Chapter 3

OPERATION USING THE KEYPAD

This chapter describes inverter operation using the keypad. The inverter features three operation modes (Running, Programming and Alarm modes) which enable you to run and stop the motor, monitor running status, set function code data, display running information required for maintenance, and display alarm data.

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3.1 Overview of Operation Modes

FRENIC-Mini features the following three operation modes:

■ Running mode : This mode allows you to enter run/stop commands in regular operation. You may also monitor the running status in realtime.

■ Programming mode : This mode allows you to set function code data and check a variety of information relating to the inverter status and maintenance.

■ Alarm mode : If an alarm occurs, the inverter automatically enters this Alarm mode in which the corresponding alarm code* and its related information may be displayed on the LED monitor.

* Alarm code: Shows the error factor that has activated the protective function. For details, refer to Chapter 8, Section 8.8 "Details of Protective Functions."

Figure 3.1 shows the status transition of the inverter between these three operation modes. If the inverter is turned ON, it automatically enters Running mode, making it possible to start or stop the motor.

To make the transition between those operation modes, you need to press the specified keys as shown below, except at the occurrence of an alarm. If an alarm occurs in Running mode, the inverter will automatically switch to Alarm mode.

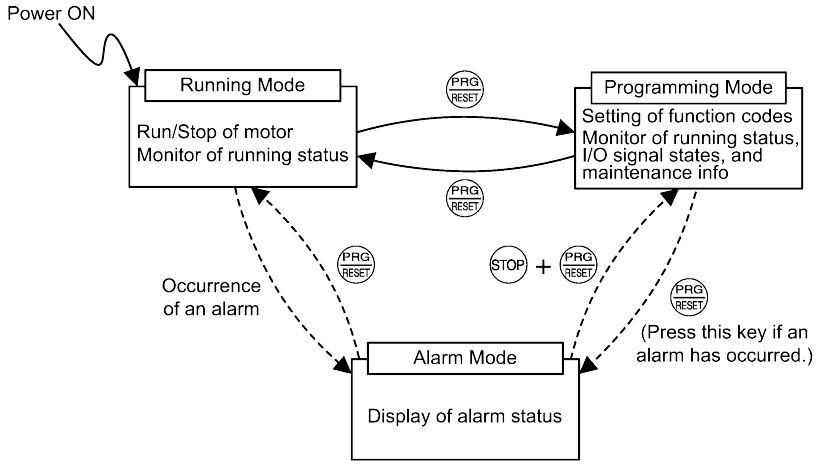
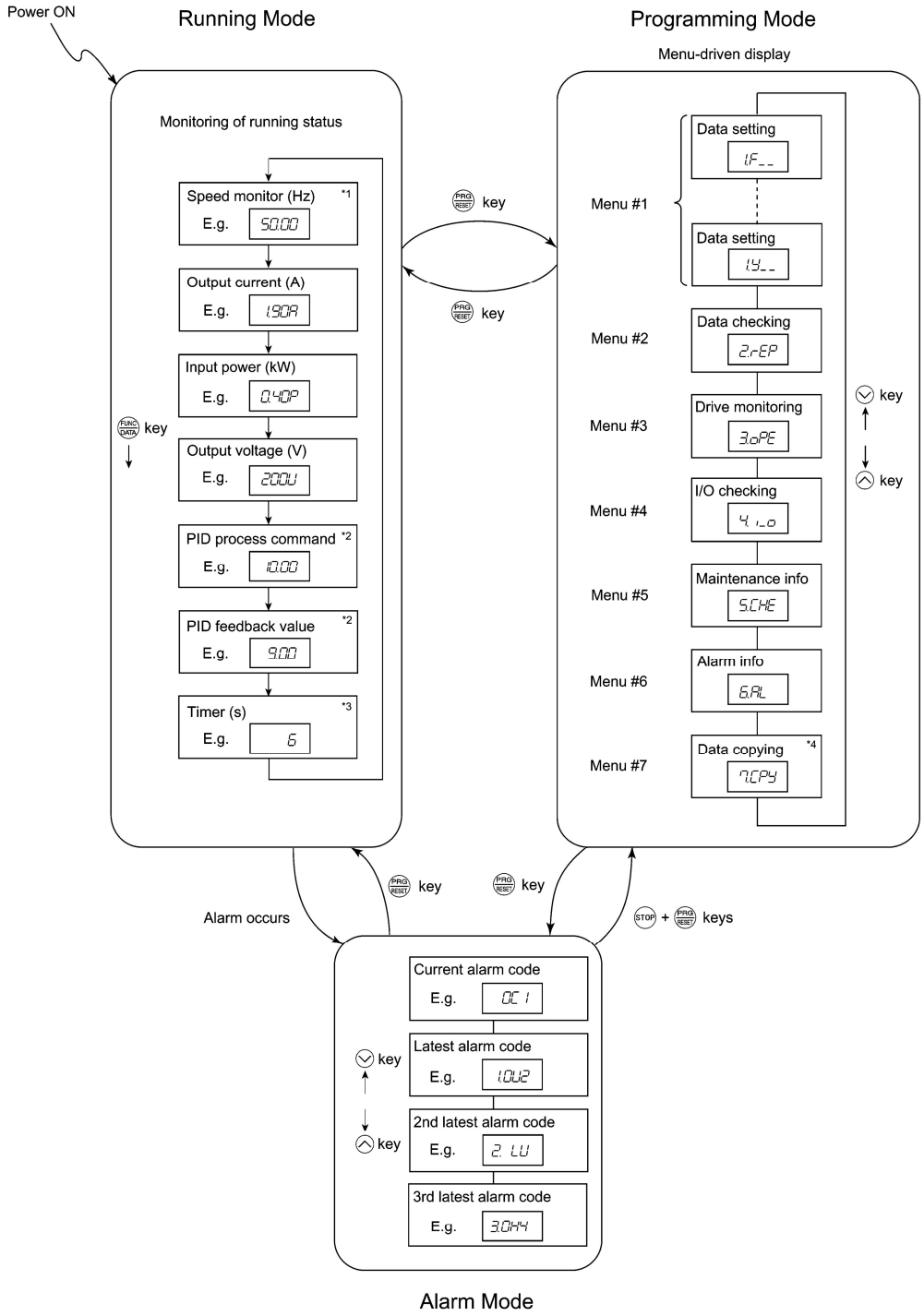


Figure 3.1 Status Transition between Operation Modes

The figure below shows the transition between the running status monitoring screens in Running mode, that between the menu screens in Programming mode, and that between the alarm code screens in Alarm mode.



*1 The speed monitor may display the output frequency (Hz), set frequency (Hz), load shaft speed (r/min), line speed (m/min.), and constant feeding rate time (min.) which can be selected by setting up function code E48.

*2 These PID-related information will appear only when the inverter is under the PID control. (Refer to Section 3.2.2.)

*3 This will appear only when timer operation is enabled by setting up function code C21. (Refer to Chapter 9, Section 9.2.3 "C codes (Control functions of frequency).")

*4 This will appear only when the remote keypad (option) is set up for use.

Figure 3.2 Basic Screen Transition in Each Operation Mode

3.2 Running Mode

If the inverter is turned ON, it automatically enters Running mode in which you may:

(1) Run/stop the motor
(2) Set up the set frequency and others
(3) Monitor the running status (e.g., output frequency, output current)
(4) Jog (inch) the motor

3.2.1 Run/stop the motor

By factory default, pressing the (RUN) key starts running the motor in the forward direction and pressing the (STOP) key brings the motor to a decelerated stop. The (RUN) key is enabled only in Running mode.

Changing function code F02 data makes it possible to run the motor in the reverse direction by pressing the (RUN) key, determine the motor rotational direction by entering input signals to the terminals, and control the motor by pressing (RUN) / (STOP) keys.

3.2.2 Set up the set frequency and others

By using the potentiometer and (∧) / (∨) keys on the keypad, you may set up the desired set frequency and PID process commands. It is also possible to set up the set frequency as frequency, load shaft speed, line speed, and constant feeding rate time by setting function code E48.

Setting up the set frequency with the potentiometer on the keypad (factory default)

If you set function code F01 to "4: Potentiometer on the keypad" (factory default) and select frequency setting-1 with function codes E01 through E03 (Hz2/Hz1 = OFF), then the potentiometer becomes enabled to set up the set frequency. Setting function code C30 to "4: Potentiometer on the keypad" and selecting frequency setting-2 (Hz2/Hz1 = ON) also produce the same effect.

Setting up the set frequency with (∧) / (∨) keys

If you set function code F01 to "0: Keypad operation" and select frequency setting-1, then (∧) / (∨) keys become enabled to set up the set frequency in Running mode. In any other operation modes, those keys remain disabled.

Pressing (∧) / (∨) keys calls up the set frequency with the lowest digit blinking. Pressing (∧) / (∨) keys again makes it possible to change the set frequency. The new setting will be saved internally. Even if the inverter is switched to any other frequency entry method and then returned to the keypad entry method, the setting will be retained.

Further, even turning OFF the inverter will automatically save the setting into the non-volatile memory. At the next time when the inverter is turned ON, the setting will become the default frequency.

If you set function code F01 to "0: Keypad operation" but do not select frequency setting-1, then (∧) / (∨) keys cannot be used for setting up the set frequency. Pressing those keys will just display the currently selected set frequency.

To set up the set frequency from any other displayed items, it is dependent on function code E48 data (= 4, 5, or 6) "LED monitor details (Select speed monitor)" as listed in the following table.

E48 data "LED monitor details (Select speed monitor)"	Set frequency display	Conversion of displayed value
0: Output frequency (before slip compensation)	Frequency setting	
1: Output frequency (after slip compensation)	Frequency setting	
2: Set frequency	Frequency setting	
4: Load shaft speed	Load shaft speed setting	Frequency setting x E50
5: Line speed	Line speed setting	Frequency setting x E50
6: Constant feeding rate time	Constant feeding rate time	$\frac{\text{E50}}{\text{Frequency setting} \times \text{E39}}$

Tip If you set function code C30 to "0: Keypad operation" and select frequency setting-2, then ⌃ / ⌄ keys become also enabled to set up the set frequency.

■ Make setting under PID control

To enable PID control, you need to set function code J01 to 1 or 2.

In the PID control mode, the items that can be set or checked with ⌃ / ⌄ keys are different from those under normal frequency control, depending upon the current LED monitor setting. If the LED monitor is set to the speed monitor (E43 = 0), you may access manual feed commands (Set frequency) with ⌃ / ⌄ keys; if it is set to any other, you may access PID process commands with those keys.

Refer to Chapter 4, Section 4.8 "PID Frequency Command Generator" for details on the PID control.

Setting the PID process command with the built-in potentiometer

Set function code E60 to "3: PID process command 1" and J02 to "1: PID process command 1." After that, selecting PID control remote process command enables you to set the PID process command using the built-in potentiometer.

Setting the PID process command with ⌃ / ⌄ keys

Set function code J02 to "0: Keypad operation" and set the LED monitor to the setting other than the speed monitor (E43 = 0) in Running mode. This makes it possible to set the PID process command using ⌃ / ⌄ keys. This setting is possible only in Running mode.

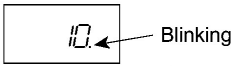
Pressing ⌃ / ⌄ keys displays the PID process command with the lowest digit blinking on the LED monitor. Pressing ⌃ / ⌄ keys again makes it possible to change the PID process command. Once the PID process command is modified, it will be saved internally. Even if the inverter is switched to any other PID process command entry method and then returned to the keypad entry method, the setting will be retained.

Further, even turning OFF the inverter will automatically save the setting into the non-volatile memory. At the next time when the inverter is turned ON, the setting will become the default PID process command.

Even if the PID process command is selected ((SS4) = ON) in the multistep frequency, it is still possible to set the process command using the keypad.

When function code J02 has been set to any value except 0, pressing ⌃ / ⌄ keys displays the PID process command currently selected (setting is not possible).

When the PID process command is displayed, the decimal point next to the lowest digit on the LED display blinks to discriminate it from the frequency setting.



Setting up the set frequency with ⌃ / ⌄ keys under the PID control

To set the set frequency with ⌃ / ⌄ keys under the PID control, you need to specify the following conditions:

- Set function code F01 to "0: Keypad operation."
- Select frequency setting-1 (Frequency settings from communications link: Disabled, and Multistep frequency settings: Disabled) as manual speed command.
- Set the LED monitor to the speed monitor in Running mode.

The above setting is impossible in any operation mode except Running mode.

The setting procedure is the same as that for usual frequency setting.

If you press ⌃ / ⌄ keys in any conditions other than those described above, the following will appear:

Frequency setting 1 (F01)	Frequency setting from communications link	Multistep frequency setting	PID control cancelled	Displayed using ⌃ / ⌄ keys
0	Disabled	Disabled	PID enabled	Frequency setting by keypad
			Cancelled	
Other than the above			PID enabled	PID output (as final frequency command)
			Cancelled	Manual speed command currently selected (frequency setting)

Tip

- When setting the frequency and others with ⌃ / ⌄ keys, the lowest digit on the display will blink. Change the setting, starting from the lowest digit and the cursor will move gradually to the next digit to be changed.
- When the data is to be changed rapidly, hold down the PRG/RESET key for 1 second or longer, and the blinking cursor will move to the next digit where the data can be changed (cursor movement).

3.2.3 Monitor the running status

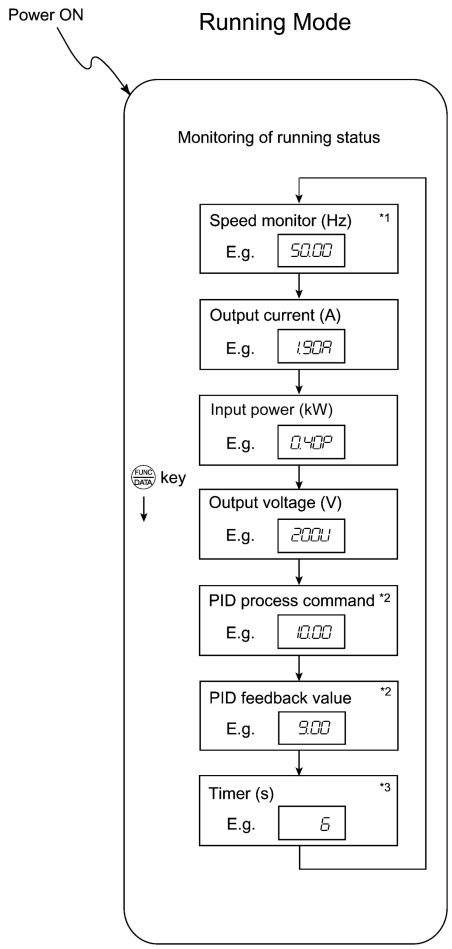
In Running mode, the seven items listed below can be monitored. Immediately after the inverter is turned ON, the monitor item specified by function code E43 is displayed. Press the FUNC/DATA key to switch between monitor items.

Table 3.1 Monitor Items

Monitor Items	Display Sample on the LED monitor	Meaning of Displayed Value
Speed monitor (Hz, r/min, m/min, min)	50.00	Refer to Table 3.2.
Output current (A)	1.90A	Detected value
Input power (kW)	0.40P	*P*: An alternative expression for kW
Output voltage (V)	200U	Commanded value
PID process command (Note)	10.00	(PID process command or PID feedback value) × (PID display coefficient A – B) + B PID display coefficient A and B: Refer to function codes E40 and E41
PID feedback value (Note)	9.00	
Timer (sec) (Note)	6	Remaining effective timer count

Note: The PID process command and PID feedback value are displayed only under the PID control using a process command (J01 = 1 or 2). Further, the timer (for timer operation) is only displayed when timer is enabled (C21 = 1).

Figure 3.3 shows the procedure example for selecting the desired monitor item.



*1 The speed monitor may display the output frequency (Hz), set frequency (Hz), load shaft speed (r/min), line speed (m/min.), and contrast feeding rate time (min.) which can be selected by setting up function code E48.

*2 These PID-related information will appear only when the inverter is under the PID control. (Refer to Section 3.2.2.)

*3 This will appear only when timer operation is enabled by setting up function code C21. (Refer to Chapter 9, Section 9.2.3 "C codes (Control functions of frequency).")

Figure 3.3 Monitor Item Selection Example

Table 3.2 lists the display items for the speed monitor that can be chosen with function code E48.

Table 3.2 Display Items on the Speed Monitor

Speed monitor items	Function code E48 data	Meaning of Displayed Value
Output frequency (before slip compensation) (Hz) (Factory default)	0	Pre-slip compensation frequency
Output frequency (after slip compensation) (Hz)	1	Frequency actually being outputted
Set frequency (Hz)	2	Final set frequency
Load shaft speed (r/min)	4	Display value = Output frequency (Hz) x E50*
Line speed (m/min)	5	Display value = Output frequency (Hz) x E50*
Constant feeding rate time (min)	6	Display value = $\frac{\text{E50}}{\text{Output frequency} \times \text{E39}}$ *

* Output frequencies contained in these formulas are output frequencies before slip compensation.

3.2.4 Jog (inch) the motor

In Running mode, pressing (STOP) + (∧) keys at the same time (simultaneous keying) can make the inverter ready for jogging. The *JoG* appears on the LED monitor.

To return the inverter from the ready-to-jog state to the usual running state, you need to press (STOP) + (∧) keys simultaneously.

Using the external input signal command (JOG) also allows the transition between the ready-to-jog state and usual running state.

Refer to function codes E01 to E03 in Chapter 9, Section 9.2.2 "E codes (Extension terminal functions)" for details.

During jogging, the jogging frequency (C20) and acceleration/deceleration time for jogging (H54) will apply. They are exclusively prepared for jogging and required to be set up individually.

When jogging the motor from the keypad, the inverter will only run while the (RUN) key is held down, and contrarily the moment the (RUN) key is released, the inverter will decelerate and stop the motor.

Note The transition ((STOP) + (∧) keys) between the ready-to-jog state and usual running state is enabled only when the inverter is not in operation.

3.3 Programming Mode

Pressing the PRG/RESET key in Running mode switches the inverter to Programming mode. This mode provides the following functions which can be easily selected with the menu-driven system.

(1) Data setting (Menu #1)
(2) Data checking (Menu #2)
(3) Drive monitoring (Menu #3)
(4) I/O checking (Menu #4)
(5) Maintenance information (Menu #5)
(6) Alarm information (Menu #6)
(7) Data copying (Menu #7)

The table below lists the menus, letters that will appear on the LED monitor, and functions. The leftmost digit (numerals) of each letter string indicates the corresponding menu number and the remaining three digits indicate the menu contents.

When the inverter enters Programming mode from the second time on, the menu that was selected last in Programming mode will be displayed.

Table 3.3 Menus Available in Programming Mode

Menu	LED monitor shows:	Main functions		Refer to:
Menu #1 "Data setting"	1.F_ _	F codes (Fundamental functions)	Selecting each of these function codes enables its data to be displayed/ changed.	Section 3.3.1
	1.E_ _	E codes (Extension terminal functions)		
	1.C_ _	C codes (Control functions of frequency)		
	1.P_ _	P codes (Motor parameters)		
	1.H_ _	H codes (High performance functions)		
	1.J_ _	J codes (Application functions)		
	1.y_ _	y codes (Link functions)		
Menu #2 "Data checking"	2.rEP	Displays only function codes that have been changed from their factory defaults. You may refer to or change those function codes data.		Section 3.3.2
Menu #3 "Drive monitoring"	3.oPE	Displays the running information required for maintenance or test running.		Section 3.3.3
Menu #4 "I/O checking"	4.I_O	Displays external I/O signal information.		Section 3.3.4
Menu #5 "Maintenance information"	5.CHE	Displays maintenance information including cumulative running time.		Section 3.3.5
Menu #6 "Alarm information"	6.AL	Displays the latest four alarm codes. You may refer to the running information at the time when the alarm occurred.		Section 3.3.6
Menu #7 "Data copying"	7.CPy	Allows you to read or write function code data, as well as verifying it. NOTE: To use this function, a remote keypad (option) is necessary.		

Limiting menus to be displayed

The menu-driven system has a limiter function (specified by function code E52) that limits menus to be displayed for the purpose of simple operation. The factory default is to display Menu #1 "Data setting" only, allowing no switching to any other menu.

Function Code E52 – Keypad (Mode Selection)

Function code data (E52)	Menus selectable
0: Function code data setting mode	Menu #1 "Data setting" (factory default)
1: Function code data check mode	Menu #2 "Data checking"
2: Full-menu mode	Menu #1 through #6 (#7*)

* Menu #7 appears only when the remote keypad (option) is set up for use.

Tip If the full-menu mode is selected, pressing the ⌃ / ⌄ keys will cycle through menus. With the FUNC/DATA key, you may select the desired menu. Once all of the menus have been cycled through, the display will return to the first menu.

3.3.1 Setting the function codes--"Data Setting"

Menu #1 "Data setting" in Programming mode allows you to set function codes for making the inverter functions match your needs.

The table below lists the function codes available in the FRENIC-Mini. The function codes are displayed on the LED monitor on the keypad as shown below.

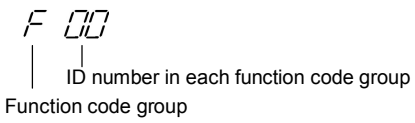


Table 3.4 List of FRENIC-Mini Function Codes

Function code group	Function code	Function	Description
F codes (Fundamental functions)	F00 to F51	Basic functions	To be used for basic motor running.
E codes (Extension terminal functions)	E01 to E99	Terminal functions	To be used to select the functions of the control circuit terminals. To be used to set functions related to the LED monitor display.
C codes (Control functions of frequency)	C01 to C52	Control functions	To be used to set application functions related to frequency settings.
P codes (Motor parameters)	P02 to P99	Motor parameters	To be used to set specific parameters for the motor capacity, etc.
H codes (High performance functions)	H03 to H98	High level functions	To be used for high added value functions and complicated control, etc.
J codes (Application functions)	J01 to J06	Application functions	To be used for PID control.
y codes (Link functions)	y01 to y99	Link functions	To be used for communications.

Refer to Chapter 9 "FUNCTION CODES" for details on the function codes.

Function codes that require simultaneous keying

To change data for function codes F00 (Data Protection) and H03 (Data Initialization), simultaneous keying operation is necessary--STOP + ∧ keys or STOP + ∨ keys. This prevents data from being lost by mistake.

Changing, validating, and saving of function code data during running

Some function code data can be changed while the motor is running and some cannot. Further, amongst the function codes whose data can be changed while the motor is running, there are some for which the changes can be validated immediately and others for which they cannot. Refer to the "Change when running" column in Chapter 9, Section 9.1 "Function Code Tables."

Figure 3.4 shows the status transition for Menu #1 "Data setting" and Figure 3.5 shows an example of the function code data changing procedure.

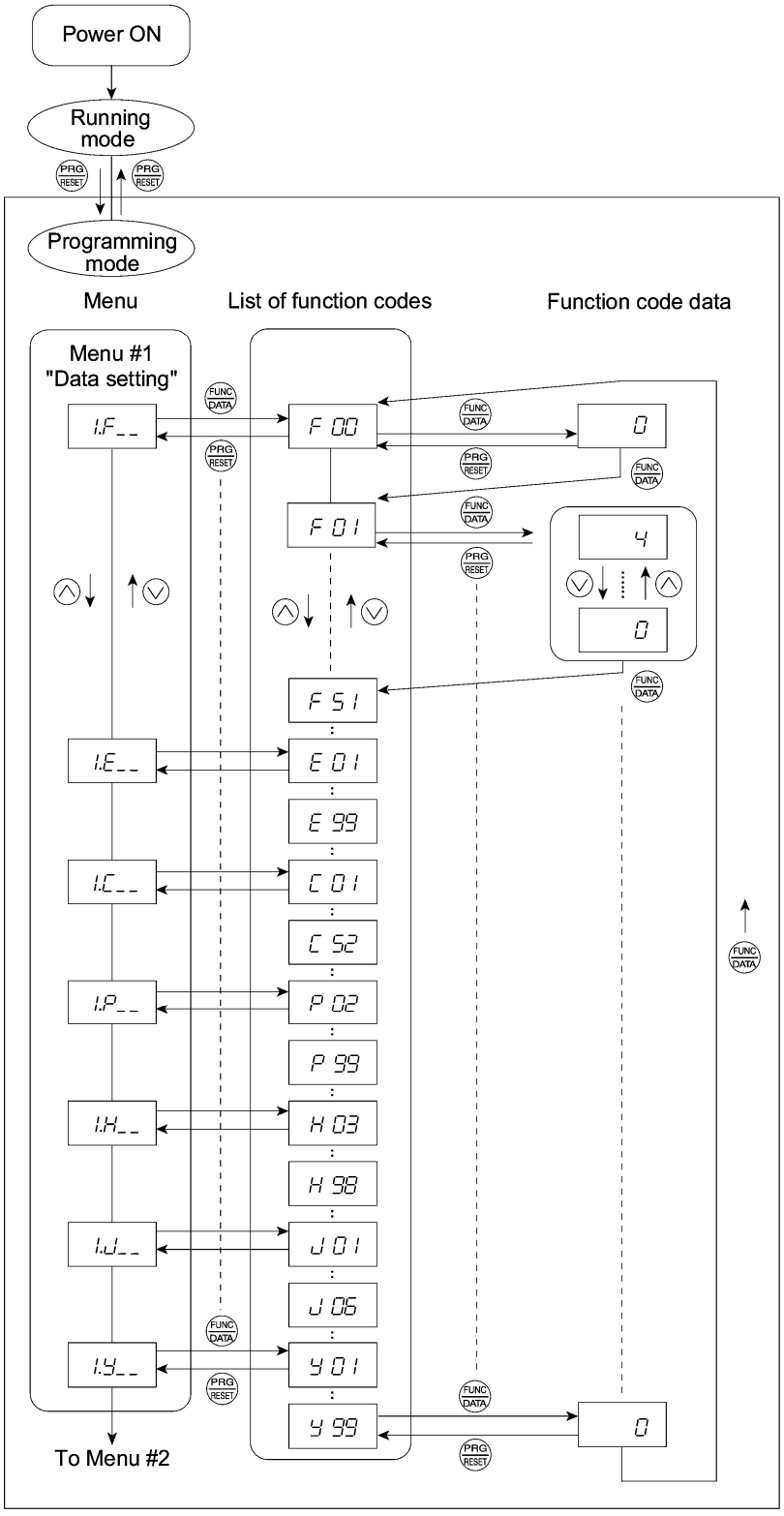


Figure 3.4 Status Transition Diagram for "Data Setting"

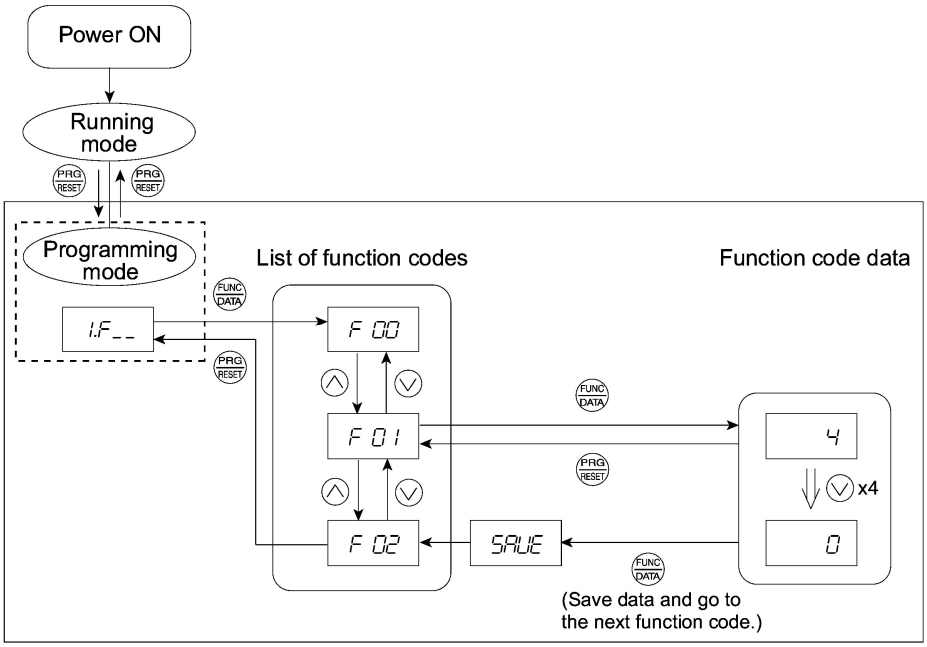


Figure 3.5 Example of Function Code Data Changing Procedure

Basic key operation

This section will give a description of the basic key operation, following the example of the function code data changing procedure shown in Figure 3.5.

This example shows you how to change function code F01 data from the factory default of "Potentiometer operation on the keypad (F01 = 4)" to "▲ / ▼ keys operation (F01 = 0)."

(1) With the menu displayed, use ▲ / ▼ keys to select the desired function code group. (In this example, select *1.F_ _*).

(2) Press the FUNC DATA key to display the function codes in the function code group selected in (1). (In this example, function code *F00* will appear.)

Even if the function code list for a particular function code group is displayed, it is possible to transfer the display to a different function code group using ▲ / ▼ keys.

(3) Select the desired function code using ▲ / ▼ keys and press the FUNC DATA key. (In this example, select function code *F01*.)

The data of this function code will appear. (In this example, data *4* of *F01* will appear.)

(4) Change the function code data using ▲ / ▼ keys. (In this example, press the ▼ key four times to change data from *4* to *0*.)

(5) Press the FUNC DATA key to establish the function code data.

The *SAUE* will appear and the data will be saved in the non-volatile memory. The display will return to the function code list, then move to the next function code. (In this example, *F02*.)

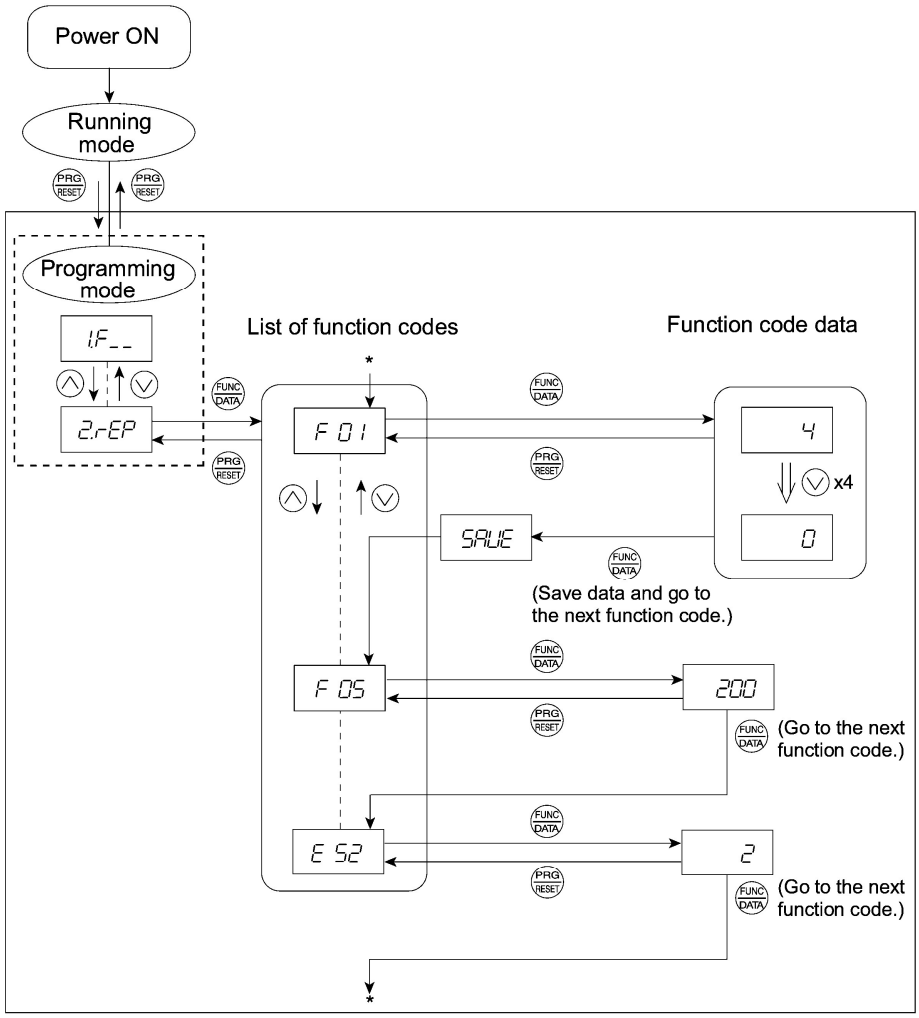
Pressing the PRG RESET key before the FUNC DATA key cancels the change made to the data. The data reverts to the previous value, the display returns to the function code list, and the original function code reappears.

(6) Press the PRG RESET key to return to the menu from the function code list.

Tip Cursor movement: You may move the cursor when changing function code data in the same way as with the frequency settings. Refer to Section 3.2.2 "Set up the set frequency and others."

3.3.2 Checking changed function codes--"Data Checking"

Menu #2 "Data checking" in Programming mode allows you to check function code data that have been changed. Only data that has been changed from the factory defaults are displayed on the LED monitor. You may refer to the function code data and change again if necessary. Figure 3.6 shows the status transition diagram for "Data checking."



* Pressing the FUNC DATA key when the *E 52* data is displayed will take you back to *F 01*.

Figure 3.6 Data Checking Status Transition Diagram (Changes made only to F01, F05, E52)

Basic key operation

The basic key operation is the same as for Menu #2 "Data setting."

Tip To monitor Menu #2 "Data checking," it is necessary to set function code E52 data to 1 (Function code data check mode) or 2 (Full-menu mode).

3.3.3 Monitoring the running status--"Drive Monitoring"

Menu #3 "Drive monitoring" is used to check the running status during maintenance and test running. The display items for "Drive monitoring" are listed in Table 3.5. Using keys, you may check those items in succession. Figure 3.7 shows the status transition diagram for "Drive monitoring."

Table 3.5 Drive Monitoring Display Items

LED monitor shows:	Contents	Unit	Description
3_00	Output frequency	Hz	Output frequency before slip compensation
3_01	Output frequency	Hz	Output frequency after slip compensation
3_02	Output current	A	Present output current
3_03	Output voltage	V	Present output voltage
3_05	Set frequency	Hz	Present set frequency
3_06	Rotational direction	N/A	Displays the rotational direction specified by a run command being outputted. *F*: forward; *R*: reverse, – – – –: stop
3_07	Running status	N/A	Displays the running status in hex. format. Refer to "Displaying running status" on the page 3-16.
3_09	Load shaft speed (line speed)	r/min (m/min)	The unit for load shaft speed is r/min and that for line speed is m/min. Display value = (Output frequency Hz before slip compensation) × (Function code E50) [ ] is displayed for 10000 (r/min or m/min) or more. When [ ] is displayed, the data is overflowing, which means that the function code should be reviewed. For example: Load shaft speed = Displayed data × 10 (r/min)
3_10	PID process commands	N/A	These commands are displayed through the use of function code E40 and E41 (PID display coefficient A and B). Display value = (PID process command) × (PID display coefficient A - B) + B If PID control is disabled, "– – – –" appears.
3_11	PID feedback value	N/A	This value is displayed through the use of function code E40 and function code E41 (PID display coefficient A and B). Display value = (PID feedback value) × (PID display coefficient A - B) + B If PID control is disabled, "– – – –" appears.

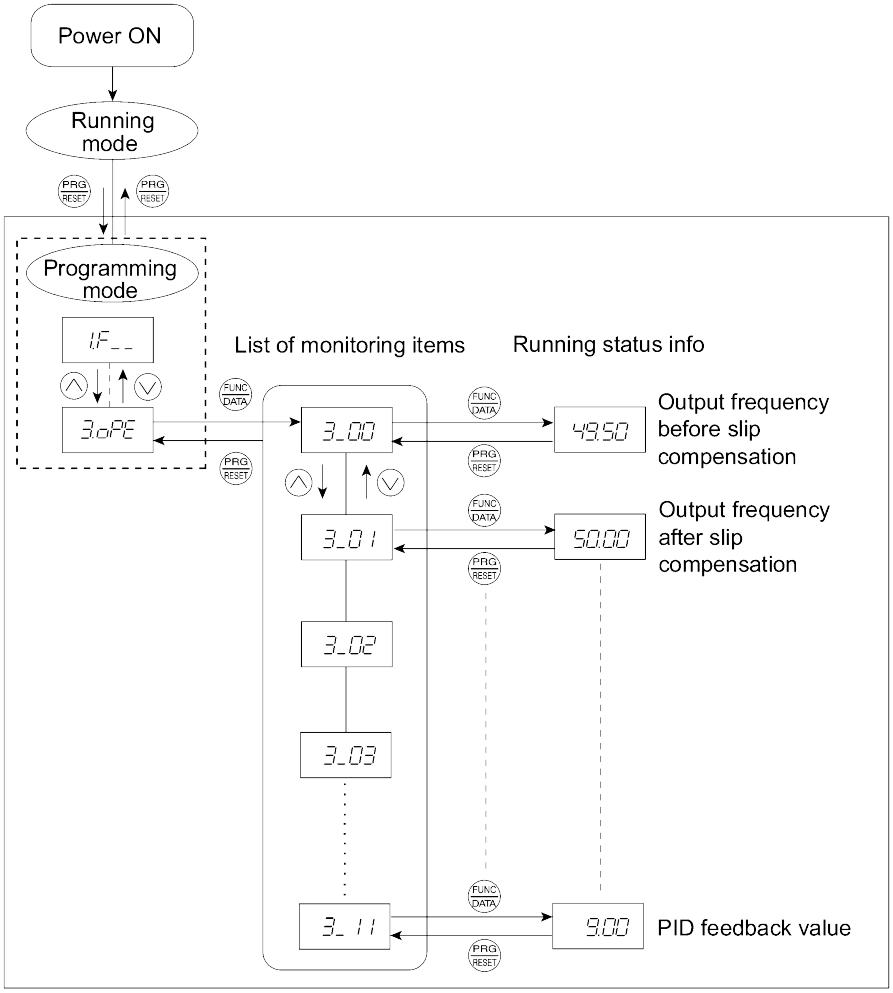


Figure 3.7 Drive Monitoring Status Transition

Basic key operation

(1) With the menu displayed, use ▲ / ▼ keys to select "Drive monitoring" (*3.oPE*).

(2) Press the FUNC DATA key to display the desired code in the monitoring items list (e.g. *3_00*).

(3) Use ▲ / ▼ keys to select the desired monitoring item, then press the FUNC DATA key.
The running status information for the selected item will appear.

(4) Press the PRG RESET key to return to the monitoring items list. Press the PRG RESET key again to return to the menu.

Tip If the menu cannot switch to any other one, set function code E52 to 2 (Full-menu mode).

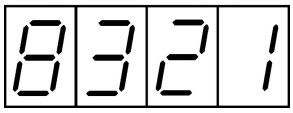
Displaying running status

To display the running status in hexadecimal format, each state has been assigned to bit 0 to 15 as listed in Table 3.6. Table 3.7 shows the relationship between each of the status assignments and the LED monitor display. Table 3.8 gives the conversion table from 4-bit binary to hexadecimal.

Table 3.6 Running Status Bit Allocation

Bit	Notation	Content
15	BUSY	1 when function code data is being written.
14	WR	Always 0.
13		Always 0.
12	RL	1 when communications is effective (when run commands and set frequencies commands are issued via communications).
11	ALM	1 when an alarm has occurred.
10	DEC	1 during deceleration.
9	ACC	1 during acceleration.
8	IL	1 during current limitation.
7	VL	1 under voltage control.
6	TL	Always 0.
5	NUV	1 when DC link bus voltage has increased up to the specified level (0 for undervoltage).
4	BRK	Always 0.
3	INT	1 when the inverter output is shut down.
2	EXT	1 during DC braking.
1	REV	1 during running in the reverse direction.
0	FWD	1 during running in the forward direction.

Table 3.7 Running Status Display

LED No.		LED4				LED3				LED2				LED1			
Bit		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Notation		BUSY	WR		RL	ALM	DEC	ACC	IL	VL	TL	NUV	BRK	INT	EXT	REV	FWD
Example	Binary	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1
	Hexa-decimal on the LED monitor																

Hexadecimal expression

A 16-bit binary number is expressed in hexadecimal format (4 bits). Table 3.8 shows the expression corresponding to decimals. The hexadecimals are shown as they appear on the LED monitor.

Table 3.8 Binary and Hexadecimal Conversion

Binary				Hexadecimal	Decimal	Binary				Hexadecimal	Decimal
0	0	0	0	*0*	0	1	0	0	0	*8*	8
0	0	0	1	*1*	1	1	0	0	1	*9*	9
0	0	1	0	*2*	2	1	0	1	0	*A*	10
0	0	1	1	*3*	3	1	0	1	1	*b*	11
0	1	0	0	*4*	4	1	1	0	0	*C*	12
0	1	0	1	*5*	5	1	1	0	1	*d*	13
0	1	1	0	*6*	6	1	1	1	0	*E*	14
0	1	1	1	*7*	7	1	1	1	1	*F*	15

3.3.4 Checking I/O signal status--"I/O Checking"

With Menu #4 "I/O checking," you may display the status of external I/O signals without using a measuring instrument. External signals that can be displayed include digital I/O signals and analog I/O signals. Table 3.9 lists check items available. The status transition for I/O checking is shown in Figure 3.8.

Table 3.9 I/O Check Items

LED monitor shows:	Display contents	Description
4_00	I/O signals on the control circuit terminals	Shows the ON/OFF state of the digital I/O terminals. Refer to "[1] Displaying control I/O signal terminals" on page 3-19 for details on the display contents.
4_01	I/O signals on the control circuit terminals under communication control	Shows the ON/OFF state for the digital input terminals that received a command via RS485 communications. Refer to "[1] Displaying control I/O signal terminals" on page 3-19 and "[2] Displaying control I/O signal terminals under communication control" on page 3-20 for details on the display contents.
4_02	Input voltage on terminal [12]	Shows the input voltage on terminal [12] in volts (V).
4_03	Input current on terminal [C1]	Shows the input current on terminal [C1] in milliamperes (mA).
4_04	Output voltage to analog meters [FMA]	Shows the output voltage on terminal [FMA] in volts (V).

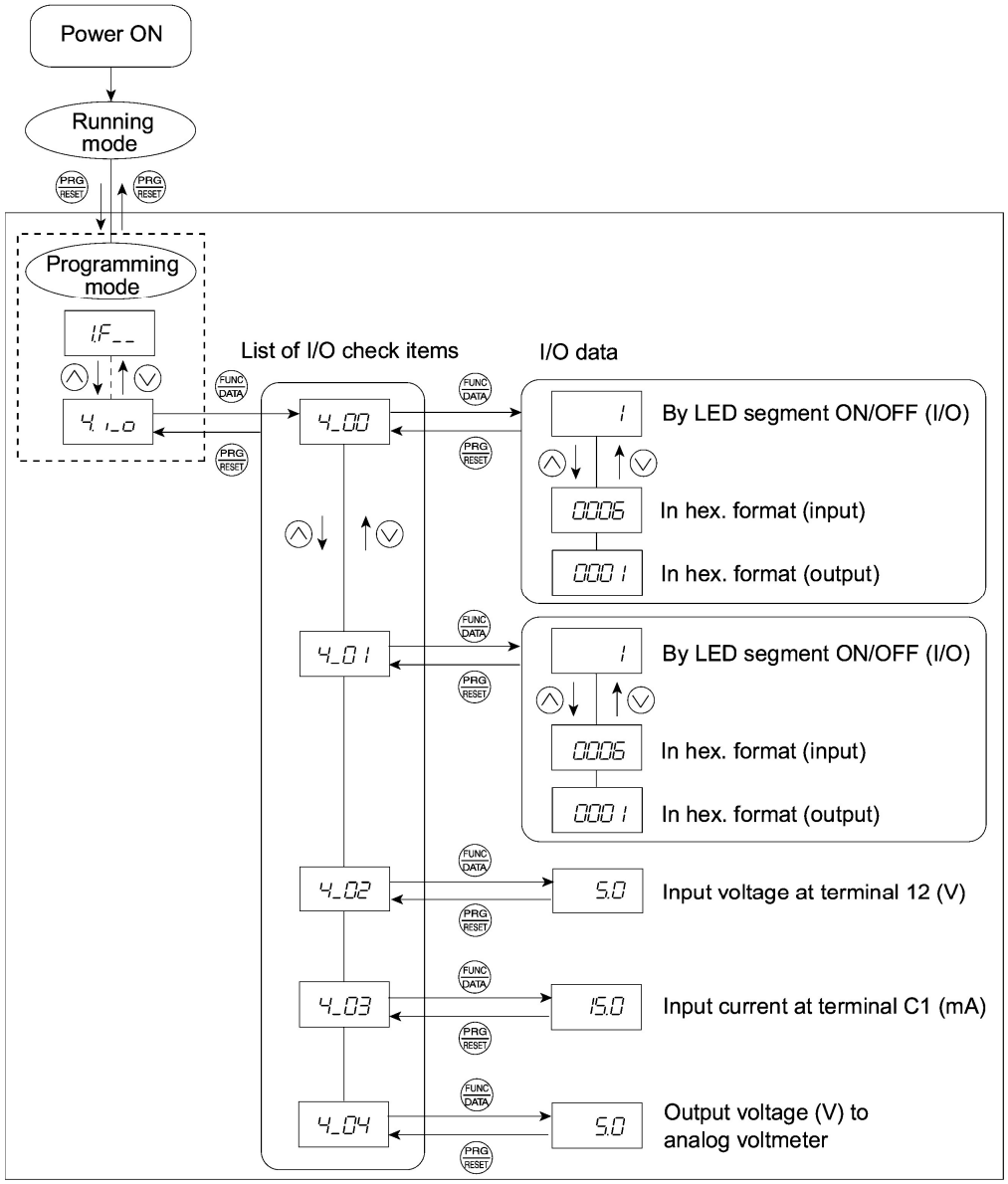


Figure 3.8 Status Transition of I/O Check

Basic key operation

(1) With the menu displayed, use ▲ / ▼ keys to select "I/O check"(*4. I/O*)

(2) Press the FUNC DATA key to display the codes for the I/O check item list. (e.g. *4_00*)

(3) Use ▲ / ▼ keys to select the desired I/O check item, then press the FUNC DATA key.

The corresponding I/O check data will appear. For control circuit I/O terminals, use ▲ / ▼ keys to select one of the two different display methods.

(4) Press the PRG RESET key to return to the I/O check item list. Press the PRG RESET key again to return to the menu.

Tip If the menu cannot switch to any other one, set function code E52 to 2 (Full-menu mode).

[1] Displaying control I/O signal terminals

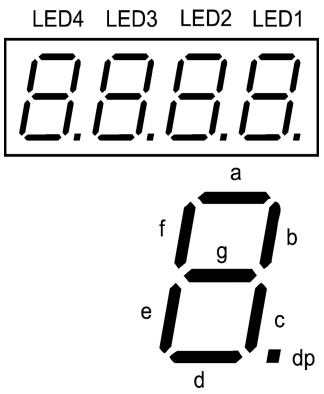
The I/O signal status of control circuit terminals may be displayed with ON/OFF of the LED segment or in hexadecimal display.

■ Display I/O signal status with ON/OFF of the LED segment

As shown in Table 3.10 and the figure below, segments "a" to "e" on LED1 light when the digital input terminals ([FWD], [REV], [X1], [X2], and [X3]) are short-circuited (ON) with the terminal [CM] and do not light when they are opened (OFF). Segment "a" on LED3 lights when the circuit between output terminal [Y1] and terminal [Y1E] is closed (ON) and does not light when the circuit is open (OFF). LED4 is for terminals [30A], [30B], [30C]. Segment "a" on LED4 lights when the circuit between terminals [30C] and [30A] are short-circuited (ON) and does not light when they are opened.

Note This LED monitor displays hardware terminal information, which means that it may not light when it is in reverse logic (refer to Chapter 9 "FUNCTION CODES" for details), even when it is active.

Table 3.10 Segment Display for External Signal Information



Segment	LED4	LED3	LED2	LED1
a	[30A/B/C]	[Y1]–[Y1E]	–	[FWD]–[CM] or [FWD]–[PLC]*2
b	–	–	–	[REV]–[CM]or [REV]–[PLC]*2
c	–	–	–	[X1]–[CM] or [X1]–[PLC]*2
d	–	–	–	[X2]–[CM] or [X2]–[PLC]*2
e	–	–	–	[X3]–[CM] or [X3]–[PLC]*2
f	–	–	(XF)*1	–
g	–	–	(XR)*1	–
dp	–	–	(RST)*1	–

– : No correlating control circuit terminals

*1 (XF), (XR), and (RST) are reserved for communications. Refer to "[2] Displaying control I/O signal terminals under communication control."

*2 Terminal [CM] if the jumper switch is set for a sink; terminal [PLC] if the jumper switch is set for a source.

■ Displaying I/O signal status in hexadecimal format

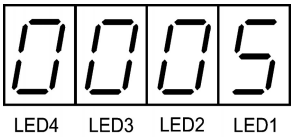
Each I/O terminal is assigned to bit 15 through bit 0 as listed in Table 3.11. An unassigned bit is interpreted as "0." Allocated bit data is displayed on the LED monitor in 4-digit hexadecimals ("0" to "F" each).

With the FRENIC-Mini, digital input terminals [FWD] and [REV] are assigned to bit 0 and bit 1, respectively. Terminals [X1] through [X3] are assigned to bits 2 through 4. The value "1" is set for each bit when the assigned input terminal is short-circuited (ON) with terminal [CM]. The value "0" when it opens (OFF). For example, when [FWD] and [X1] are ON and all others are OFF, the display on LED4 to LED1 would be 0005.

Bit 0 is assigned to digital output terminal [Y1]. The value "1" is set when the terminal is short-circuited with [Y1E], and the value "0" is set when it opens. The status of the mechanical relay contact output terminal [30A], [30B] and [30C] are assigned to bit 8. The value "1" is set when the circuit between output terminals [30A] and [30C] is closed and the value "0" when the circuit between [30B] and [30C] is closed. For example, if [Y1] is ON and the circuit between [30A] and [30C] are short-circuited with each other, then the display for LED4 to LED1 would be 0101.

How the hexadecimal display is configured for the terminals to which bits 0 to 15 are assigned and the 7-segment LED is shown below.

Table 3.11 Segment Display for I/O Signal Status in Hexadecimal Format

LED No.		LED4				LED3				LED2				LED1			
Bit		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input terminal		(RST)*	(XR)*	(XF)*	-	-	-	-	-	-	-	-	[X3]	[X2]	[X1]	[REV]	[FWD]
Output terminal		-	-	-	-	-	-	-	[30A/C]	-	-	-	-	-	-	-	[Y1]
Example	Binary	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	Hexa-decimal on the LED monitor																

– : No correlating control terminals

* (XF), (XR), and (RST) are reserved for communications. Refer to "[2] Displaying control I/O signal terminals under communication control" below.

[2] Displaying control I/O signal terminals under communication control

There are two control circuit input displays under communications link control – "display with ON/OFF of the LED segment" and "in hexadecimal format" for input commanded from RS485 communications link. The content is similar to that of the control circuit I/O signal terminal status display; however, (XF) and (XR) are added as inputs and nothing is assigned as output terminals.

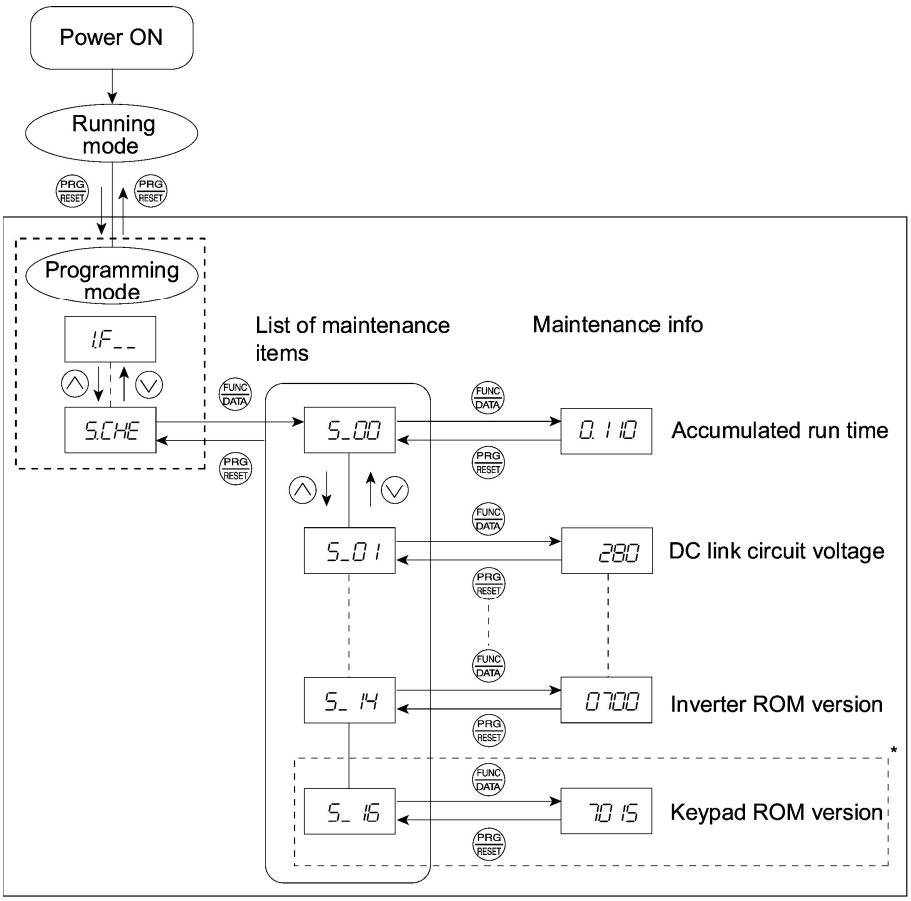
Refer to the RS485 Communication User's Manual (MEH448) for details on command inputs through RS485 communication.

3.3.5 Reading maintenance information--"Maintenance Information"

Menu #5 "Maintenance information" in Programming mode contains information necessary for performing maintenance on the inverter. Table 3.12 lists the maintenance information display items and Figure 3.9 shows the status transition for maintenance information.

Table 3.12 Maintenance Display Items

LED monitor shows:	Display contents	Description
5_00	Accumulated run time	Shows the accumulated power-ON time of the inverter. Unit: thousands of hours. When the total ON-time is less than 10,000 hours (display: 0.001 to 9.999), it is possible to check data in hourly units. When the total time is 10,000 hours or more (display: 10.00 to 65.53), the display will change to units of 10 hours. When the total time exceeds 65,535 hours, the display will be reset to 0 and the count will start again.
5_01	DC link bus voltage	Shows the DC link bus voltage of the inverter. Unit: V (volts)
5_03	Max. temperature of heat sink	Shows the maximum temperature of the heat sink for every hour. Unit: ºC
5_04	Max. effective current	Shows the maximum effective current for every hour. Unit: A (amperes)
5_05	Capacitance of the DC link bus capacitor	Shows the current capacitance of the DC link bus capacitor, based on the capacitance when shipped as 100%. Refer to the FRENIC-Mini Instruction Manual (INR-SI47-0791-E), Chapter 7 "MAINTENANCE AND INSPECTION" for details. Unit: %
5_06	Accumulated run time of electrolytic capacitor on the printed circuit board/s	Shows the accumulated run time of the capacitor mounted on the printed circuit board/s. The display method is the same as for "Accumulated run time" above. However, when the total time exceeds 65,535 hours, the count stops and the display remains at 65.53.
5_07	Accumulated run time of the cooling fan	Shows the accumulated run time of the cooling fan. If the cooling fan ON/OFF control (function code H06) is effective, the time when the fan is stopped is not counted. The display method is the same as for "Accumulated run time" above. However, when the total time exceeds 65,535 hours, the count stops and the display remains at 65.53.
5_08	Number of startups	The motor run times (the number of times the inverter run command is set to ON) are calculated and displayed. 1.000 indicates 1,000 times. When any number ranging from 0.001 to 9.999 is displayed, the display increases by 0.001 per startup, and when any number from 10.00 to 65.53 is displayed, the display increases by 0.01 every 10 startups.
5_11	No. of RS485 errors	Shows the total number of times RS485 communications error has occurred after the power is turned ON. Once the number of errors exceeds 9.999, the display (count) returns to 0.
5_12	RS485 error contents	Shows the latest error that has occurred with RS485 communications in hexadecimal format. Refer to the RS485 Communication User's Manual (MEH448).
5_14	ROM version of inverter	Shows the ROM version of the inverter as a 4-digit display.
5_16	ROM version of keypad	Shows the ROM version of the keypad as a 4-digit display. (For remote keypad only.)



* The part in the dotted-line box is applicable only when a remote keypad is set up for operation.

Figure 3.9 Status Transition of Maintenance Information

Basic key operations

(1) With the menu displayed, use ▲ / ▼ keys to select "Maintenance information" (*5.CHE*).

(2) Press the FUNC/DATA key to display the list of maintenance item codes (e.g. *5_00*).

(3) Use ▲ / ▼ keys to select the desired maintenance item, then press the FUNC/DATA key.
The data of the corresponding maintenance item will appear.

(4) Press the PRG/RESET key to return to the list of maintenance items. Press the PRG/RESET key again to return to the menu.

Tip If the menu cannot switch to any other one, set function code E52 to 2 (Full-menu mode).

3.3.6 Reading alarm information--"Alarm Information"

Menu #6 "Alarm information" in Programming mode shows the cause of the past 4 alarms as alarm codes. Further, it is also possible to display alarm information that indicates the status of the inverter when the alarm occurred. Table 3.13 shows the contents of the alarm information and Figure 3.10 shows the status transition of the alarm information.

Table 3.13 Alarm Information Contents

LED monitor shows: (Item No.)	Display contents	Description
6_00	Output frequency	Output frequency before slip compensation
6_01	Output current	Present output current
6_02	Output voltage	Present output voltage
6_04	Set frequency	Present set frequency
6_05	Rotational direction	This shows the rotational direction of a run command being output. *F*: forward; *R*: reverse; – – – –: stop
6_06	Running status	This shows the running status as a hexadecimal display. Refer to Displaying running status in Section 3.3.3 "Monitoring the running status."
6_07	Accumulated running time	Shows the cumulative power-ON time of the inverter. Unit: thousands of hours. When the total ON time is less than 10,000 hours (display: 0.001 to 9.999), it is possible to check data in hourly units. When the total time is 10,000 hours or more (display: 10.00 to 65.53), the display will change to units of 10 hours. When the total time exceeds 65,535 hours, the display returns to 0 and the count will start again.
6_08	No. of startups	The motor run times (the number of times the inverter run command is set to ON) are calculated and displayed. 1.000 indicates 1,000 times. When any number from 0.001 to 9.999 is displayed, the display increases by 0.001 per startup, and when any number from 10.00 to 65.53 is displayed, the display increases by 0.01 every 10 startups.
6_09	DC link bus voltage	Shows the DC link bus voltage of the inverter's main circuit. Unit: V (volts)
6_11	Max. temperature of heat sink	Shows the maximum temperature of the heat sink. Unit: ºC
6_12	Terminal I/O signal status (displayed with the ON/OFF of LED segments)	Shows the ON/OFF status of the digital I/O terminals. Refer to Section 3.3.4 "[1] Displaying control I/O signal terminals" for details.
6_13	Terminal input signal status (in hexadecimal format)	
6_14	Terminal output signal status (in hexadecimal display)	
6_15	No. of consecutive occurrences	This is the number of times the same alarm has occurred consecutively.
6_16	Overlapping alarm 1	Simultaneously occurring alarm codes (1) (– – – – is displayed if no alarms have occurred.)
6_17	Overlapping alarm 2	Simultaneously occurring alarm codes (2) (– – – – is displayed if no alarms have occurred.)
6_18	Terminal I/O signal status under communication control (displayed with the ON/OFF of LED segments)	Shows the ON/OFF status of the digital I/O terminals under communication control. Refer to Section 3.3.4 "[2] Displaying control I/O signal terminals under communication control" for details.

Table 3.13 Continued

LED monitor shows: (Item No.)	Display contents	Description
6_19	Terminal input signal status under communication control (in hexadecimal format)	Shows the ON/OFF status of the digital I/O terminals under communication control. Refer to Section 3.3.4 "[2] Displaying control I/O signal terminals under communication control" for details.
6_20	Terminal output signal status under communication control (in hexadecimal display)	

Note When the same alarm occurs a number of times in succession, the alarm information for the first time is retained and the information for the following alarms is not updated.

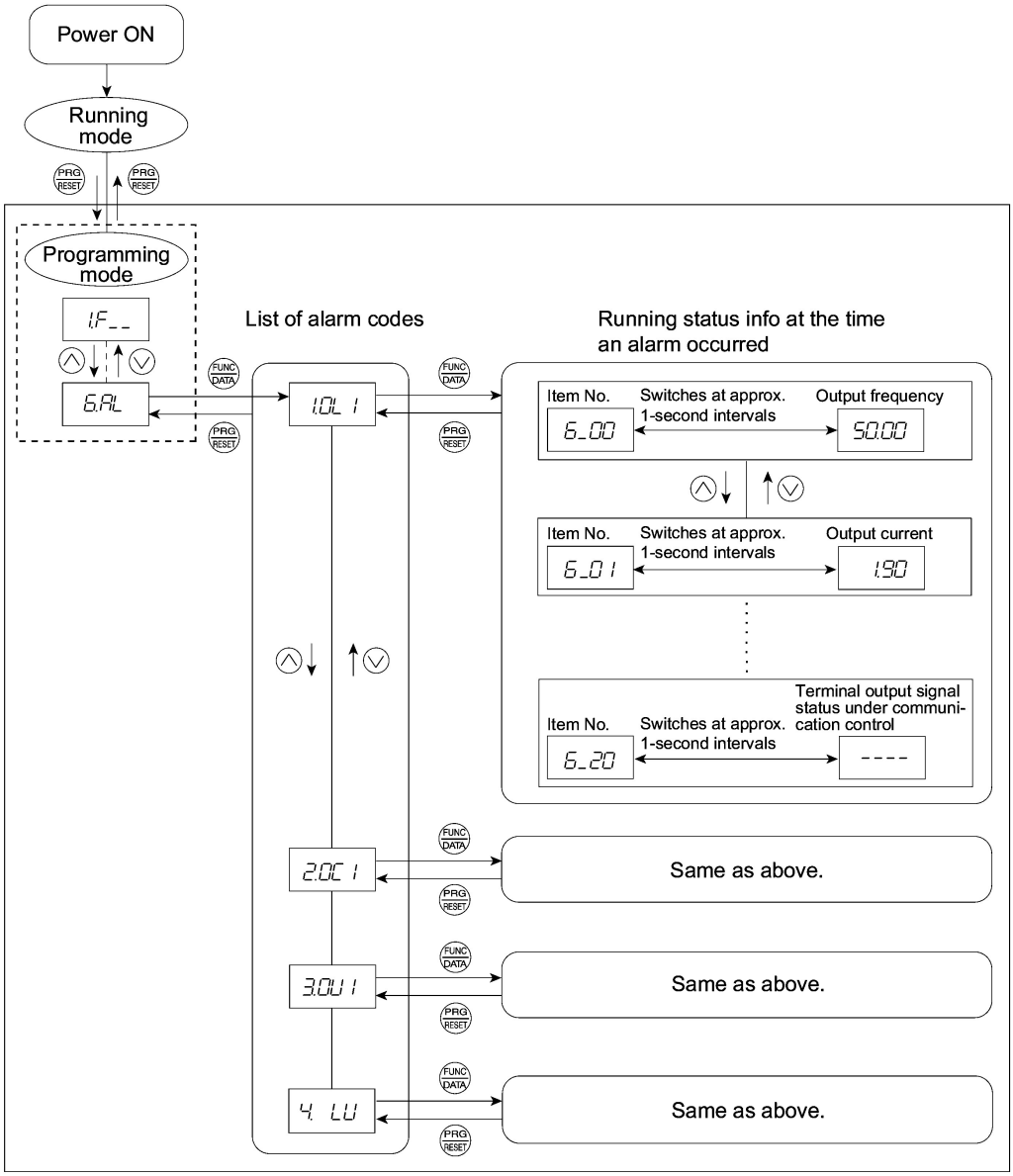


Figure 3.10 Status Transition of Alarm Information

Basic key operations

(1) With the menu displayed, use ▲ / ▼ keys to select "Alarm information" (*6.AL*).

(2) Press the FUNC/DATA key to display the alarm list code (e.g. *1.0L1*).

In the list of alarm codes, the alarm information for the last 4 alarms will be saved as an alarm history.

(3) Each time ▲ / ▼ keys are pressed, the last four alarms are displayed in order from the most recent one as "*1*," "*2*," "*3*" and "*4.*"

(4) Press the FUNC/DATA key while the alarm code is displayed, and the corresponding alarm item number (e.g. *6_00*) and data (e.g. Output frequency) will be displayed continuously in turn for 1 second each. It is possible to display the item number (e.g. *6_01*) and data (e.g. Output current) for each desired alarm using ▲ / ▼ keys.

(5) Press the PRG/RESET key to return to the alarm list. Press the PRG/RESET key again to return to the menu.

Tip If the menu cannot switch to any other one, set function code E52 to 2 (Full-menu mode).

3.4 Alarm Mode

When the protective function is activated to issue an alarm, the inverter automatically transfers to Alarm mode and the alarm code will appear in the LED monitor. Figure 3.11 shows the status transition of Alarm mode.

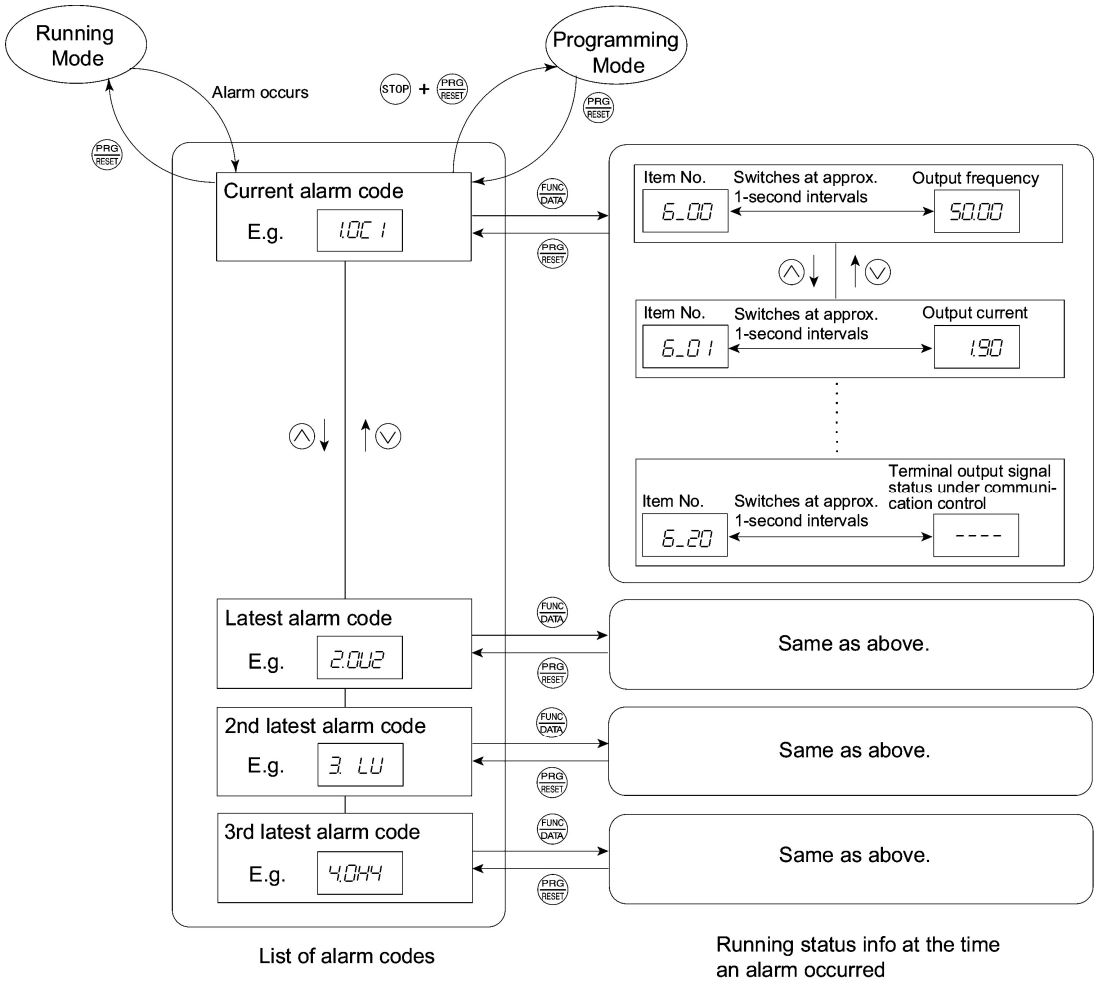


Figure 3.11 Status Transition of Alarm Mode

3.4.1 Releasing the alarm and transferring the inverter to Running mode

Remove the cause of the alarm and press the PRG RESET key to release the alarm and return to Running mode. The PRG RESET key is enabled only when the alarm code is displayed.

3.4.2 Displaying the alarm history

It is possible to display the most recent 3 alarm codes in addition to the one currently displayed. Previous alarm codes can be displayed by pressing ∧ / ∨ keys while the current alarm code is displayed.

3.4.3 Displaying the running information when an alarm occurs

If an alarm occurs, you may check various running status information (output frequency and output current, etc.) by pressing the PRG/RESET key when the alarm code is displayed. The item number and data for each running information is displayed in alternation.

Further, you can switch between the various running information using ∧ / ∨ keys. Detailed running information is the same as for Menu #6 "Alarm information" in Programming mode. Refer to Table 3.13 in Section 3.3.6 "Reading alarm information."

Pressing the PRG/RESET key while the running information is displayed returns the display to the alarm codes.

Note Pressing the PRG/RESET key continuously a number of times while the running information is displayed after removing the cause of the alarm will cause the inverter to transit to the alarm code display, and the next alarm to be released. If a run command had been input at this stage, the motor will start up.

3.4.4 Transferring to Programming mode

Further, it is also possible to transfer the inverter to Programming mode by pressing STOP + PRG/RESET keys simultaneously while the alarm is displayed and to then check and adjust the function code data.