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RENESAS

APPLICATION NOTE

μPD17104

APPLICATION FOR ELECTRIC FAN

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Date Published August 1990P
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NEC

APPLICATION NOTE

μPD17104

APPLICATION FOR ELECTRIC FAN

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CONTENTS

CHAPTER 1 OUTLINE

Most electric fans available in recent years employ microcomputers to provide various functions as values added, such as random blow simulating natural breeze, and employment of the Sleeping Timer that gradually reduce the air flow with time or gradually lengthens the intervals at which intermittent fan operation is carried out.

This Application Note introduces programs for the μPD17104 used to control the fan motor, head swing motor, and timers, for an electric fan.

The μPD17104 is a low-price "tiny microcontroller", which consists of 1K-byte ROM, 16-word RAM, and 16 I/O ports. The μPD17104 is suitable for electrical appliances, in which relatively simple control action is required, such as electric fans.

CHAPTER 2 FUNCTIONS OF MICROCOMPUTER-CONTROLLED ELECTRIC FAN

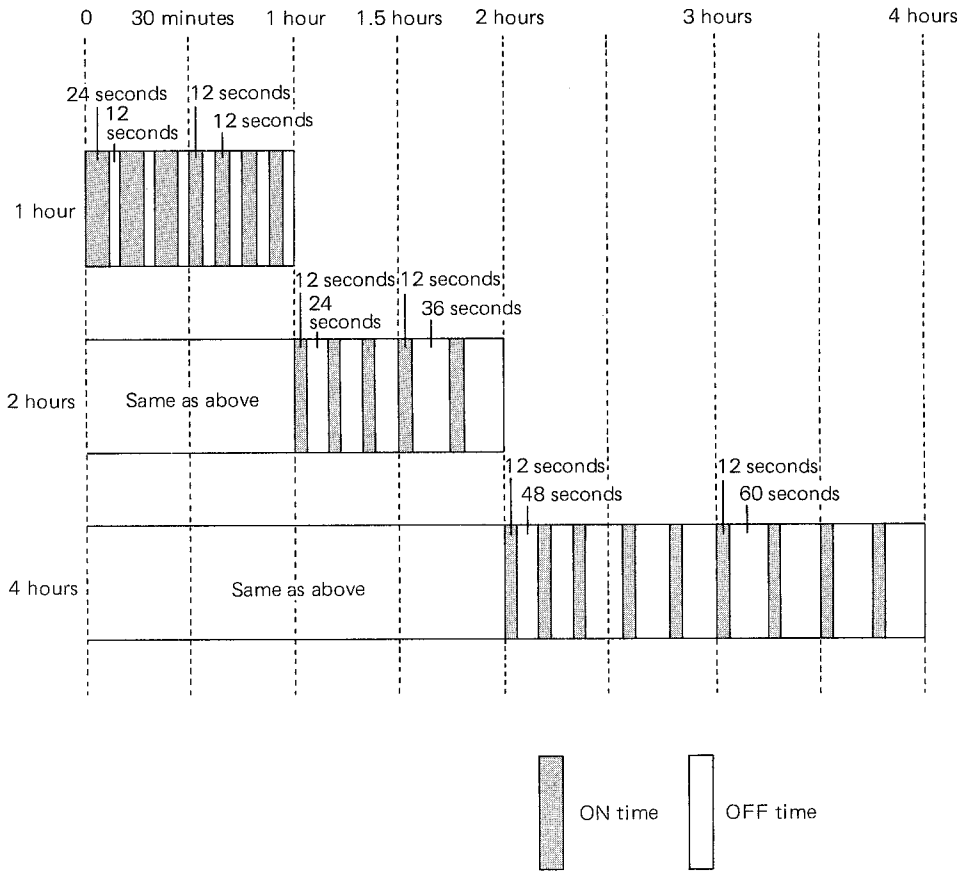
2.1 FUNCTIONAL DESCRIPTION

This electric fan has the following functions:

- Wind speed selectable from Low, Medium, and High
- Random air flow changing wind velocity (Low random air flow, Medium random air flow, High random air flow)
- Electronics timer for 30 minute, 1 hour, or 2 hour operation
- Sleeping Timer for 1 hour, 2 hour, or 4 hour operation (Sleeping Timer: repeats ON → OFF → ON, and gradually lengthens intervals at which intermittent fan operation is carried out.)
- Motor specifically provided for head swing operation

2.2 INPUT KEYS AND OPERATION

- On/Air flow key . . . . . Air velocity changes from Low, to Medium, to High, then to Low by repeatedly pressing the key. Initially low is selected. The LED indication corresponds to the air velocity.
- Timer key . . . . . Timer length changes from 30 minutes to 1 hour, to 2 hours, to Timer-OFF, then to 30 minutes by repeatedly pressing the key. The LED indication corresponds to the timer length.
- Sleeping Timer key . . . . Sleeping Timer length changes from 1 hour, to 2 hours, to 4 hours, to Sleeping Timer-OFF, then to 1 hour by repeatedly pressing the key. The LED indication corresponds to the Sleeping Timer length.
  ON → OFF → ON → is repeated in the pattern shown in the following page.

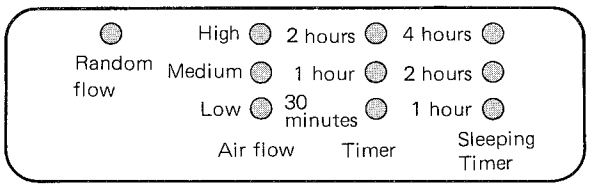


The air flow during ON time can be selected from Low, Medium, High, and random air flows.

- Random key . . . . . When this key is pressed, air flow randomly changes and the random LED illuminates. Normal operation can be resumed by pressing this key again (the random LED also goes OFF).
  By using this key, in conjunction with On/Air flow key, Low random air flow, Medium random air flow, or High random air flow can be selected.
- Head swing key . . . . . When this key is pressed, the fan head swings to left and right, and the head swing LED also illuminates. Head swing can be stopped by pressing this key again (the head swing LED also goes OFF).
- OFF key . . . . . When this key is pressed, all LEDs go off, and the operation of the fan stops.

2.3 DISPLAY

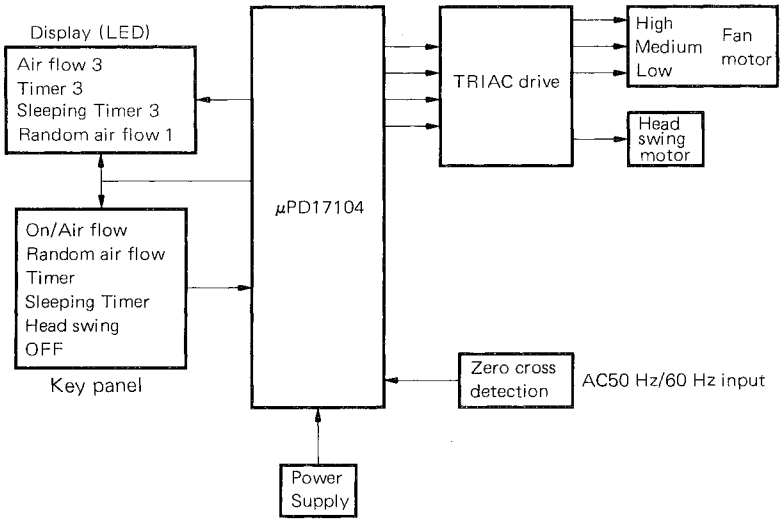
Ten LEDs are used, as shown in the figure below, to indicate such as the air flow's and time.



CHAPTER 3 HARDWARE AND SOFTWARE SPECIFICATIONS

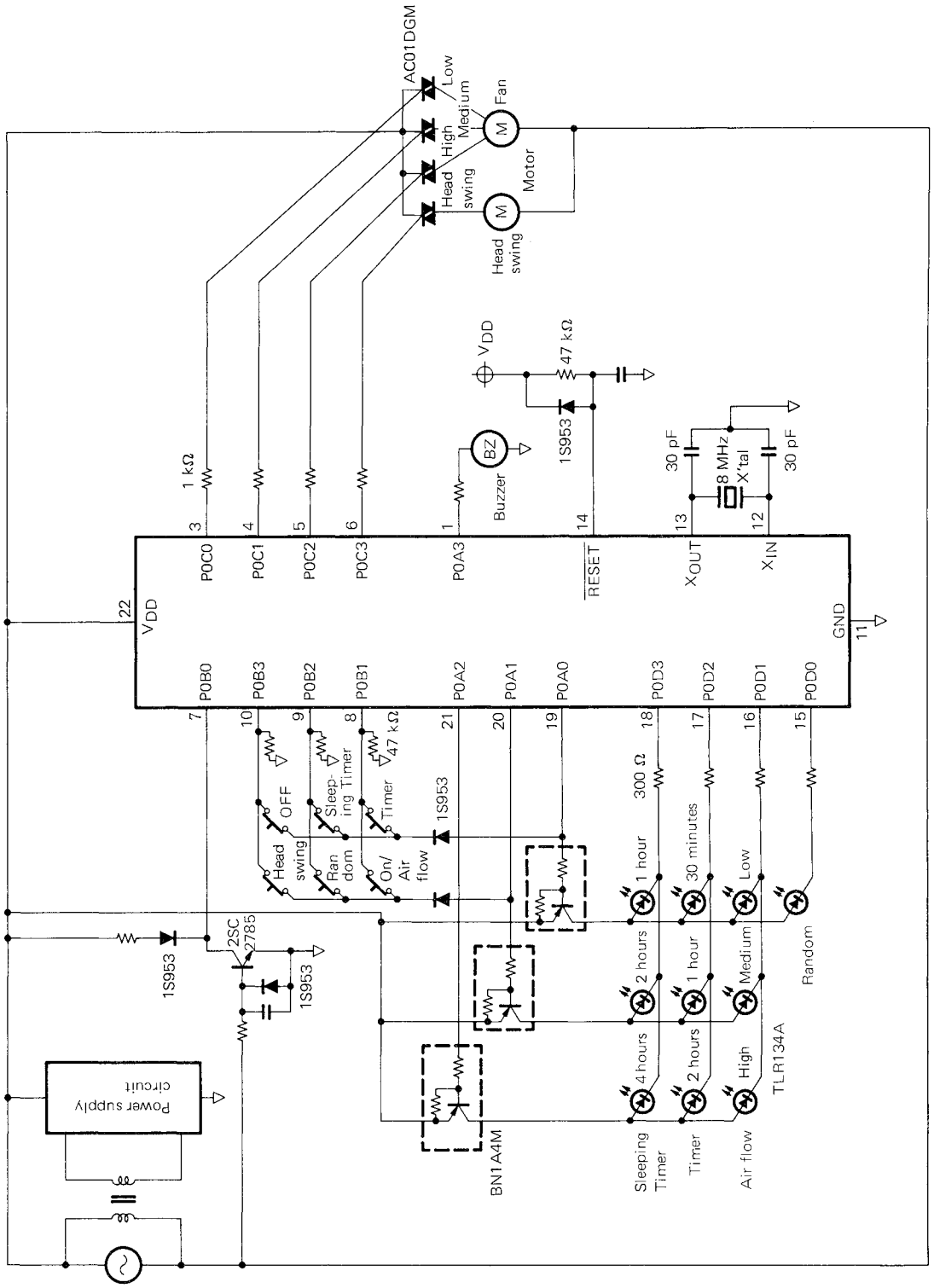
3.1 BLOCK DIAGRAM

The figure below shows a block diagram of this system.



3.2 CIRCUIT DIAGRAM

The figure below shows a circuit diagram for the electric fan used in this system (constants are for reference purposes only).



3.3 PORT ASSIGNMENT

Pin No.	Port name	Input/ Output	Signal name	Active level	Condition at Power on Reset (See **Note 1**)	Condition during standby mode		Function etc.
						STOP mode	HALT mode	
1	P0A3	O	Buzzer output	H/L	L	L	–	
2	NC	–	Unused	–	–	–	–	
3	P0C0	O	Low air flow TRIAC output	L	H	H	–	
4	P0C1	O	Medium air flow TRIAC output	L	H	H	–	
5	P0C2	O	High air flow TRIAC output	L	H	H	–	
6	P0C3	O	Head swing TRIAC output	L	H	H	–	
7	P0B0	I	Zero cross detection	H/L	–	–	–	
8	P0B1	I	Key input	H	–	–	–	Standby mode release
9	P0B2	I	Key input	H	–	–	–	
10	P0B3	I	Key input	H	–	–	–	
11	GND	–	–	–	–	–	–	GND potential pin
12	X_{IN}	–	System clock oscillator	–	–	–	–	8 MHz ceramic resonator
13	X_{OUT}	–	System clock oscillator	–	–	–	–	8 MHz ceramic resonator

Note 1: Before initial setting

(continued)

Pin No.	Port name	Input/ Output	Signal name	Active level	Condition at Power on Reset (See **Note 1**)	Condition during standby mode		Function etc.
						STOP mode	HALT mode	
14	$\overline{\text{RESET}}$	I	Reset	L	—	—	—	CPU reset pin
15	P0D0	O	LED segment signal output	L	H	H	—	
16	P0D1	O	LED segment signal output	L	H	H	—	
17	P0D2	O	LED segment signal output	L	H	H	—	
18	P0D3	O	LED segment signal output	L	H	H	—	
19	P0A0	O	LED digit signal output/key scan 1 signal output	**Note 2**	L	L	—	
20	P0A1	O	LED digit signal output/key scan 2 signal output	**Note 2**	L	H	—	
21	P0A2	O	LED digit signal output	L	H	H	—	
22	V_{DD}	—	—	—	—	—	—	Positive power supply pin

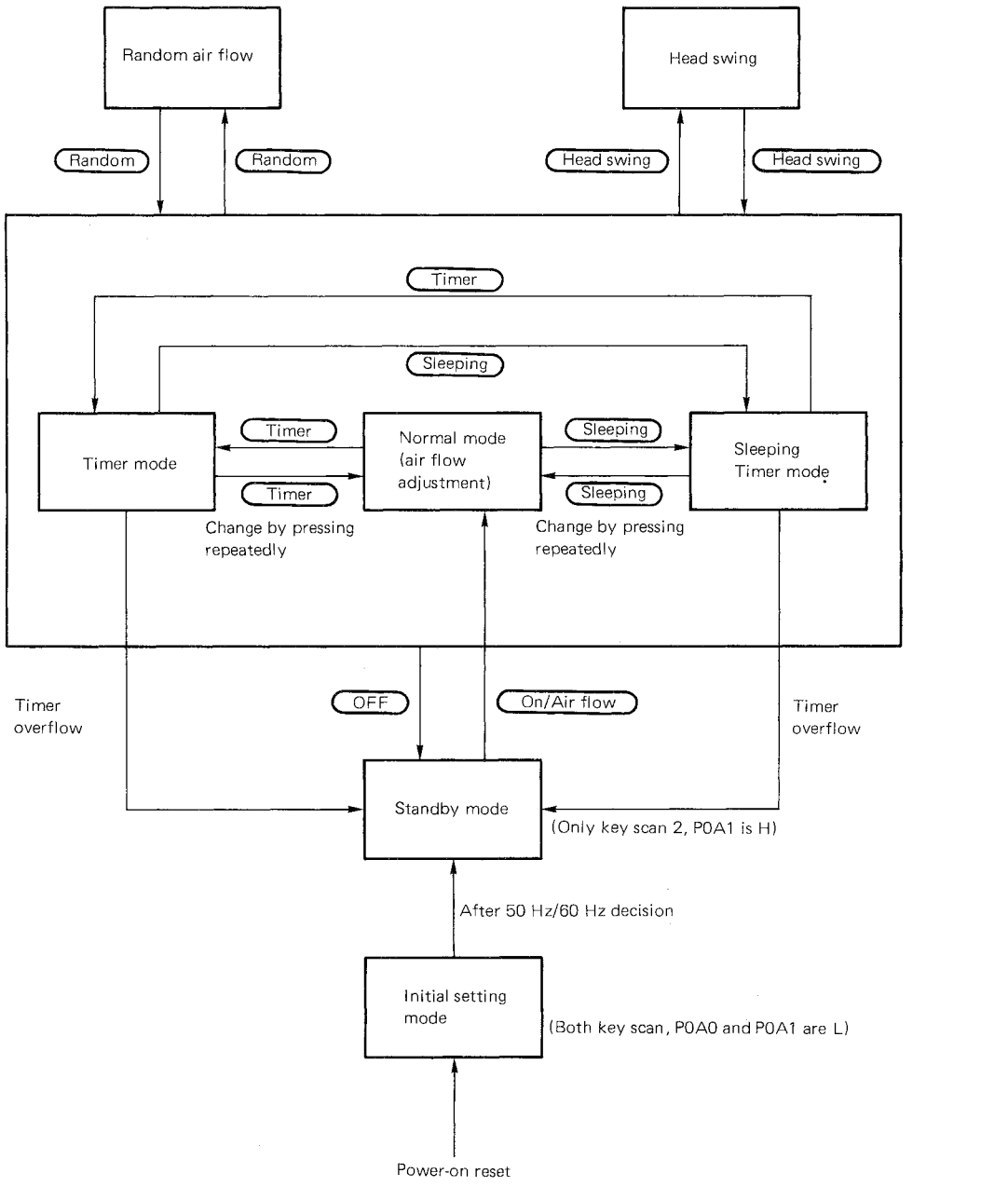
Note 1: Before initial setting

2: Pins 19 and 20 Active low for LED digit
Active high for key scan

3.4 STATUS TRANSITION DIAGRAM AND STATUS TRANSITION TABLE

The figure below shows status transition of this system for key input.

(1) Status transition diagram



(2) Status transition table

Key input / Status	On/Air flow	Timer	Sleeping timer	Random	Head swing	Off	Time overflow	After 60 Hz/ 50 Hz decision
Normal mode	○	Timer mode	Sleeping Timer mode	○	○	Standby mode	—	—
Timer mode	○	Timer length change. Moving to normal mode is possible	Sleeping Timer mode	○	○	Standby mode	Standby mode	—
Sleeping Timer mode	○	Timer mode	Timer length change. Moving to normal mode is possible	○	○	Standby mode	Standby mode	—
Standby mode	Normal mode	—	—	—	—	—	—	—
Initial setting		—	—	—	—	—	—	Standby mode

○: Mode is not changed, but processing is carried out in the respective mode.
—: Input is invalid.

3.5 DESCRIPTION OF EACH MODE

(1) Initial setting mode

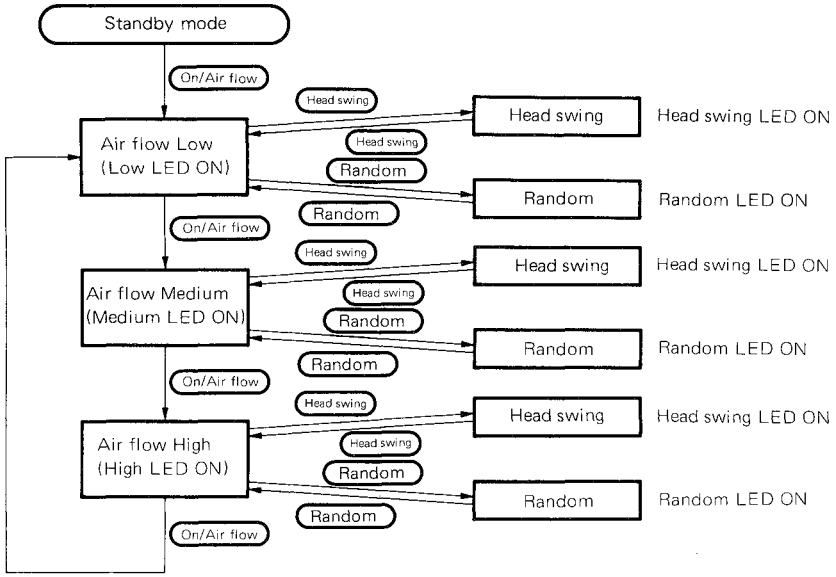
After power-on reset, checks the frequency of the AC power supply pulse (reference pulse of various control timings) input to the P0B0 pin to determine whether the frequency is 50 Hz or 60 Hz, then enters the standby mode.

(2) Standby mode

All operations are stopped and the system enters the standby mode (STOP mode). The standby mode is released only when the On/Air flow key is pressed.

(3) Normal mode

When the On/Air flow key is pressed in the standby mode, the system enters the Normal mode, and the fan starts to operate at Low speed without head swing. Then, status change, as shown in the figure below, becomes possible. Air flow, head swing, and random air flow can be independently set.

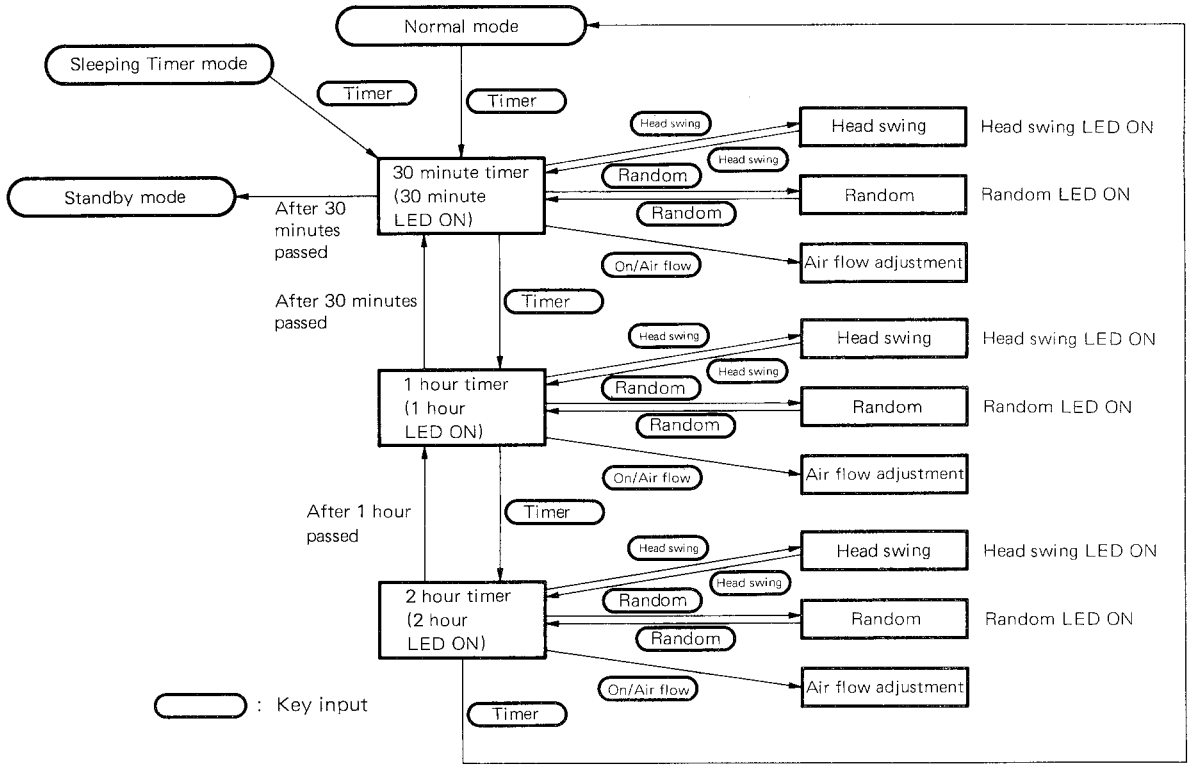


* Air flow indication LED is always ON

: Key input

(4) Timer mode

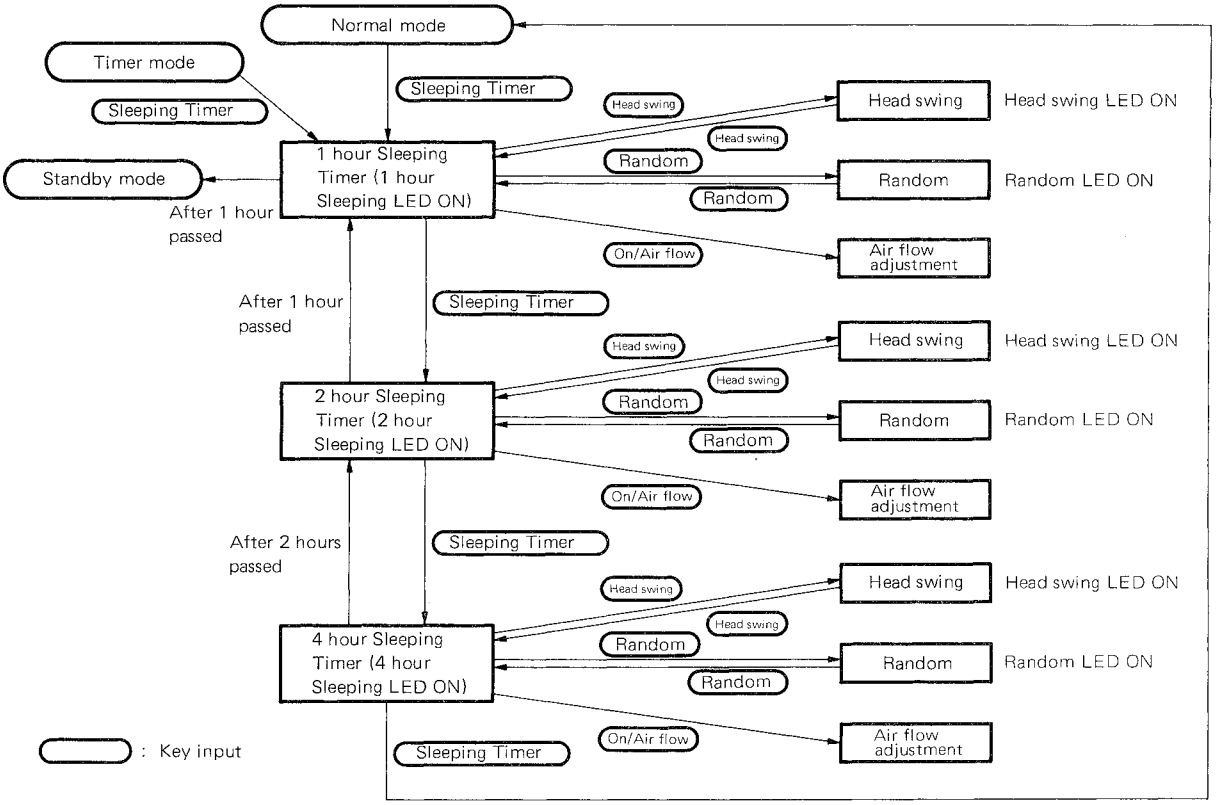
When the timer key is pressed in the Normal mode or the Sleeping Timer mode, the system enters this mode, and the 30 minutes timer is set. Then, status change, as shown in the figure below, becomes possible. LED indication changes as time passes, and the system enters the standby mode after the specified time passed (timer overflow).



(5) Sleeping Timer mode

When the Sleeping Timer key is pressed in the Normal mode or the Timer mode, the system enters this mode, and the 1 hour sleeping timer is set. Then, status change, as shown in the figure below, becomes possible. The Sleeping Timer length, air flow, head swing, and random air flow can be independently set.

LED indication changes as time passes, and the system enters the standby mode after the specified time passed.



3.6 KEYS

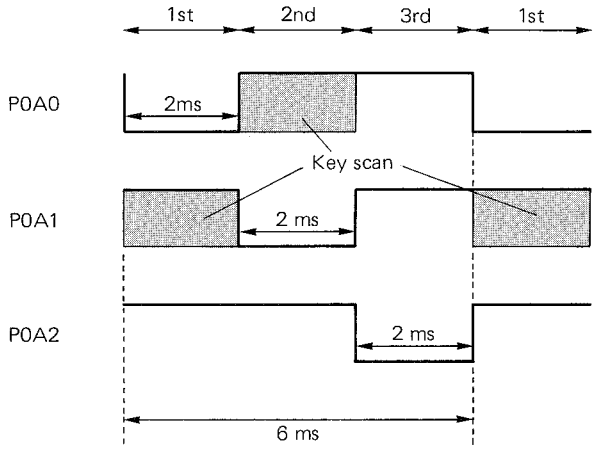
(1) Key and port assignment diagram

P0A0	P0A1	
Timer	On/ Air flow	P0B1/RLS$_{STOP}$
Sleeping Timer	Random	P0B2
OFF	Head swing	P0B3

When a key is pressed, 4 kHz buzzer sounds for 50 ms.

(2) Key scan

The LED display digit signal output pins also serve as key scan signal output pins. Their interval is 6 ms.



The display digit signals are active low, and the key scan signals are active high.

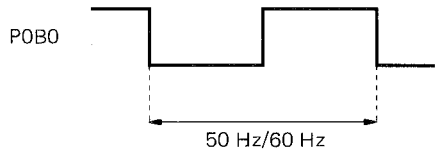
(3) Key valid/invalid table

O: Valid
—: Invalid

Key name / Mode	ON/ Air flow	Timer	Sleeping Timer	Random	Head swing	OFF
Normal mode	O	O	O	O	O	O
Timer mode	O	O	O	O	O	O
Sleeping Timer mode	O	O	O	O	O	O
Standby mode	O	—	—	—	—	—

3.7 ZERO-CROSS PULSE DETECTION

50 Hz/60 Hz AC signal used as the reference pulse for time control for Timer, Sleeping Timer, and random air flow, is detected by software. The duty ratio for the input pulse must be at least 40 %.



3.8 DISPLAY

Display is 1/3 duty dynamic drive LED. Timing is as shown in (3) in 3.6. The table shown below describes the port assignment.

(1) Port assignment table

Segment / Digit	P0D0	P0D1	P0D2	P0D3
P0A0	Random	Air flow (High)	Timer 2 hours	Sleeping Timer 4 hours
P0A1		Air flow (Medium)	Timer 1 hour	Sleeping Timer 2 hours
P0A2		Air flow (Low)	Timer 30 minutes	Sleeping Timer 1 hour

Both segments and digits are active low.

(2) Key processing

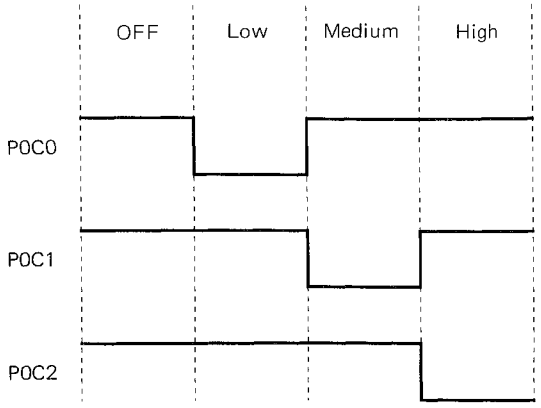
Key name	Condition	Processing		
		When pressed once	When held down	Multiple pressing
On/Air flow	During standby	Enters the Normal mode, and operates with Low air flow.	No change unless Key is released.	Invalid
	During Normal mode	Air flow can be changed from Low to Medium, to High, then to Low by pressing repeatedly.		
Random	Other than standby mode	When pressed once, random operation, in which the air flow is randomly changed, is carried out. When pressed again, the random operation is stopped and the normal operation will be resumed.	Same as above	Invalid
Head swing	Same as above	Swings the head to left and right. When pressed again, head swing operation will be stopped.	Same as above	Invalid
Timer	Same as above	When pressed once, the timer is set to 30 minutes. When repeatedly pressed, setting will be changed to 1 hour, to 2 hours, to timer off, then to 30 minutes.	Same as above	Invalid
Sleeping Timer	Same as above	ON → OFF → ON will be repeated. The OFF period will be gradually increased. Initially, the total time is set to 1 hour. When repeatedly pressed, setting can be changed to 2 hours, to 4 hours, then to OFF.	Same as above	Invalid
OFF	Same as above	Stops all operations, and enters the standby mode	Same as above	Invalid

Chattering is protected up to 30 ms for both ON and OFF.

3.9 FAN MOTOR CONTROL

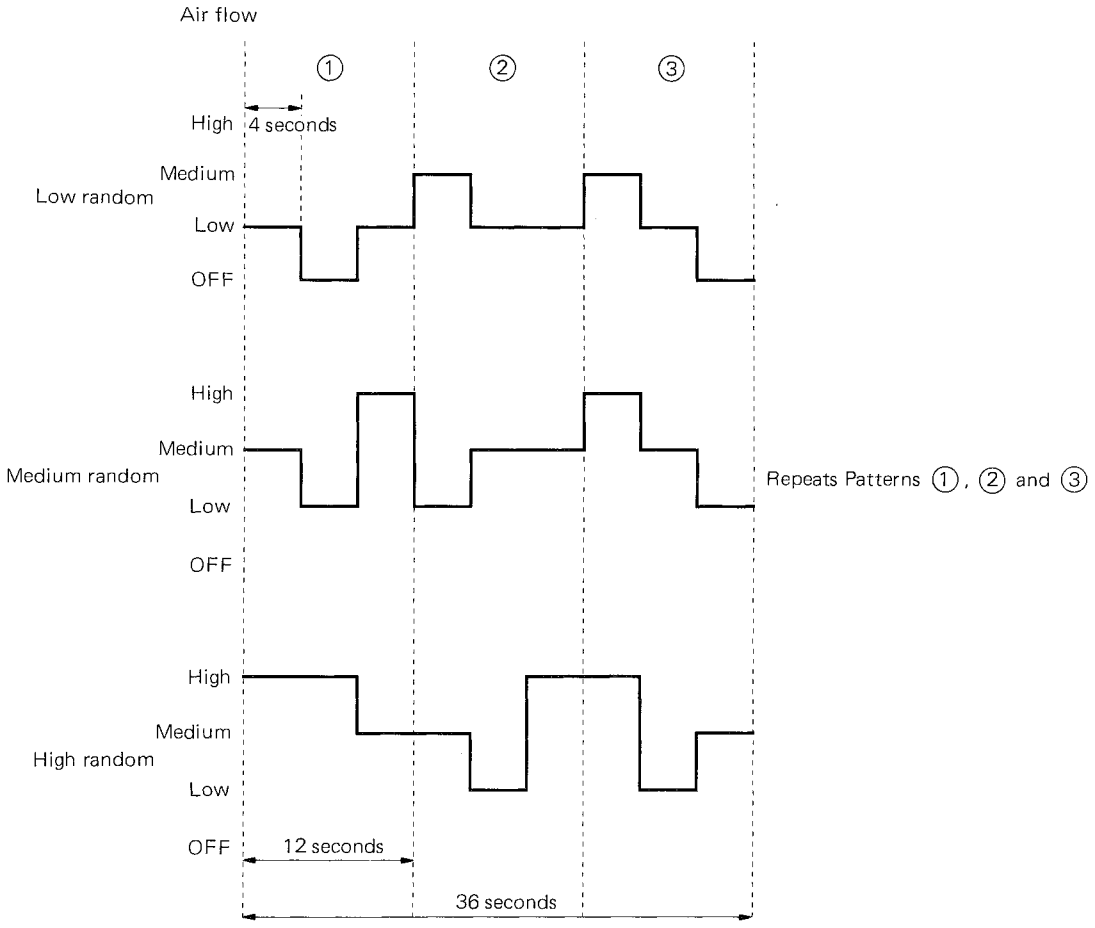
(1) Port output condition for each air flow

The following figure shows the output condition of each port in OFF, Low, Medium, and High air flow. TRIAC, which drives the motor, is turned ON at low level.



(2) Air flow variation pattern for random air flow

Random air flow has three modes; Low random air flow, Medium random air flow, and High random air flow. The figure below shows the variation pattern for the random air flow. The air flow changes in units of 4 seconds, and one cycle is 36 seconds.



(3) Combining Sleeping Timer and random air flow

When random air flow is used in conjunction with Sleeping Timer, stop period is periodically inserted into Patterns ①, ② and ③ described in (2). The timing becomes as follows:

Up to 30 minutes . . . . .

After two Patterns among ①, ②, and ③ have been activated, stops for 12 seconds.

① → ② → 12 sec stop → ③ → ① → 12 sec stop → ② → ③ → . . . . .

30 minutes to 1 hour . . . . .

After each of Patterns ①, ②, and ③ has been activated, stops for 12 seconds.

① → 12 sec stop → ② → 12 sec stop → ③ → 12 sec stop → ① → . . . . .

1 to 1.5 hours . . . . . .

After each of Patterns ①, ②, and ③ has been activated, stops for 24 seconds.

① → 24 sec stop → ② → 24 sec stop → ③ → 24 sec stop → ① → . . . . .

1.5 to 2 hours . . . . .

After each of Patterns ①, ②, and ③ has been activated, stops for 36 seconds.

① → 36 sec stop → ② → 36 sec stop → ③ → 36 sec stop → ① → . . . . .

2 to 3 hours . . . . .

After each of Patterns ①, ②, and ③ has been activated, stops for 48 seconds.

① → 48 sec stop → ② → 48 sec stop → ③ → 48 sec stop → ① → . . . . .

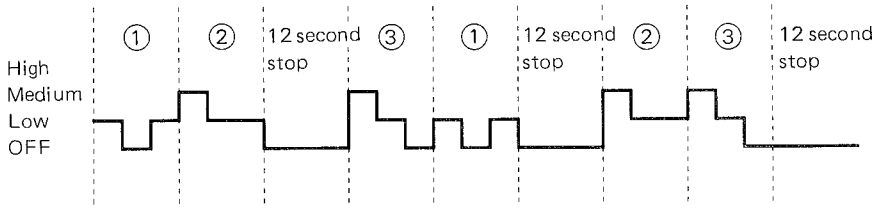
3 to 4 hours . . . . .

After each of Patterns ①, ②, and ③ has been activated, stops for 60 seconds.

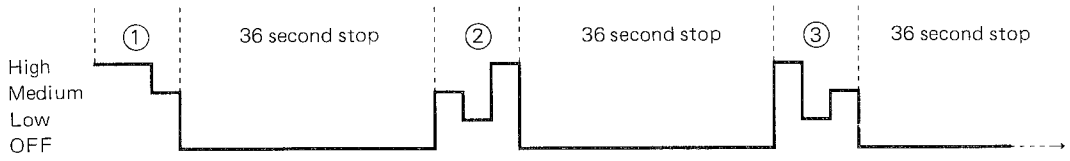
① → 60 sec stop → ② → 60 sec stop → ③ → 60 sec stop → ① → . . . . .

The following shows examples of air flow change, when random air flow is used in conjunction with the Sleeping Timer:

Example 1: Low random air flow up to 30 minutes



Example 2: High random air flow during 1.5 to 2 hours



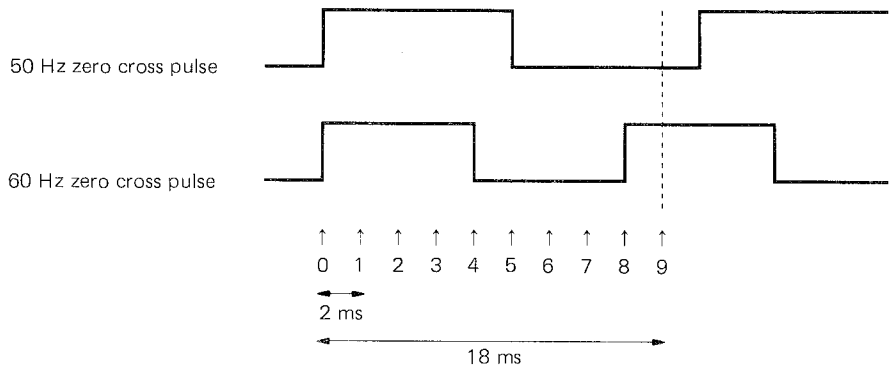
CHAPTER 4 CONTROL PROGRAM

4.1 ALGORITHM

The steps in this program are adjusted in such a manner that the main routine is repeated in 2 ms. In each cycle, key scan signal and LED digit signal outputs are switched.

Zero cross pulses from the P0B0 pin are counted to generate the period of Timer, Sleeping Timer, and the random air flow patterns. If the line frequency is 50 Hz, 200 counts are equivalent to 4 seconds. 240 counts are required to generate 4 seconds, when the line frequency is 60 Hz.

50 Hz/60 Hz decision is made in the following manner during initial setting.

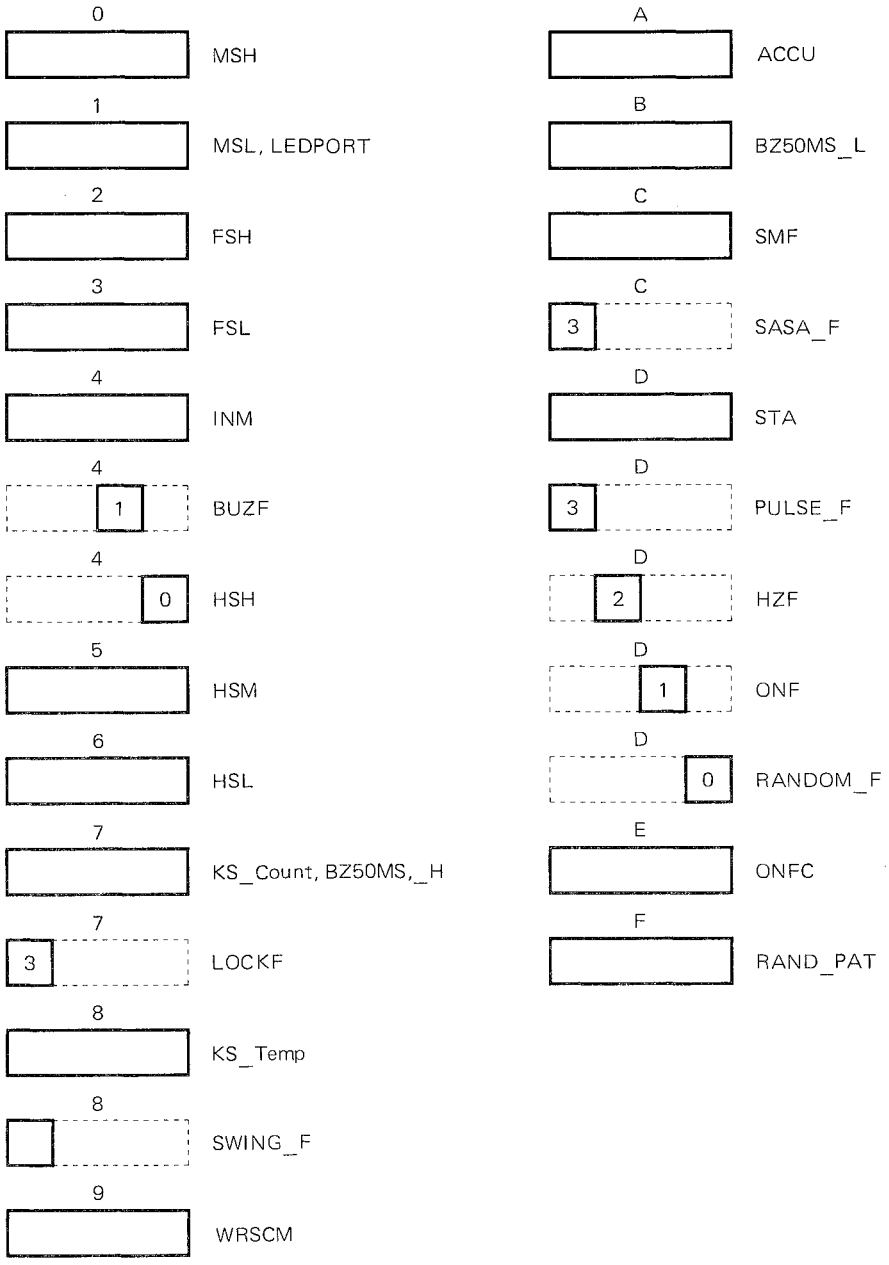


The P0B0 pin level is checked every 2 ms after the zero cross pulse changes from "L" to "H". If the pin level is "L", when the 9th check is made (after 18 ms),the frequency is 50 Hz. If it is "H", the frequency is determined to be 60 Hz.

The TRIAC, which drives the motor, is not controlled in synchronization with the AC frequency, but is controlled with DC level.

4.2 RAM MAP (Description of Symbols and Flags)

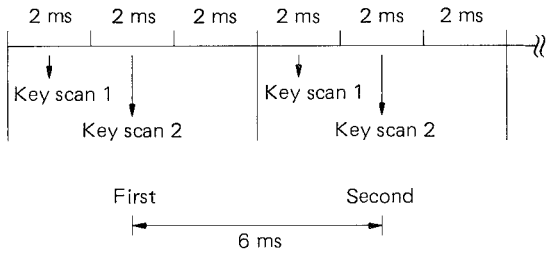
Address 0X

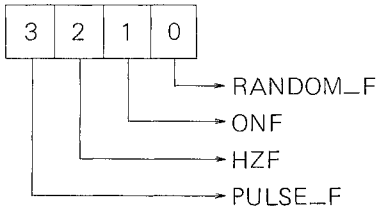


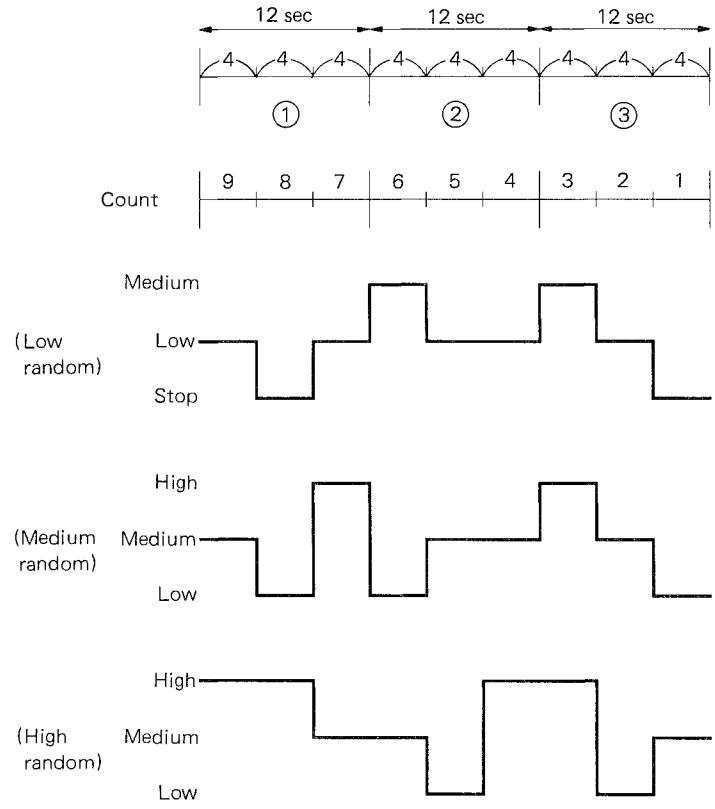
Address 7X

Description of symbols and flags

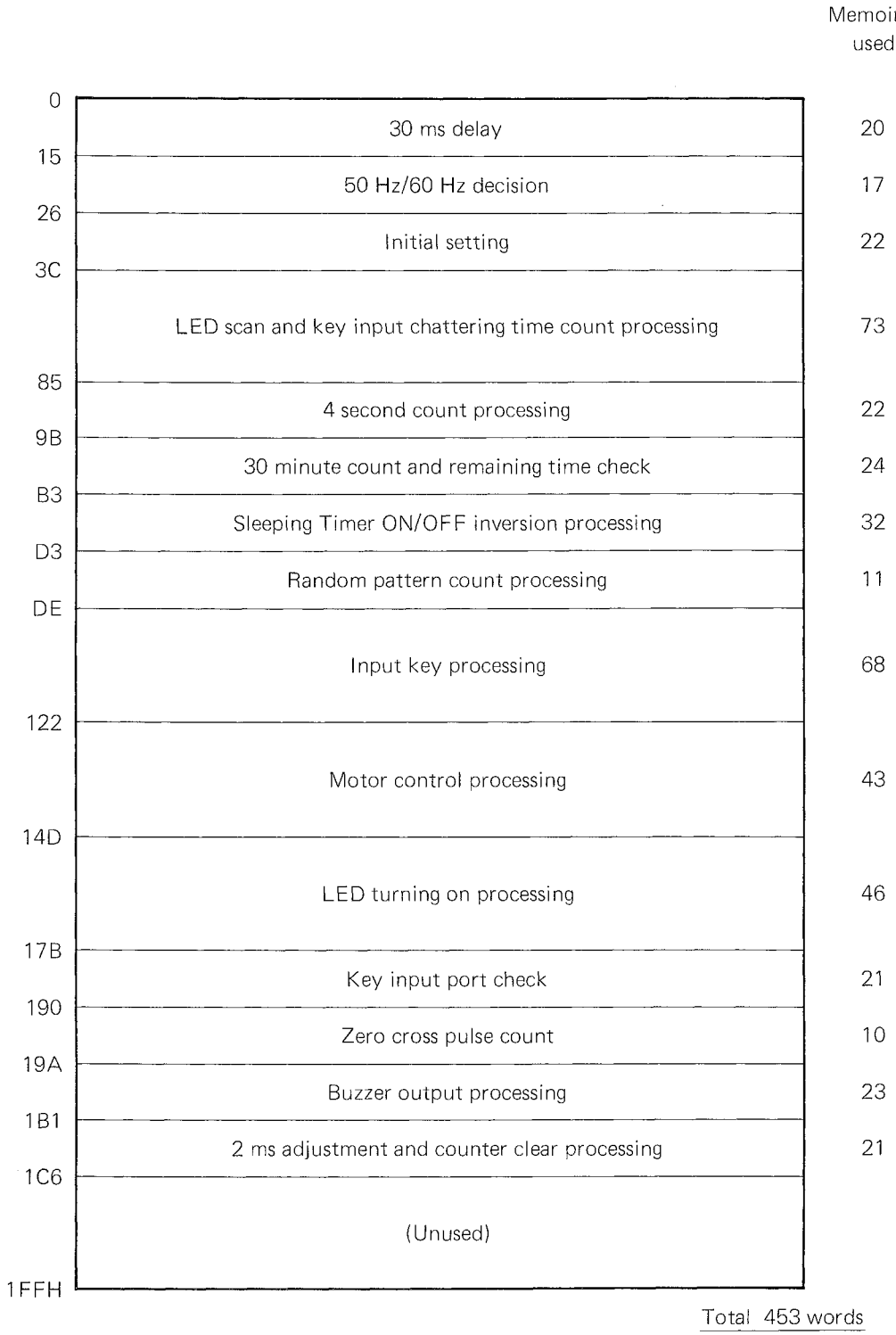
Symbol and flag	Name	Description
BUZF	Buzzer flag	The flag is set when initial setting is made or when a key input is determined to be valid. The flag is reset after 50 ms buzzer output.
LOCKF	Lock flag	The flag is set after 36 ms (chattering protect time) are counted or when multiple keys are depressed. The flag is reset when the key is released.
SWING_F	Head swing flag	This flag is set during head swing operation.
SASA_F	Sleeping Timer flag	This flag is set during the Sleeping Timer mode.
PULSE_F	Pulse flag	This flag is set when zero cross pulse is "H", and reset when it is "L".
HZF	HZ flag	This flag is set when zero cross pulse is 60 Hz.
ONF	ON/OFF flag	This flag is set during the Normal mode, Timer mode, or Sleeping Timer mode operation. This flag is reset during stop periods for the Sleeping Timer mode.
RANDOM_F	Random flag	This flag is set during the random air flow mode.
MSH	2 ms counter (upper)	These are used as a temporary counter, in order to adjust the main routine time to 2 ms, and to count 124 μs of buzzer output. Additionally, these are used to count 30 ms before initiating determination of 50 Hz/60 Hz after power-on setting, and to count 18 ms to determine whether the line frequency is 50 Hz or 60 Hz. In this case, 1 count is made every 5 instruction executions (10 μs).
MSL	2 ms counter (lower)	
LEDPORT	LED signal output register	This is a temporary register, which temporarily stores the LED segment data.
FSH	4 sec. counter (upper)	This counter counts 4 seconds to control time for the Timer, Sleeping Timer, and random air flow. 1 count is made every zero cross pulse. Additionally, these are used to count 30 ms before initiating determination of 50 Hz/60 Hz after power-on setting, and to count 18 ms to determine whether the line frequency is 50 Hz or 60 Hz. In this case, 1 count is made every 2 ms (after counting MSH, MSL).
FSL	4 sec. counter (lower)	
INM	Sleeping Timer set period register	3 2 x x : : : : 0 0 x x Unused 0 1 x x Sleeping Timer set to 1 hr 1 0 x x Sleeping Timer set to 2 hrs 1 1 x x Sleeping Timer set to 4 hrs

<table>
<tr><th>Symbol and flag</th><th>Name</th><th colspan="2">Description</th></tr>
<tr><td>HSH</td><td>30 min. counter (upper)</td><td colspan="2" rowspan="3">Timer, Sleeping Timer time control counter. Counts one every 4 seconds (after counting FSL, FSH)</td></tr>
<tr><td>HSM</td><td>30 min. counter (middle)</td></tr>
<tr><td>HSL</td><td>30 min. counter (lower)</td></tr>
<tr><td>KS_Count</td><td>Key scan counter</td><td colspan="2">Chattering time counter. Lower 3 bits of address 07H are used. Port is checked every 6 ms. When "H" is counted six time, the key input is recognized as valid input, then the lock flag is set. This counter is cleared when the key is released.
 
</td></tr>
<tr><td>BZ50MS_H</td><td>Buzzer 50 ms counter (upper)</td><td>Bit 0 of address 07H is used.</td><td rowspan="2">Counts buzzer output time 50 ms. When the buzzer flag is set, counts one every 2 ms.</td></tr>
<tr><td>BZ50MS_L</td><td>Buzzer 50 ms counter (lower)</td><td></td></tr>
<tr><td>KS_Temp</td><td>Key input status register</td><td colspan="2">This register indicates which key is pressed.
<table>
<tr><th>x</th><th>2</th><th>1</th><th>0</th></tr>
</table>
x 0 0 0 ..... No key input
x 0 0 1 ..... Air flow key
x 0 1 0 ..... Random key
x 0 1 1 ..... Head swing key
x 1 0 0 ..... Multiple key depressing
x 1 0 1 ..... Timer key
x 1 1 0 ..... Sleeping Timer key
x 1 1 1 ..... OFF key</td></tr>
</table>

<table>
<tr><th>Symbol and flag</th><th>Name</th><th>Description</th></tr>
<tr><td>WRSCM</td><td>Air flow status register
LED scan mode register</td><td>The upper 2 bits indicate the current air flow status, and the lower 2 bits indicate the status of the LED scan mode.
<table>
<tr><th>3</th><th>2</th><th>x</th><th>x</th><th></th><th>x</th><th>x</th><th>1</th><th>0</th><th></th></tr>
<tr><td>0</td><td>1</td><td>x</td><td>x</td><td>Low</td><td>x</td><td>x</td><td>0</td><td>1</td><td>1st scan</td></tr>
<tr><td>1</td><td>0</td><td>x</td><td>x</td><td>Medium</td><td>x</td><td>x</td><td>1</td><td>0</td><td>2nd scan</td></tr>
<tr><td>1</td><td>1</td><td>x</td><td>x</td><td>High</td><td>x</td><td>x</td><td>1</td><td>1</td><td>3rd scan</td></tr>
</table></td></tr>
<tr><td>ACCU</td><td>General register</td><td>This register temporarily stores data.</td></tr>
<tr><td>SMF</td><td>Timer/
Sleeping Timer
status register</td><td>This register indicates the remaining time of the Timer and Sleeping Timer. When other than in the Normal mode, the contents are decremented (−1) every 30 minutes, and enters the standby mode when the specified time passed.
<table>
<tr><th>3</th><th>2</th><th>1</th><th>0</th><th></th><th></th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>..... Timer</td><td>0.5 h</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>.....</td><td>1 h</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>.....</td><td>1.5 h</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>.....</td><td>2 h</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>..... Normal mode</td><td></td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>..... Sleeping Timer</td><td>0.5 h</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>.....</td><td>1 h</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>.....</td><td>1.5 h</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>.....</td><td>2 h</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>.....</td><td>2.5 h</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>.....</td><td>3 h</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>.....</td><td>3.5 h</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>.....</td><td>4 h</td></tr>
</table></td></tr>
<tr><td>STA</td><td>Status flag register</td><td> 
</td></tr>
</table>

<table>
<tr><th>Symbol and flag</th><th>Name</th><th>Description</th></tr>
<tr><td>ONFC</td><td>Sleeping Timer pattern counter</td><td>Used for counting the operation time and stop time in the Sleeping Timer. The contents are decremented (−1) every 4 seconds, and ON/OFF is inverted when the contents become 0.
<table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr></table>0 0 1 1 ..... 12 seconds
0 1 1 0 ..... 24 seconds
1 0 0 1 ..... 36 seconds
1 1 0 0 ..... 48 seconds
1 1 1 1 ..... 60 seconds</td></tr>
<tr><td>RAND_PAT</td><td>Random pattern counter</td><td>This counter exchanges random patterns. Initial value is 9, and the contents are decremented (−1) every 4 seconds. The value returns to 9 when the contents become 0.
 
</td></tr>
</table>

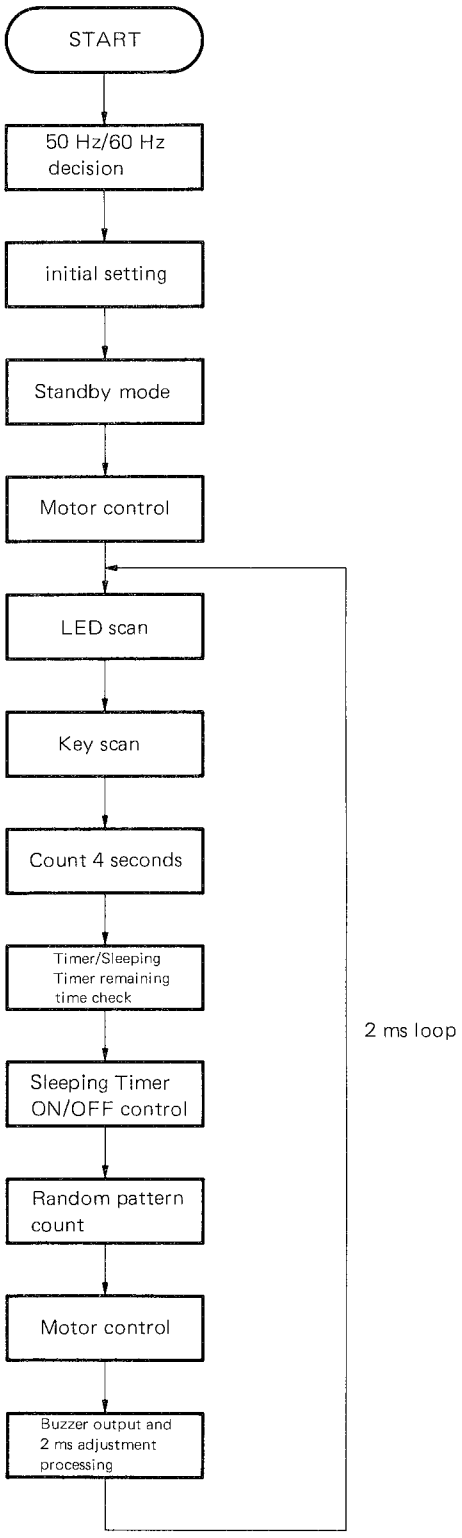
4.3 MEMORY MAP



4.4 GENERAL FLOW CHART

The figure below shows the general flow for this program.

Time adjustment subroutines or NOP instructions are inserted for this program, in various locations of each branch destination, so that the execution time for the main routine becomes 2 ms.



4.5 DETAILED FLOW CHART

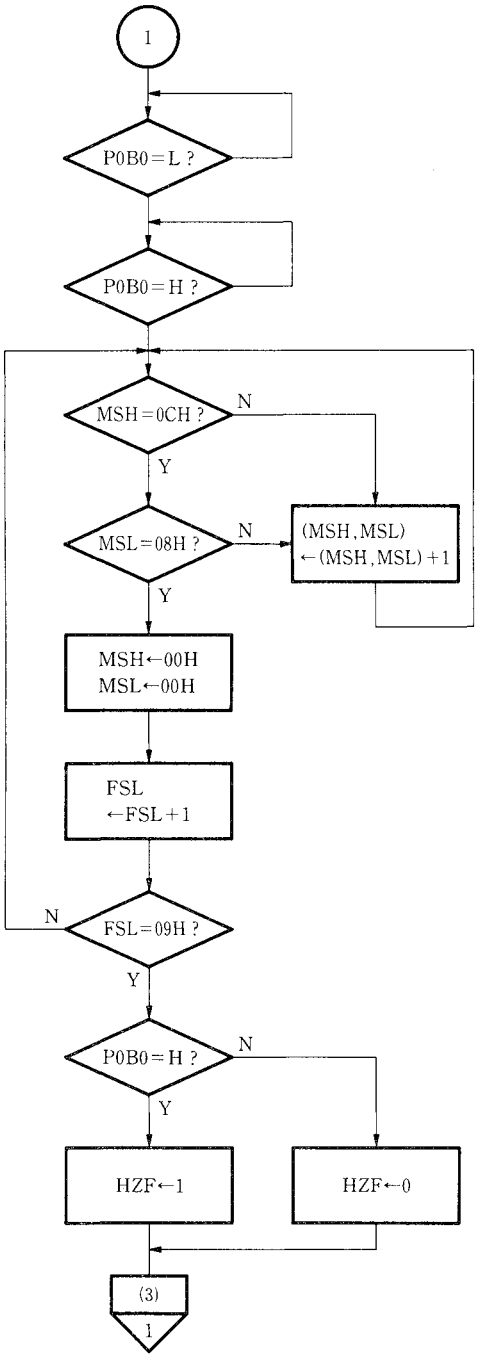
4.5.1 30 ms Delay

(1)

Input variable	Flow chart	Processing, remarks	Output variable
	START		
	MSH←00H MSL←00H	Clears 2 ms counter	MSH MSL
	FSH←00H FSL←00H	Clears 4 ms counter	FSH FSL
MSL MSH	MSH=0CH ? N Y HSL=08H ? N → (MSH,MSL) ←(MSH,MSL)+1	10 ms (5 instructions) x 200 = 2 ms count	MSH MSL
	MSH←00H MSL←00H	Clears 2 ms counter	MSH MSL
FSL	FSL ←FSL+1		FSL
	N FSL=0FH ? Y	2 ms x 15 counts? Yes: 30 ms has passed	
	P0A←0100B P0C←1111B P0D←1111B	Sets output port to reset state	P0A P0C P0D
	MSH←00H MSL←00H	Clears 2 ms counter	MSH MSL
	FSH←00H FSL←00H		FSH FSL
	(2) 1		

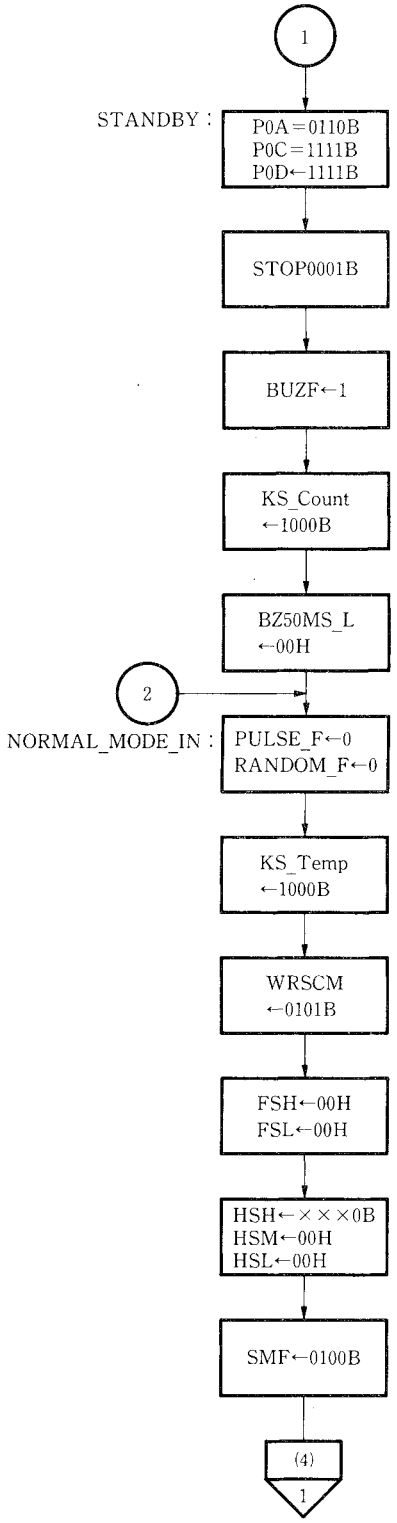
4.5.2 50 Hz/60 Hz Decision

(2)

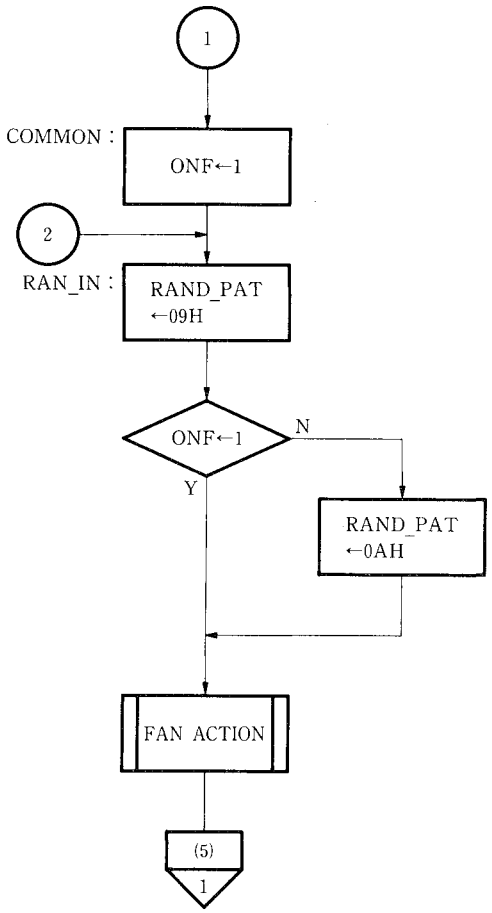
Input variable	Flow chart	Processing, remarks	Output variable
		Waits until zero cross pulse becomes "L" Waits until zero cross pulse becomes "H" (Checks the point at which "L" changes to "H") Counts 2 ms	MSH MSH MSL
MSH MSL			MSH MSL
FSL		2 ms x 9 counts? Yes: 18 ms has passed	FSL
		Sets HZF (60 Hz), if the level of the zero cross pulse is "H" when 18 ms has passed after it changed from "L" to "H", and reset HZF (50 Hz), if it is "L".	HZF

4.5.3 Initial Setting

(3)

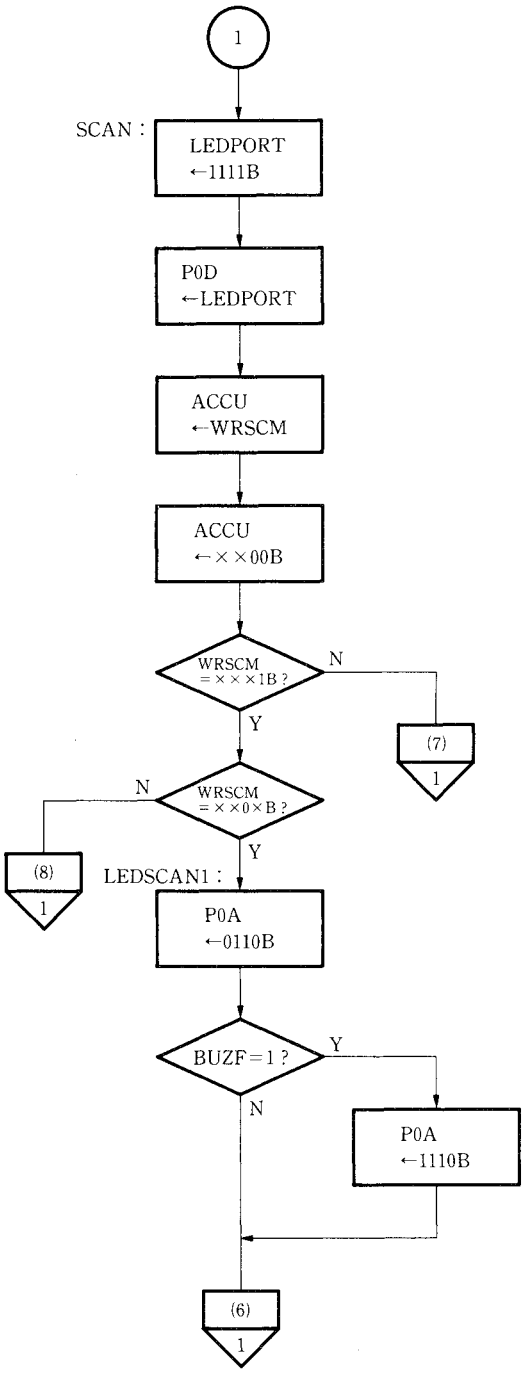
Input variable	Flow chart	Processing, remarks	Output variable
		Sets output port to the standby state	P0A P0C P0D
		Releases the standby mode at the rising edge of P0B1 (On/ Air flow key input)	
		Sets the buzzer flag	BUZF
		Sets the lock flag and clears the key scan counter	KS_Count
		Clears the buzzer 50 ms counter	BZ50MS_L
		Resets the pulse flag and random flag	PULSE_F RANDOM_F
		Sets head swing to OFF, and no input key	KS_Temp
		Sets to Low air flow and 1st scan mode	WRSCM
		Clears 4 second counter	FSH FSL
		Clears 30 minute counter	HSH HSM HSL
		Sets to the normal mode	SMF

(4)

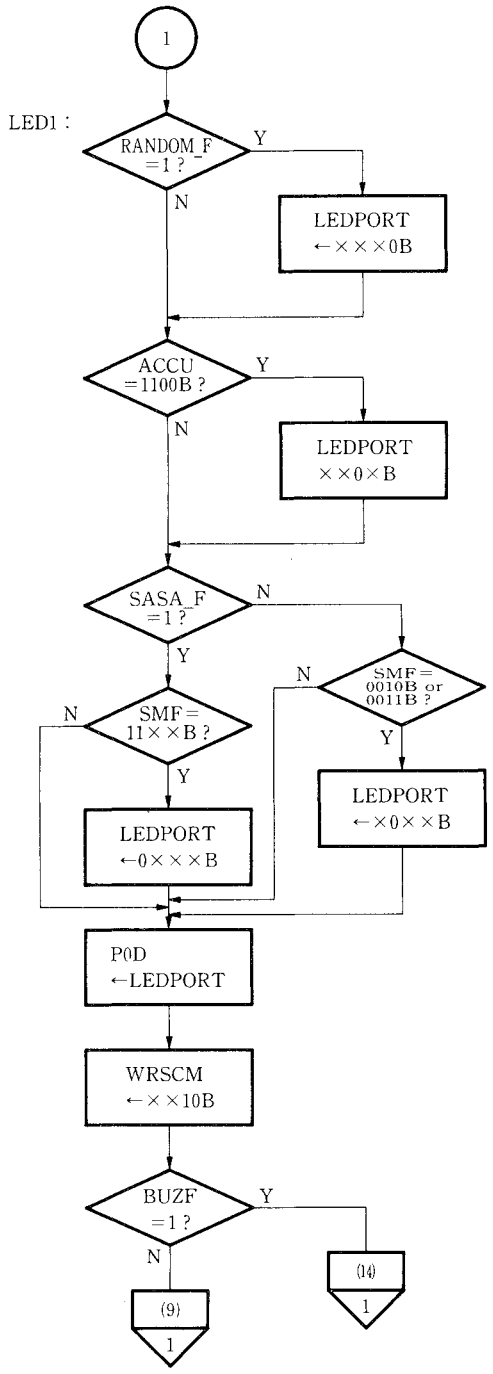
Input variable	Flow chart	Processing, remarks	Output variable
		Sets ON/OFF flag (sets to operation mode) Sets the random pattern count value to 9 Operation mode? If it is the stop mode, resets the random pattern count value Motor control subroutine	ONF RAND_PAT RAND_PAT

4.5.4 LED Scan

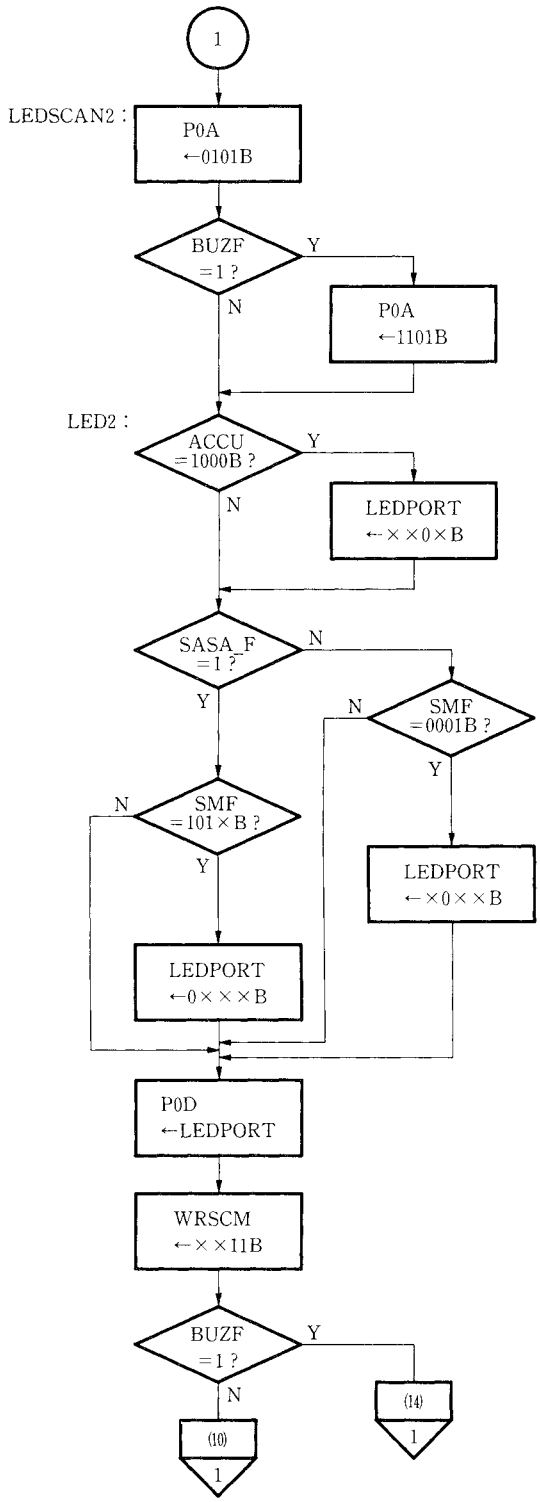
(5)

Input variable	Flow chart	Processing, remarks	Output variable
		Sets all LED segment outputs to "H" (turns all LEDs off)	LEDPORT
LEDPORT			P0D
WRSCM		Stores the air flow condition to the general register	ACCU
			ACCU
		1st or 3rd scan mode?	
		1st scan mode?	
		Sets to 1st scan mode	P0A
		Is buzzer flag set?	
		Sets buzzer output port to "H"	P0A

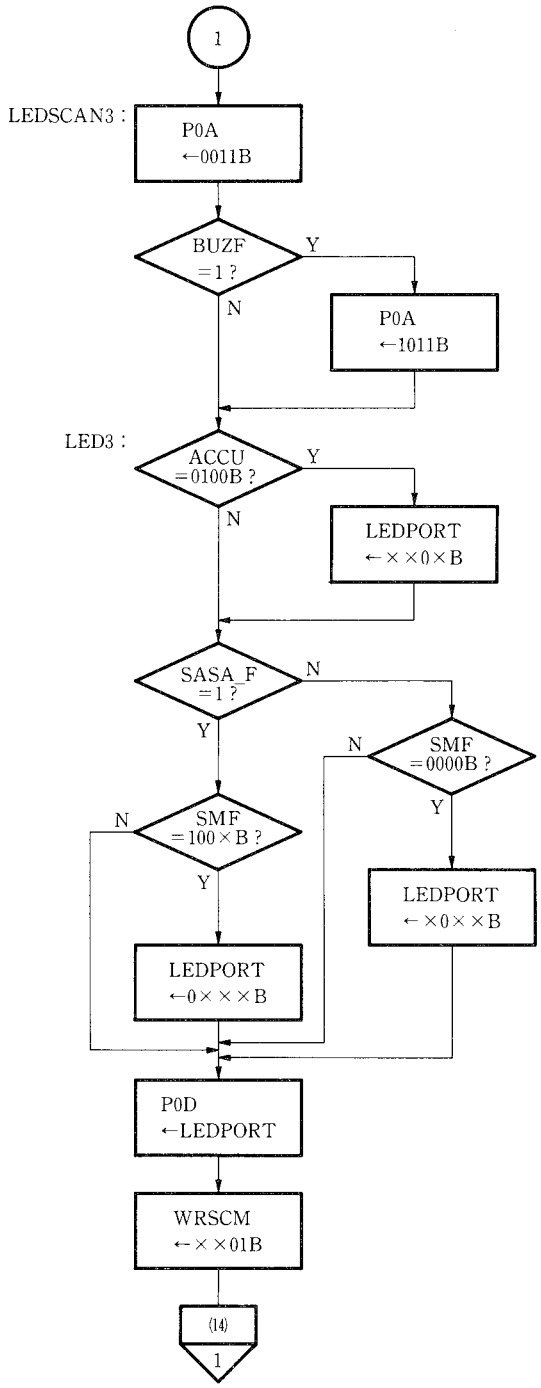
(6)

Input variable	Flow chart	Processing, remarks	Output variable
		(1st LED scan)	
		Random mode?	
		Prepares random LED to turn on	LEDPORT
		High air flow mode?	
		Prepares High air flow LED to turn on	LEDPORT
		Sleeping Timer mode?	
		Is the remaining time of Timer 1 to 2 hrs?	
		Is the remaining time of Sleeping Timer 2 to 4 hrs?	
		Prepares 2 hr timer LED to turn on	LEDPORT
		Prepares 4 hr Sleeping Timer LED to turn on	LEDPORT
LEDPORT		Turn LED on	P0D
		Sets to 2nd LED scan mode	WRSCM
		Is the buzzer flag set?	

(7)

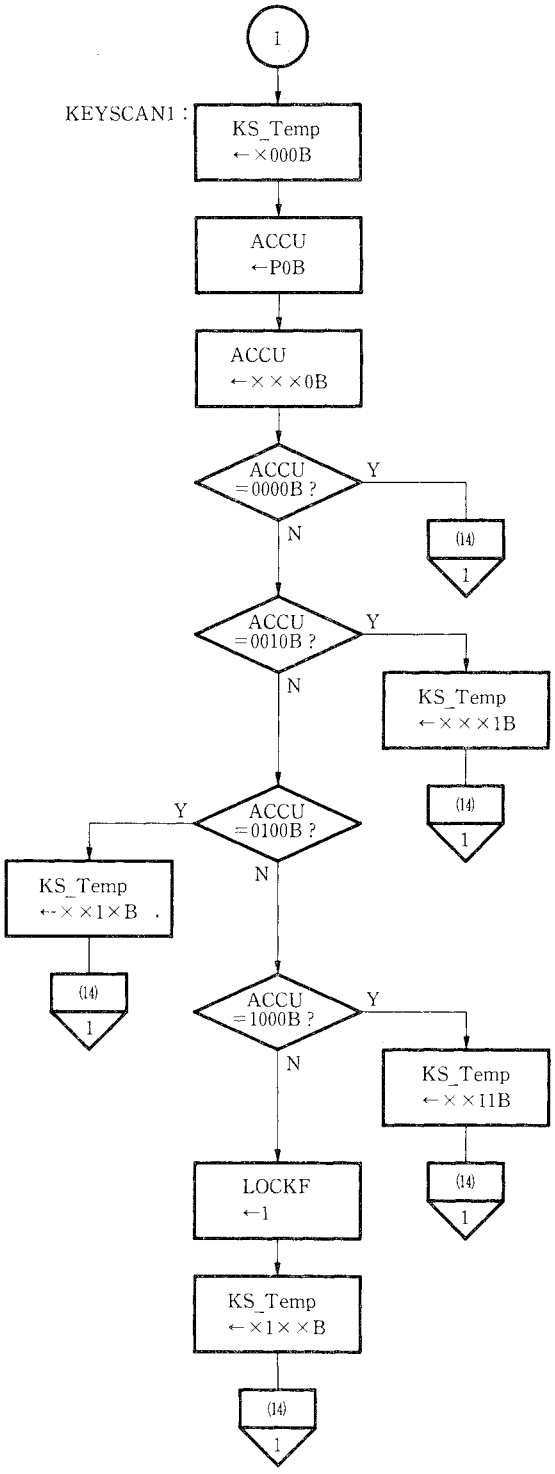
Input variable	Flow chart	Processing, remarks	Output variable
		(2nd LED scan)	
		Sets to 2nd scan mode?	P0A
		Is the buzzer flag set?	
		Sets the buzzer output port to "H"	P0A
		Medium air flow mode?	
		Prepares Medium air flow LED to turn on	LEDPORT
		Sleeping Timer mode?	
		Is the remaining time of Timer 30 min. to 1 hrs?	
		Is the remaining time of Sleeping Timer 1 to 2 hrs?	
		Prepares 1 hr timer LED to turn on	LEDPORT
		Prepares 2 hr Sleeping Timer LED to turn on	LEDPORT
LEDPORT		Turn LED on	P0D
		Sets to 3rd LED scan mode	WRSCM
		Is the buzzer flag set?	

(8)

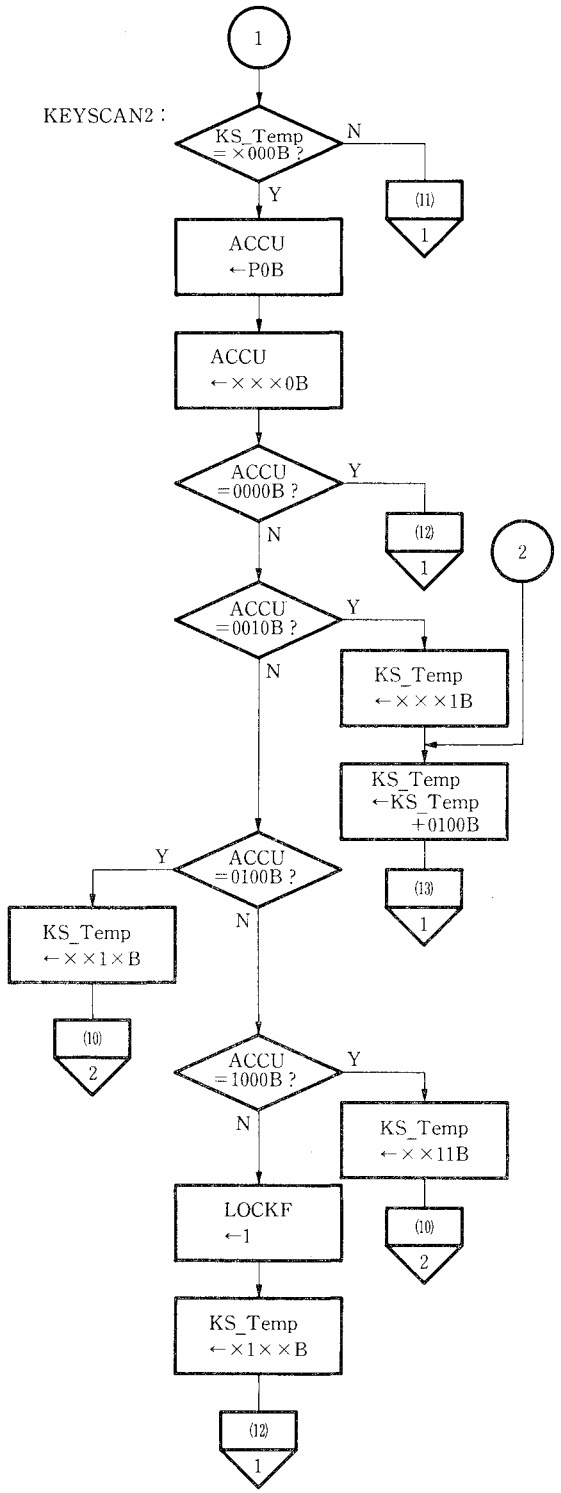
Input variable	Flow chart	Processing, remarks	Output variable
		(3rd LED scan)	
		Sets to 3rd scan mode?	P0A
		Is the buzzer flag set?	
		Sets the buzzer output port to "H"	P0A
		Low air flow mode?	
		Prepares Low air flow LED to turn on	LEDPORT
		Sleeping timer mode?	
		Is the remaining time of Timer 30 min. or less?	
		Is the remaining time of Sleeping Timer 1 hr or less?	
		Prepares 30 minute timer LED to turn on	LEDPORT
		Prepares 1hr Sleeping Timer LED to turn on	LEDPORT
LEDPORT		Turn LED on	P0D
		Sets to 1st scan mode	WRSCM

4.5.5 Key Scan

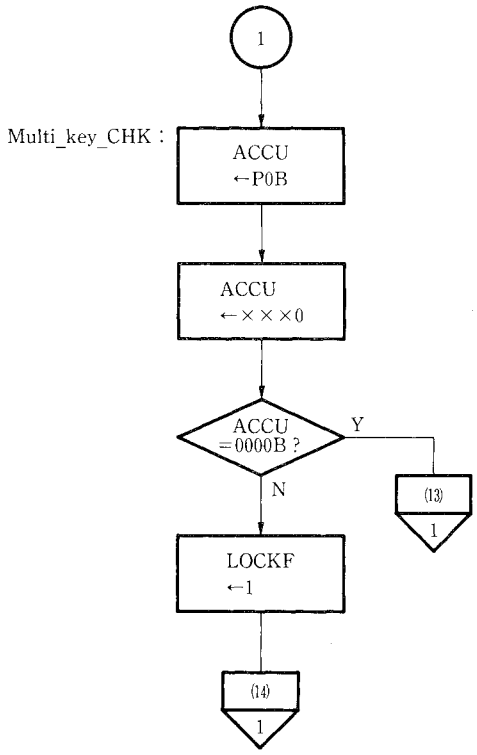
(9)

Input variable	Flow chart	Processing, remarks	Output variable
P0B		1st scan	
		Sets to no key input state	KS_Temp
		Checks key input port	ACCU
		Resets bit 0 only (checks key input only)	ACCU
		No key input?	
		Air flow key input?	
		Temporarily stores air flow key input information	KS_Temp
		Random key input?	
		Temporarily stores random key input information	KS_Temp
		Head swing key input?	
		Temporarily stores head swing key input information	KS_Temp
		Regards multiple keyings, and sets the lock flag	LOCKF
		Sets to multiple keying state	KS_Temp

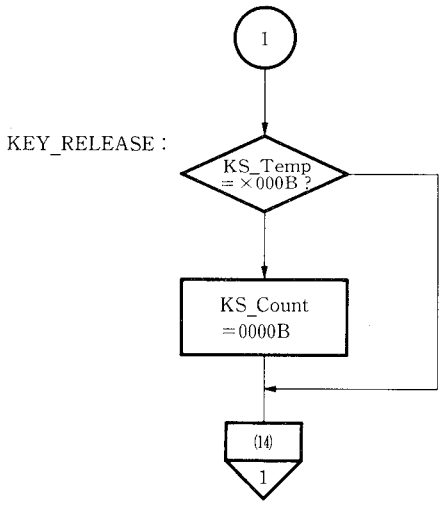
(10)

Input variable	Flow chart	Processing, remarks	Output variable
		2nd scan	
		No key input in 1st scan?	
P0B		Checks key input port	ACCU
		Resets bit 0 only (checks key input only)	ACCU
		No key input?	
		Timer key input?	
		Temporarily stores timer key input information	KS_Temp
KS_Temp		Distinguishes from 1st key scan	KS_Temp
		Sleeping Timer key input?	
		Temporarily stores Sleeping Timer key input information	KS_Temp
		OFF key input?	
		Temporarily stores OFF key input information	KS_Temp
		Regards multiple Keyings, and sets the lock flag	LOCKF
		Sets to multiple keying state	KS_Temp

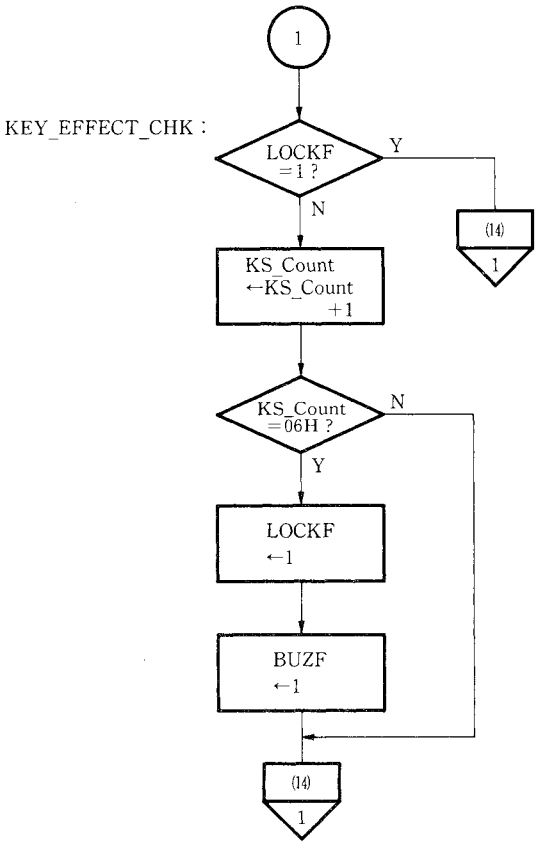
(11)

Input variable	Flow chart	Processing, remarks	Output variable
P0B		Multiple keying check Key input port check Resets bit 0 only (checks key input only) No key input? Regards multiple Keyings, and sets the lock flag	 ACCU ACCU LOCKF

(12)

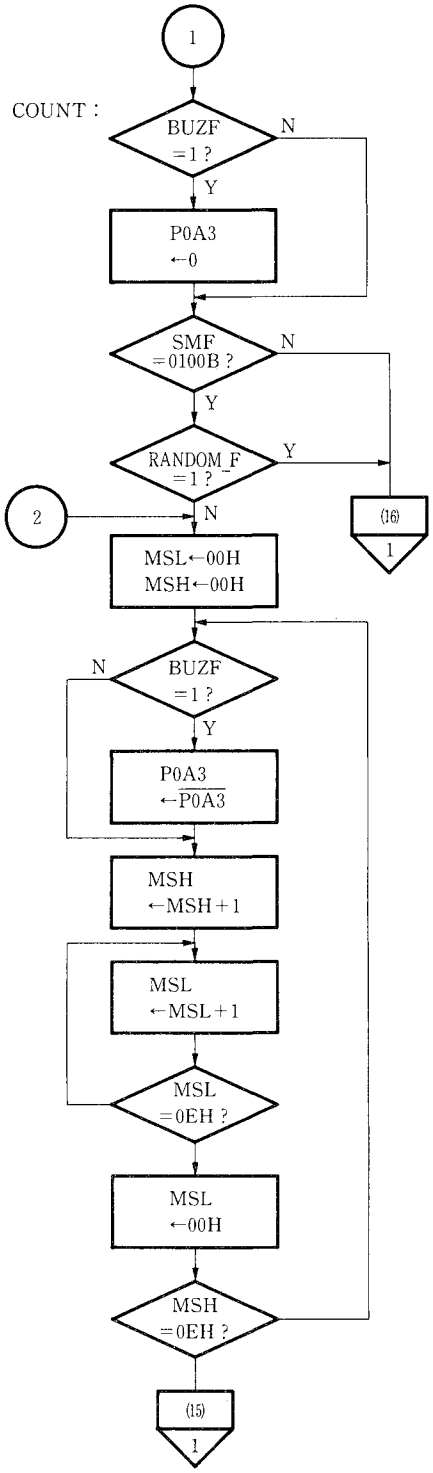
Input variable	Flow chart	Processing, remarks	Output variable
		No key input? Clears the key scan counter ("H" level check counter for key input port) Also resets the lock flag simultaneously	KS_Count

(13)

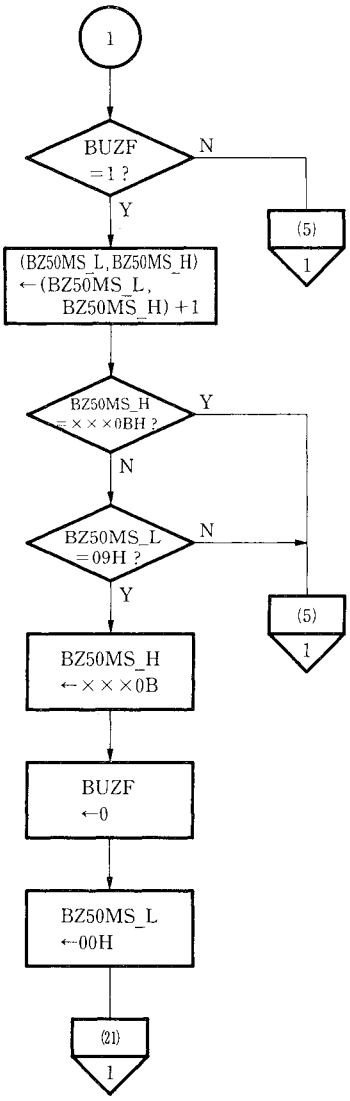
Input variable	Flow chart	Processing, remarks	Output variable
		Is lock flag set? (Is the key input already recognized?)	LOCKF
KS_Count		Key scan counter + 1	KS_Count
		Is the key scan count value 6?	
		Recognizes the key input and sets the lock flag	LOCKF
		Sets the buzzer flag	BUZF

4.5.6 Buzzer Output and 2 ms Adjustment Process

(14)

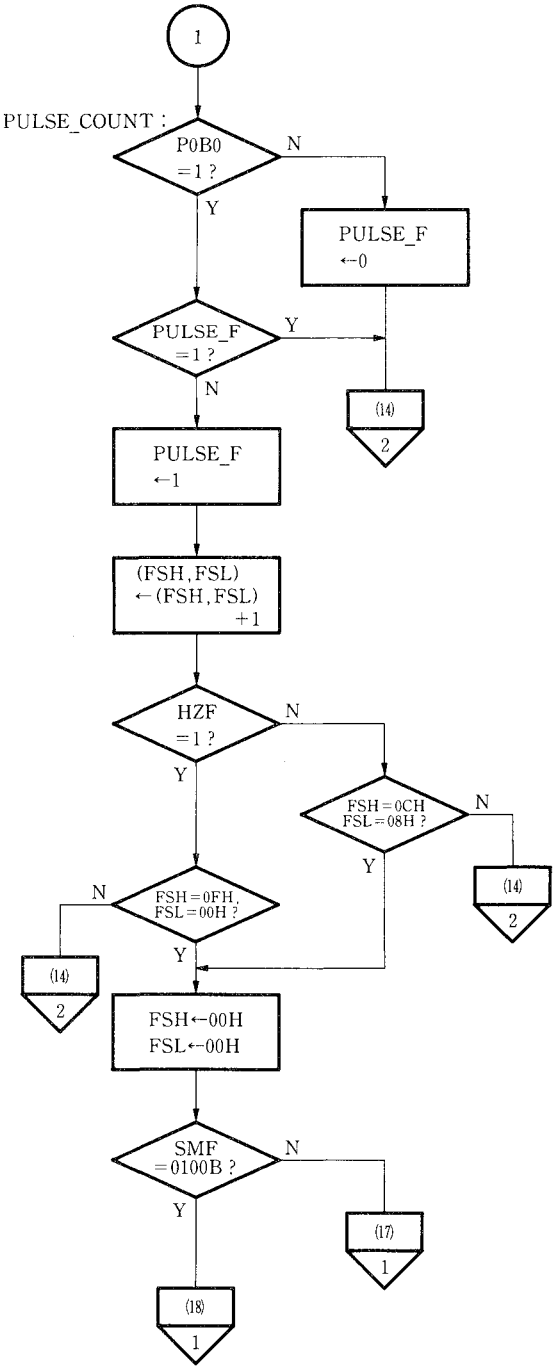
Input variable	Flow chart	Processing, remarks	Output variable
		Is buzzer flag set? Sets buzzer output port to "L" level Normal mode? Random mode? Clears 2 ms counter Is buzzer flag set? Inverts buzzer output port level If buzzer is ON, outputs a 248 μs frequency pulse If buzzer is OFF, adjusts time	P0A3 MSL MSH P0A3 MSH MSL MSL
P0A3			
MSH			
MSL			

(15)

Input variable	Flow chart	Processing, remarks	Output variable
BZ50MS_L BZ50MS_H		Is buzzer flag set? Increments (+1) the buzzer 50 ms counter 2 ms x 25 counts? Yes: 50 ms has passed Clears the upper 50 ms counter Resets buzzer flag Clears the lower 50 ms counter	 BZ50MS_L BZ50MS_H BZ50MS_H BUZF BZ50MS_L

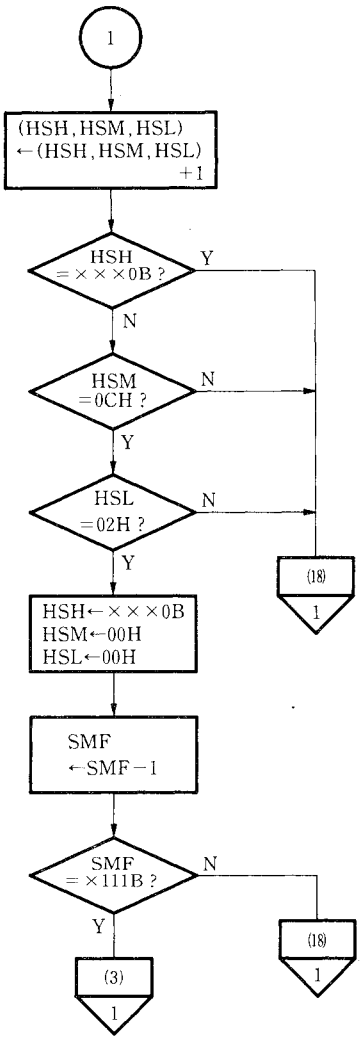
4.5.7 4 sec Count

(16)

Input variable	Flow chart	Processing, remarks	Output variable
FSH FSL		Is zero cross pulse "H"? If "L", resets the pulse flag The pulse flag already set? Sets the pulse flag Increments (+1) the 4 second counter Is HZF set? (60 Hz) Have 4 seconds passed? (50 Hz) Have 4 seconds passed? (60 Hz) Clears 4 second counter Normal/random mode?	PULSE_F PULSE_F FSH FSL FSH FSL

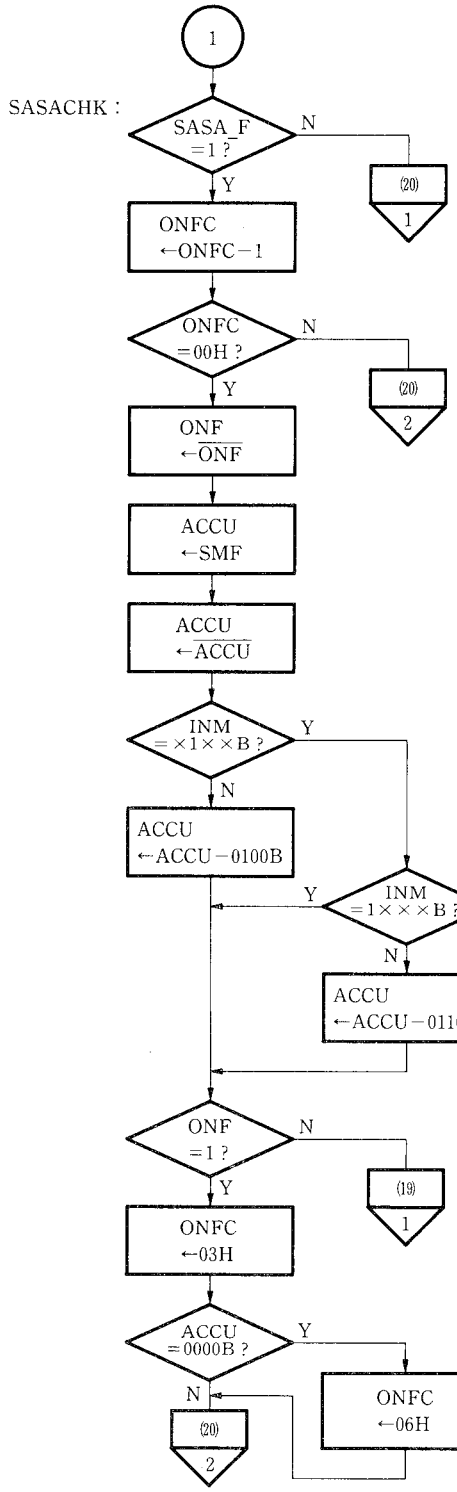
4.5.8 Timer, Sleeping Timer Remaining Time Check

(17)

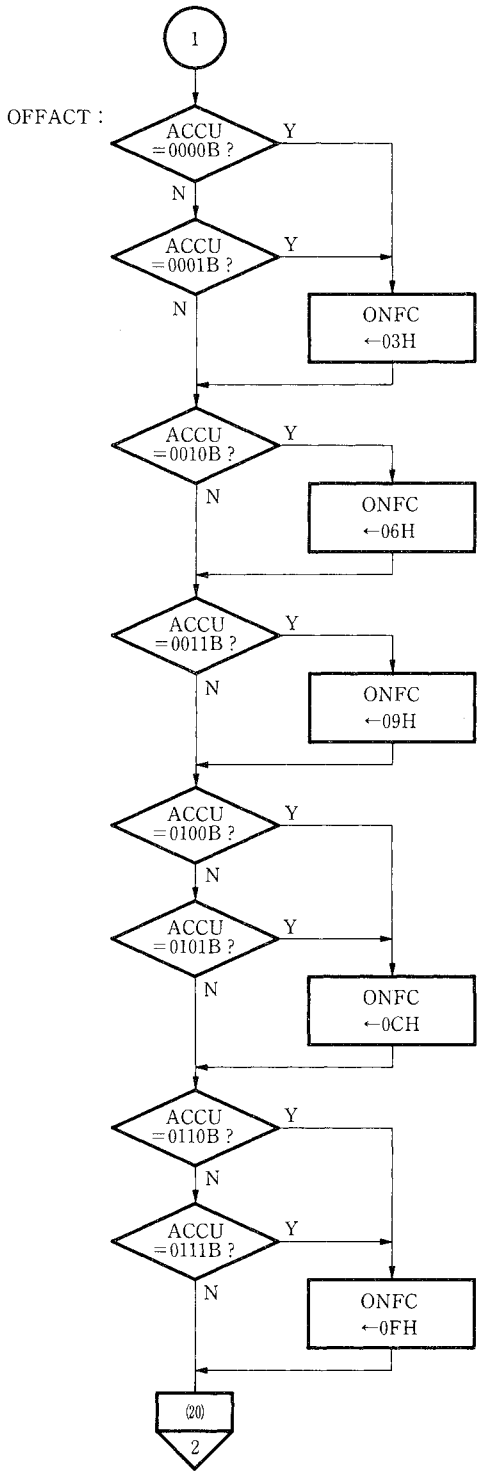
Input variable	Flow chart	Processing, remarks	Output variable
HSH HSM HSL		Increments (+1) 30 minute counter Have 30 minutes passed? Clears 30 minute counter Decrements (−1) the Timer and Sleeping Timer remaining time counter No time remaining?	HSH HSM HSL HSH HSM HSL SMF
SMF			

4.5.9 Sleeping Timer ON/OFF Control

(18)

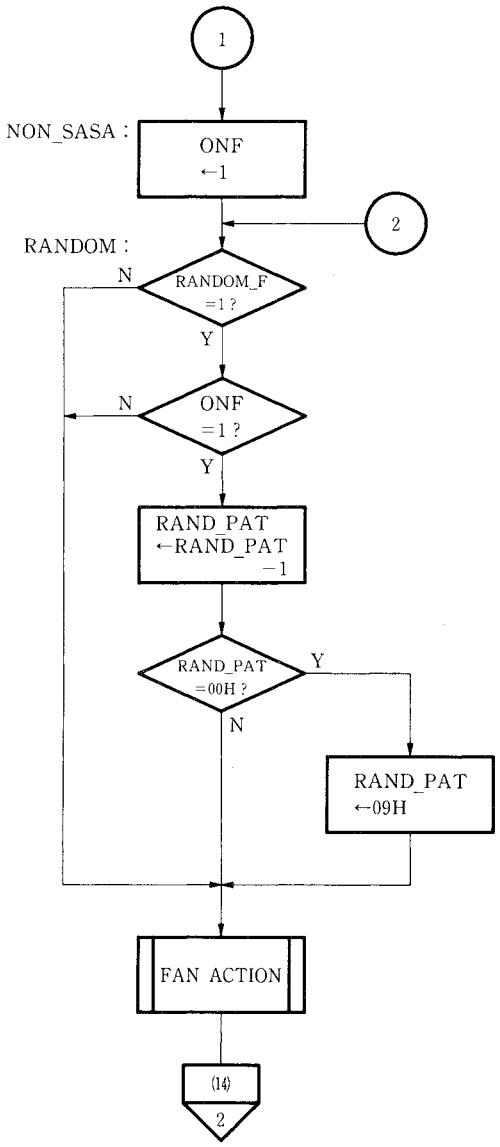
Input variable	Flow chart	Processing, remarks	Output variable
			
ONFC		Decrement (−1) ONF/OFF counter	ONFC
		ON/OFF switching required?	ONF
ONF		Inverts ON/OFF flag	ACCU
SMF		Stores the Sleeping Timer remaining time into the general register	ACCU
ACCU		Inverts all bits of the general register	ACCU
		1 hr or 4 hr Sleeping Timer?	
ACCU		Checks the time passed from the 2 h Sleeping Timer was started	ACCU
		4 hr Sleeping Timer?	
ACCU		Checks the time passed from the 4 h Sleeping Timer was started	
		Operation mode?	
		Sets the ON/OFF counter value to 3 (12 second operation)	ONFC
		Within 30 minutes from the start of operation?	
		Sets the ON/OFF counter value to 6 (24 second operation)	ONFC

(19)

Input variable	Flow chart	Processing, remarks	Output variable
		Sleeping Timer stop mode?	
		Within 30 minutes from the start of operation?	
		30 min. to 1 hr?	
		Sets the ON/OFF counter value to 3 (12 second stop)	ONFC
		1 to 1.5 hrs?	
		Sets the ON/OFF counter value to 6 (24 second stop)	ONFC
		1.5 to 2 hrs?	
		Sets the ON/OFF counter value to 9 (36 second stop)	ONFC
		2 to 2.5 hrs?	
		2.5 to 3 hrs?	
		Sets the ON/OFF counter value to 12 (48 second stop)	ONFC
		3 to 3.5 hrs?	
		3.5 to 4 hrs?	
		Sets the ON/OFF counter value to 15 (60 second stop)	ONFC

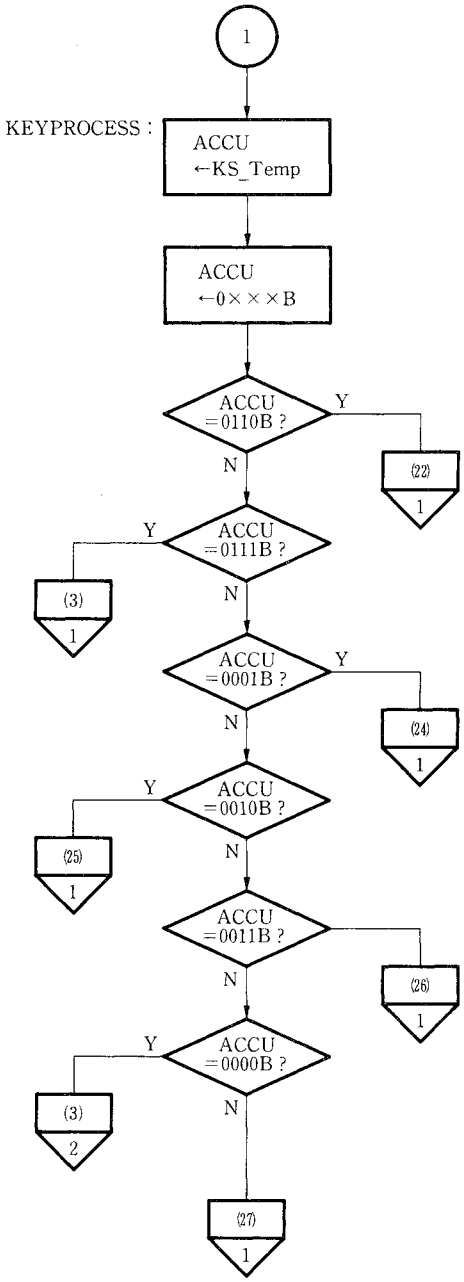
4.5.10 Random Pattern Count

(20)

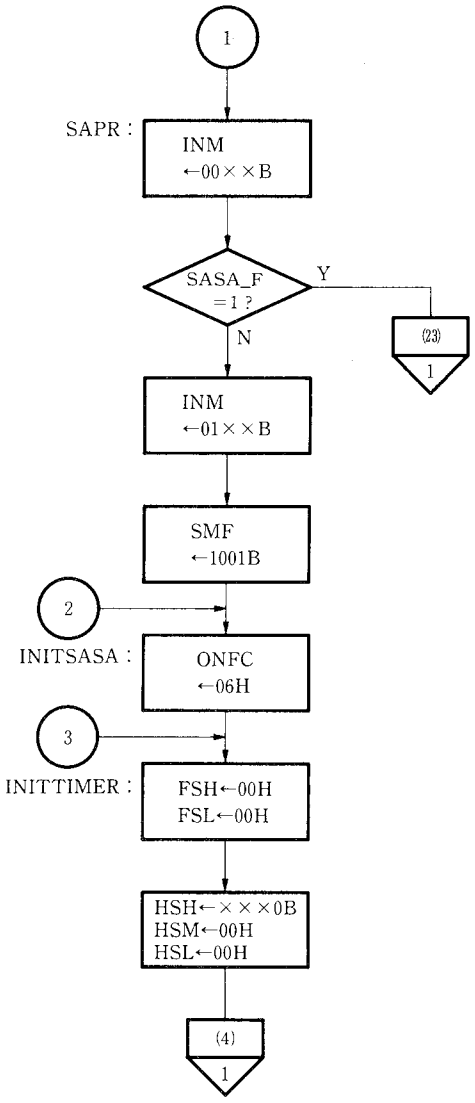
Input variable	Flow chart	Processing, remarks	Output variable
RAND_PAT		Sets ON/OFF flag (sets to operation mode) Random mode? Is ON/OFF flag set? Decrements (−1) the random pattern counter Is random pattern counter 0? Returns the random pattern counter to 9 Motor control subroutine	ONF RAND_PAT RAND_PAT

4.5.11 Input Key Process

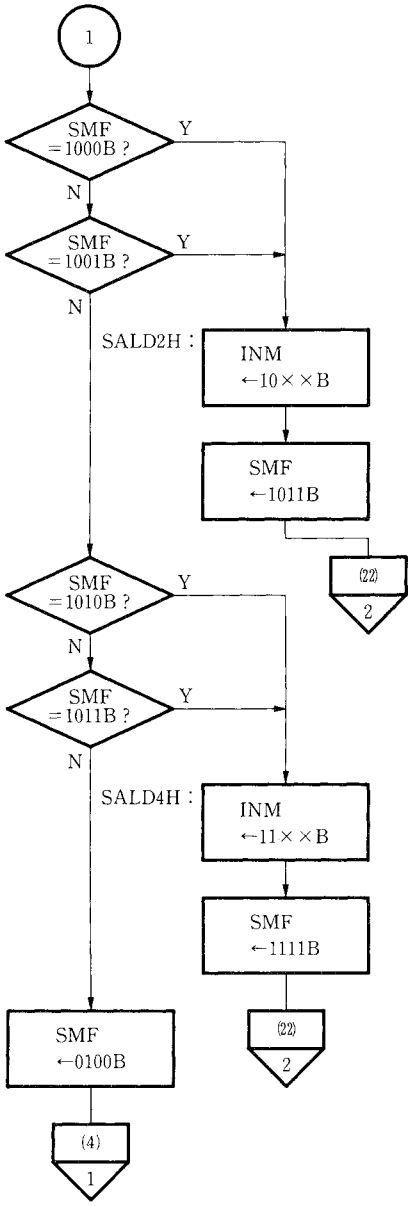
(21)

Input variable	Flow chart	Processing, remarks	Output variable
KS_Temp		Stores only key input information into the general register	ACCU ACCU
		Sleeping Timer key input?	
		Off key input?	
		Air flow key input?	
		Random key input?	
		Head swing key input?	
		Initial operation?	

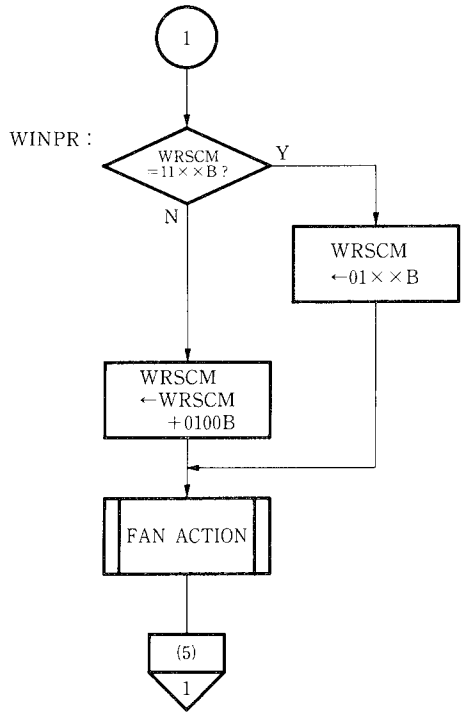
(22)

Input variable	Flow chart	Processing, remarks	Output variable
		Resets the Sleeping Timer set period register Sleeping Timer mode? Sets 1 hr sleeping Timer Sets 1 hr as the remaining time Sets the ON/OFF counter value to 6 (24 second operation) Clears 4 second counter Clears 30 minute counter	INM INM SMF ONFC FSH FSL HSH HSM HSL

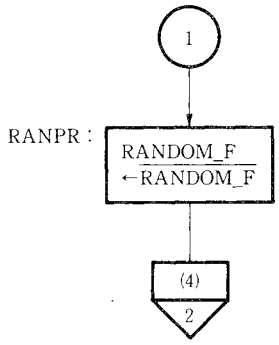
(23)

Input variable	Flow chart	Processing, remarks	Output variable
		Is the remaining time within 30 minutes?	
		Is the remaining time within 30 minutes to 1 hr?	
		Sets 2 hrs Sleeping Timer	INM
		Sets 2 hrs as the remaining time	SMF
		Is the remaining time within 1 hr to 1.5 hr?	
		Is the remaining time within 1.5 hr to 2 hrs?	
		Sets 4 hr Sleeping Timer	INM
		Sets 4 hrs as the remaining time	SMF
		Sets the Normal mode	SMF

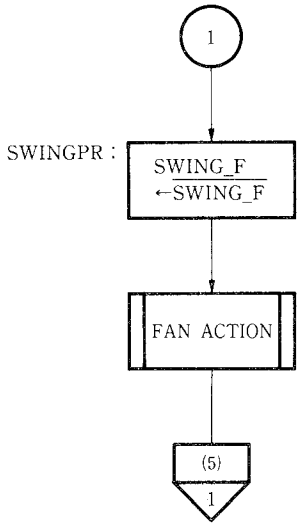
(24)

Input variable	Flow chart	Processing, remarks	Output variable
WRSCM		High air flow mode? Sets the low air mode Low → Medium Medium → High Motor control subroutine	WRSCM WRSCM

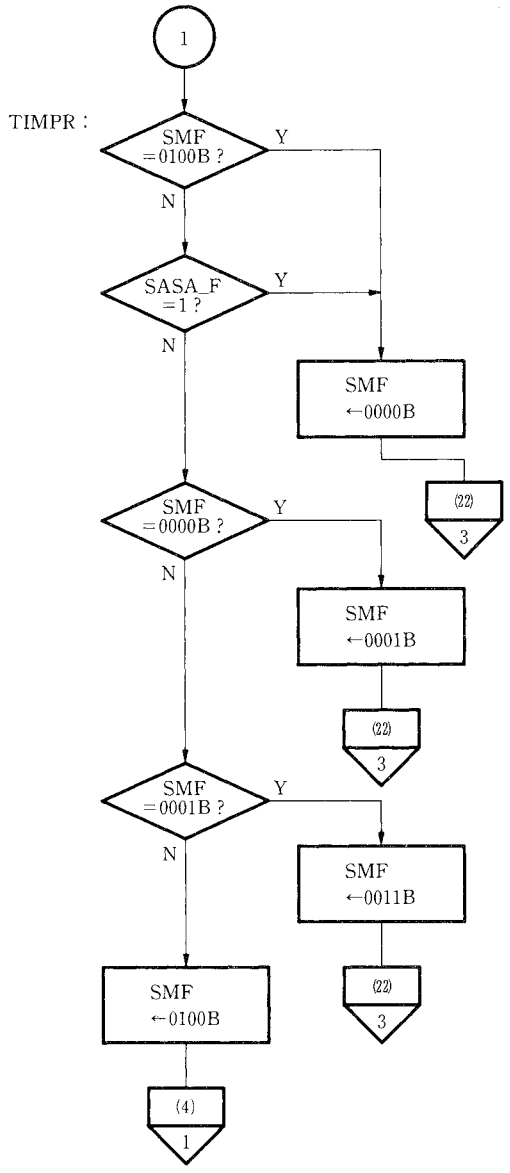
(25)

Input variable	Flow chart	Processing, remarks	Output variable
RANDOM_F		Inverts the random flag	RANDOM_F

(26)

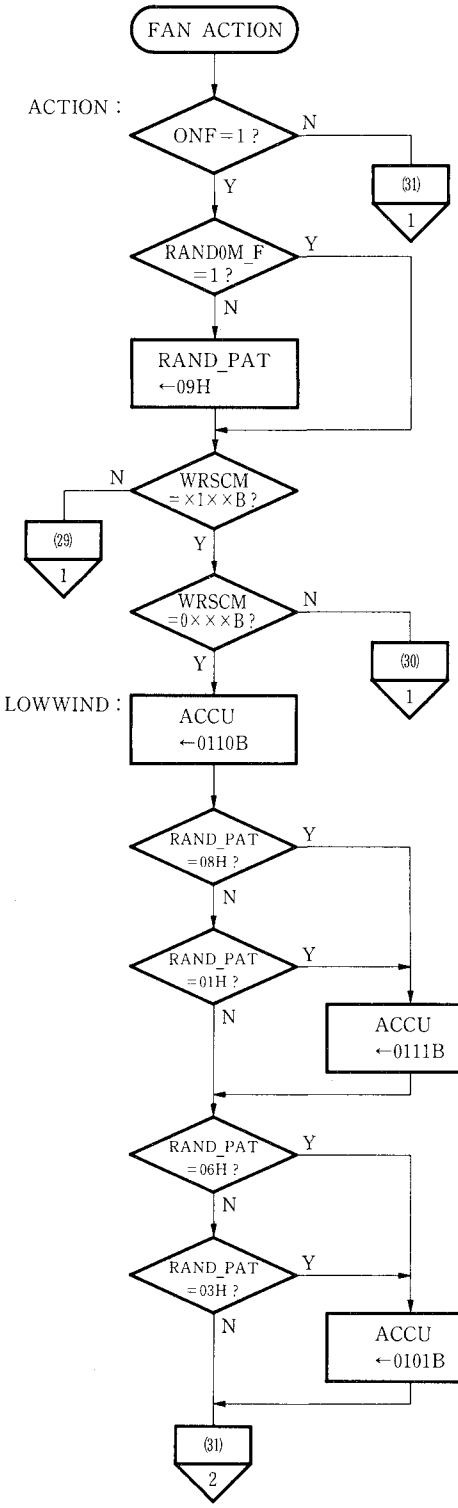
Input variable	Flow chart	Processing, remarks	Output variable
SWING_F		Inverts the head swing flag Motor control subroutine	SWING_F

(27)

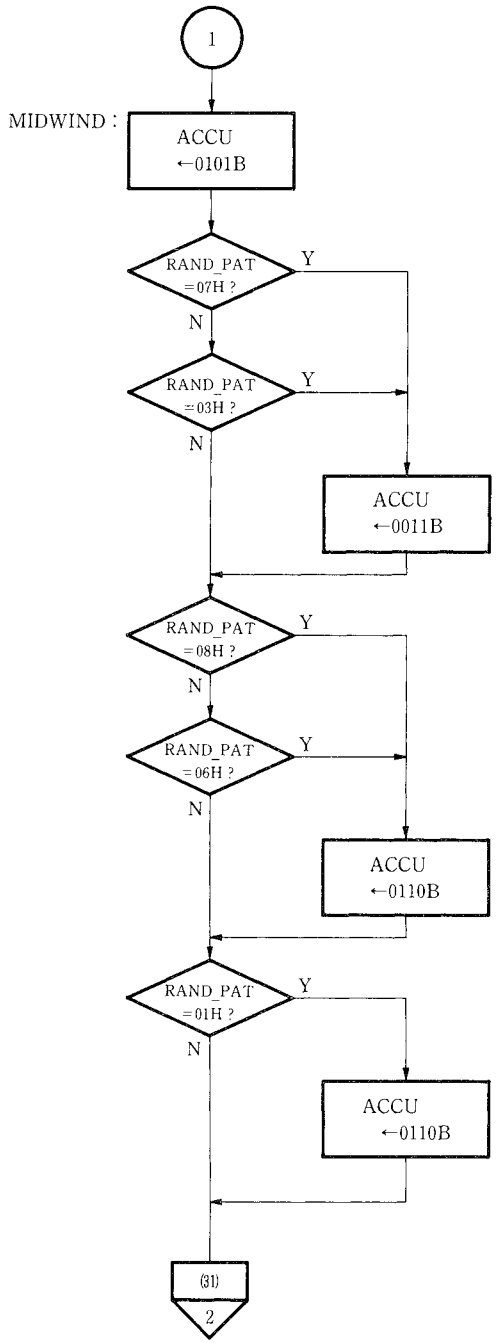
Input variable	Flow chart	Processing, remarks	Output variable
		Timer key input processing	
		Normal mode?	
		Sleeping Timer mode?	
		Sets Timer mode to 30 minutes	SMF
		30 minutes Timer mode?	
		Sets Timer mode to 1 hr	SMF
		1 hr timer mode?	
		Sets Timer mode to 2 hr	SMF
		Sets to Normal mode	SMF

4.5.12 Motor Control

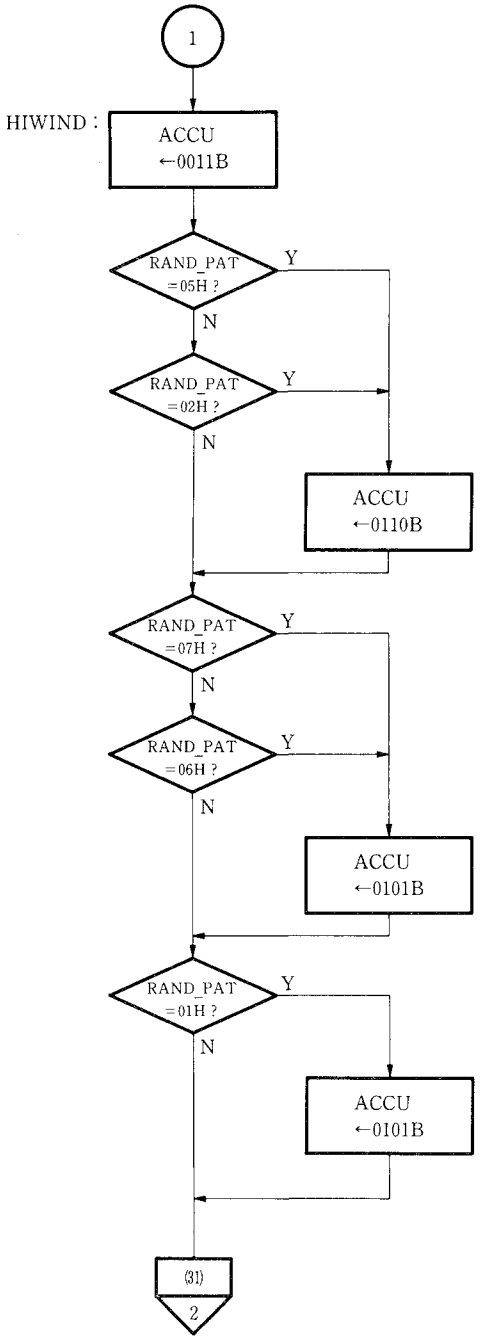
(28)

Input variable	Flow chart	Processing, remarks	Output variable
		Operation mode? Random mode? If not random mode, sets 9 as the pattern count value Low air flow or High air flow mode? Low air flow mode? Stores Low air flow pattern into the general register Is the random pattern count value 8? Is the random pattern count value 1? Stores the stop pattern into the general register Is the random pattern count value 6? Is the random pattern count value 3? Stores the Medium air flow pattern into the general register * Low air flow pattern when the random pattern count value is 2, 4, 5, 7, or 9	RAND_PAT ACCU ACCU ACCU

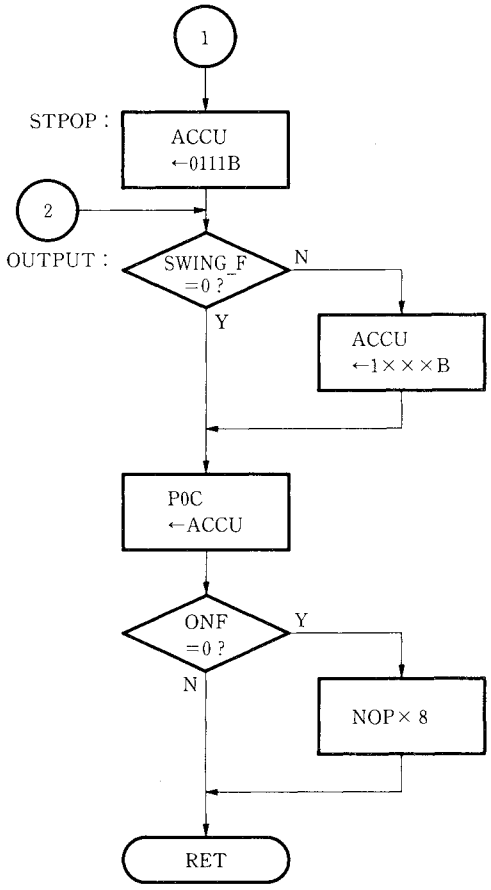
(29)

Input variable	Flow chart	Processing, remarks	Output variable
		(Medium, Medium random air flow output)	
		Stores Medium air flow pattern into the general register	ACCU
		Is the random pattern count value 7?	
		Is the random pattern count value 3?	
		Stores the High air flow pattern into the general register	ACCU
		Is the random pattern count value 8?	
		Is the random pattern count value 6?	
		Stores the Low air flow pattern into the general register	ACCU
		Is the random pattern count value 1?	
		Stores the Low air flow pattern into the general register	ACCU
		* Medium air flow pattern when the random pattern count value is 2, 4, 5, or 9	

(30)

Input variable	Flow chart	Processing, remarks	Output variable
		(High, High random air flow output)	
		Stores High air flow pattern into the general register	ACCU
		Is the random pattern count value 5?	
		Is the random pattern count value 2?	
		Stores the Low air flow pattern into the general register	ACCU
		Is the random pattern count value 7?	
		Is the random pattern count value 6?	
		Stores the Medium air flow pattern into the general register	ACCU
		Is the random pattern count value 1?	
		Stores the Medium air flow pattern into the general register	ACCU
		* High air flow pattern when the random pattern count value is 3, 4, 8, or 9	

(31)

Input variable	Flow chart	Processing, remarks	Output variable
ACCU		Stores the stop pattern into the general register Head swing ON? Sets to head swing OFF mode Outputs the general register contents to the motor control port Stop mode? Counts 2 μs x 8 = 16 μs (time adjustment) Return	ACCU ACCU P0C

4.6 SOURCE PROGRAM LIST

```
                ;
                ;*****************************************
                ;                                       *
                ;       ASSEMBLER DEF                   *
                ;                                       *
                ;*****************************************
0070            P0A     MEM 0.70H               ;PORT A
0071            P0B     MEM 0.71H               ;PORT B
0072            P0C     MEM 0.72H               ;PORT C
0073            P0D     MEM 0.73H               ;PORT D
                ;
0001            LEDPORT MEM 0.01H               ;LED OUTPUT TEMPORARY REG.
0000            MSH     MEM 0.00H               ;2ms_Counter_High_Nibble
0001            MSL     MEM 0.01H               ;2ms_Counter_Low_Nibble
0002            FSH     MEM 0.02H               ;4Sec_Counter_High_Nibble
0003            FSL     MEM 0.03H               ;4Sec_Counter_Low_Nibble
0004            INM     MEM 0.04H
0004            HSH     MEM 0.04H               ;30Minutes_Counter_High_Nibble
0005            HSM     MEM 0.05H               ;30Minutes_Counter_Mid_Nibble
0006            HSL     MEM 0.06H               ;30Minutes_Counter_Low_Nibble
0007            KS_Count  MEM 0.07H             ;KeyScan_Counter_REG.
0007            BZ50MS_H  MEM 0.07H             ;BUZZ_50ms_Counter_HIGH_NIBBLE
0008            KS_Temp   MEM 0.08H             ;KeyScan_Temporary_REG.
0009            WRSCM     MEM 0.09H             ;Wind_Status & KeyScan_Mode REG.
000A            ACCU      MEM 0.0AH             ;ACCUMULATOR
000B            BZ50MS_L  MEM 0.0BH             ;BUZZ_50ms_Counter_LOW_NIBBLE
000C            SMF     MEM 0.0CH               ;Status_Mode
000D            STA     MEM 0.0DH               ;Status_Flag_REG.
000E            ONFC    MEM 0.0EH               ;SASATIMER_ON_OFF_PATTERN_REG.
000F            RAND_PAT  MEM 0.0FH             ;RANDOM_PATTERN_REG.
                ;
0088            SWING_F FLG  KS_Temp.3          ;SWING_FLAG
0042            BUZF    FLG  HSH.1              ;BUZZ_ON_FLAG
0078            LOCKF   FLG  KS_Count.3         ;LOCK_MODE_FLAG
                ;
00C8            SASA_F  FLG  SMF.3              ;SASA_FLAG
                ;
00D8            PULSE_F FLG  STA.3              ;PULSE_FLAG
00D4            HZF     FLG  STA.2              ;50/60Hz_MODE_FLAG
00D2            ONF     FLG  STA.1              ;ON_OFF_MODE_FLAG
00D1            RANDOM_F  FLG  STA.0            ;RANDOM_MODE_FLAG
                ;
                ;*********************************************
                ;                                           *
                ;       4 Sec & 30 Minutes Adjustment       *
                ;                                           *
                ;*********************************************
                ;       50HZ MODE
                ;-------------------------------------------------------------------------o
                ; SET "HZ50_4secADJ" VALUE ==>   :    199(C7H) <---- 200(C8H) ----> 201(C9H)  :
                ;                                :                    ^^                    :
                ;      4Sec_Counter SPEED  ==>   :     FAST          Standard        SLOW     :
                ;-------------------------------------------------------------------------o
                ;
                ;       60HZ MODE
                ;-------------------------------------------------------------------------o
                ; SET "HZ60_4secADJ" VALUE ==>   :    239(EFH) <---- 240(F0H) ----> 241(F1H)  :
                ;                                :                    ^^                    :
                ;      4Sec_Counter SPEED  ==>   :     FAST          Standard        SLOW     :
                ;-------------------------------------------------------------------------o
                ;
```

```
141                     ;       30 Minutes ADJ
142                     ;
143                     ;-------------------------------------------------------------------------o
144                     ; SET "Minute_30ADJ" VALUE ==>   :    449(1C1H) <--- 450(1C2) ---> 451(1C3)   :
145                     ;                                :                    ^                  :
146                     ;      4Sec_Counter SPEED  ==>   :    FAST          Standard        SLOW     :
147                     ;-------------------------------------------------------------------------o
148                     ;
149     000C                    HZ50_4secADJH   DAT     0CH     ;50 Hz MODE : 4sec Counter ADJ HIGH
150     0008                    HZ50_4secADJL   DAT     08H     ;50 Hz MODE : 4sec Counter ADJ LOW
151     000F                    HZ60_4secADJH   DAT     0FH     ;60 Hz MODE : 4sec Counter ADJ HIGH
152     0000                    HZ60_4secADJL   DAT     00H     ;60 Hz MODE : 4sec Counter ADJ LOW
153     0002                    Minute_30ADJ    DAT     02H     ;30 Minutes Counter ADJ
154                     ;
155     0003                    HI      DAT  0011B              ;PORTC HIGH OUTPUT VALUE
156     0005                    MID     DAT  0101B              ;PORTC MID  OUTPUT VALUE
157     0006                    LOW     DAT  0110B              ;PORTC LOW  OUTPUT VALUE
158     0007                    STP     DAT  0111B              ;PORTC STOP OUTPUT VALUE
159                     ;
160                     ;
161                     ;*****************************************
162                     ;                                       *
163                     ;       FAN MAIN PROGRAM                *
164                     ;                                       *
165                     ;*****************************************
166                     ;
167                     ;
168                     ;*****************************************
169                     ;       POWER ON DELAY                  *
170                     ;*****************************************
171 0000 074F0                  NOP                             ;POWER ON DELAY
172 0001 074F0                  NOP                             ;DELAY WAITING FOR STABLE STATUS
173 0002 074F0                  NOP
174 0003 074F0                  NOP
175 0004 074F0                  NOP
176 0005 074F0                  NOP
177 0006 074F0                  NOP
178 0007 074F0                  NOP
179 0008 074F0                  NOP
180 0009 074F0                  NOP
181 000A 074F0                  NOP
182 000B 1C1BC                  CALL    MS_H_L_CLR              ;INIT MS REG.
183 000C 1C1BF                  CALL    FS_H_L_CLR              ;INIT FS REG.
184                     ;
185                     POWER_DELAY:
186 000D 1C1B1                  CALL    WAIT_2MS                ;DELAY 2MS
187 000E 1C1BC                  CALL    MS_H_L_CLR              ;RESET MS REG.
188 000F 10031                  ADD     FSL, #01H               ;INC 1
189 0010 0903F                  SKE     FSL, #0FH               ;2ms * 15 = 30ms ENDING ?
190 0011 0C00D                  BR      POWER_DELAY
191                     ;*****************************************
192                     ;       POWER ON RESET                  *
193                     ;*****************************************
194 0012 1D704                  MOV     P0A, #0100B             ;POWER ON RESET
195 0013 1D72F                  MOV     P0C, #1111B
196 0014 1D73F                  MOV     P0D, #1111B
197                     ;*****************************************
198                     ;       50/60 Hz DECISION               *
199                     ;*****************************************
200                     ;
201 0015 1C1BC                  CALL    MS_H_L_CLR              ;CLR 2ms_COUNTER_REG
202 0016 1C1BF                  CALL    FS_H_L_CLR              ;INIT FS REG.
203                     HZ_INIT:
204             1               SKF1    P0B0                    ;TEST ZEROCROSS BEGIN WITH "LOW" STATUS
+   1 0017 1F711    1           SKF     .MF.P0B0 SHR 4.#.DF.P0B0 AND 0FH
205 0018 0C017                  BR      HZ_INIT                 ;"HIGH" STATUS RETEST AGAIN
206                     ;
```

```
  207                   HZIN:
  208              1            SKT1    P0B0                    ;READ Zerocrossing PULSE 1st "HIGH"
+   1 0019 1E711   1            SKT     .MF.P0B0 SHR 4,#.DF.P0B0 AND 0FH
  209 001A 0C019               BR      HZIN                    ;REPEAT READ
  210 001B 1D030               MOV     FSL,#00H                ;INITIAL COUNTER_9 VALUE=0
  211                   ;
  212                   HZ_WAIT:                                ;DELAY 18ms
  213 001C 1C1B1               CALL    WAIT_2MS                ;DELAY 2ms FOR COUNT
  214 001D 1C1BC               CALL    MS_H_L_CLR              ;CLR 2ms_Counter_REG
  215 001E 10031               ADD     FSL,#01H                ;COUNT 1 PER 2ms
  216 001F 09039               SKE     FSL,#09H                ;COUNTER_9= 9 ? (2ms * 9 = 18ms )
  217 0020 0C01C               BR      HZ_WAIT                 ;REPEAT WAIT 2ms
  218                   ;
  219              1            SKT1    P0B0                    ;CHK 9th PULSE
+   1 0021 1E711   1            SKT     .MF.P0B0 SHR 4,#.DF.P0B0 AND 0FH
  220 0022 0C025               BR      HZ50                    ;9th Pulse =" LOW ",SET 50Hz FLAG
  221              1            SET1    HZF                     ;9th Pulse ="HIGH ",SET 60Hz FLAG
+   1 0023 160D4   1            OR      .MF.HZF SHR 4,#.DF.HZF AND 0FH
  222 0024 0C026               BR      STANDBY                 ;BRANCH STANDBY MODE
  223                   HZ50:
  224              1            CLR1    HZF                     ;HZF=0 IN 50Hz
+   1 0025 140DB   1            AND     .MF.HZF SHR 4,#.DF.(NOT HZF AND 0FH)
  225                   ;
  226                   ;*****************************************
  227                   ;       STANDBY MODE                     *
  228                   ;*****************************************
  229                   STANDBY:                                ;STANDBY MODE INITIAL OUTPUT PORT
  230 0026 1D706               MOV     P0A,#0110B
  231 0027 1D72F               MOV     P0C,#1111B
  232 0028 1D73F               MOV     P0D,#1111B
  233 0029 072F1               STOP        0001B
  234                   ;*****************************************
  235                   ;       INITIAL                          *
  236                   ;*****************************************
  237              1            SET1    BUZF                    ;WHEN "ON" KEY PRESSED,SET BUZZ_ON
+   1 002A 16042   1            OR      .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
  238 002B 1D078               MOV     KS_Count,#1000B         ;SET "LOCK" FLAG & CLR KEYSCAN_COUNTER
  239 002C 1D0B0               MOV     BZ50MS_L,#00H            ;INIT BUZZ_50ms_COUNTER
  240                   ;
  241                   NORMAL_MODE_IN:                         ;1st "ON" KEY RETURN HERE
  242              1            CLR2    PULSE_F,RANDOM_F        ;CLR PULSE_FLAG & RANDOM_FLAG
+   1 002D 140D6   1            AND     .MF.PULSE_F SHR 4,#.DF.(NOT (PULSE_F OR RANDOM_F) AND 0FH)
  243 002E 1D088               MOV     KS_Temp,#1000B          ;RESET SWING_FLAG & KEYSCAN_STATUS_REG.
  244 002F 1D095               MOV     WRSCM,#0101B            ;INIT "LOW" Wind & "1st" SCAN MODE
  245 0030 1C1BF               CALL    FS_H_L_CLR              ;INIT 4Sec_Counter
  246 0031 1C1C2               CALL    HS_H_M_L_CLR            ;INIT 30Minutes_Counter
  247                   ;---------------------------------
  248                   ;       KEYPROCESS RETURN POINT  -
  249                   ;---------------------------------
  250                   NORMAL_INT:                             ;"NORMAL MODE" KEYPROCESS RETURN HERE
  251 0032 1D0C4               MOV     SMF,#0100B              ;RESET "STATUS_MODE_REG" =NORMAL MODE
  252 0033 0C037               BR      COMMON                  ;SKIP NEXT LINES RESET INSTRUCTION
  253                   ;
  254                   INITSASA:                               ;"SASA_TIMER" KEYPROCESS RETURN HERE
  255 0034 1D0E6               MOV     ONFC,#06H               ;RESET ON_OFF_PATTERN_COUNTER=9
  256                   ;
  257                   INITTIMER:                              ;"TIMER" KEYPROCESS RETURN HERE
  258 0035 1C1BF               CALL    FS_H_L_CLR              ;RESET 4Sec_COUNTER
  259 0036 1C1C2               CALL    HS_H_M_L_CLR            ;RESET 30 Minutes_Counter
  260                   ;
  261                   COMMON:                                 ;COMMON RESET ITEM
  262              1            SET1    ONF                     ;SET ON_OFF_FLAG = ON
+   1 0037 160D2   1            OR      .MF.ONF SHR 4,#.DF.ONF AND 0FH
  263                   ;
  264                   RAN_IN:                                 ;"RANDOM" KEYPROCESS RETURN HERE
  265 0038 1D0F9               MOV     RAND_PAT,#09H           ;RESET RANDOM_PATTERN = 9
  266              1            SKT1    ONF                     ;CHK OFF MODE
```

```
+   1 0039 1E0D2  1           SKT     .MF.ONF SHR 4,#.DF.ONF AND 0FH
  267 003A 1D0FA              MOV     RAND_PAT,#0AH           ;RESET RANDOM_PATTERN = A
  268                 ;
  269                 KEY_INT:                                ;WIND & SWING KEYPROCESS RETURN HERE
  270                 ;*****************************************
  271                 ;       INIT ACTION                       *
  272                 ;*****************************************
  273 003B 1C122              CALL    ACTION                  ;INIT ACTION
  274                 ;;                                      ;
  275                 ;#########################################
  276                 ;                                       #
  277                 ;       SCAN                            #
  278                 ;                                       #
  279                 ;#########################################
  280                 SCAN:                                   ;PROGRAM LOOP START HERE
  281 003C 1D01F              MOV     LEDPORT,#1111B          ;INIT LEDPORT
  282 003D 18731              ST      P0D,LEDPORT             ;RESET LED OUTPUT PORT_D
  283                 ;
  284 003E 0809A              LD      ACCU,WRSCM              ;LOAD WIND REG.  FOR CHK
  285 003F 140AC              AND     ACCU,#1100B             ;ACCU=11XX (WR)
  286                 ;
  287                 ;SCAN MODE DECISION
  288 0040 1E091              SKT     WRSCM,#0001B            ;TEST IF 2nd SCAN_MODE (XXX1=XX01,XX11)
  289 0041 0C054              BR      LEDSCAN2                ;BRANCH  2nd SCAN_MODE (XX10)
  290 0042 1F092              SKF     WRSCM,#0010B            ;TEST IF 3nd SCAN_MODE (XX0X=XX00,XX01)
  291 0043 0C07E              BR      LEDSCAN3                ;BRANCH  3nd SCAN_MODE (XX11)
  292                                                         ;OTHER   1st SCAN_MODE (XX01)
  293                 ;*****************************************
  294                 ;       LEDSCAN1    KEYSCAN1              *
  295                 ;*****************************************
  296                 ;LEDSCAN1:
  297                 ;
  298 0044 1D706              MOV     P0A,#0110B              ;SET 1st LEDSCAN OUTPUT PORT_A ACTION
  299             1           SKF1    BUZF                    ;CHK IF BUZZ ON MODE
+   1 0045 1F042  1           SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
  300 0046 1D70E              MOV     P0A,#1110B              ;SET BUZZER PORT ON "HIGH"
  301                 ;
  302 0047 1C14D              CALL    LED1                    ;CALL LEDSCAN1 SUBROUTINE
  303                 ;
  304 0048 1409C              AND     WRSCM,#1100B            ;SET 2nd SCAN_MODE ( WRSCM=XX10 )
  305 0049 16092              OR      WRSCM,#0010B
  306                 ;---------------------------------
  307             1           SKF1    BUZF                    ;CHK IF BUZZ MODE
+   1 004A 1F042  1           SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
  308 004B 0C052              BR      COUNT1_1                ;BUZZ MODE,KEYSCAN SKIP
  309                 ;KEYSCAN1:
  310 004C 14088              AND     KS_Temp,#1000B          ;CLR KEYSCAN_STATUS =000
  311                 ;
  312 004D 1C17B              CALL    KEYSCAN                 ;CALL KEYSCAN SUBROUTINE
  313                 ;
  314                 ;RETURN
  315 004E 074F0              NOP                             ;RETURN HERE
  316                 ;RETURN SKIP
  317 004F 1D017              MOV     MSL,#07H
  318                 COUNT_ADJ:
  319 0050 1C1B8              CALL    MSADJ                   ;TIME DELAY ADJ
  320 0051 0C085              BR      COUNT
  321                 ;
  322                 COUNT1_1:
  323 0052 1D01C              MOV     MSL,#0CH
  324 0053 0C050              BR      COUNT_ADJ
  325                 ;*****************************************
  326                 ;       LEDSCAN2    KEYSCAN2              *
  327                 ;*****************************************
  328                 ;
  329                 LEDSCAN2:
  330 0054 1D705              MOV     P0A,#0101B              ;SET 2st LEDSCAN OUTPUT PORT_A ACTION
```

```
 331                1            SKF1    BUZF                    ;CHK IF BUZZ ON MODE
+  1 0055 1F042     1            SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
 332 0056 1D70D                  MOV     P0A,#1101B              ;SET BUZZER PORT ON "HIGH"
 333                     ;
 334 0057 1C15A                  CALL    LED2                    ;CALL LEDSCAN2 SUBROUTINE
 335                     ;
 336 0058 1409C                  AND     WRSCM,#1100B            ;SET 3nd SCAN_MODE ( WRSCM=XX11 )
 337 0059 16093                  OR      WRSCM,#0011B
 338                     ;---------------------------------
 339                1            SKF1    BUZF                    ;CHK IF BUZZ MODE
+  1 005A 1F042     1            SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
 340 005B 0C052                  BR      COUNT1_1                ;BUZZ MODE,KEYSCAN SKIP
 341                     ;---------------------------------
 342                     ;KEYSCAN2:
 343 005C 1F087                  SKF     KS_Temp,#0111B          ;1ST KeyScan_Temporary=000 ?
 344 005D 0C067                  BR      Multi_Key_CHK           ;1ST KeyScan_Temporary=NOT ZERO
 345                     ;
 346 005E 1C17B                  CALL    KEYSCAN                 ;CALL 2nd KEYSCAN SUBROUTINE
 347                     ;RETURN
 348 005F 0C062                  BR      KEY_RELEASE             ;1st & 2nd BOTH NO KEY PRESS===> RELEASE
 349                     ;RETURN SKIP
 350 0060 10084                  ADD     KS_Temp,#0100B          ;ADJ 2ND KeyScan_Temporary=1XX
 351 0061 0C071                  BR      KEY_EFFECT_CHK          ;2nd KEYSCAN TAKE EFFECT
 352                     ;---------------------------------
 353                     KEY_RELEASE:
 354 0062 1F087                  SKF     KS_Temp,#0111B          ;KEYSCAN_TEMP EMPTY CHK
 355 0063 0C065                  BR      KYRL                    ;NOT EMPTY
 356 0064 1D070                  MOV     KS_Count,#0000B         ;NON KEY PRESS ! RELEASE !
 357                     ;
 358 0065 1D016          KYRL:   MOV     MSL,#06H                ;
 359 0066 0C050                  BR      COUNT_ADJ
 360                     ;-------------------------------------------
 361                     Multi_Key_CHK:
 362 0067 0871A                  LD      ACCU,P0B                ;LOAD 2nd KEYSCAN STATUS
 363 0068 140AE                  AND     ACCU,#1110B             ;MASK 1110
 364 0069 090A0                  SKE     ACCU,#0000B             ;CHK 2nd KEYSCAN=0 ?
 365 006A 0C06E                  BR      ERRKY                   ;2nd KEYSCAN <> 0 ===> Multi KEY PERSS
 366                                                             ;                      (ERROR KEY)
 367 006B 1D013                  MOV     MSL,#03H                ;2ms COUNTER ADJ
 368 006C 1C1B8                  CALL    MSADJ
 369 006D 0C071                  BR      KEY_EFFECT_CHK          ;1st KEYSCAN TAKE EFFECT
 370                     ERRKY:
 371                1            SET1    LOCKF                   ;ERROR KEY LOCK
+  1 006E 16078     1            OR      .MF.LOCKF SHR 4,#.DF.LOCKF AND 0FH
 372 006F 1D019                  MOV     MSL,#09H
 373 0070 0C050                  BR      COUNT_ADJ
 374                     ;*********************************************
 375                     ;       KEY_EFFECT_CHK                      *
 376                     ;*********************************************
 377                     KEY_EFFECT_CHK:
 378                1            SKF1    LOCKF                   ;CHK IF KEY LOCK MODE ?
+  1 0071 1F078     1            SKF     .MF.LOCKF SHR 4,#.DF.LOCKF AND 0FH
 379 0072 0C07A                  BR      COUNT2_1                ;KEY LOCK,BRANCH OUT !
 380                     ;
 381 0073 10071                  ADD     KS_Count,#01H           ;KEY_SCAN_COUNTER + 1
 382                     ;
 383 0074 09076                  SKE     KS_Count,#06H           ;KEY_SCAN_COUNTER = 6 ?
 384 0075 0C07C                  BR      COUNT2_2                ;KEY_SCAN_COUNTER < 6,BRANCH OUT
 385                     ;
 386                1            SET1    LOCKF                   ;LOCK KEY COUNT
+  1 0076 16078     1            OR      .MF.LOCKF SHR 4,#.DF.LOCKF AND 0FH
 387                1            SET1    BUZF                    ;SET BUZZ_ON MODE
+  1 0077 16042     1            OR      .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
 388                     ;
 389 0078 1D013                  MOV     MSL,#03H                ;2ms ADJ
 390 0079 0C050                  BR      COUNT_ADJ
 391                     ;
```

```
392                     COUNT2_1:
393 007A 1D015                  MOV     MSL, #05H               ;2ms ADJ
394 007B 0C050                  BR      COUNT_ADJ
395                     ;
396                     COUNT2_2:
397 007C 1D014                  MOV     MSL, #04H
398 007D 0C050                  BR      COUNT_ADJ
399                     ;
400                     ;*********************************************
401                     ;       LEDSCAN3                                *
402                     ;*********************************************
403                     ;
404                     LEDSCAN3:
405 007E 1D703                  MOV     P0A, #0011B             ;SET 3rd LEDSCAN OUTPUT PORT_A ACTION
406             1               SKF1    BUZF                    ;CHK IF BUZZ ON MODE
+   1 007F 1F042  1             SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
407 0080 1D70B                  MOV     P0A, #1011B             ;SET BUZZER PORT ON "HIGH"
408                     ;
409 0081 1C165                  CALL    LED3                    ;CALL 3rd LEDSCAN SUBROUTINE
410                     ;------------------------------
411 0082 1409C                  AND     WRSCM, #1100B           ;SET NEXT SCAN_MODE TO 1st
412 0083 16091                  OR      WRSCM, #0001B           ; (XX01)
413                     ;
414 0084 0C052                  BR      COUNT1_1
415                     ;*********************************************
416                     ;       COUNT                           *
417                     ;*********************************************
418                     COUNT:                                  ;COUNT 4 Sec ONLY
419                     ;
420             1               SKF1    BUZF                    ;CHK BUZZ_ON MODE ?
+   1 0085 1F042  1             SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
421             1               CLR1    P0A3                    ;BUZZ_ON MODE MIDDLE POINT SET
+   1 0086 14707  1             AND     .MF.P0A3 SHR 4,#.DF.(NOT P0A3 AND 0FH)
422                                                             ;SET BUZZ="LOW" (2ND)
423                     ;
424 0087 0B0C4                  SKNE    SMF, #0100B             ;NORMAL MODE ?
425             1               SKF1    RANDOM_F                ;NORMAL RANDOM MODE ?
+   1 0088 1F0D1  1             SKF     .MF.RANDOM_F SHR 4,#.DF.RANDOM_F AND 0FH
426 0089 0C08B                  BR      PULSE                   ;TIMER COUNTER MODE
427 008A 0C0AA                  BR      COUNT_WAITADJ1          ;NORMAL MODE ONLY, SKIP TO COUNT WAIT
428                     ;------------------------------
429                     ;       PULSE_COUNT
430                     ;------------------------------
431                     PULSE:                                  ;READ 50/60 Hz Pulse
432 008B 1C190                  CALL    PULSE_COUNT
433                     ;
434                     ;RETURN
435 008C 0C0AC                  BR      COUNT_WAITADJ2          ;NON HZ PULSE SKIP TO COUNT WAIT
436                     ;RETURN SKIP
437 008D 10031                  ADD     FSL, #01H               ;4SEC+1
438 008E 12020                  ADDC    FSH, #00H
439                     ;--------------------------------
440                     ;       FS 4sec Ending CHK
441                     ;--------------------------------
442             1               SKT1    HZF                     ;CHK 50/60 Hz MODE
+   1 008F 1E0D4  1             SKT     .MF.HZF SHR 4,#.DF.HZF AND 0FH
443 0090 0C095                  BR      HZ50CHK                 ;HZF=0  BRANCH 50Hz CHK
444                     ;60HzCHK
445 0091 0B02F                  SKNE    FSH, #HZ60_4secADJH     ;CHK 60 pulse * 4 = 240 ?
446 0092 09030                  SKE     FSL, #HZ60_4secADJL
447 0093 0C0AE                  BR      COUNT_WAITADJ3          ;< 4Sec NOTHING TO DO
448 0094 0C099                  BR      FS_INIT                 ;= 4Sec, BRANCH TO TIMER CHK
449                     ;
450                     HZ50CHK:
451 0095 0B02C                  SKNE    FSH, #HZ50_4secADJH     ;CHK 50 pulse * 4 = 200 ?
452 0096 09038                  SKE     FSL, #HZ50_4secADJL
453 0097 0C0AE                  BR      COUNT_WAITADJ3          ;< 4 Sec NOTHING TO DO
```

```
454 0098 074F0              NOP                             ;2ms_Counter ADJ
455                 ;-------------------------------
456                 ;       4ms Ending
457                 ;-------------------------------
458                 FS_INIT:
459 0099 1C1BF              CALL    FS_H_L_CLR              ;4 Sec Ending RESET 4 Sec_Counter=0
460 009A 074F0              NOP                             ;2ms_Counter ADJ
461                 ;
462                 ;*********************************************
463                 ;       TIMER                                 *
464                 ;*********************************************
465 009B 0B0C4              SKNE    SMF, #0100B             ;NORMAL RANDOM MODE?
466 009C 0C0B1              BR      SASACHKADJ1             ;NORMAL RANDOM MODE
467                 ;
468                 ;                                       ;4Sec * 450 =1800sec
469 009D 10061              ADD     HSL, #01H               ;30 MIN+1 (TIMER, SASA TIMER MODE)
470 009E 12050              ADDC    HSM, #00H
471 009F 12040              ADDC    HSH, #00H
472                 ;-------------------------------
473                 ;       HS 30 minutes Ending CHK
474                 ;-------------------------------
475                                                         ;1800Sec/4=450,  (1C2H)=450
476 00A0 1F041              SKF     HSH, #01H               ;CHK 30 Minutes HIGH BIT (XXX0)
477 00A1 0905C              SKE     HSM, #0CH
478 00A2 0C0A4              BR      H2                      ;NOT YET 30 minutes SKIP TO SASACHK
479 00A3 09062              SKE     HSL, #Minute_30ADJ
480 00A4 0C0B2      H2:     BR      SASACHKADJ2             ;NOT YET 30 minutes SKIP TO SASACHK
481                 ;-------------------------------
482                 ;       30_Minutes Ending
483                 ;-------------------------------
484                 ;                                       ;30 Minutes ENDING
485 00A5 1C1C2              CALL    HS_H_M_L_CLR            ;30 minutes REG(HS) RESEET
486                 ;-------------------------------
487                 ;       STATUS ENDING CHK
488                 ;-------------------------------
489                 ;                                       ;CHECK SMF=END ?
490 00A6 110C1              SUB     SMF, #01H               ;SMF=SMF-1
491 00A7 1E0C7              SKT     SMF, #0111B             ;CHK ENDING
492 00A8 0C0B3              BR      SASACHK                 ;SMF NOT yet = 0
493 00A9 0C026              BR      STANDBY                 ;SMF=0
494                 ;-------------------------------
495                 ;       COUNT WAIT ADJ
496                 ;-------------------------------
497                 ;                                        < 4sec COME HERE , NOTHING TO DO
498                 COUNT_WAITADJ1:                         ;2ms_Cunter ADJ
499 00AA 1D01F              MOV     MSL, #0FH               ;
500 00AB 0C0AF              BR      WAIT_ADJ
501                 COUNT_WAITADJ2:
502 00AC 1D01E              MOV     MSL, #0EH
503 00AD 0C0AF              BR      WAIT_ADJ
504                 COUNT_WAITADJ3:
505 00AE 1D01B              MOV     MSL, #0BH
506                 WAIT_ADJ:
507 00AF 1C1B8              CALL    MSADJ
508 00B0 0C0DB              BR      COUNT_WAIT
509                 ;-------------------------------
510                 ;       SASACHK  WAIT ADJ
511                 ;-------------------------------
512                 ;                                       ;TIMER COUNTER MODE , <30 minutes
513                 SASACHKADJ1:                            ;2ms_Cunter ADJ
514 00B1 1C11C              CALL    ADJ6                    ;
515                 SASACHKADJ2:
516 00B2 0C0B3              BR      SASACHK
517                 ;;;                                     ;
518                 ;*********************************************
519                 ;       SASA CHK                              *
520                 ;*********************************************
```

```
 521                    SASACHK:
 522                1           SKT1    SASA_F                  ;SASA MODE ?
+  1 00B3 1E0C8    1           SKT     .MF.SASA_F SHR 4,#.DF.SASA_F AND 0FH
 523 00B4 0C0D3                 BR      NON_SASA                ;NOT SASA MODE BRANCH TO RANDOM CHK
 524                    ;
 525 00B5 110E1                 SUB     ONFC,#01H               ;SASA_ON_OFF_PATTERN_COUNTER - 1
 526                    ;
 527 00B6 090E0                 SKE     ONFC,#00H               ;SASA_ON_OFF_PATTERN_COUNTER = 0 ?
 528 00B7 0C0D4                 BR      RANDOM                  ;SASA_ON_OFF_PATTERN_COUNTER <>0
 529                                                            ;BRANCH RANDOM CHK
 530                    ;-----------------------------
 531                    ;       SASA PATTERN ENDING             ;RESET SASA_PATTERN_COUNTER
 532                    ;-----------------------------
 533                1           NOT1    ONF                     ;INVERT SASA_ON_OFF_FLAG
+  1 00B8 150D2    1           XOR     .MF.ONF SHR 4,#.DF.ONF AND 0FH
 534                    ;-----------------------------
 535                    ;       PATTERN OFFSET
 536                    ;-----------------------------
 537 00B9 080CA                 LD      ACCU,SMF                ;XOR SMF TO ACCU FOR SASA OFFSET
 538 00BA 150AF                 XOR     ACCU,#1111B
 539                    ;
 540                    ;                                       ;OFFSET 4H,2H,1H
 541                    ;SASA OFFSET DECISION
 542 00BB 1E044                 SKT     INM,#0100B              ;X1XX=01XX(1H),11XX(4H) SKIP
 543                    ;OFFSET2H:
 544 00BC 110A4                 SUB     ACCU,#0100B             ;OFFSET SASA 2H VALUE
 545 00BD 1E048                 SKT     INM,#1000B              ;1XXX=10XX(2H),11XX(4H) SKIP
 546                    ;OFFSET1H:
 547 00BE 110A6                 SUB     ACCU,#0110B             ;OFFSET SASA 1H VALUE
 548                    ;OFFSET4H:                               ;NON OFFSET
 549                    ;-------------------------------
 550                    ;ON_OFF_CHK:
 551                1           SKT1    ONF                     ;SASA ON MODE ?
+  1 00BF 1E0D2    1           SKT     .MF.ONF SHR 4,#.DF.ONF AND 0FH
 552 00C0 0C0C5                 BR      OFFACT                  ;SASA OFF MODE
 553                    ;
 554                    ;-------------------------------
 555                    ;       SASA_ON_PATTERN RESET
 556                    ;-------------------------------
 557                    ;ONACT:
 558 00C1 1D0E3                 MOV     ONFC,#03H               ;LOAD SASA ON 0.5H ---> 4H = 12 Sec
 559 00C2 0B0A0                 SKNE    ACCU,#0000B             ;SASA ON 0.5H MODE ?
 560 00C3 1D0E6                 MOV     ONFC,#06H               ;LOAD SASA ON     0.5H     = 24 Sec
 561 00C4 0C0D4                 BR      RANDOM
 562                    ;
 563                    ;-------------------------------
 564                    ;       SASA_OFF_PATTERN RESET
 565                    ;-------------------------------
 566                    OFFACT:                                 ;OFF MODE
 567 00C5 090A0                 SKE     ACCU,#0000B             ;  0H --- 1H MODE ?
 568 00C6 0B0A1                 SKNE    ACCU,#0001B
 569                    ;LD3:                                   ;LOAD 12 SEC
 570 00C7 1D0E3                 MOV     ONFC,#03H               ;SASA_TIMER_ON_OFF_PATTERN_COUNTER=3
 571                    ;
 572 00C8 0B0A2                 SKNE    ACCU,#0010B             ;  1H --- 1.5H MODE ?
 573                    ;LD6:
 574 00C9 1D0E6                 MOV     ONFC,#06H               ;SASA_TIMER_ON_OFF_PATTERN_COUNTER=6
 575 00CA 0B0A3                 SKNE    ACCU,#0011B             ;1.5H --- 2H MODE ?
 576                    ;LD9:                                   ;LOAD 36 SEC
 577 00CB 1D0E9                 MOV     ONFC,#09H               ;SASA_TIMER_ON_OFF_PATTERN_COUNTER=9
 578 00CC 090A4                 SKE     ACCU,#0100B             ;  2H --- 3H MODE ?
 579 00CD 0B0A5                 SKNE    ACCU,#0101B
 580                    ;LD12:                                  ;LOAD 48 SEC
 581 00CE 1D0EC                 MOV     ONFC,#0CH               ;SASA_TIMER_ON_OFF_PATTERN_COUNTER=12
 582 00CF 090A6                 SKE     ACCU,#0110B             ;  3H --- 4H MODE ?
 583 00D0 0B0A7                 SKNE    ACCU,#0111B
 584                    ;LD15:                                  ;LOAD 60 SEC
```

```
 585 00D1 1D0EF              MOV     ONFC, #0FH              ;SASA_TIMER_ON_OFF_PATTERN_COUNTER=15
 586 00D2 0C0D4              BR      RANDOM
 587                 ;
 588                 ;*****************************************
 589                 ;       RANDOM CHK                       *
 590                 ;*****************************************
 591                 NON_SASA:
 592           |             SET1    ONF                     ;EVERY NON_SASA MODE, SET ONF=1
+  1 00D3 160D2  |             OR      .MF.ONF SHR 4,#.DF.ONF AND 0FH
 593                 RANDOM:                               ;
 594           |             SKF1    RANDOM_F                ;CHK RANDOM MODE ?
+  1 00D4 1F0D1  |             SKF     .MF.RANDOM_F SHR 4,#.DF.RANDOM_F AND 0FH
 595           |             SKT1    ONF                     ;CHK SASA_OFF MODE ?
+  1 00D5 1E0D2  |             SKT     .MF.ONF SHR 4,#.DF.ONF AND 0FH
 596 00D6 0C0DA              BR      END_RANDOM              ;NON_RANDOM & SASA_OFF
 597                                                       ;BRANCH OUT RANDOM_MODE
 598                 ;---------------------------
 599                 ;       RANDOM MODE PROCESS
 600                 ;---------------------------
 601 00D7 110F1              SUB     RAND_PAT,#01H           ;RANDOM_PATTERM - 1(RAND_PAT-1)
 602                 ;
 603 00D8 0B0F0              SKNE    RAND_PAT,#00H           ;RANDOM_PATTERM ENDING ? (RAND_PAT=0 ?)
 604 00D9 1D0F9              MOV     RAND_PAT,#09H           ;  ENDING!   RESET RANDOM_PATTERM = 9
 605                                                       ; NOT ENDING BRANCH TO NEXT ACTION
 606                 END_RANDOM:
 607                 ;*****************************************
 608                 ;       OUTPUT ACTION                    *
 609                 ;*****************************************
 610                 ;OUTPUT_ACTION:
 611 00DA 1C122              CALL    ACTION                  ;MAKE ACTION AFTER EVERY 4 SEC ENDING
 612                 ;*****************************************
 613                 ;       COUNT WAIT TO 2ms                *
 614                 ;*****************************************
 615                 COUNT_WAIT:                           ;EVERY CHK ACTION OK, WAITING TO 2ms
 616 00DB 1C19A              CALL    BUZZ_WAIT_2MS   ;[1]    ;DO 126us BUZZ WORKING
 617 00DC 0C03C              BR      SCAN                    ;BUZZER_ON_MODE < 50ms REPEAT SCAN
 618 00DD 0C0DE              BR      KEYPROCESS              ;BUZZER_ON_MODE = 50ms GOTO KEYPROCESS
 619                 ;;;                                       ;
 620                 ;*****************************************
 621                 ;       KEYPROCESS                       *
 622                 ;*****************************************
 623                 KEYPROCESS:
 624 00DE 0808A              LD      ACCU,KS_Temp            ;LOAD KEYSCAN TEMPORARY VALUE
 625 00DF 140A7              AND     ACCU,#0111B             ;MASK
 626                 ;-------------------------------
 627                 ;       KEY STATUS DECISION
 628                 ;-------------------------------
 629 00E0 0B0A6              SKNE    ACCU,#0110B             ;  SASA KEY ?
 630 00E1 0C0FA              BR      SAPR
 631                 ;
 632 00E2 0B0A7              SKNE    ACCU,#0111B             ;  CUT KEY ?
 633 00E3 0C10D              BR      CUTPR
 634                 ;
 635 00E4 0B0A1              SKNE    ACCU,#0001B             ;  WIND KEY ?
 636 00E5 0C10E              BR      WINPR
 637                 ;
 638 00E6 0B0A2              SKNE    ACCU,#0010B             ;  RANDOM KEY ?
 639 00E7 0C115              BR      RANPR
 640                 ;
 641 00E8 0B0A3              SKNE    ACCU,#0011B             ;  SWING KEY ?
 642 00E9 0C117              BR      SWINGPR
 643                 ;
 644 00EA 0B0A0              SKNE    ACCU,#0000B             ;  STNDBY KEY ?
 645 00EB 0C119              BR      STANDPR
 646                 ;---------------------------------------
 647                 ;       TIMER   KEY PROCESS
 648                 ;---------------------------------------
```

```
 649                    ;TIMPR:
 650 00EC 090C4                 SKE     SMF, #0100B             ;NORMAL MODE ?
 651              1             SKF1    SASA_F                  ;SASA MODE ?
+  1 00ED 1F0C8  1             SKF     .MF.SASA_F SHR 4,#.DF.SASA_F AND 0FH
 652 00EE 0C0F8                 BR      TIMADJ3                 ;NORMAL/SASA ==> 0.5H
 653                    ;TIMADJ:
 654 00EF 0B0C0                 SKNE    SMF, #0000B             ;0.5H MODE?
 655 00F0 0C0F4                 BR      TIMADJ1                 ;0.5H ==> 1H
 656                    ;
 657 00F1 0B0C1                 SKNE    SMF, #0001B             ;1H MODE ?
 658 00F2 0C0F6                 BR      TIMADJ2                 ;1H ==> 2H
 659                    ;--------------------------------
 660                    ;TIMADJ0:
 661 00F3 0C032                 BR      NORMAL_INT              ;02H ==> NORMAL
 662                    ;
 663                    TIMADJ1:
 664 00F4 1D0C1                 MOV     SMF, #0001B             ;0.5H ==> 01H
 665 00F5 0C035                 BR      INITTIMER
 666                    ;
 667                    TIMADJ2:
 668 00F6 1D0C3                 MOV     SMF, #0011B             ;01H ==> 02H
 669 00F7 0C035                 BR      INITTIMER
 670                    ;
 671                    TIMADJ3:
 672 00F8 1D0C0                 MOV     SMF, #0000B             ;NORMAL/SASA ==> 0.5H
 673 00F9 0C035                 BR      INITTIMER
 674                    ;
 675                    ;---------------------------------------
 676                    ;       SASA    KEY PROCESS
 677                    ;---------------------------------------
 678                    SAPR:
 679 00FA 14043                 AND     INM, #0011B             ;INIT INM REG
 680              1             SKT1    SASA_F                  ;SASA MODE ?
+  1 00FB 1E0C8  1             SKT     .MF.SASA_F SHR 4,#.DF.SASA_F AND 0FH
 681 00FC 0C10A                 BR      SAADJ0                  ;NORMAL/TIMER ==> 01H
 682                    ;
 683                    ;SASA MODE ADJ
 684 00FD 090C8                 SKE     SMF, #1000B             ;01H ==> 02H
 685 00FE 0B0C9                 SKNE    SMF, #1001B
 686 00FF 0C104                 BR      SALD2H
 687                    ;
 688 0100 090CA                 SKE     SMF, #1010B             ;02H ==> 04H
 689 0101 0B0CB                 SKNE    SMF, #1011B
 690 0102 0C107                 BR      SALD4H
 691                    ;--------------------------------
 692 0103 0C032                 BR      NORMAL_INT              ;04H ==> NORMAL MODE
 693                    ;
 694                    SALD2H:
 695 0104 16048                 OR      INM, #1000B
 696 0105 1D0CB                 MOV     SMF, #1011B             ;01H ==> 02H
 697 0106 0C034                 BR      INITSASA
 698                    ;
 699                    SALD4H:
 700 0107 1604C                 OR      INM, #1100B
 701 0108 1D0CF                 MOV     SMF, #1111B             ;02H ==> 04H
 702 0109 0C034                 BR      INITSASA
 703                    ;
 704                    SAADJ0:
 705 010A 16044                 OR      INM, #0100B
 706 010B 1D0C9                 MOV     SMF, #1001B             ;NORMAL/TIMER ==> 01H
 707 010C 0C034                 BR      INITSASA
 708                    ;
 709                    ;---------------------------------------
 710                    ;       CUT     KEY PROCESS
 711                    ;---------------------------------------
 712                    CUTPR:
 713 010D 0C026                 BR      STANDBY
```

```
                        ;
                        ;--------------------------------------
                        ;       WIND    KEY PROCESS
                        ;--------------------------------------
                        WINPR:
0010E 1E09C                     SKT     WRSCM.#1100B            ;WR=11 ?
0010F 0C113                     BR      WRADJ
00110 14093                     AND     WRSCM.#0011B            ;WR=11 ==> 01
00111 16094                     OR      WRSCM.#0100B
00112 0C03B                     BR      KEY_INT
                        WRADJ:
00113 10094                     ADD     WRSCM.#0100B
00114 0C03B                     BR      KEY_INT
                        ;
                        ;--------------------------------------
                        ;       RANDOM  KEY PROCESS
                        ;--------------------------------------
                        RANPR:
                1               NOT1    RANDOM_F                ;INVERT RANDOM_F ?
+   1 00115 150D1       1       XOR     .MF.RANDOM_F SHR 4,#.DF.RANDOM_F AND 0FH
00116 0C038                     BR      RAN_IN
                        ;--------------------------------------
                        ;       SWING   KEY PROCESS
                        ;--------------------------------------
                        SWINGPR:
                1               NOT1    SWING_F                 ;INVERT SWING FLAG
+   1 00117 15088       1       XOR     .MF.SWING_F SHR 4,#.DF.SWING_F AND 0FH
00118 0C03B                     BR      KEY_INT
                        ;--------------------------------------
                        ;       STANDBY KEY PROCESS
                        ;--------------------------------------
                        STANDPR:
00119 0C02D                     BR      NORMAL_MODE_IN          ;1st "ON" KEY PROCESS
                        ;
                        ;*****************************************
                        ;       PROGRAM ADJ                     *
                        ;*****************************************
                        ;
0011A 074F0             ADJ8:   NOP             ; [8]           ;2ms_Cunter ADJ
0011B 074F0                     NOP             ; [7]
0011C 074F0             ADJ6:   NOP             ; [6]
0011D 074F0                     NOP             ; [5]
0011E 074F0                     NOP             ; [4]
0011F 074F0                     NOP             ; [3]
00120 074F0                     NOP             ; [2]
00121 070E0                     RET             ; [1]
                        ;;;                                     ;
                        ;*****************************************
                        ;       CALL SUBROUTINE HERE            *
                        ;*****************************************
                        ;*****************************************
                        ;       ACTION  SUBROUTINE      [+17]   *
                        ;*****************************************
                        ACTION:
                        ;
                1               SKT1    ONF                     ;ON ACTION ?
+   1 00122 1E0D2       1       SKT     .MF.ONF SHR 4,#.DF.ONF AND 0FH
00123 0C146                     BR      STPOP                   ;OFF ACTION
                        ;
                1               SKT1    RANDOM_F                ;RANDOM ?
+   1 00124 1E0D1       1       SKT     .MF.RANDOM_F SHR 4,#.DF.RANDOM_F AND 0FH
00125 1D0F9                     MOV     RAND_PAT,#09H           ;NORMAL WIND MODE SET
                        ;--------------------------------------
                        ;       RANDOM WIND CHK
                        ;--------------------------------------
                        ;RANDOM_WIND_MODE DECISION
00126 1E094                     SKT     WRSCM.#0100B            ;X1XX=01XX, 11XX SKIP
```

```
777 0127 0C132              BR      MIDWIND                 ;10XX   MID_WIND MODE
778 0128 1F098              SKF     WRSCM, #1000B           ;0XXX=01XX, 00XX SKIP
779 0129 0C13C              BR      HIWIND                  ;11XX   HI_WIND_MODE
780                 ;---------------------- RANDOM LOW WIND MODE -----------------
781                 ;LOWWIND:
782 012A 1D0A6              MOV     ACCU, #LOW              ;INIT OUTPUT PORT=X110
783                 ;
784 012B 090F8              SKE     RAND_PAT, #08H          ;RAND_PAT=8
785 012C 0B0F1              SKNE    RAND_PAT, #01H          ;RAND_PAT=1
786 012D 1D0A7              MOV     ACCU, #STP              ;SET OUTPUT PORT=X111
787
788                 ;
789 012E 090F6              SKE     RAND_PAT, #06H          ;RAND_PAT=6
790 012F 0B0F3              SKNE    RAND_PAT, #03H          ;RAND_PAT=3
791 0130 1D0A5              MOV     ACCU, #MID              ;SET OUTPUT PORT=X101
792 0131 0C147              BR      OUTPUT                  ;RAND_PAT=2, 4, 5, 7, 9
793                 ;
794                 ;---------------------- RANDOM MID WIND MODE -----------------
795                 MIDWIND:
796 0132 1D0A5              MOV     ACCU, #MID              ;INIT OUTPUT PORT=X101
797                 ;
798 0133 090F7              SKE     RAND_PAT, #07H          ;RAND_PAT=7
799 0134 0B0F3              SKNE    RAND_PAT, #03H          ;RAND_PAT=3
800 0135 1D0A3              MOV     ACCU, #HI               ;SET OUTPUT PORT=X011
801                 ;
802 0136 090F8              SKE     RAND_PAT, #08H          ;RAND_PAT=8
803 0137 0B0F6              SKNE    RAND_PAT, #06H          ;RAND_PAT=6
804 0138 1D0A6              MOV     ACCU, #LOW              ;SET OUTPUT PORT=X110
805                 ;
806 0139 0B0F1              SKNE    RAND_PAT, #01H          ;RAND_PAT=1
807 013A 1D0A6              MOV     ACCU, #LOW              ;SET OUTPUT PORT=X110
808 013B 0C147              BR      OUTPUT                  ;RAND_PAT=2, 4, 5, 9
809                 ;---------------------- RANDOM HI WIND MODE ------------------
810                 HIWIND:
811 013C 1D0A3              MOV     ACCU, #HI               ;SET OUTPUT PORT=X011
812                 ;
813 013D 090F5              SKE     RAND_PAT, #05H          ;RAND_PAT=5
814 013E 0B0F2              SKNE    RAND_PAT, #02H          ;RAND_PAT=2
815 013F 1D0A6              MOV     ACCU, #LOW              ;SET OUTPUT PORT=X110
816                 ;
817 0140 090F7              SKE     RAND_PAT, #07H          ;RAND_PAT=7
818 0141 0B0F6              SKNE    RAND_PAT, #06H          ;RAND_PAT=6
819 0142 1D0A5              MOV     ACCU, #MID              ;SET OUTPUT PORT=X101
820                 ;
821 0143 0B0F1              SKNE    RAND_PAT, #01H          ;RAND_PAT=1
822 0144 1D0A5              MOV     ACCU, #MID              ;SET OUTPUT PORT=X101
823 0145 0C147              BR      OUTPUT                  ;RAND_PAT=3, 4, 8, 9
824                 ;-------------------------------------------------------------
825                 STPOP:
826 0146 1D0A7              MOV     ACCU, #STP              ;SET OUTPUT PORT=X111
827                 ;
828                 OUTPUT:
829             1           SKF1    SWING_F                 ;CHK SWING MODE ?
+   1 0147 1F088    1       SKF     .MF, SWING_F SHR 4, #, DF, SWING_F AND 0FH
830 0148 160A8              OR      ACCU, #1000B            ;SET SWING OFF
831 0149 1872A              ST      P0C, ACCU               ;OUTPUT TO ACTION PORT (P0C)
832             1           SKF1    ONF                     ;OFF ACTION ?
+   1 014A 1F0D2    1       SKF     .MF, ONF SHR 4, #, DF, ONF AND 0FH
833 014B 070E0              RET
834 014C 0C11A              BR      ADJ8
835                 ;*********************************************
836                 ;       LEDSCAN 1st                         *
837                 ;*********************************************
838                 LED1:
839                 ;
840             1           SKF1    RANDOM_F                ;CHK RANDOM MODE ?
+   1 014D 1F0D1    1       SKF     .MF, RANDOM_F SHR 4, #, DF, RANDOM_F AND 0FH
```

```
841 014E 1401E              AND     LEDPORT, #1110B         ;RANDOM LED ON
842                 ;
843 014F 0B0AC              SKNE    ACCU, #1100B            ;CHK HI_WIND MODE
844 0150 1401D              AND     LEDPORT, #1101B         ;SCAN1 HI_WIND LED ON
845                 ;
846           1             SKF1    SASA_F                  ;CHK SASA MODE
+   1 0151 1F0C8  1         SKF     .MF.SASA_F SHR 4,#.DF.SASA_F AND 0FH
847 0152 0C157              BR      X2                      ;BR SASA CHK
848                 ;
849 0153 090C2              SKE     SMF, #0010B             ;CHK TIMER 2H MODE ?
850 0154 0B0C3              SKNE    SMF, #0011B
851 0155 0C172              BR      TL                      ;SCAN1 TIMER 2H LED ON
852 0156 0C174              BR      TIMOUT                  ;NO TIMER , RETURN
853                 ;
854                 X2:
855 0157 1E0CC              SKT     SMF, #1100B             ;CHK SASA 4H MODE(11XX)
856 0158 0C17A              BR      SDJ1                    ;NO SASA, RETURN
857 0159 0C170              BR      TH                      ;SCAN1 SASA 4H LED ON
858                 ;**********************************************
859                 ;       LEDSCAN 2nd                         *
860                 ;**********************************************
861                 LED2:
862 015A 0B0A8              SKNE    ACCU, #1000B            ;CHK MID_WIND MODE
863 015B 1401D              AND     LEDPORT, #1101B         ;SCAN1 MID_WIND LED ON
864                 ;TIMLED2:
865           1             SKT1    SASA_F                  ;CHK SASA MODE
+   1 015C 1E0C8  1         SKT     .MF.SASA_F SHR 4,#.DF.SASA_F AND 0FH
866 015D 0C162              BR      Y2                      ;BR TIMER MODE
867                 ;
868 015E 090CA              SKE     SMF, #1010B             ;CHK SASA 2H MODE
869 015F 0B0CB              SKNE    SMF, #1011B
870 0160 0C170              BR      TH                      ;SCAN2 SASA 2H LED ON
871 0161 0C176              BR      SDJ5                    ;NO SASA, RETURN
872                 ;
873                 Y2:
874 0162 090C1              SKE     SMF, #0001B             ;CHK TIMER 1H MODE
875 0163 0C176              BR      SDJ5                    ;NO TIMER , RETURN
876 0164 0C172              BR      TL                      ;SCAN2 TIMER 1H LED ON
877                 ;**********************************************
878                 ;       LEDSCAN 3rd                         *
879                 ;**********************************************
880                 LED3:
881 0165 0B0A4              SKNE    ACCU, #0100B            ;CHK LOW_WIND MODE
882 0166 1401D              AND     LEDPORT, #1101B         ;SCAN1 LOW_WIND LED ON
883                 ;TIMLED3:
884           1             SKT1    SASA_F                  ;CHK SASA MODE ?
+   1 0167 1E0C8  1         SKT     .MF.SASA_F SHR 4,#.DF.SASA_F AND 0FH
885 0168 0C16D              BR      Z2                      ;BR TIMER MODE
886                 ;
887 0169 090C8              SKE     SMF, #1000B             ;CHK SASA 1H MODE ?
888 016A 0B0C9              SKNE    SMF, #1001B
889 016B 0C170              BR      TH                      ;SCAN2 SASA 1H LED ON
890 016C 0C176              BR      SDJ5                    ;NO SASA , RETURN
891                 ;
892                 Z2:
893 016D 090C0              SKE     SMF, #0000B             ;CHK TIMER 0.5H MODE
894 016E 0C176              BR      SDJ5                    ;NO TIMER, RETURN
895 016F 0C172              BR      TL                      ;SCAN3 TIMER 0.5H LED ON
896                 ;-----------------------------
897                 TH:
898 0170 14017              AND     LEDPORT, #0111B         ;LED TIME OUTPUT HI BIT
899 0171 0C174              BR      TIMOUT
900                 TL:
901 0172 1401B              AND     LEDPORT, #1011B         ;LED TIME OUTPUT LOW BIT
902 0173 0C174              BR      TIMOUT
903                 TIMOUT:
904 0174 18731              ST      P0D, LEDPORT            ;LED OUTPUT TO P0C
```

```
905 0175 070E0              RET
906                 ;---------------------------
907                 ;       SDJ
908                 ;---------------------------
909 0176 074F0      SDJ5:   NOP
910 0177 074F0              NOP
911 0178 074F0              NOP
912 0179 074F0              NOP
913 017A 0C174      SDJ1:   BR      TIMOUT
914                 ;;;                                         ;
915                 ;-----------------------------------------
916                 ;       KEYSCAN                 [+9]    -
917                 ;-----------------------------------------
918                 KEYSCAN:
919 017B 0871A              LD      ACCU, P0B               ;LOAD KEY PORT (P0B)
920 017C 140AE              AND     ACCU, #1110B            ;MASK KEY=XXX0 (SKIP ZERO CROSSING)
921                 ;
922 017D 0B0A0              SKNE    ACCU, #0000B            ;KEY=000X ?
923 017E 0C188              BR      NON_KEY
924 017F 0B0A2              SKNE    ACCU, #0010B            ;KEY=001X ?
925 0180 0C18A              BR      WIND_TIMER_KEY
926 0181 0B0A4              SKNE    ACCU, #0100B            ;KEY=010X ?
927 0182 0C18C              BR      RANDOM_SASA_KEY
928 0183 0B0A8              SKNE    ACCU, #1000B            ;KEY=100X ?
929 0184 0C18E              BR      SWING_CUT_KEY
930                 ;---------------------------------
931                 ;       MULKY
932                 ;---------------------------------
933                 ;MULKY:
934             1           SET1    LOCKF                   ;MULTI PRESS ERROR KEY(LOCK)
+   1 0185 16078    1       OR      .MF.LOCKF SHR 4,#.DF.LOCKF AND 0FH
935 0186 16084              OR      KS_Temp, #0100B
936 0187 070E0              RET
937                 ;---------------------------------
938                 ;       NON KEY
939                 ;---------------------------------
940                 NON_KEY:
941 0188 074F0              NOP                             ;RELEASE KEY
942 0189 070E0              RET
943                 ;---------------------------------
944                 ;       WIND_TIMER_KEY
945                 ;---------------------------------
946                 WIND_TIMER_KEY:
947 018A 16081              OR      KS_Temp, #0001B         ;KeyScan_Temporary=X001 WIND/TIMER KEY
948 018B 0C18D              BR      SKDJ2
949                 ;
950                 ;---------------------------------
951                 ;       RANDOM_SASA_KEY
952                 ;---------------------------------
953                 RANDOM_SASA_KEY:
954 018C 16082              OR      KS_Temp, #0010B         ;KeyScan_Temporary=X010 RANDOM/SASA KEY
955 018D 0C18F      SKDJ2:  BR      SKDJ1
956                 ;
957                 ;---------------------------------
958                 ;       SWING_CUT KEY
959                 ;---------------------------------
960                 SWING_CUT_KEY:
961 018E 16083              OR      KS_Temp, #0011B         ;KeyScan_Temporary=X011 SWING/CUT  KEY
962 018F 071E0      SKDJ1:  RETSK                   ;[9]
963                 ;
964                 ;-----------------------------------------
965                 ;       PULSE COUNT             [+4]    -
966                 ;-----------------------------------------
967                 PULSE_COUNT:
968             1           SKT1    P0B0                    ;CHK PULSE=HIGH ?
+   1 0190 1E711    1       SKT     .MF.P0B0 SHR 4,#.DF.P0B0 AND 0FH
969 0191 0C196              BR      PFCLR                   ;   PULSE=LOW
```

```
 970                    ;------------
 971                    ;PULSE_HIGH -
 972                    ;------------
 973                1           SKF1    PULSE_F                 ;PULSE_F EVER SET ?
+  1 0192 1F0D8    1           SKF     .MF.PULSE_F SHR 4,#.DF.PULSE_F AND 0FH
 974 0193 0C198                 BR      PRET                    ;PULSE_F SET ALREADY
 975                1           SET1    PULSE_F                 ;1st High Pulse SET PULSE_F=1
+  1 0194 160D8    1           OR      .MF.PULSE_F SHR 4,#.DF.PULSE_F AND 0FH
 976 0195 071E0                 RETSK
 977                    ;------------
 978                    ;PULSE_LOW  -
 979                    ;------------
 980                    PFCLR:                                  ;PULSE_LOW STATE
 981 0196 074F0                 NOP
 982                1           CLR1    PULSE_F                 ;CLR PULSE_F=0
+  1 0197 140D7    1           AND     .MF.PULSE_F SHR 4,#.DF,(NOT PULSE_F AND 0FH)
 983 0198 074F0         PRET:   NOP
 984 0199 070E0                 RET
 985                    ;----------------------------------------
 986                    ;       BUZZ WAIT 2MS           [+5]    -
 987                    ;----------------------------------------
 988                    BUZZ_WAIT_2MS:
 989                    ;
 990 019A 1D010                 MOV     MSL,#00H        ;[2]    ;INITIAL 124us_COUNTER  MAX=[7]
 991 019B 1D000                 MOV     MSH,#00H        ;[3]    ;INITIAL 2ms_COUNTER    MAX=[14(0EH)]
 992                    ;
 993                1   LOP0:   SKF1    BUZF            ;[1]
+  1 019C 1F042    1           SKF     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
 994                1           NOT1    P0A3            ;[2]    ;INVERT BUZZER "H/L"
+  1 019D 15708    1           XOR     .MF.P0A3 SHR 4,#.DF.P0A3 AND 0FH
 995 019E 10001                 ADD     MSH,#01H        ;[3]    ;2ms Counter + 1
 996                    ;                                       ; DELAY 112us
 997 019F 074F0         LOP1:   NOP                     ;[1]    [4]
 998 01A0 10011                 ADD     MSL,#01H        ;[2]     V
 999 01A1 0901E                 SKE     MSL,#0EH        ;[3]     V      2us * 4 * 14(0EH) = 112 us
1000 01A2 0C19F                 BR      LOP1            ;[4]    [59]
1001                    ;---------------------------
1002                    ;       124 us Ending
1003                    ;---------------------------
1004 01A3 1D010                 MOV     MSL,#00H        ;[1]    [60]    CLR 124us Counter(MSL)
1005 01A4 0900E                 SKE     MSH,#0EH        ;[2]    [61]    2ms Ending ?
1006 01A5 0C19C                 BR      LOP0            ;[3]    [62]    2us * 62 = 124 us
1007                    ;
1008                    ;---------------------------
1009                    ;       2ms Ending
1010                    ;---------------------------
1011                1           SKT1    BUZF                    ; BUZZER MODE ?
+  1 01A6 1E042    1           SKT     .MF.BUZF SHR 4,#.DF.BUZF AND 0FH
1012 01A7 070E0                 RET                             ; BUZZER OFF MODE
1013                    ;
1014 01A8 100B1                 ADD     BZ50MS_L,#01H           ;50ms_COUNTER +1
1015 01A9 12070                 ADDC    BZ50MS_H,#00H
1016                    ;                                       ;   (19H)=(25) 2ms*25=50ms
1017 01AA 1F071                 SKF     BZ50MS_H,#01H           ;CHK >=50ms ?
1018 01AB 090B9                 SKE     BZ50MS_L,#09H           ;
1019 01AC 070E0                 RET                             ;    < 50ms REPEAT SCAN
1020                    ;
1021                    ;---------------------------
1022                    ;       50ms Ending
1023                    ;---------------------------
1024                    ;
1025                    ;                                       ;    = 50ms GOTO KEYPRESS ROUTINE
1026 01AD 1407E                 AND     BZ50MS_H,#1110B         ;CLR KeyScan_Counter=XXX0
1027                1           CLR1    BUZF                    ;RESET TO BUZZ_OFF_MODE
+  1 01AE 1404D    1           AND     .MF.BUZF SHR 4,#.DF,(NOT BUZF AND 0FH)
1028 01AF 140B0                 AND     BZ50MS_L,#00H           ;CLR BUZZ_50ms_COUNTER
1029 01B0 071E0                 RETSK                           ;BRANCH TO KEYPROCESS
```

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 1030                   ;----------------------------------------
 1031                   ;       WAIT 2MS                [+5]    -
 1032                   ;----------------------------------------
 1033                   WAIT_2MS:                                       ;2000us/10us=200 (C8H)
 1034 01B1 0C1B4                BR      AZ0             ;[2]    ;INITIAL JUMP
 1035                   ;
 1036 01B2 10011        AZ1:    ADD     MSL,#01H        ;[1]    ;MS+1
 1037 01B3 12000                ADDC    MSH,#00H        ;[2]
 1038 01B4 0B00C        AZ0:    SKNE    MSH,#0CH        ;[3]    ;CHK MS=C8H ?
 1039 01B5 09018                SKE     MSL,#08H        ;[4]
 1040 01B6 0C1B2                BR      AZ1             ;[5]
 1041 01B7 070E0                RET                             ;MS=C8H (2ms)
 1042                   ;----------------------------------------
 1043                   ;       2ms     ADJ                     -
 1044                   ;----------------------------------------
 1045                   MSADJ:                                          ;2ms Counter ADJ
 1046 01B8 11011                SUB     MSL,#01H        ;[1]    ;ADJ VALUE - 1
 1047 01B9 09010                SKE     MSL,#00H        ;[2]    ;ADJ VALUE = 0 ?
 1048 01BA 0C1B8                BR      MSADJ           ;[3]    ;ADJ VALUE <>0 ,REPEAT SUB
 1049 01BB 070E0                RET                             ;ADJ VALUE = 0 ,RETURN
 1050                   ;----------------------------------------
 1051                   ;       2ms     REG (MS) RESET  [+3]    -
 1052                   ;----------------------------------------
 1053                   MS_H_L_CLR:
 1054 01BC 1D000                MOV     MSH,#00H
 1055 01BD 1D010                MOV     MSL,#00H
 1056 01BE 070E0                RET
 1057                   ;----------------------------------------
 1058                   ;       4ms_Counter REG (FS) RESET [+3] -
 1059                   ;----------------------------------------
 1060                   FS_H_L_CLR:
 1061 01BF 1D020                MOV     FSH,#00H
 1062 01C0 1D030                MOV     FSL,#00H
 1063 01C1 070E0                RET
 1064                   ;----------------------------------------
 1065                   ;       HALF_HOUR REG (HS) RESET [+4]   -
 1066                   ;----------------------------------------
 1067                   HS_H_M_L_CLR:
 1068 01C2 1404E                AND     HSH,#1110B
 1069 01C3 1D050                MOV     HSM,#00H
 1070 01C4 1D060                MOV     HSL,#00H
 1071 01C5 070E0                RET
 1072                   ;
 1073                           OPTION
 1074              1            OPTP0B OPEN,OPEN,OPEN,OPEN
+ 14       0000   1
 1075              1            OPTRES RESPLUP
+  5       0001   1
 1076                           ENDOP
 1077                           END


TOTAL ERRORS   = 0
TOTAL WARNINGS = 0

END OF LIST
;
AS17K V1.02 02 << D17104 XREF LIST >>          12:49:58 12/17/89 PAGE 01-001

PROG = FAN27 TEST

SOURCE = FAN27.ASM

SYMBOL            TYPE A VALUE  /REF(#DEF)

ACCU              MEM  L   0.0A /# 104    ,  284    ,  285    ,  362    ,  363    ,  364    ,  537    ,  538    ,  544    ,  547
                                   559    ,  567    ,  568    ,  572    ,  575    ,  578    ,  579    ,  582    ,  583    ,  624
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                                 625    , 629    , 632    , 635    , 638    , 641    , 644    , 782    , 786    , 791
                                 796    , 800    , 804    , 807    , 811    , 815    , 819    , 822    , 826    , 830
                                 831    , 843    , 862    , 881    , 919    , 920    , 922    , 924    , 926    , 928
ACTION             LAB  L      122 /  273    , 611    ,# 765
ADJ6               LAB  L      11C /  514    ,# 752
ADJ8               LAB  L      11A /# 750    , 834
AZ0                LAB  L      1B4 / 1034    ,#1038
AZ1                LAB  L      1B2 /#1036    , 1040
BUZF               FLG  L 0.04.1 /# 112    , 237    , 237-1  , 237-1  , 299    , 299-1  , 299-1  , 307    , 307-1  , 307-1
                                 331    , 331-1  , 331-1  , 339    , 339-1  , 339-1  , 387    , 387-1  , 387-1  , 406
                                 406-1  , 406-1  , 420    , 420-1  , 420-1  , 993    , 993-1  , 993-1  , 1011   , 1011-1
                                 1011-1 , 1027   , 1027-1 , 1027-1
BUZZ_WAIT_2MS      LAB  L      19A /  616    ,# 988
BZ50MS_H           MEM  L     0.07 /# 101    , 1015   , 1017   , 1026
BZ50MS_L           MEM  L     0.0B /# 105    , 239    , 1014   , 1018   , 1028
COMMON             LAB  L       37 /  252    ,# 261
COUNT              LAB  L       85 /  320    ,# 418
COUNT1_1           LAB  L       52 /  308    ,# 322    , 340    , 414
COUNT2_1           LAB  L       7A /  379    ,# 392
COUNT2_2           LAB  L       7C /  384    ,# 396
COUNT_ADJ          LAB  L       50 /# 318    , 324    , 359    , 373    , 390    , 394    , 398
COUNT_WAIT         LAB  L       DB /  508    ,# 615
COUNT_WAITADJ1     LAB  L       AA /  427    ,# 498
COUNT_WAITADJ2     LAB  L       AC /  435    ,# 501
COUNT_WAITADJ3     LAB  L       AE /  447    , 453    ,# 504
CUTPR              LAB  L      10D /  633    ,# 712
END_RANDOM         LAB  L       DA /  596    ,# 606
ERRKY              LAB  L       6E /  365    ,# 370
FS_H_L_CLR         LAB  L      1BF /  183    , 202    , 245    , 258    , 459    ,#1060
FS_INIT            LAB  L       99 /  448    ,# 458
FSH                MEM  L     0.02 /#  94    , 438    , 445    , 451    , 1061
FSL                MEM  L     0.03 /#  95    , 188    , 189    , 210    , 215    , 216    , 437    , 446    , 452    , 1062
H2                 LAB  L       A4 /  478    ,# 480
HI                 DAT  L        3 /# 155    , 800    , 811
HIWIND             LAB  L      13C /  779    ,# 810
HS_H_M_L_CLR       LAB  L      1C2 /  246    , 259    , 485    ,#1067
HSH                MEM  L     0.04 /#  97    , 112    , 471    , 476    , 1068
HSL                MEM  L     0.06 /#  99    , 469    , 479    , 1070
HSM                MEM  L     0.05 /#  98    , 470    , 477    , 1069
HZ50               LAB  L       25 /  220    ,# 223
HZ50_4secADJH      DAT  L        C /# 149    , 451
HZ50_4secADJL      DAT  L        8 /# 150    , 452
HZ50CHK            LAB  L       95 /  443    ,# 450
HZ60_4secADJH      DAT  L        F /# 151    , 445
HZ60_4secADJL      DAT  L        0 /# 152    , 446
HZ_INIT            LAB  L       17 /# 203    , 205
HZ_WAIT            LAB  L       1C /# 212    , 217
HZF                FLG  L 0.0D.2 /# 118    , 221    , 221-1  , 221-1  , 224    , 224-1  , 224-1  , 442    , 442-1  , 442-1
HZIN               LAB  L       19 /# 207    , 209
INITSASA           LAB  L       34 /# 254    , 697    , 702    , 707
INITTIMER          LAB  L       35 /# 257    , 665    , 669    , 673
INM                MEM  L     0.04 /#  96    , 542    , 545    , 679    , 695    , 700    , 705
KEY_EFFECT_CHK     LAB  L       71 /  351    , 369    ,# 377
KEY_INT            LAB  L       3B /# 269    , 723    , 726    , 739
KEY_RELEASE        LAB  L       62 /  348    ,# 353
KEYPROCESS         LAB  L       DE /  618    ,# 623
KEYSCAN            LAB  L      17B /  312    , 346    ,# 918
KS_Count           MEM  L     0.07 /# 100    , 113    , 238    , 356    , 381    , 383
KS_Temp            MEM  L     0.08 /# 102    , 111    , 243    , 310    , 343    , 350    , 354    , 624    , 935    , 947
                                 954    , 961
KYRL               LAB  L       65 /  355    ,# 358
LED1               LAB  L      14D /  302    ,# 838
LED2               LAB  L      15A /  334    ,# 861
LED3               LAB  L      165 /  409    ,# 880
LEDPORT            MEM  L     0.01 /#  91    , 281    , 282    , 841    , 844    , 863    , 882    , 898    , 901    , 904
LEDSCAN2           LAB  L       54 /  289    ,# 329
LEDSCAN3           LAB  L       7E /  291    ,# 404
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STANDPR          LAB  L    119 /  645    ,# 743
STP              DAT  L      7 /# 158    ,  786    ,  826
STPOP            LAB  L    146 /  768    ,# 825
SWING_CUT_KEY    LAB  L    18E /  929    ,# 960
SWING_F          FLG  L 0.08.3 /# 111    ,  738    ,  738-1  ,  738-1  ,  829    ,  829-1  ,  829-1
SWINGPR          LAB  L    117 /  642    ,# 737
TH               LAB  L    170 /  857    ,  870    ,  889    ,# 897
TIMADJ1          LAB  L     F4 /  655    ,# 663
TIMADJ2          LAB  L     F6 /  658    ,# 667
TIMADJ3          LAB  L     F8 /  652    ,# 671
TIMOUT           LAB  L    174 /  852    ,  899    ,  902    ,# 903    ,  913
TL               LAB  L    172 /  851    ,  876    ,  895    ,# 900
WAIT_2MS         LAB  L    1B1 /  186    ,  213    ,#1033
WAIT_ADJ         LAB  L     AF /  500    ,  503    ,# 506
WIND_TIMER_KEY   LAB  L    18A /  925    ,# 946
WINPR            LAB  L    10E /  636    ,# 718
WRADJ            LAB  L    113 /  720    ,# 724
WRSCM            MEM  L 0.09 /# 103    ,  244    ,  284    ,  288    ,  290    ,  304    ,  305    ,  336    ,  337    ,  411
                                412    ,  719    ,  721    ,  722    ,  725    ,  776    ,  778
X2               LAB  L    157 /  847    ,# 854
Y2               LAB  L    162 /  866    ,# 873
Z2               LAB  L    16D /  885    ,# 892


TOTAL SYMBOLS = 136

END OF XREF LIST
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