supplied to dilute concentrated icemaking water in water tank.
	61	Water supply time	Time to supply water for hard water control.
Ice left in water pan	70	Operating temp	Upper limit of operating temp to control ice left in water pan at the end of freeze cycle. Decrease amount of defrosting water by reducing ice left in opening water pan after freeze cycle.
	71	Hot gas valve on time	Hot gas valve opening time to control ice left in water pan.
	72	Hot gas valve off time	Hot gas valve closing time to control ice left in water pan. For the controller boards of P01873-01 (Ver. 1.9A or later), P01873-02 (Ver. 1.4A or later) and P01873-03 (Ver. 1.0A or later), No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting". When No. 71 is set to "0", No. 72 is also set to "0".

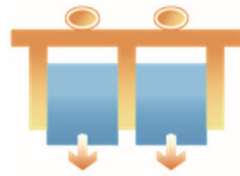
Ice bridge	73	Hot gas valve off time	Time to keep hot gas valve closed after 20 sec in defrost cycle. Prevent ice bridge in bin by delaying ice dropping time.
Low temp in defrost cycle	74	Operating temp	Upper temperature limit at the beginning of defrost cycle.
High pressure	80	Sensed temp	Temperature sensed by condenser thermistor.

Note: To prevent the actuator motor defects,

*1. **Do not set the defrost completion temperature low.**

The defrost completion temperature is used to ensure the required standby time until the water pan starts to close after ice is released from the evaporator.

When the evaporator temperature reaches 0°C, ice is gradually released (drops into the bin) from



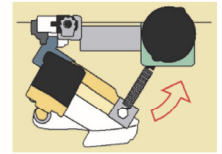
Ice is released

-->

Standby time is ensured

-->

Start to close



the evaporator and the water pan starts to close as the target temperature is reached.

The target temperature is factory adjusted so that it will take **about 20 seconds** for the water pan to start closing after release of ice **when the ambient temperature is around 30°C.**

* The evaporator temperature rises depending on the ambient temperature. The water pan starts to close earlier when the ambient temperature is higher and the water pan starts to close later when the ambient temperature is lower.

i.e. Approx. 20 sec at 30°C < 30 sec at 20°C < 60 sec at 10°C

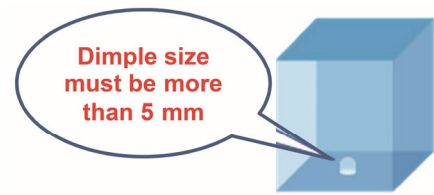
If defrost completion temperature is low...

If the setting change is made when the ambient temperature is low, the evaporator temperature rises from 0°C to the target temperature before the end of the defrost cycle (ice is released from the evaporator) when the ambient temperature becomes higher. In this case, the water pan starts to close in the middle of the defrost cycle and ice will be stuck between the evaporator and water plate, which will cause an excessive load on the actuator motor gear.

If ice cubes are released separately from the evaporator, the water pan starts to close when the thermistor senses the target temperature, even if some ice cubes are left on the evaporator. In this case, the freeze cycle begins (resumes) with ice cubes left on the evaporator, resulting in making abnormal shape of ice which can easily be stuck and cause an excessive load on the actuator motor gear.

***2. Do not make dimple diameter small.**

The dimple in ice is necessary and important to repeat the freeze and defrost cycles normally. The freeze completion temperature and time are factory adjusted to make **the dimple diameter more than 5 mm on average.**



If dimple in ice is small...

Some spray holes and return holes in the water plate freeze. The load on the actuator motor gear rapidly increases when ice is forced to be released (by cam rotation) during the defrost cycle.

If ice is forced to be released when the spray holes and return holes on the water plate are frozen, the linked parts of ice in the evaporator are torn off and remain frozen on the surface of the water plate. This linked ice is not completely melted by the cleaning water (water supply) for flushing the water plate surface and remains widely on the water plate when ice is released from the evaporator. Furthermore, a smaller amount of linked parts during the defrost cycle tends to make ice stuck between the evaporator and water plate. That is because ice cubes are released separately (each ice cube is lightweight) and easily get stuck on ice attached to the water plate surface, which will cause an excessive load on the actuator motor gear.

* There is no problem making the dimple diameter larger (10 to 15 mm) to increase the ice making capacity or shorten the freeze cycle time.

Maintenance Mode Settings

** Auxiliary code F1 and earlier

	No	Item	220AA (50Hz**)	130A (50Hz) Embraco comp.	130A (50Hz) Secop comp.	100A (50Hz)
Basic	1	Defrost completion temp	5	6	6	6
	2	Integrated constant 1 (temp)	-22	-20	-22	-28
	3	Integrated constant 2 (time)	10	12	12	12
	4	Ambient temp correction operating temp for integrated value	35	44	44	44
	5	Ambient temp correction rate for integrated value	95	90	90	90
	6	Freeze backup timer	45	45	45	45
Water supply	10	Defrosting water supply time, water temp less than 13°C	95	90	90	90
	11	Defrosting water supply time, water temp 13°C or more	30	30	30	30
	12	Icemaking water supply time, partial drain flush	30	35	35	35
		* Icemaking water supply time, full drain flush	60	70	70	70
	13	Water temp measurement correction value	10	10	10	8
	14	* Full / partial drain flush selection	1	1	1	1
	15	Additional icemaking water supply time, partial drain flush	22	0	0	0
		* Additional icemaking water supply time, full drain flush	44	0	0	0
Other	21	Double stack bin control	1	1	1	1
	22	Refrigeration unit operation in bin control cycle	0	0	0	0
Model	30	Type	2	2	2	2
Defrost cycle low temp control	34	Operating temp	48	48	48	48
Water regulator	36	Water regulator error detecting temp	0	0	0	0
Compressor	37	Compressor output selection	1	1	1	1
Slush ice	50	Pump off time	0	0	0	0
	51	Water supply time	0	0	0	0
Hard water	60	Operating condition	10	10	10	10
	61	Water supply time	0	0	0	0
Ice left in water pan	70	Operating temp	40	44	44	44
	71	Hot gas valve on time	2	10	10	10
	72	*** Hot gas valve off time	28	20	20	20
Ice bridge	73	Hot gas valve off time	0	0	0	0
Low temp in defrost cycle	74	Operating temp	20	27	27	27
High pressure	80	Sensed temp	58	58	58	58

* When No. 14 is set to "0" (full drain flush), change Nos. 12 and 15 also to full drain flush settings.

*** For the controller boards of P01873-01 (Ver. 1.9A or later) and P01873-02 (Ver. 1.4A or later), No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting".

	No	Item	220AA-21 (50Hz)	220AA-23 (50Hz)	130A-21 (50Hz)	130A-23 (50Hz)
Basic	1	Defrost completion temp	5	5	10	5
	2	Integrated constant 1 (temp)	-8.5	-25	-15	-20.5
	3	Integrated constant 2 (time)	5	11	5	12
	4	Ambient temp correction operating temp for integrated value	35	35	50	44
	5	Ambient temp correction rate for integrated value	100	95	100	90
	6	Freeze backup timer	45	45	45	45
Water supply	10	Defrosting water supply time, water temp less than 13°C	95	95	90	99
	11	Defrosting water supply time, water temp 13°C or more	30	30	30	30
	12	Icemaking water supply time, partial drain flush	30	30	35	35
		* Icemaking water supply time, full drain flush	60	60	70	70
	13	Water temp measurement correction value	10	10	8	12
	14	* Full / partial drain flush selection	1	1	1	1
	15	Additional icemaking water supply time, partial drain flush	22	22	0	0
		* Additional icemaking water supply time, full drain flush	44	44	0	0
Other	21	Double stack bin control	1	1	1	1
	22	Refrigeration unit operation in bin control cycle	0	0	0	0
Model	30	Type	2	2	2	2
Defrost cycle low temp control	34	Operating temp	48	48	48	48
Water regulator	36	Water regulator error detecting temp	0	0	0	0
Compressor	37	Compressor output selection	1	1	1	1
Slush ice	50	Pump off time	0	0	30	0
	51	Water supply time	0	0	0	0
Hard water	60	Operating condition	10	10	10	10
	61	Water supply time	0	0	0	0
Ice left in water pan	70	Operating temp	40	40	44	44
	71	Hot gas valve on time	10	2	0	10
	72	** Hot gas valve off time	20	28	0	20
Ice bridge	73	Hot gas valve off time	0	0	20	0
Low temp in defrost cycle	74	Operating temp	0	20	0	27
High pressure	80	Sensed temp	58	58	58	58

* When No. 14 is set to "0" (full drain flush), change Nos. 12 and 15 also to full drain flush settings.

** For the controller boards of P01873-01 (Ver. 1.9A or later) and P01873-02 (Ver. 1.4A or later), No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting".

** Auxiliary code F2 and later

	No	Item	100A-23 (50Hz)	220AA (50Hz**) (60Hz)	130A (60Hz)	100A (60Hz)
Basic	1	Defrost completion temp	5	5	6	6
	2	Integrated constant 1 (temp)	-23.5	-24	-19.5	-28
	3	Integrated constant 2 (time)	12	10	15	12
	4	Ambient temp correction operating temp for integrated value	44	35	44	44
	5	Ambient temp correction rate for integrated value	90	95	90	90
	6	Freeze backup timer	45	45	45	45
Water supply	10	Defrosting water supply time, water temp less than 13°C	90	95	90	90
	11	Defrosting water supply time, water temp 13°C or more	30	30	30	30
	12	Icemaking water supply time, partial drain flush	35	30	35	35
		* Icemaking water supply time, full drain flush	70	60	70	70
	13	Water temp measurement correction value	8	10	9	8
	14	* Full / partial drain flush selection	1	1	1	1
	15	Additional icemaking water supply time, partial drain flush	0	22	0	0
		* Additional icemaking water supply time, full drain flush	0	44	0	0
Other	21	Double stack bin control	1	1	1	1
	22	Refrigeration unit operation in bin control cycle	0	0	0	0
Model	30	Type	2	2	2	2
Defrost cycle low temp control	34	Operating temp	48	48	48	48
Water regulator	36	Water regulator error detecting temp	0	0	0	0
Compressor	37	Compressor output selection	1	1	1	1
Slush ice	50	Pump off time	0	0	0	0
	51	Water supply time	0	0	0	0
Hard water	60	Operating condition	10	10	10	10
	61	Water supply time	0	0	0	0
Ice left in water pan	70	Operating temp	44	40	44	44
	71	Hot gas valve on time	10	2	10	10
	72	*** Hot gas valve off time	20	28	20	20
Ice bridge	73	Hot gas valve off time	12	0	0	0
Low temp in defrost cycle	74	Operating temp	27	20	34	30
High pressure	80	Sensed temp	58	59	59	58

* When No. 14 is set to "0" (full drain flush), change Nos. 12 and 15 also to full drain flush settings.

*** For the controller boards of P01873-01 (Ver. 1.9A or later) and P01873-02 (Ver. 1.4A or later), No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting".

	No	Item	220AWA (50Hz)	220AWA-21 (50Hz)	220AWA (60Hz)
Basic	1	Defrost completion temp	5	3	4
	2	Integrated constant 1 (temp)	-20	-8	-19
	3	Integrated constant 2 (time)	10	5	13
	4	Ambient temp correction operating temp for integrated value	35	35	35
	5	Ambient temp correction rate for integrated value	95	100	95
	6	Freeze backup timer	45	45	45
Water supply	10	Defrosting water supply time, water temp less than 13°C	95	95	95
	11	Defrosting water supply time, water temp 13°C or more	30	30	30
	12	Icemaking water supply time, partial drain flush	30	30	30
		* Icemaking water supply time, full drain flush	60	60	60
	13	Water temp measurement correction value	11	10	10
	14	* Full / partial drain flush selection	1	1	1
	15	Additional icemaking water supply time, partial drain flush	22	22	22
		* Additional icemaking water supply time, full drain flush	44	44	44
Other	21	Double stack bin control	1	1	1
	22	Refrigeration unit operation in bin control cycle	0	0	0
Model	30	Type	0	0	0
Defrost cycle low temp control	34	Operating temp	60	60	60
Water regulator	36	Water regulator error detecting temp	0	0	0
Compressor	37	Compressor output selection	1	1	1
Slush ice	50	Pump off time	0	0	0
	51	Water supply time	0	0	0
Hard water	60	Operating condition	10	10	10
	61	Water supply time	0	0	0
Ice left in water pan	70	Operating temp	40	40	49
	71	Hot gas valve on time	5	0	10
	72	*** Hot gas valve off time	25	0	20
Ice bridge	73	Hot gas valve off time	0	0	0
Low temp in defrost cycle	74	Operating temp	0	0	0
High pressure	80	Sensed temp	58	58	58

* When No. 14 is set to "0" (full drain flush), change Nos. 12 and 15 also to full drain flush settings.

** For the controller boards of P01873-01 (Ver. 1.9A or later) and P01873-02 (Ver. 1.4A or later), No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting".

** Self-cleaning model

	No	Item	220AA (50Hz**)	220AWA (50Hz**)
Basic	1	Defrost completion temp	6	6
	2	Integrated constant 1 (temp)	-22.0	-21.5
	3	Integrated constant 2 (time)	13	12
	4	Ambient temp correction operating temp for integrated value	35	35
	5	Ambient temp correction rate for integrated value	100	100
	6	Freeze backup timer	45	45
Water supply	10	Defrosting water supply time, water temp less than 13°C	95	95
	11	Defrosting water supply time, water temp 13°C or more	30	30
	12	Icemaking water supply time, partial drain flush	-	-
		* Icemaking water supply time, full drain flush	60	60
	13	Water temp measurement correction value	11	11
	14	* Full / partial drain flush selection	0	0
	15	Additional icemaking water supply time, partial drain flush	-	-
		* Additional icemaking water supply time, full drain flush	44	44
Other	17	Defrosting water control	0	0
	18	Defrost completion temp correction	0	0
	21	Double stack bin control	1	1
	22	Refrigeration unit operation in bin control cycle	0	0
	24	Cleaning cycle time	20	20
	25	Rinse cycle number	4	4
	26	Rinse cycle time	5	5
	27	Evaporator draining time	5	5
Model	28	Tank draining time	3	3
	30	Type	2	0
Defrost cycle low temp control	34	Operating temp	60	60
Water regulator	36	Water regulator error detecting temp	0	0
Compressor	37	Compressor output selection	1	1
Slush ice	50	Pump off time	0	0
	51	Water supply time	0	0
Hard water	60	Operating condition	10	10
	61	Water supply time	0	0
Ice left in water pan	70	Operating temp	40	46
	71	Hot gas valve on time	10	10
	72	*** Hot gas valve off time	20	20
Ice bridge	73	Hot gas valve off time	0	0
Low temp in defrost cycle	74	Operating temp	0	0
High pressure	80	Sensed temp	58	58

* When No. 14 is set to "0" (full drain flush), change Nos. 12 and 15 also to full drain flush settings.

*** For the controller boards of P01873-01 (Ver. 1.9A or later), P01873-02 (Ver. 1.4A or later) and P01873-03 (Ver. 1.0A or later), No. 72 is not manually adjustable, but is automatically set to "30 sec minus No. 71 setting".

[d] DISPLAY MODE (LOG CLEARING)

When the up switch is pressed for more than 3 seconds, the display mode starts to allow various items and logs to be checked, displayed or cleared.

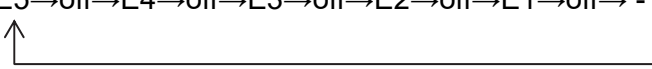
- 1) Press the up switch for more than 3 seconds while the unit is running. The display shows "n1".
- 2) Press the up switch to increase the number and the down switch to decrease the number.
- 3) Press the reset switch to select the desired number. The current value appears in the display.
- 4) Press the reset switch while the value is displayed. The display shows the number again.

To reset, leave the switches untouched for 30 seconds.

To clear, press the up and down switches together for 5 seconds while the value is displayed.

Display Mode List

No	Item	Description	Clear
n1	Freeze cycle time count up (min)	0 to 99 min	No
n2	Freeze cycle completion rate (%)	0 to 100% (00 = 100%)	No
n3	Current cube control thermistor temp	Rounded to the nearest whole number	No
n4	Current ambient thermistor temp	Rounded to the nearest whole number	No
n5	Water temp (presumed)	"H" for 13°C or more "L" for less than 13°C	No
n6	Current condenser thermistor temp	Rounded to the nearest whole number	No
h1	Last freeze cycle time (min)	Same as current freeze cycle time. Freeze cycle is not considered complete if interrupted by bin control switch or reset switch.	Yes
h2	Number of freeze cycles	Number of cycles completed. 10 is added every 10 cycles. Freeze cycle is not considered complete or counted in if interrupted by bin control switch or reset switch.	Yes
h3	Total number of freeze cycles	< Display > e.g. 655350 cycles (start) (end) 65→off→53→off→50→off→ - - ↑	No

h4	Error log	Display up to 5 errors from latest to oldest for 1 sec ON, 0.5 sec OFF, “- -” at the end, then back to latest error. In case of less than 5 errors, display oldest error, “- -”, then back to latest one. < Display > e.g. E5 (latest), E4, E3, E2, E1 (oldest) (latest) (oldest) E5→off→E4→off→E3→off→E2→off→E1→off→ - - 	Yes
h5	Software version	For Ver 1.0A, display “01.”→”0A”→”01.”alternately for 1 sec ON, 0.5 sec OFF.	No
h6	Default model code	Display set model codes from “00” to “9F” (hexadecimal, 160 patterns)	No (*)

* To clear the model code, press the up and down switches together for 15 seconds (for controller board replacement and setting error correction only).

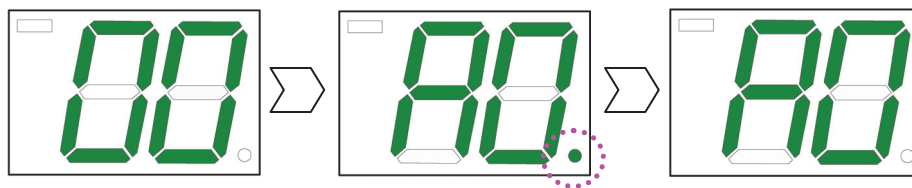
[e] MODEL CODE SETTING MODE

Note: Use this mode only when the controller board is replaced or the model code setting needs to be corrected.

- 1) When the up switch is pressed for more than 3 seconds, the display mode starts and the display shows “n1”.
- 2) Press the up or down switch to have “h6” in the display.
- 3) Press the reset switch. The current memorised model code appears in the display.
- 4) Press the up and down switches together for 15 seconds. The display shows “00”.
- 5) Press the up switch to increase the first digit in the 7-segment display, and the down switch to increase the second digit. The digit changes in the following order: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. Set the proper model code according to the model code list below. When a preset model code is displayed, the dot on the bottom right lights up.
- 6) When the chosen preset model code is displayed, press the reset switch to store the board memory (the display shows “on” and the machine will then always start up with this memorized program as default).

* To check the current memorised model code, view in the display mode (follow steps 1) to 3) above).

<Controller board replaced> <Chosen model code displayed> <Model code memorised>

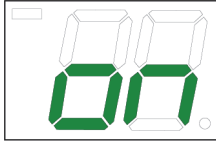
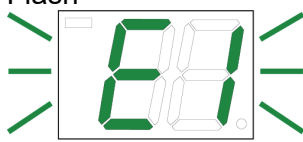
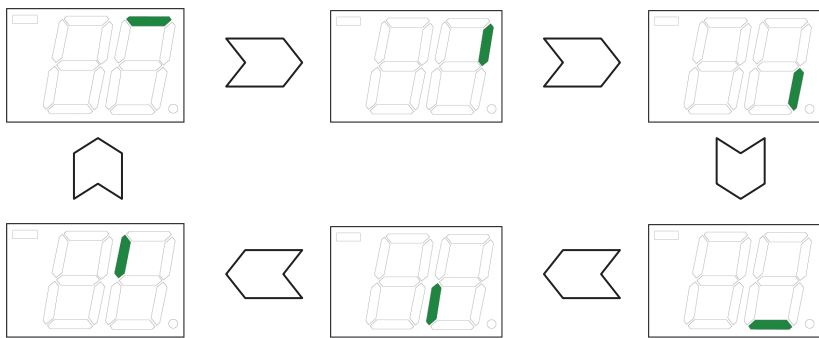


Model Code List

1st Digit	2nd Digit	Model
8	0	IM-220AA (50Hz) [auxiliary code F1 & earlier]
8	1	IM-130A (50Hz) [Embraco comp.]
8	2	IM-100A (50Hz)
8	6	IM-220AA-23 (50Hz)
8	7	IM-130A-23 (50Hz)
8	8	IM-100A-23 (50Hz)
8	9	IM-220AA (60Hz), IM-220AA (50Hz) [auxiliary code F2 & later]
9	0	IM-130A (60Hz)
9	1	IM-100A (60Hz)
9	2	IM-220AWA (50Hz)
9	3	IM-220AWA (60Hz)
9	4	IM-220AA-21 (50Hz)
9	5	IM-220AWA-21 (50Hz)
9	6	IM-130A-21 (50Hz)
9	7	IM-220AA (50Hz) [Self-cleaning model: M028-C106]
9	8	IM-220AWA (50Hz) [Self-cleaning model: M028-C207]
9	9	IM-130A (50Hz) [Secop comp.]

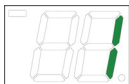
4. 7-SEGMENT DISPLAY

[a] NORMAL MODE

Item	Display
Power on Defrost cycle Freeze cycle Bin full	
Freeze temp setting	Display range from -5.0 to -40.0 
Error code	Flash  E1: Abnormal freeze cycle E2: Abnormal defrost cycle EE: Other (See "5. ERROR CODES")
Water circuit flush	

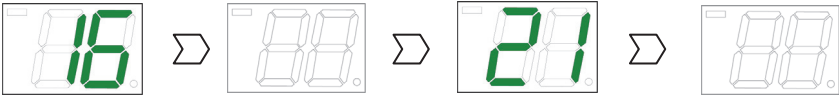
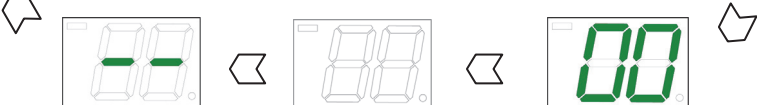
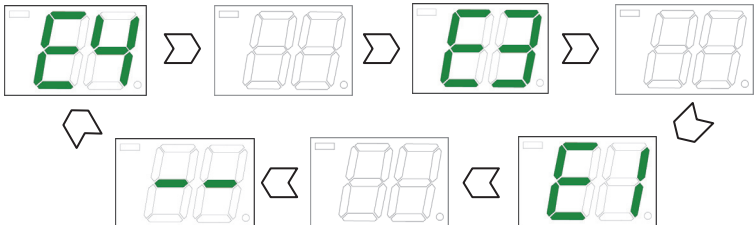
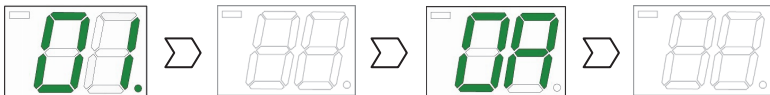
[b] MAINTENANCE MODE

No.	Item	Display (example)
1	Defrost completion temp	 16°C
2	Integrated constant 1 (temp)	-18°C -18.5°C   Dot appears for value with ".5" as in -18.5°C
3	Integrated constant 2 (time)	 21 min

4	Ambient temp correction operating temp for integrated value	Same as No. 1	
5	Ambient temp correction rate for integrated value	 90%	 100% (last 2 digits only)
6	Freeze backup timer	Same as No. 3	
10	Defrosting water supply time, water temp less than 13°C	Same as No. 3 (unit: sec)	
11	Defrosting water supply time, water temp 13°C or more	Same as No. 3 (unit: sec)	
12	Icemaking water supply time, normal	Same as No. 3 (unit: sec)	
13	Water temp measurement correction value	Same as No. 1	
14	Full / partial drain flush selection	Same as Nos. 21 and 22	
15	Additional icemaking water supply time	Same as No. 3 (unit: sec)	
17	Defrosting water control	Same as Nos. 21 and 22	
18	Defrost completion temp correction	Same as No. 1	
21	Double stack bin control	0	
22	Refrigeration unit operation in bin control cycle	1	
24	Cleaning cycle time	Same as No. 3	
25	Rinse cycle number	Same as No. 3 (unit: cycles)	
26	Rinse cycle time	Same as No. 3	
27	Evaporator draining time	Same as No. 3	
28	Tank draining time	Same as No. 3	
30	Model type	Same as Nos. 21 and 22 (Setting range from 0 to 3)	
34	Defrost cycle low temp control, operating temp	Same as No. 1	
36	Water regulator error detecting temp	Same as No. 1	
37	Compressor output selection	Same as Nos. 21 and 22	
50	Slush ice, pump off time	Same as No. 3 (unit: sec)	
51	Slush ice, water supply time	Same as No. 3 (unit: sec)	
60	Hard water, operating condition	Same as No. 5	
61	Hard water, water supply time	Same as No. 3 (unit: sec)	
70	Ice left in water pan, operating temp	Same as No. 1	
71	Ice left in water pan, hot gas valve on time	Same as No. 3 (unit: sec)	
72	Ice left in water pan, hot gas valve off time	Same as No. 3 (unit: sec)	

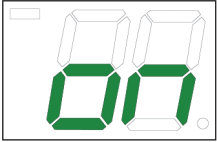
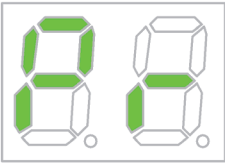
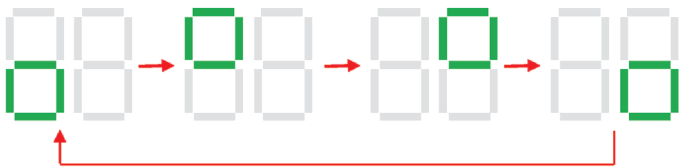
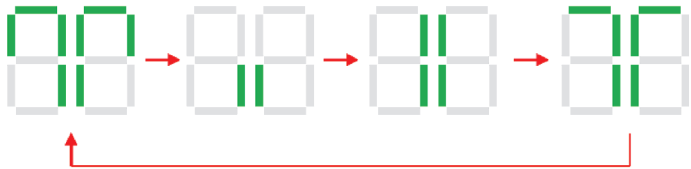
73	Ice bridge, hot gas valve off time	Same as No. 3 (unit: sec)
74	Low temp in defrost cycle, operating temp	Same as No. 1
80	High pressure, sensed temp	Same as No. 1

[c] DISPLAY MODE

No.	Item	Display (example)
—	n*, h*	 
n1	Freeze cycle time count up (min)	21 min or 21% 
n2	Freeze cycle completion rate (%)	100% (last 2 digits only) 
n3	Current cube control thermistor temp	-19°C 
n4	Current ambient thermistor temp	24°C 
n5	Water temp (presumed)	Water temp 13°C or more  Water temp less than 13°C 
n6	Current condenser thermistor temp	Same as n3 and n4
h1	Last freeze cycle time (min)	 21 min
h2	Number of freeze cycles	If counted number of cycles is 162100 
h3	Total number of freeze cycles	
h4	Error log	If 3 errors from latest to oldest are E4, E3, and E1 
h5	Software version	Ver 1.0A is displayed as follows alternately for 1 sec ON and 0.5 sec OFF 

h6	Default model code	Set model codes from “00” to “9F” (hexadecimal, 160 patterns)
		

[d] SELF-CLEANING MODE (for M028-C106 and M028-C207)

Item	Display
Power on Defrost cycle Freeze cycle Bin full	
Preset	
Ready for cleaning solution supply	Display switches every 0.2 sec as follows. 
Cleaning cycle Rinse cycle	Display switches every 0.2 sec as follows. 

5. ERROR CODES

[a] ERROR CODES, CAUTION CODES

- * When the controller board detects an error, the display shows one of the following error and caution codes in the display mode. Operation depends on the type of error.
- * The error codes other than E1, E2 and EL are indicated as “EE” in the 7-segment display at the time of occurrence. The error log is indicated up to five errors from the latest entry.

Error	Item	Description	Operation	Reset
E1	Freeze error	Freeze backup timer (45 - 90 minutes after water pan starts to close) counts up before freeze cycle completes, and evaporator temperature is 0°C or higher.	Shut down	Press reset switch
E2	Defrost error	Defrost backup timer (30 minutes after water pan starts to open) counts up before defrost cycle completes.	Shut down	Press reset switch
E3	Water pan opening error	Water pan has not fully opened within 60 seconds, and 3 minutes have passed even with opening failure control.	Halt	Press reset switch
		Unit resumes operation after 60 minutes and repeats the above error.	Shut down	
E4	Water pan closing error	Water pan has not fully closed within 60 seconds, and 50 seconds have passed even with closing failure control.	Halt	Press reset switch
		Unit resumes operation after 60 minutes and repeats the above error.	Shut down	
E5	High temperature error	Evaporator temperature stays 60°C or higher for 5 seconds or more.	Shut down	Press reset switch
E9	Condenser thermistor error	Condenser thermistor circuit is open or shorted for 2 seconds.	Shut down	Replace thermistor
EA	Data error	Model setting data memory IC is defective.	Shut down	Replace controller board
EC	Cube control thermistor error	Cube control thermistor circuit is open or shorted for 2 seconds.	Shut down	Replace thermistor
Ed	Water regulator error	Cooling water cannot stop by water regulator error, and thermistor senses set point or lower temperature.	Continue	Press reset switch
EL	Float switch error	Float switch is on when water pan has fully closed in self-cleaning mode.	Shut down	Press reset switch

Caution	Item	Description	Operation	Reset
C1	Cleaning solution supply error	Cleaning solution has not been sufficiently supplied in self-cleaning mode, and down switch is pressed or 15 minutes pass with float switch off.	Stand by	Sufficiently supply cleaning solution
	Rinse water supply error	Rinse water has not been sufficiently supplied due to low water, and icemaking water supply time passes with float switch off.	Halt	Automatically resets
		Unit resumes operation after 30 minutes and repeats the above error.		
C2	High pressure	[Air-cooled] Condenser thermistor senses maintenance mode No. 80 or higher temperature. [Water-cooled] Pressure switch senses 2.65MPa or higher pressure.	Continue	After 10 minutes, condensing temperature 50°C or lower, pressure 1.96MPa or lower

[b] SERVICE DIAGNOSIS

Error	Check	Possible Cause	Remedy
E1	Water valve	Closing failure	Clean or replace
	Refrigeration circuit	Gas leak	Repair
		Clogged capillary	Replace heat exchanger
		Clogged expansion valve	Replace
	Compressor	Defective	Replace
		Starting failure	Check supply voltage or replace electrical components
	Compressor relay	Coil circuit open	Replace
	Condenser	Clogged	Clean
	Fan Motor	Locked	Replace
		Low RPM	Replace
		Broken fan	Replace fan
E2	Hot gas valve	Closing failure	Replace
	Cube control thermistor	Disconnected	Reconnect
E3	Hot gas valve	Opening failure	Replace
	Controller board	Defective	Replace
E4	Actuator motor	Defective	Replace
	Controller board	Relay contact failure	Replace
		Defective	Replace
E5	Actuator motor	Defective	Replace
	Controller board	Relay contact failure	Replace
E9	Hot gas valve	Closing failure	Replace
	Controller board	Relay contact failure	Replace
EA	Cube control thermistor	Open or short circuit	Replace
	Controller board	Connector disconnected	Reconnect
EC	Controller board	Defective	Replace
	Cube control thermistor	Open or short circuit	Replace
Ed	Water regulator	Open or short circuit	Replace
		Connector disconnected	Reconnect
EL	Float switch	Clogged with foreign matter	Unclog
		Corroded spring	Replace

Caution	Check	Possible Cause	Remedy
C1	Cleaning solution (when display segments light up in rotation)	No or insufficient cleaning solution supply	Supply cleaning solution
	Water supply (when display shows fountain image)	Low water, low water pressure	Wait for water supply in 30 min after halt
C2	Air-cooled condenser	Dirty with oily smoke, low condensing capacity	Clean
		Clogged filter	Clean
	Water-cooled condenser	Dirty with scale, low condensing capacity	Clean
	Water circuit	Low water	Check shutoff valve
	Fan motor	Defective	Replace
	Ambient temperature	Too high	Ventilate and cool down

6. TROUBLESHOOTING

[a] INSTRUCTIONS FOR SERVICE ENGINEER

- 1) Check that the icemaker has been earthed properly. If not, the controller board will not work properly.
- 2) Do not change wiring and connections, or the controller board will not work properly.
- 3) Do not touch the electronic devices on the controller board or the back of the controller board.
- 4) Do not repair the electronic devices and parts on the controller board in the field except for the fuse (250V AC, 6.3A, 5mm DIA x 20mm).
- 5) To get static free, always touch the metal part of the icemaker before servicing.
- 6) Handle the controller board by the edges only.
- 7) Do not drop the controller board on the floor.

[b] CHECKING CONTROLLER BOARD

- 1) Before checking the controller board, check the cube control thermistor and bin control switch for proper operation. See “BEFORE CHECKING CONTROLLER BOARD” in the service manual for the applicable model.
- 2) If the above parts are operating properly, check each part according to “5. [b] SERVICE DIAGNOSIS”.

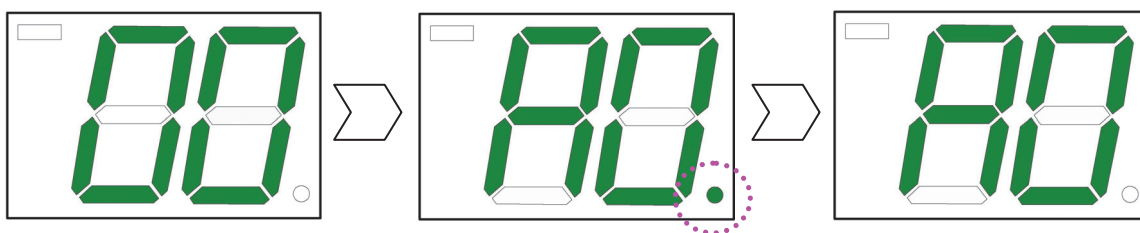
7. REMOVAL AND REPLACEMENT

The replacement controller board is in common use for all the models.

To replace:

- 1) Unplug the icemaker or disconnect the power source.
- 2) Remove the front cover and control box cover.
- 3) Disconnect all the connectors from the controller board. Remove the controller board from the control box.
- 4) Install the replacement controller board in the control box. Reconnect the connectors.
- 5) Replace the control box cover and front cover.
- 6) Plug in the icemaker or connect the power source. As the replacement controller board has not been set for the proper model code, the 7-segment display illuminates “00”.
 - * The code “00” does not belong to any model.
- 7) Press the up switch to increase the first digit in the 7-segment display, and the down switch to increase the second digit. The digit changes in the following order: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. Set the proper model code according to the model code list provided with the replacement controller board (see next page). When a preset model code is displayed, the dot on the bottom right lights up.
- 8) When the chosen preset model code is displayed, press the reset switch to store the board memory (the display shows “on” and the machine will then always start up with this memorized program as default).

<Controller board replaced> <Chosen model code displayed> <Model code memorised>



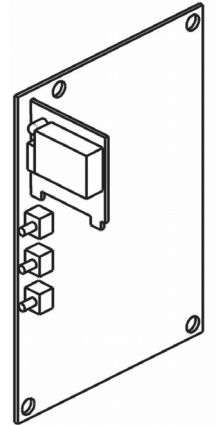
- * To check the current memorised model code, view in the display mode (press and hold the up switch for 3 seconds – the display changes to “n1”, then press the up switch several times to find “h6”, then press the reset switch and the memorised code appears in the display).
- * If for any reason the machine needs to be reset back to the factory settings, hold

the up and down switches for 15 seconds whilst the code is displayed (in display mode). The machine will stop working and the display will reset to “00” (cleared memory).

The controller board will then need to be reprogrammed (select and memorise the correct code for the machine) using steps 7) and 8) above.

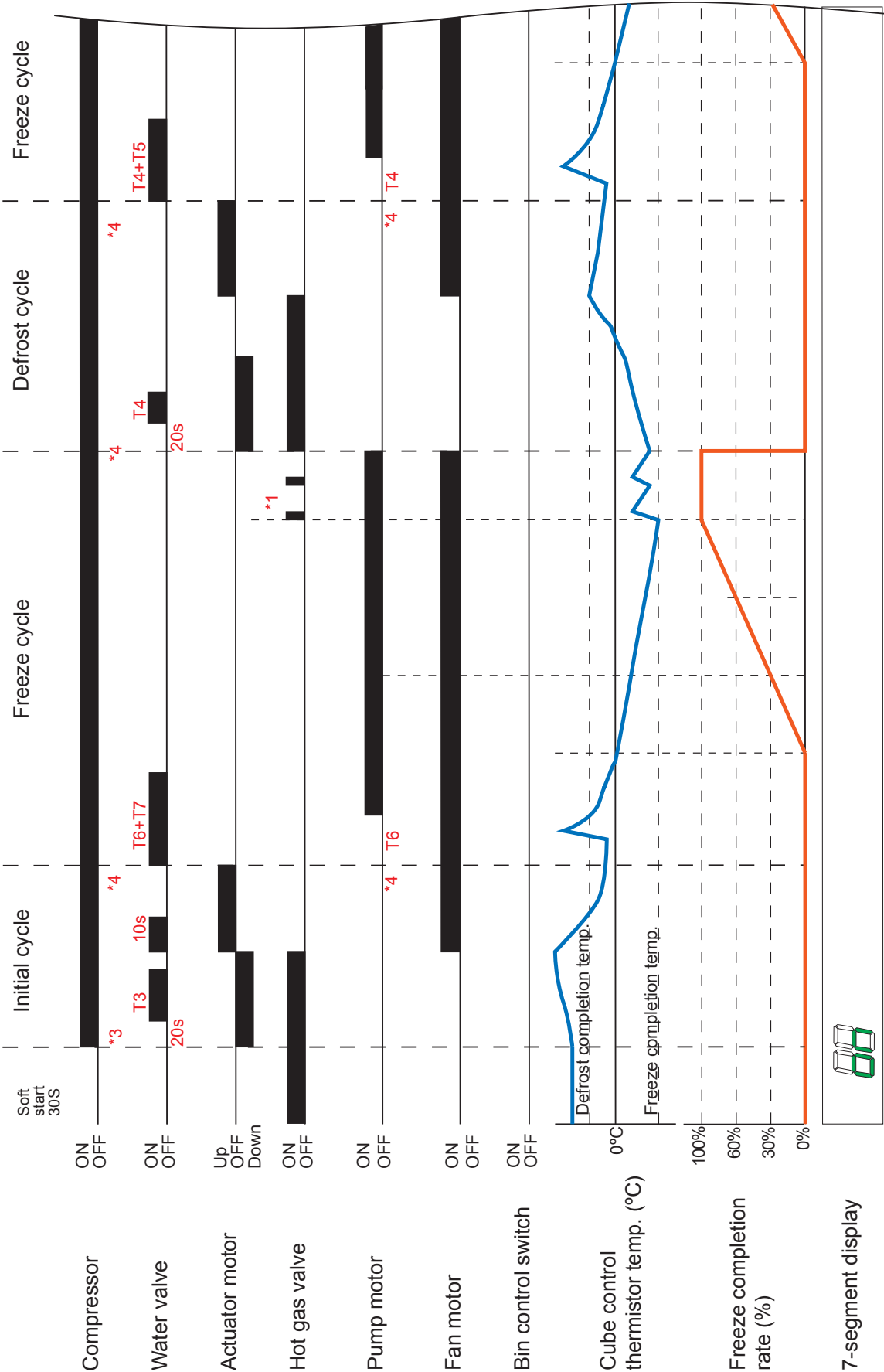
Note:

1. Be sure to get static free before servicing the controller board.
2. Do not touch the controller board with wet or dirty hands.
3. Do not impact the controller board. If it drops on the floor, do not use it.
4. Do not hold the leads when disconnecting the connectors.
 - * Locking connectors must be unlocked before being disconnected.
 - * Reconnect the connectors properly.
5. Install the new controller board in its correct position.
6. Bind the wiring inside the control box the way it was.
 - * Do not push the wiring on the controller board.
 - * Do not bind the thermistor leads and high voltage wires together.

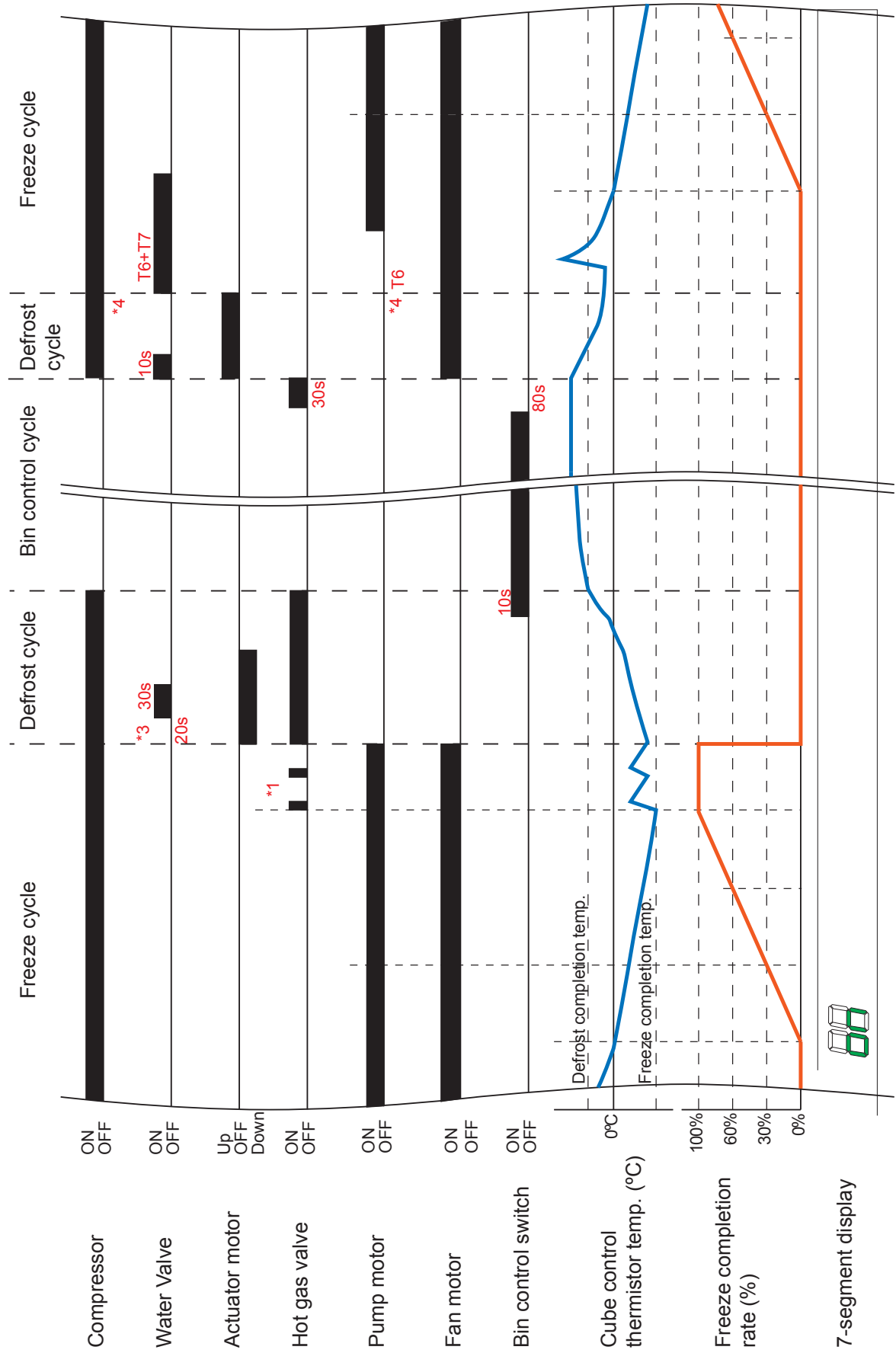


8. TIMING CHART

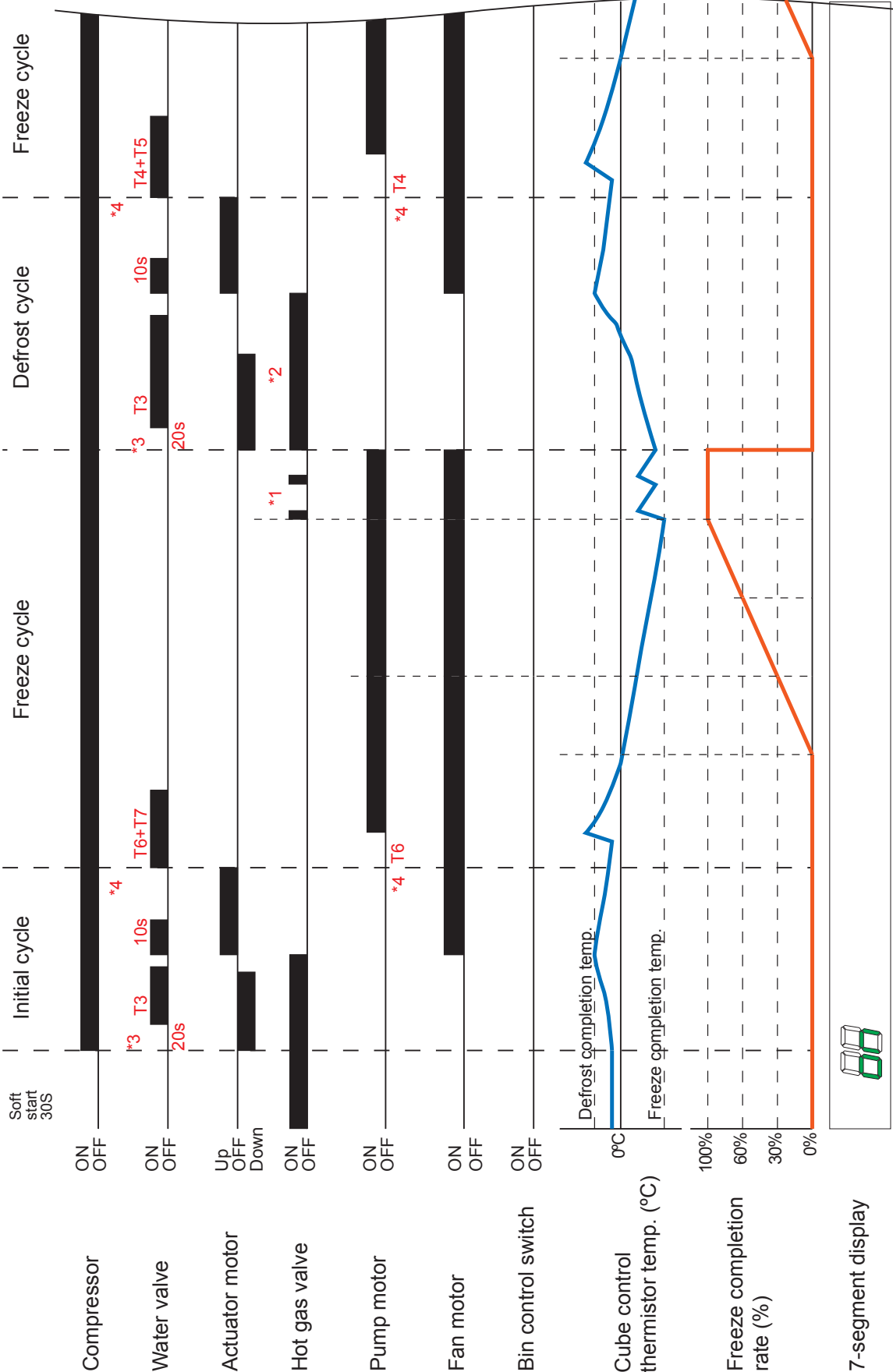
Ice production at normal temperature (partial drain flush) (RT 15°C, WT above 13°C)



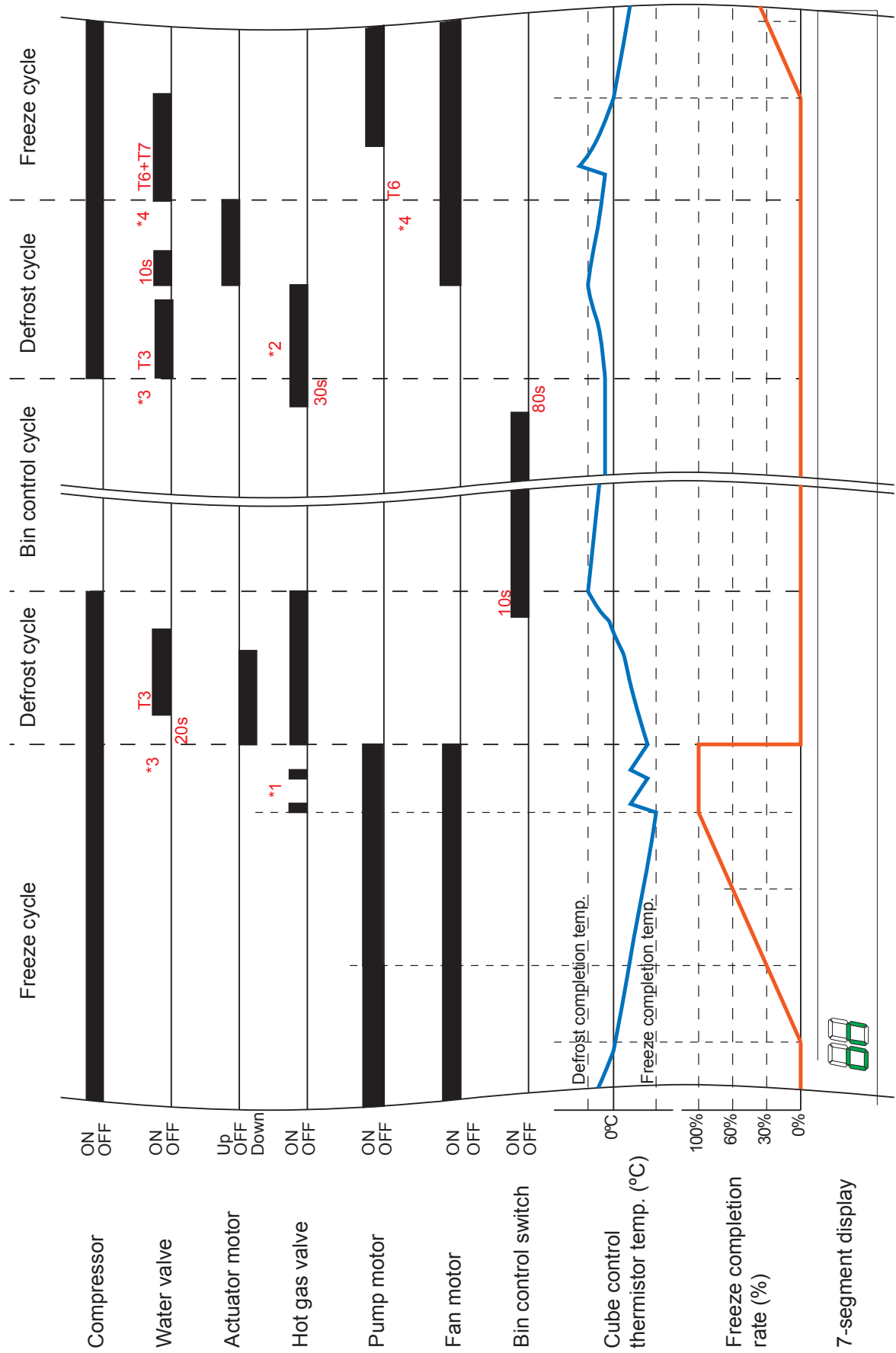
Ice storage at normal temperature (partial drain flush) (RT 15°C, WT above 13°C)



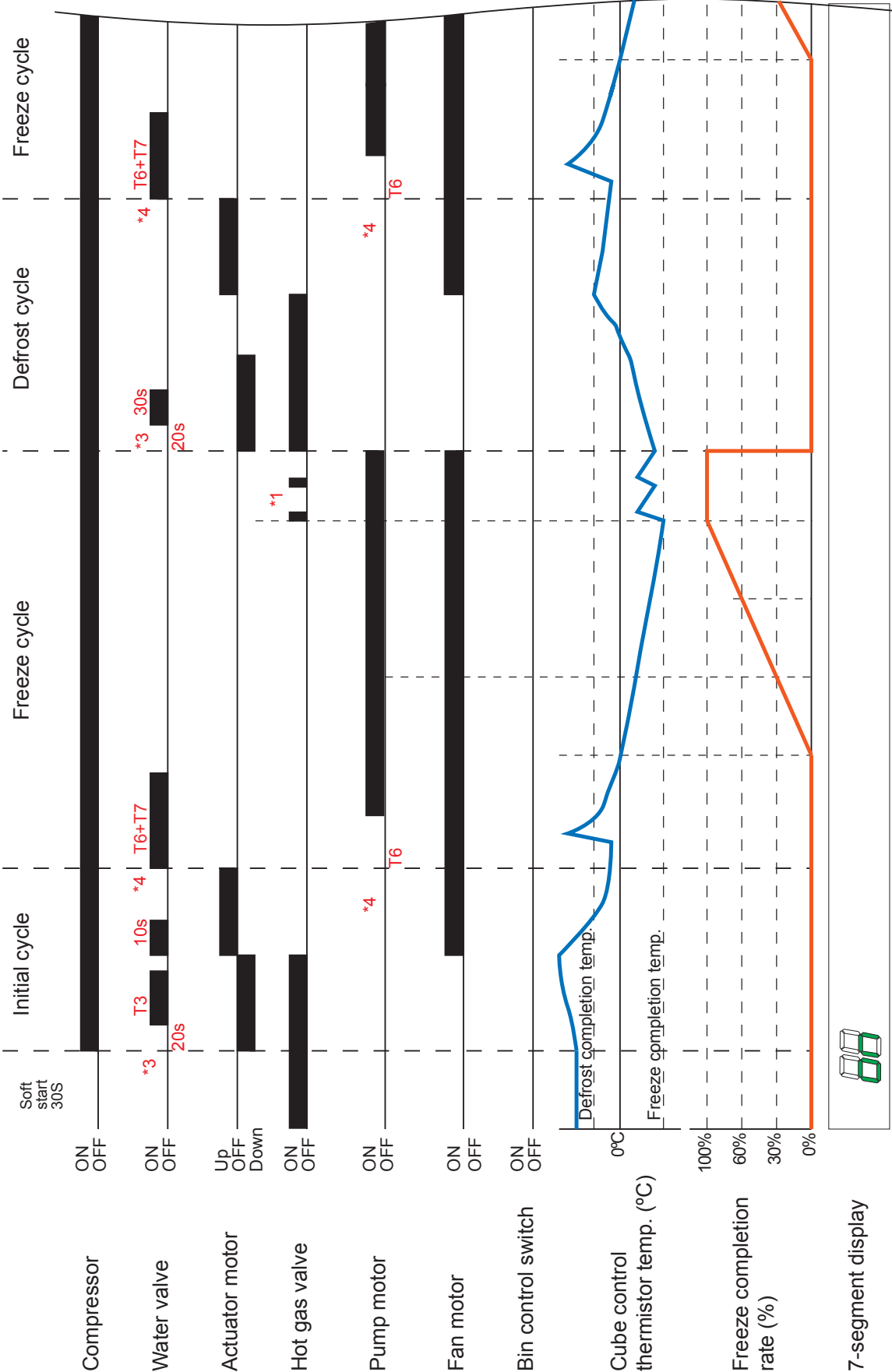
Ice production at low temperature (partial drain flush) (RT 15°C, WT below 13°C)



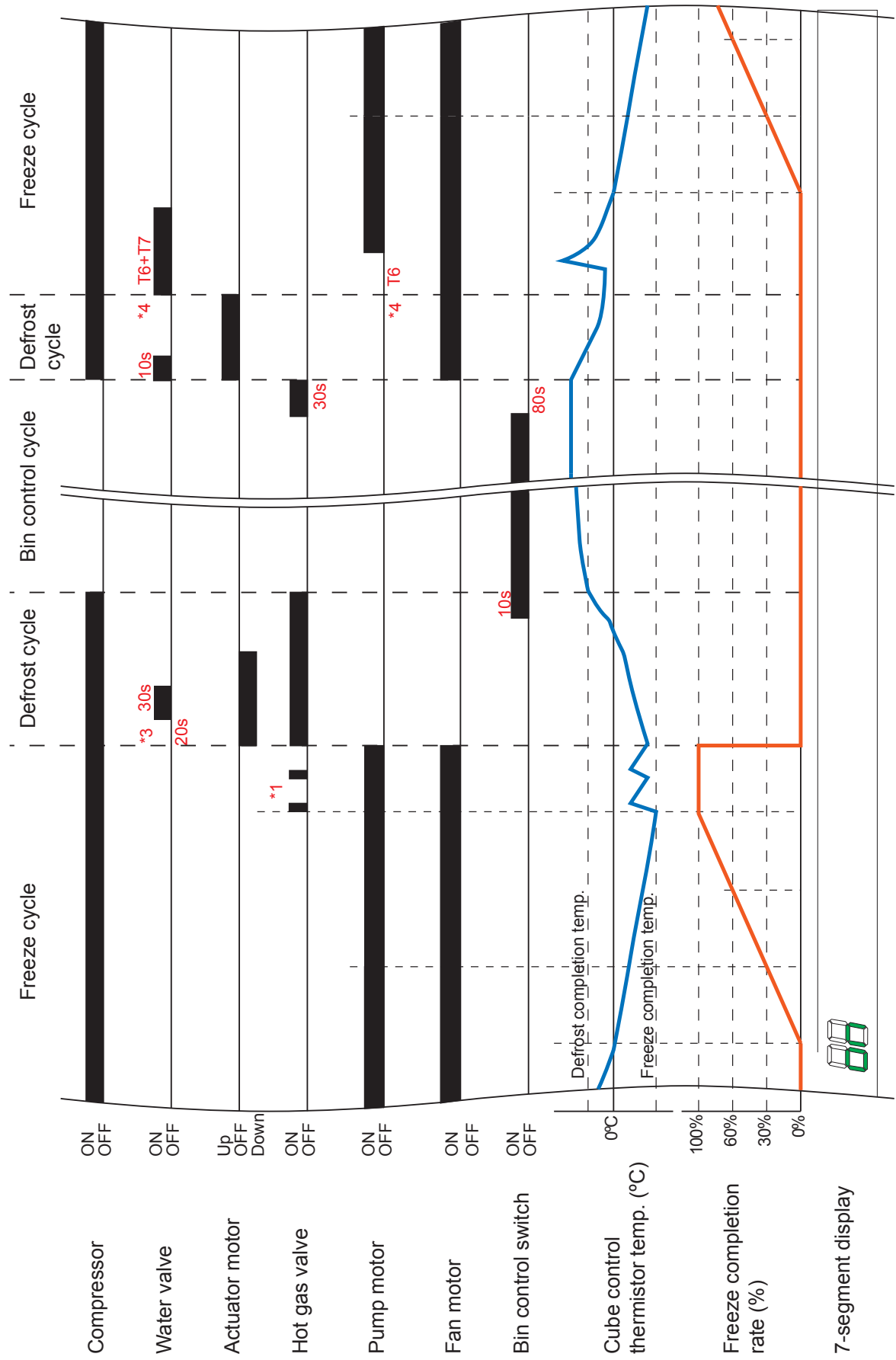
Ice storage at low temperature (partial drain flush) (RT 15°C, WT below 13°C)



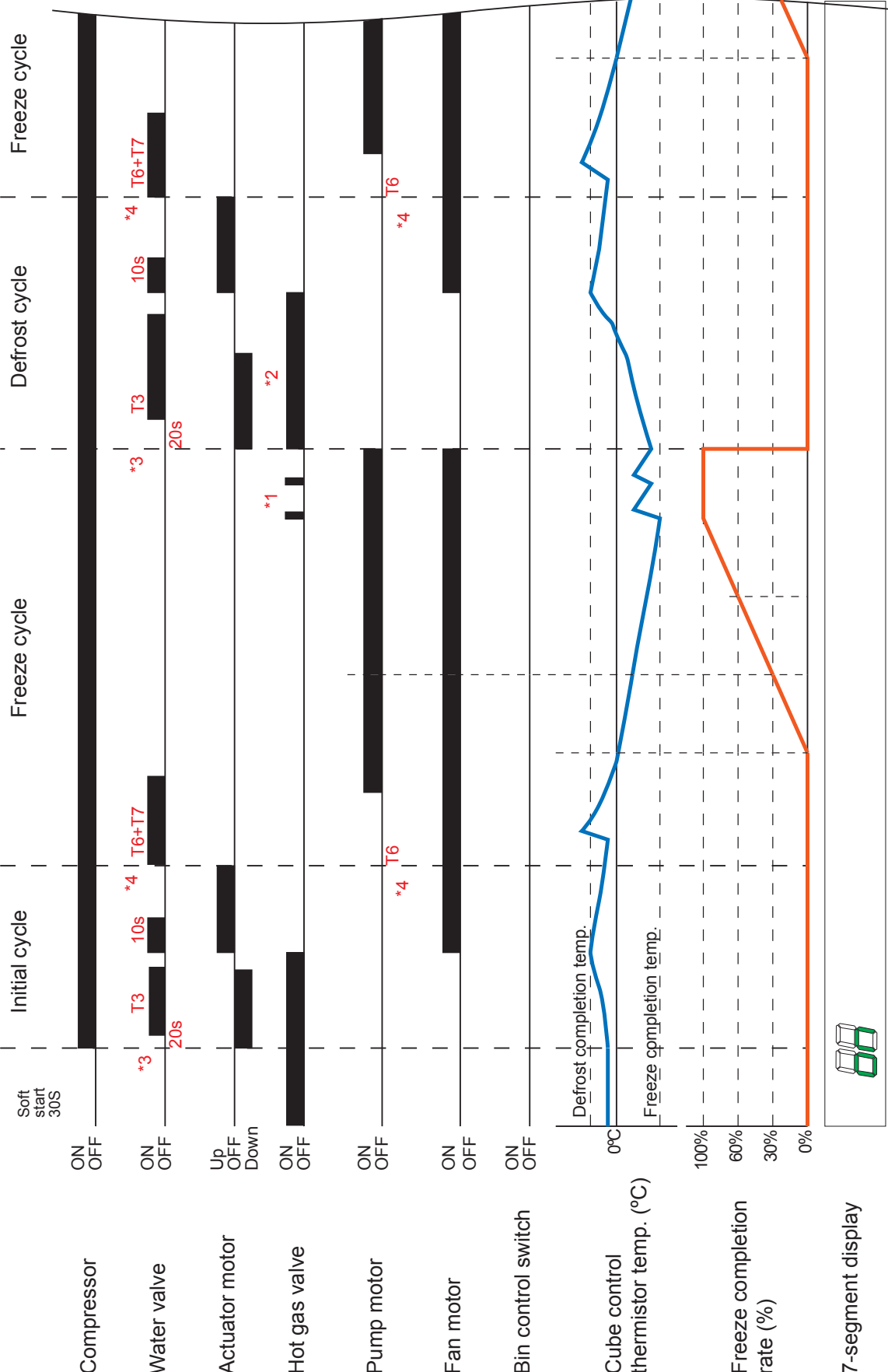
Ice production at normal temperature (full drain flush) (RT 15°C, WT above 13°C)



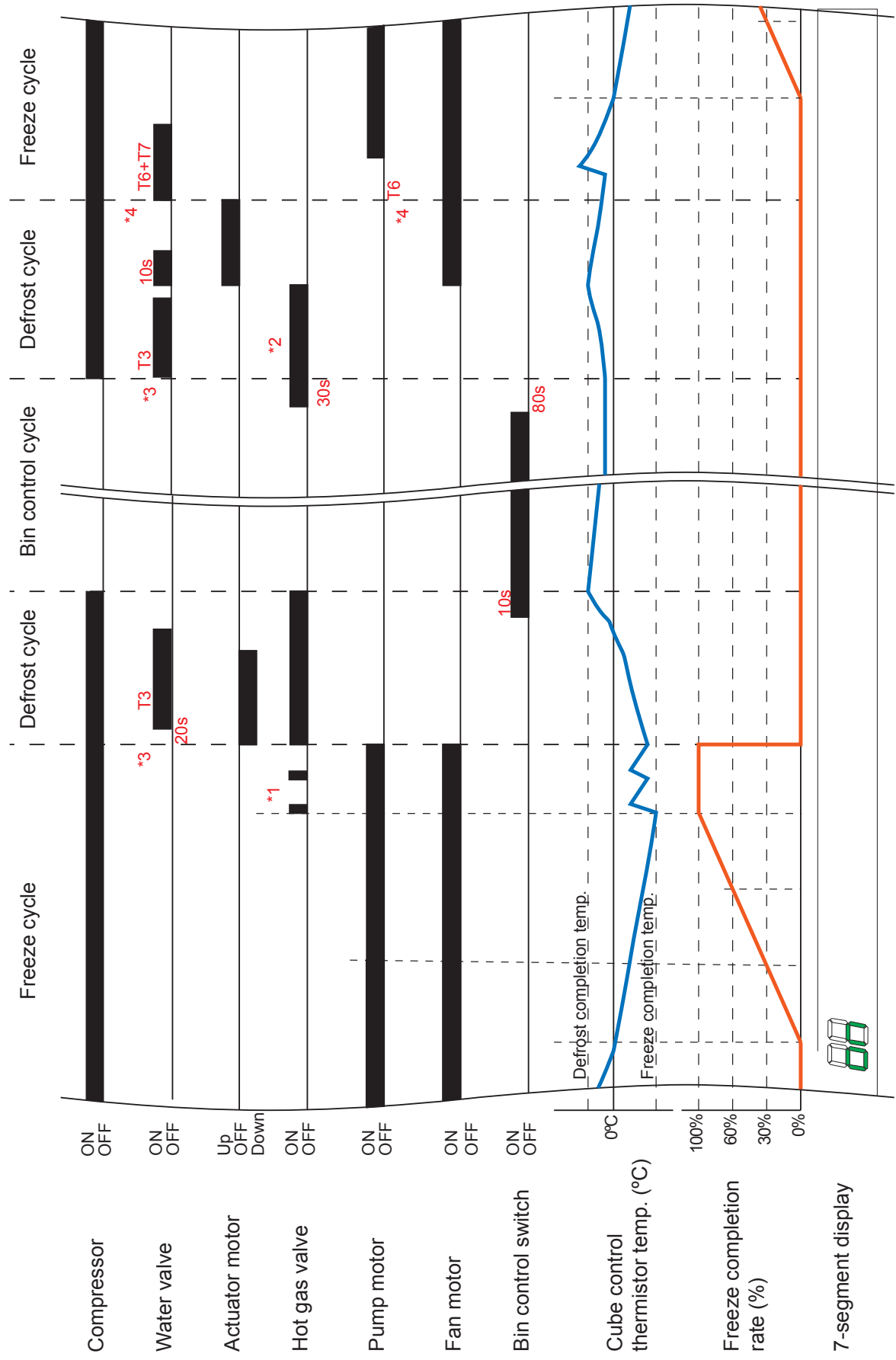
Ice storage at normal temperature (full drain flush) (RT 15°C, WT above 13°C)



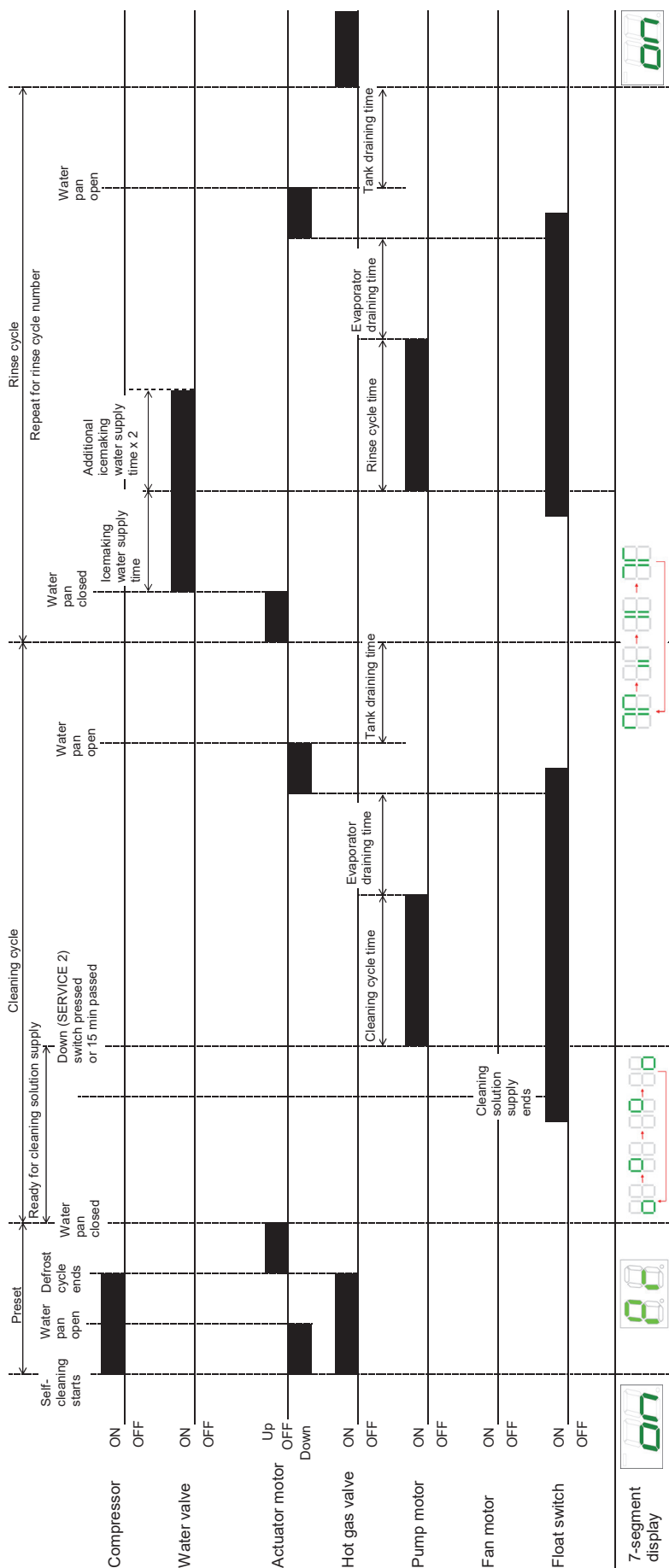
Ice production at low temperature (full drain flush) (RT 15°C, WT below 13°C)



Ice storage at low temperature (full drain flush) (RT 15°C, WT below 13°C)



SELF-CLEANING MODE (for M028-C106 and M028-C207)



- When self-cleaning mode starts, fan motor, pump motor, water valve and actuator motor up de-energize and the following operation starts.
- (When compressor, hot gas valve and actuator motor down are already energized, they stay energized and cleaning cycle starts.
- Preset**
- 1 Display shows "P1", compressor, hot gas valve and actuator motor down energize and water pan starts to open.
 - 2 When hall IC down energizes, actuator motor down de-energizes, water pan fully opens and defrost cycle starts.
 - 3 When cube control thermostat temperature reaches defrost completion temperature, compressor and hot gas valve de-energize and defrost cycle ends.
 - 4 Actuator motor up energizes and water pan starts to close.
 - 5 When hall IC up energizes, actuator motor up de-energizes, water pan fully closes and segments in display light up in rotation (see 4. [d] SELF-CLEANING MODE) until cleaning solution is supplied.
 - 6 After down switch is pressed or 15 minutes pass, cleaning cycle starts.
 - 7 Pump motor energizes and display shows fountain image (see 4. [d] SELF-CLEANING MODE).
 - 8 When cleaning cycle time (maintenance mode No. 24) passes, pump motor de-energizes.
 - 9 Unit stops for evaporator draining time (maintenance mode No. 27) after pump motor de-energizes.
 - 10 Actuator motor down energizes and water pan starts to open.
 - 11 When hall IC down energizes, actuator motor down de-energizes, water pan fully opens and unit stops for tank draining time (maintenance mode No. 28).
 - 12 After tank draining time passes, actuator motor up de-energizes and water pan starts to close.
 - 13 After hall IC up energizes, actuator motor up de-energizes, water is supplied for icemaking water supply time (maintenance mode No. 12).
 - 14 After icemaking water supply time passes, pump motor energizes.
 - 15 Water is supplied for twice the additional icemaking water supply time (maintenance mode No. 15).
 - 16 When rinse cycle time (maintenance mode No. 26) passes after pump motor energizes, pump motor de-energizes and unit stops for evaporator draining time (maintenance mode No. 27).
 - 17 Actuator motor down energizes and water pan starts to open.
 - 18 When hall IC down energizes, actuator motor down de-energizes, water pan fully opens and unit stops for tank draining time (maintenance mode No. 28).
 - 19 Unit repeats steps 12 to 17 for the rinse cycle number (maintenance mode No. 25).
 - 20 Unit completes self-cleaning mode and resumes icemaking operation (from soft start).

Notes on timing charts (*1, *2)

See "3. [b] MAINTENANCE MODE" for models not listed here.

Item			220AA (50Hz) 220AA-21 (50Hz) 220AA-23 (50Hz) 220AA (60Hz)	220AWA (50Hz) 220AWA-21 (50Hz) 220AWA (60Hz)
*1 Water pan defrost control	Ambient temp in control	/	21°C - 40°C	40°C or less
	Hot gas valve on/off time	T1	2 / 28s	5 / 25s
*2 Defrost cycle low temp control	Ambient temp in control	/	20°C or less	
	Hot gas valve on/off time	T2	40 / 40s	
*3 Defrosting water supply time (water temp. less than 13°C, or initial cycle)			T3	Max 95s
*3 Defrosting water supply time (water temp. less than 13°C, or more)			/	30s
*4 Icemaking water supply system	(Partial drain flush)	T4	30s	30s
*4 Additional water supply system		T5	22s	22s
*4 Icemaking water supply system	(Full drain flush)	T6	60s	60s
*4 Additional water supply system		T7	44s	44s

Item			100A (50Hz) 100A-23 (50Hz) 130A (50Hz) 130A-21 (50Hz) 130A-23 (50Hz)	100A (60Hz)	130A (60Hz)
*1 Water pan defrost control	Ambient temp in control	/	28°C - 44°C	31°C - 44°C	35°C - 44°C
	Hot gas valve on/off time	T1	10 / 20s	10 / 20s	10 / 20s
*2 Defrost cycle low temp control	Ambient temp in control	/	27°C or less	27°C or less	27°C or less
	Hot gas valve on/off time	T2	40 / 40s	40 / 40s	40 / 40s
*3 Defrosting water supply time (water temp. less than 13°C, or initial cycle)			T3	Max 90s	Max 90s
*3 Defrosting water supply time (water temp. less than 13°C, or more)			/	30s	30s
*4 Icemaking water supply system	(Partial drain flush)	T4	35s	35s	35s
*4 Additional water supply system		T5	0s	0s	0s
*4 Icemaking water supply system	(Full drain flush)	T6	70s	70s	70s
*4 Additional water supply system		T7	0s	0s	0s

- 1) When the power is turned on or the unit resumes operation after a bin control cycle, the water temperature is considered less than 13°C and the water valve opens for T3 seconds to supply defrosting water. If the water temperature is normal, the water pan opens and immediately starts to close again. In this case, defrosting water flows for 10 seconds and not for the above supply time.
- 2) In the partial drain flush setting, when the power is turned on or the unit resumes operation after a bin control cycle, the water valve opens for T6 seconds ($T4 \times 2$) to supply icemaking water and for T7 seconds ($T5 \times 2$) to supply additional icemaking water.
- 3) In the full drain flush setting, the icemaking water supply time is T6 seconds and the additional water supply time is T7 seconds. The water supply time will not be doubled when the power is turned on or the unit resumes operation after a bin control cycle.
- 4) The pump motor starts after the water pan closes and the icemaking water supply completes.
Partial drain flush - after T4 seconds, or after T6 seconds ($T4 \times 2$) when the power is turned on or the unit resumes operation after a bin control cycle
Full drain flush - after T6 seconds