3 Operation

3-1 Inspection and Preparation before Operation

Check the following before operation:

1. Check that the connection is correct.
   In particular, check that the power supply is not connected to any of the U, V, and W output terminals and that the ground terminal is securely grounded.

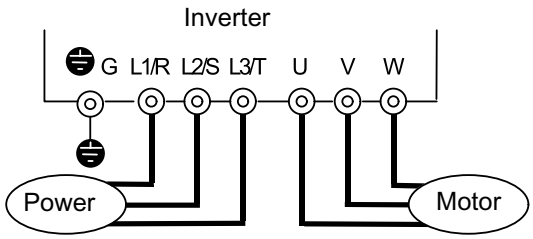


Figure 3-1-1 Inverter connection

2. Check for short-circuits and ground faults between the terminals and live sections.
3. Check for loose terminals, connectors, or screws.
4. Check that the motor is separated from mechanical equipment.
5. Turn off switches before turning power to ensure that the inverter will not start or operate abnormally at power-on.

   Check the following after power-on:
   a) Check that no alarm message is displayed on the keypad panel (see Figure 3-1-2).
   b) Check that the fan inside the inverter is rotating. (For inverters with 2.2 kW or more)

Figure 3-1-2 Display on keypad panel at power-on

WARNING

Be sure to put on the surface cover before turning on the power (close). Never remove the cover while the power is applied to the inverter.
To ensure safety, do not operate switches with wet hands.
Electric shock may result.

3-2 Operation Method

There are various methods of operation. Select a method of operation according to operating purpose and specifications by referring to Section 4-2, "Operating the Keypad Panel," and Chapter 5, "Explanation of Functions."

Table 3-2-1 lists general operation methods.

Operation command	Frequency setting	Operation command
Operation using keypad panel	Keys on keypad panel [∧] [∨]	[FWD] [REV] [STOP]
Operation using external signal	[∧] [∨]	Contact input (switch) Terminals-FWD-P24 and REV-P24
	Freq. Setting POT(VR), analog voltage, analog current	

Table 3-2-1 General operation methods

3-3 Trial Run

Upon confirming that inspection results are normal (see Section 3-1), proceed with a trial run. The initial operation mode (set at factory) is using the keypad panel.

1. Turn power on and confirm that frequency display 0.00 Hz is blinking on the LED monitor.
2. Set the frequency to about 5Hz using [∧] key.
3. To start the run, press [FWD] key (for forward rotation) or [REV] key (for reverse rotation). To stop, press [STOP] key.
4. Check the following items :
   a) Is the rotating direction correct?
   b) Is the rotation smooth? (no buzzing or abnormal vibration)
   c) Is acceleration and deceleration smooth?

   If no abnormality is detected, increase the frequency and check the above items again.

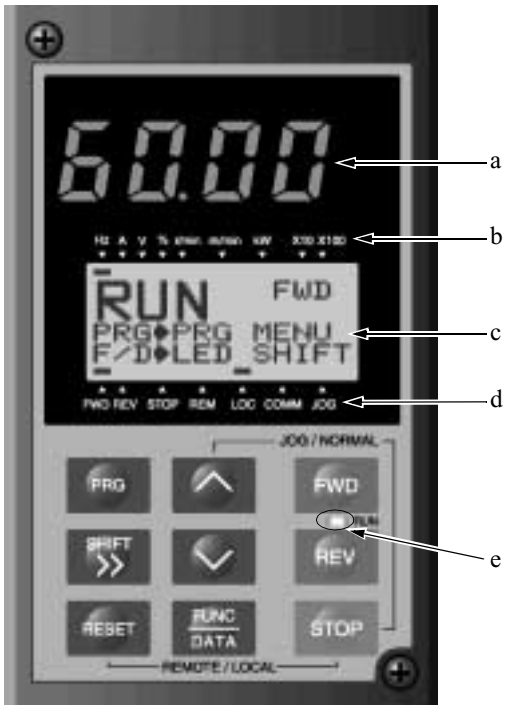
If the results of the trial run are normal, start a formal run.

Notes: - If an error is detected in the inverter or motor, immediately stop the operation and attempt to determine the cause of error referring to Chapter 7, "Troubleshooting."
- As voltage is still applied to the main circuit terminals (L1/R, L2/S, L3/T) and auxiliary control-power terminals (R0, T0) even when the output from the inverter is terminated, do not touch the terminals. The smoothing capacitor in the inverter is being charged after the power is turned off and it is not discharged immediately. Before touching an electric circuit, confirm that the charge lamp is off or a multimeter is indicating a low voltage at the terminals.

4 Keypad Panel

The keypad panel has various functions for specifying operations such as keypad operation (frequency setting, run/stop command), confirming and changing function data, confirming status, and copying.
Review the use of each function before commencing running.
The keypad panel can also be removed or inserted during running. However, if the keypad panel is removed during a keypad panel operation (e.g., run/stop, frequency setting), the inverter stops and outputs an alarm.

4-1 Appearance of Keypad Panel



a LED monitor:
Four-digit 7-segment display.
Used to display various items of monitored data such as setting frequency, output frequency and alarm code.

b Auxiliary information indication for LED monitor:
Selected units or multiple of the monitored data (on the LED monitor) are displayed on the top line of the LCD monitor.
The ▬ symbol indicates selected units or multiple number.
The symbol ▲ indicates there is an upper screen not currently displayed.

c LCD monitor:
Used to display such various items of information as operation status and function data. An operation guide message, which can be scrolled, is displayed at the bottom of the LCD monitor.

d Indication on LCD monitor:
Displays one of the following operation status:
FWD: Forward operation
REV: Reverse operation
STOP: Stop
Displays the selected operation mode:
REM: Terminal block LOC: Keypad panel
COMM: Communication terminal
JOG: Jogging mode
The symbol ▼ indicates there is a lower screen not currently displayed.

e RUN LED:
Indicates that an operation command was input by pressing the FWD or REV key.

Control keys
(valid during keypad panel operation):
Used for inverter run and stop

FWD	Forward operation command
REV	Reverse operation command
STOP	Stop command

Operation keys:
Used for screen switching, data change, frequency setting, etc.

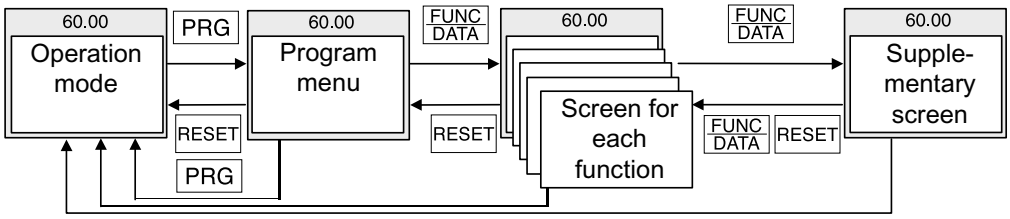
Operation key	Main function
PRG	Used to switch the current screen to the menu screen or switch to the initial screen in the operation/trip mode.
FUNC DATA	Used to switch the LED monitor or to determine the entered frequency, function code, or data.
∧ , ∨	Used to change data, move the cursor up or down, or scroll the screen
SHIFT >>	Used to move the cursor horizontally at data change. When this key is pressed with the up or down key, the cursor moves to the next function block.
RESET	Used to cancel current input data and switch the displayed screen. If an alarm occurs, this key is used to reset the trip status (valid only when the alarm mode initial screen is displayed).
STOP + ∧	Used to switch normal operation mode to jogging operation mode or vice versa. The selected mode is displayed on the LCD monitor.
STOP + RESET	Switches operation mode (from keypad panel operation mode to terminal block operation mode or reverse). When these keys are operated, function F01 data is also switched from 0 to 1 or from 1 to 0. The selected mode is displayed on the LCD indicator.

Table 4-1-1 Functions of operation keys

4-2 Keypad Panel Operation System (LCD screen, Level Structure)

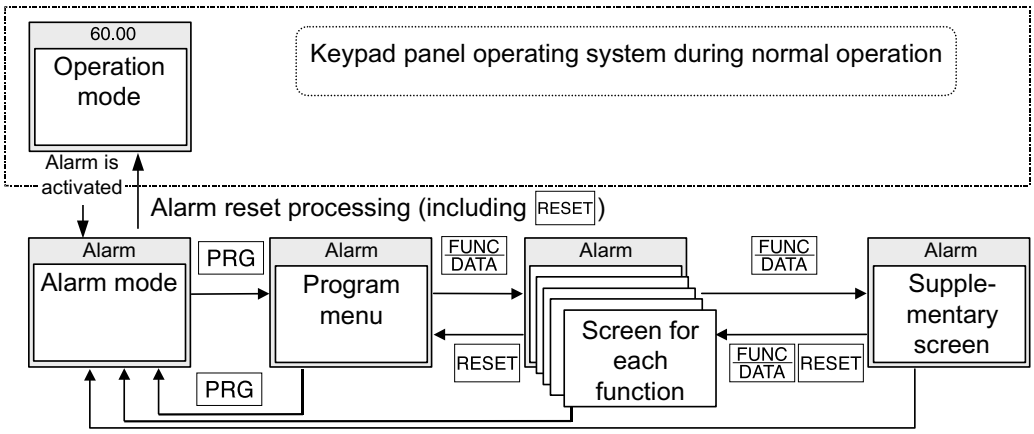
4-2-1 Normal operation

The keypad panel operation system (screen transition, level structure) is structured as follows:



4-2-2 Alarm mode

If an alarm is activated, operation is changed from normal keypad panel operation to an alarm mode operation. The alarm mode screen appears and alarm information is displayed.
The program menu, function screens, and supplementary screens remain unchanged as during normal operation, though the switching method from program menu to alarm mode is limited to PRG.



<table>
<tr><th>No.</th><th>Level name</th><th>Content</th></tr>
<tr><td>1</td><td>Operating mode</td><td>This screen is for normal operation. Frequency setting by keypad panel and the LED monitor switching are possible only when this screen is displayed.</td></tr>
<tr><td>2</td><td>Program menu</td><td>Each function of the keypad panel is displayed in menu form and can be selected. Selecting the desired function from the list and pressing FUNC DATA displays the screen of the selected function. The following functions are available as keypad panel functions (menus).
<table>
<tr><th>No.</th><th>Menu name</th><th>Outline</th></tr>
<tr><td>1</td><td>DATA SET</td><td>The code and name of the function are displayed. Selecting a function displays a data setting screen for checking, or modifying data.</td></tr>
<tr><td>2</td><td>DATA CHECK</td><td>The code and name of the function are displayed. Select a function to display a screen for checking data. Modifying data is possible as described above by going to the data setting screen.</td></tr>
<tr><td>3</td><td>OPR MNTR</td><td>Can check various data on the operating status.</td></tr>
<tr><td>4</td><td>I/O CHECK</td><td>Can check the status of analog and digital input/output for the inverter and options as an I/O checker.</td></tr>
<tr><td>5</td><td>MAINTE-NANC</td><td>Can check inverter status, life expectancy , communication error status, and ROM version information as maintenance information.</td></tr>
<tr><td>6</td><td>LOAD FCTR</td><td>Can measure maximum and average current and average breaking force in load rate measurement.</td></tr>
<tr><td>7</td><td>ALM INF</td><td>Can check the operating status and input/output status at the latest alarm occurrence.</td></tr>
<tr><td>8</td><td>ALM CAUSE</td><td>Can check the latest alarm or simultaneously occurred alarms and alarm history. Selecting the alarm and pressing FUNC DATA, displays the contents of alarm as troubleshooting.</td></tr>
<tr><td>9</td><td>DATA COPY</td><td>Places the function of one inverter in memory for copying to another inverter.</td></tr>
</table></td></tr>
<tr><td>3</td><td>Screen for each function</td><td>The function screen selected on the program menu appears, hence completing the function.</td></tr>
<tr><td>4</td><td>Supplementary screen</td><td>Functions not completed (e.g., modifying function data, displaying alarm factors) on individual function screens are displayed on the supplementary screen.</td></tr>
</table>

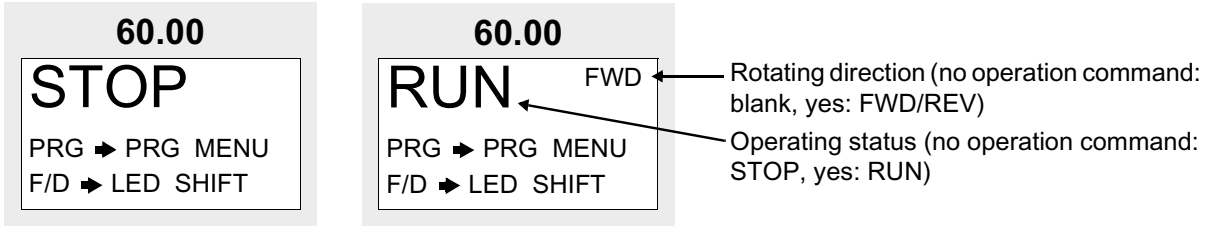
Table 4-2-1 Overview of contents displayed for each level

4-3 Operating Keypad Panel

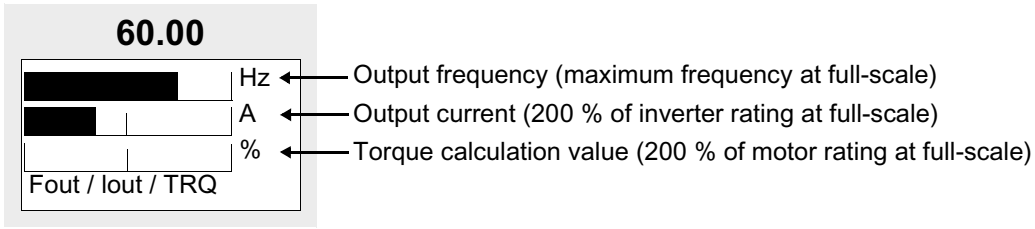
4-3-1 Operation Mode

The screen for normal inverter operation includes a screen for displaying inverter operating status and an operation guide and a screen for graphically displaying the operating status in the form of a bar graph. Switching between both screens is possible using the E45 function.

1) Operation guide (E45=0)



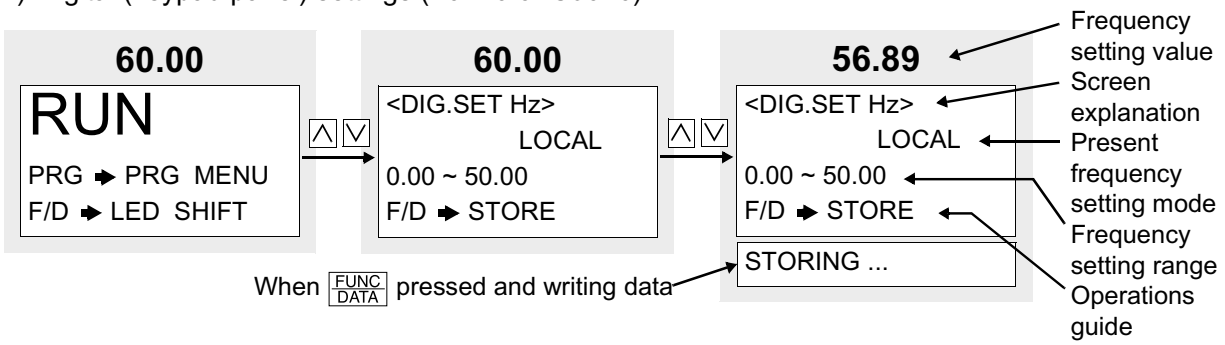
2) Bar graph (E45=1)



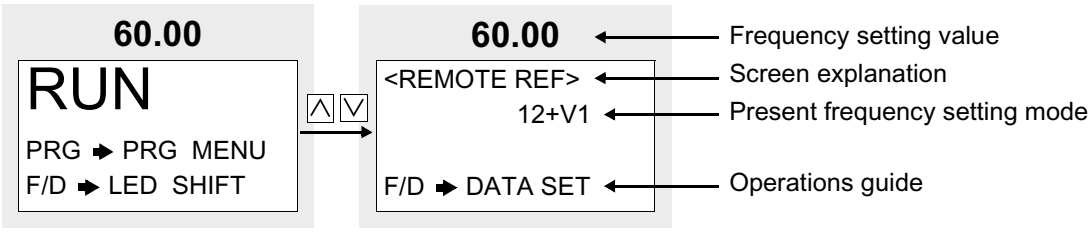
4-3-2 Setting digital frequency

On the operation mode screen, press ∧ or ∨ to display the set frequency on the LED. Data is initially incremented and decremented in the smallest possible unit. Holding down ∧ or ∨ increases or decreases the speed of increment or decrement. The digit to change data can be selected using SHIFT >> and then data can be set directly. To save the frequency settings, press FUNC DATA .
Press RESET or PRG to return to the operation mode.
If keypad panel settings are not selected, the present frequency setting mode appears on the LCD.
When selecting the PID function, PID command can be set with a process value. (Refer to technical documentation for details).

1) Digital (keypad panel) settings (F01=0 or C30=0)



2) Other than digital setting



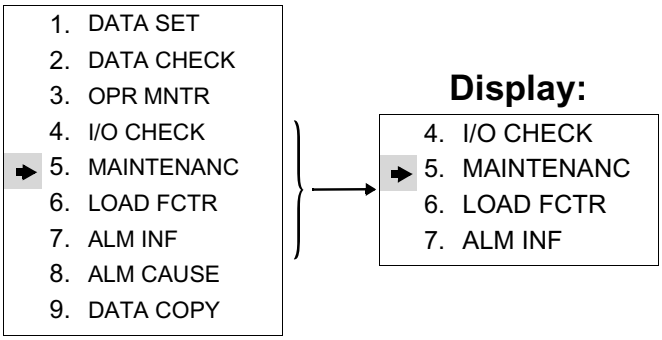
4-3-3 Switching the LED monitor

On the normal operation, press FUNC DATA to switch to LED monitor display. When power is turned on, the monitor contents set by the function (E43) are displayed on the LED.

E43	When stopping		When running (E44 =0,1)	Unit	Remarks
	(E44 = 0)	(E44 = 1)			
0	Setting frequency	Output frequency 1 (before slip compensation)		Hz	
1	Setting frequency	Output frequency 2 (after slip compensation)		Hz	
2	Setting frequency	Setting frequency		Hz	
3	Output current	Output current		A	
4	Output voltage (specified value)	Output voltage (specified value)		V	
5	Synchronous speed setting value	Synchronous speed		r/min.	For 4 digits or more, the last digits are cut, with x10, x100 marked on the indicator.
6	Line speed setting value	Line speed		m/min.	
7	Load rotation speed setting value	Load rotation speed		r/min.	
8	Torque calculation value	Torque calculation value		%	± indication
9	Power consumption	Power consumption		kW	
10	PID setting value	PID setting value		-	Displayed only when PID is effective in PID operation selection.
11	PID remote setting value	PID remote setting value		-	
12	PID feedback value	PID feedback value		-	

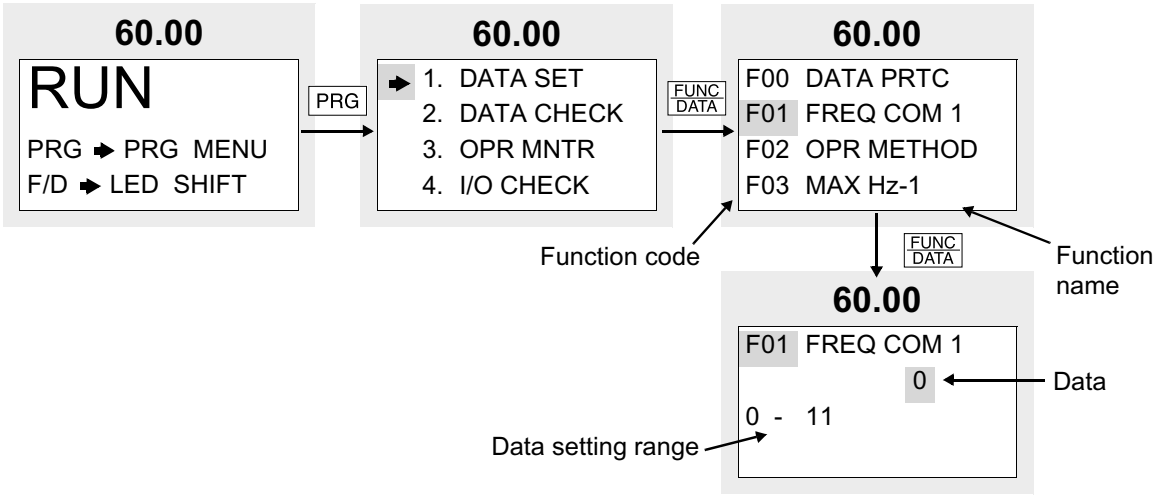
4-3-4 Menu screen

The "Program menu" screen is shown below. Only four items can be displayed simultaneously. Move the cursor with ∧ or ∨ to select an item, then press FUNC DATA to display the next screen.



4-3-5 Setting function data

On the "program menu" screen, select **"1. DATA SET"** then the "Function Select" screen appears with function codes and names on it. Select the desired function.

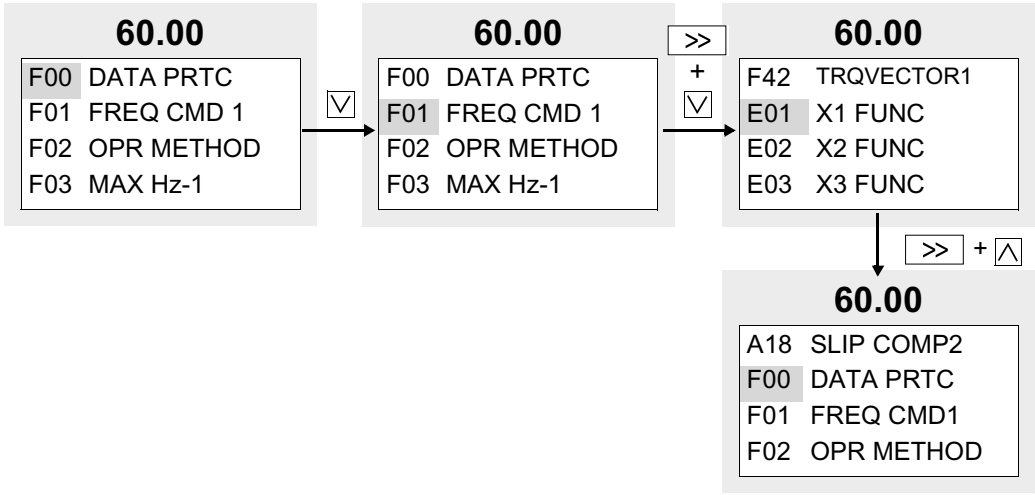


The function code consists of alphanumeric characters.
Unique alphabetical letters are assigned for each function group.

Function code	Function	Remarks
F00 - F42	Fundamental Functions	
E01 - E47	Extension Terminal Functions	
C01 - C33	Control Functions of Frequency	
P01 - P09	Motor Parameters	
H03 - H39	High Performance Functions	
A01 - A18	Alternative Motor Parameters	
o01 - o29	Optional Functions	Can be selected only with an option connected

Table 4-3-2

To scroll "Function Select" screen rapidly, use [>>] + [∧] or [>>] + [∨] to move the screen in a unit grouped by alphabet.



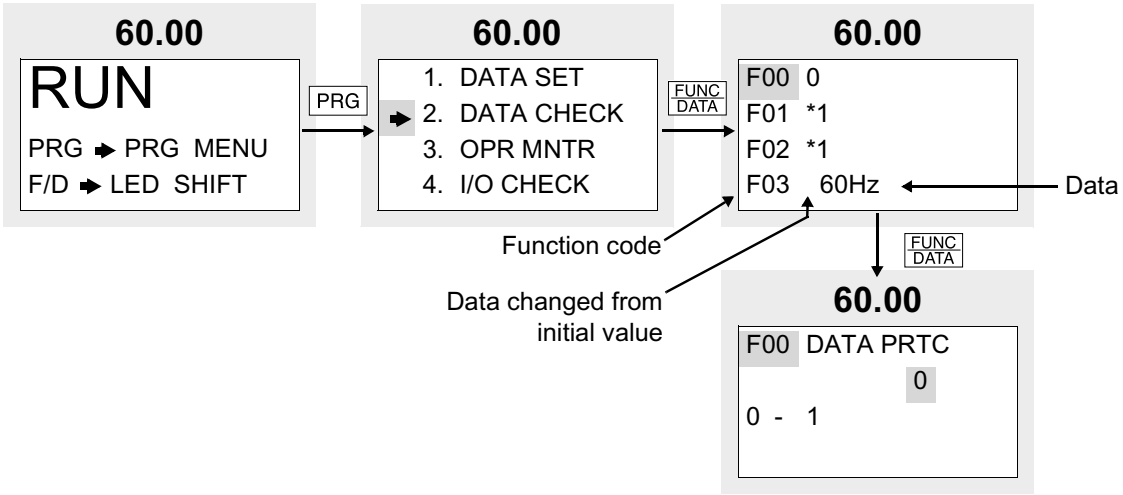
Select the desired function and press [FUNC DATA] to switch to the "data setting" screen.
On the "data setting" screen, the data values on the LCD can be increased or decreased in the smallest possible unit by pressing [∧] or [∨]. Holding down [∧] or [∨] expands the rate of change, thereby enabling values to be modified more rapidly. Otherwise, select the digit to be modified using [>>], then set data directly. When data is modified, the value before modification will be displayed at the same time for reference purpose. To save the data, press [FUNC DATA] Pressing [RESET] cancels the changes made and returns to the "Function Select" screen. The modified data will be effective in inverter operation after the data is saved by [FUNC DATA]. The inverter operation does not change only if data is modified. When data setting is disabled in the case of "Data protected" or "Data setting invalid during inverter running," make necessary changes. Data cannot be modified for the following reasons:

Display	Reason for no modification	Release method
LINK ACTIVE	Currently writing from RS-485/link option to function is being made.	Send a cancel command of function writing from RS-485. Stops a "Write" operation from the link.
NO SIGNAL [WE-KP]	The write enable for KEYPAD function is selected using a general-purpose input terminal.	Among functions E01 to E09, turn the terminal of data 19 (write enable for KEYPAD) ON.
DATA PRTCTD	Data protection is selected for function F00.	Change function F00 to 0.
INV RUNNING	An attempt is made to change a function that cannot be changed during inverter operation.	Stop inverter operation.
FWD/REV ON	An attempt is made to change a function that cannot be changed with the FWD/REV command on.	Turn FWD/REV command off.

Table 4-3-2

4-3-6 Checking function data

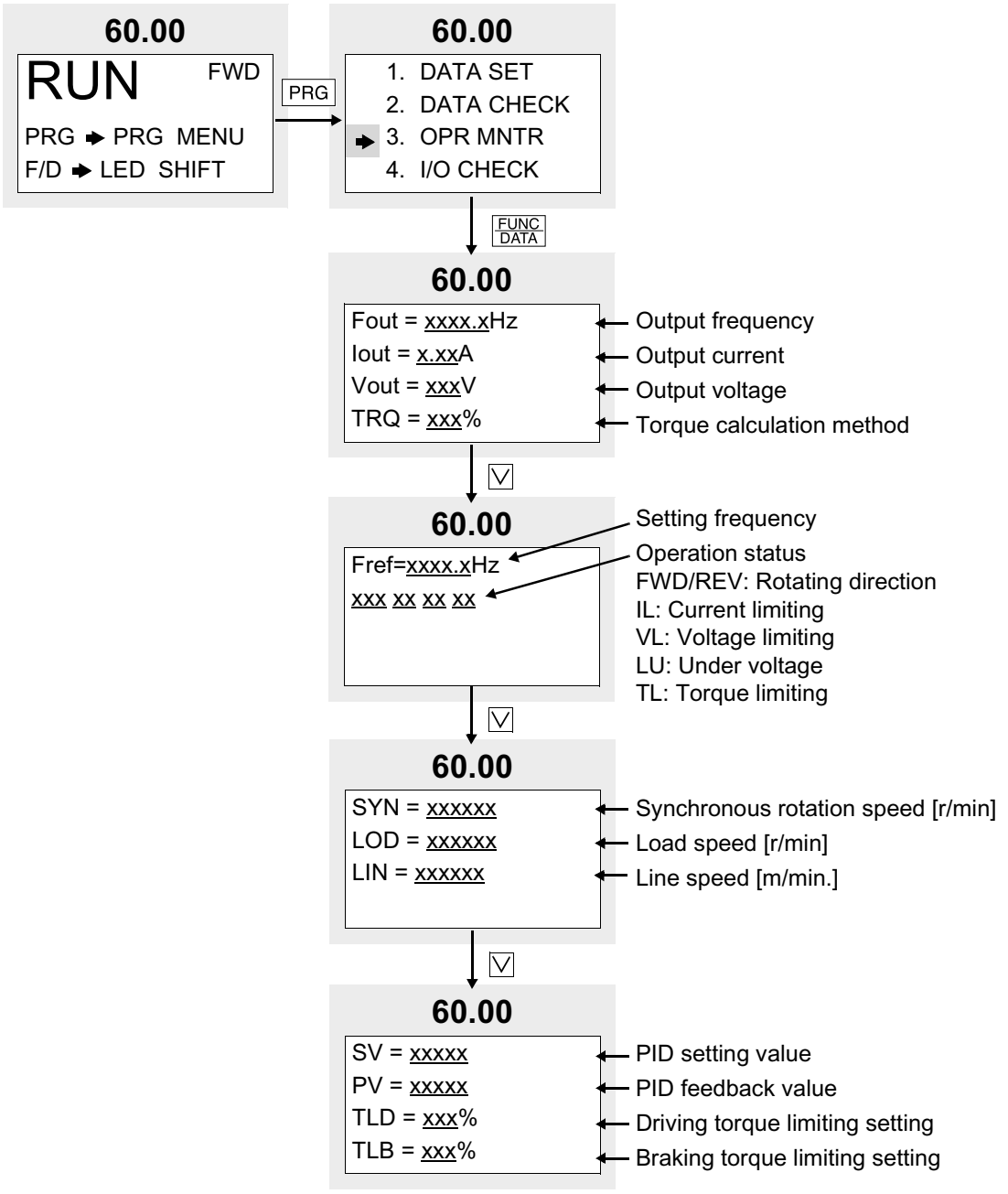
On the "Program menu" screen, select **"2. DATA CHECK"**.
The "Function Select" screen then appears with function codes and names.



Select the desired function and press FUNC DATA to check the function data. By pressing FUNC DATA, the screen switches to the "DATA SET" screen, to modify data.

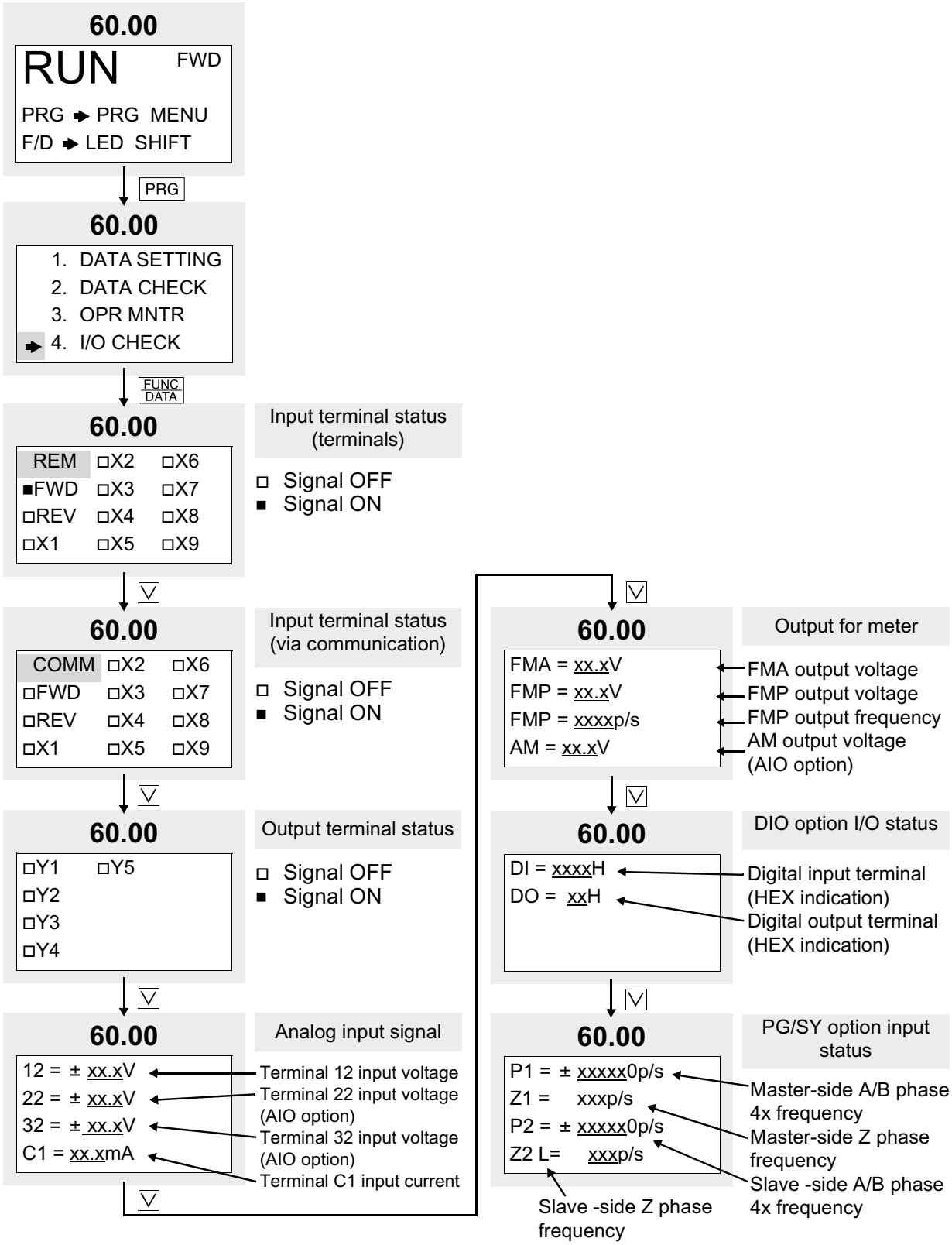
4-3-7 Monitoring operating status

On the "Program menu" screen, select **"3. OPR MNTR"** to display the present operating status of inverter. Use ⋀ and ⋁ to switch between the four operation monitor screens.



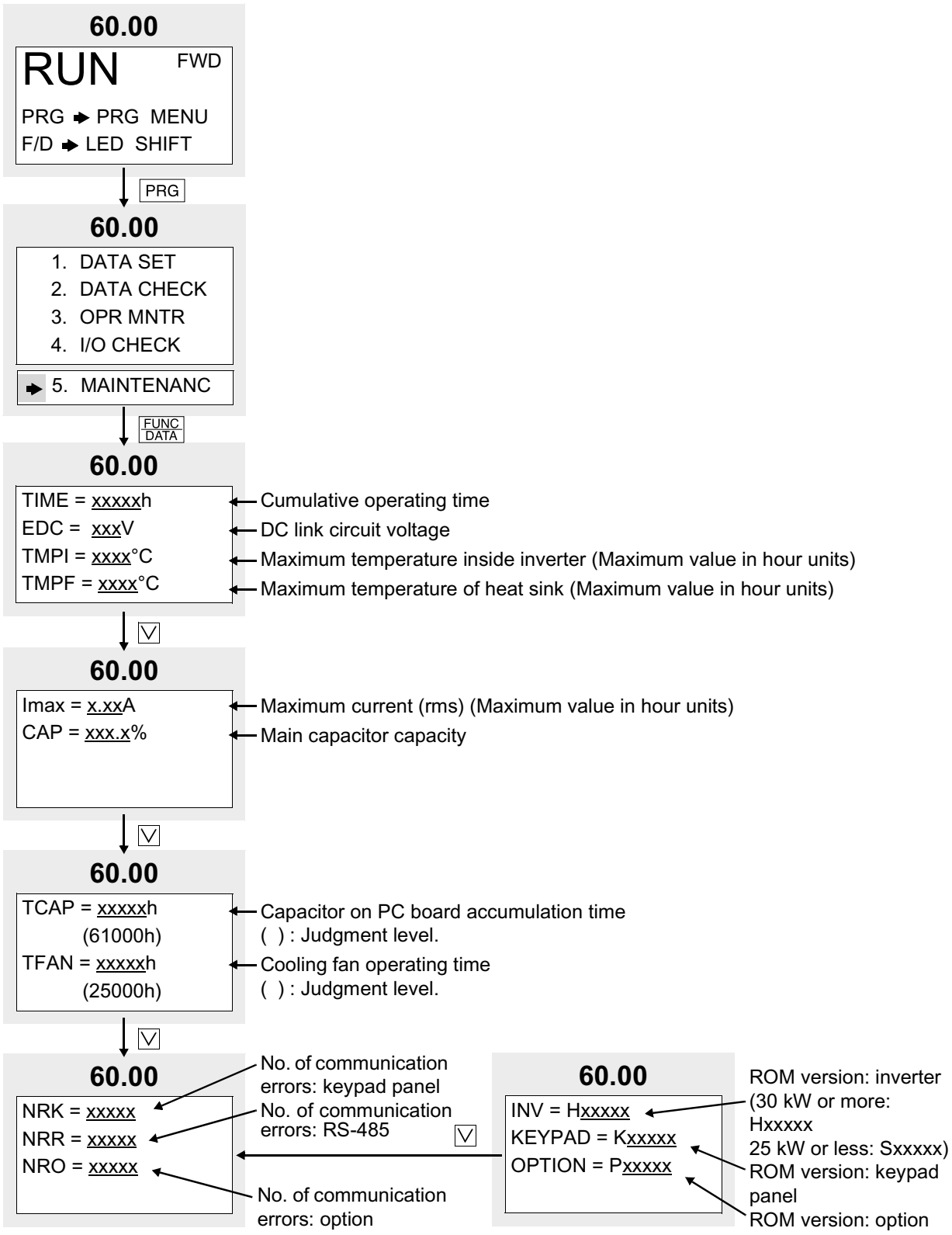
4-3-8 I/O check

On the "Program menu" screen, select **"4. I/O CHECK"** to display analog and digital input/output signal status for the inverter and options. Use ⋀ and ⋁ to switch between the seven screens of data.



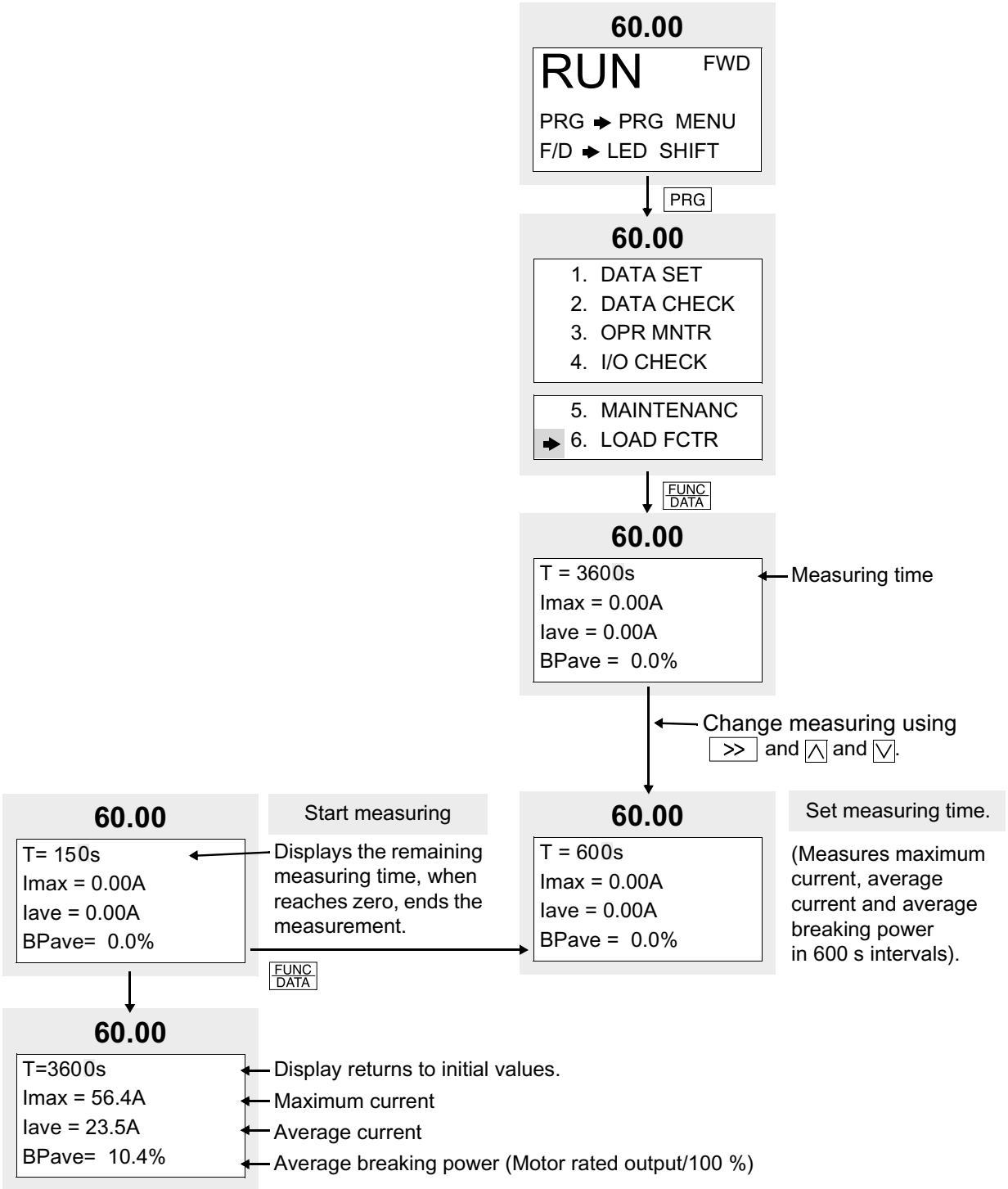
4-3-9 Maintenance information

On the "Program menu" screen, select **"5. MAINTENANC"** to display information necessary for maintenance and inspection.
Use ⋀ and ⋁ to switch between the five screens of data.



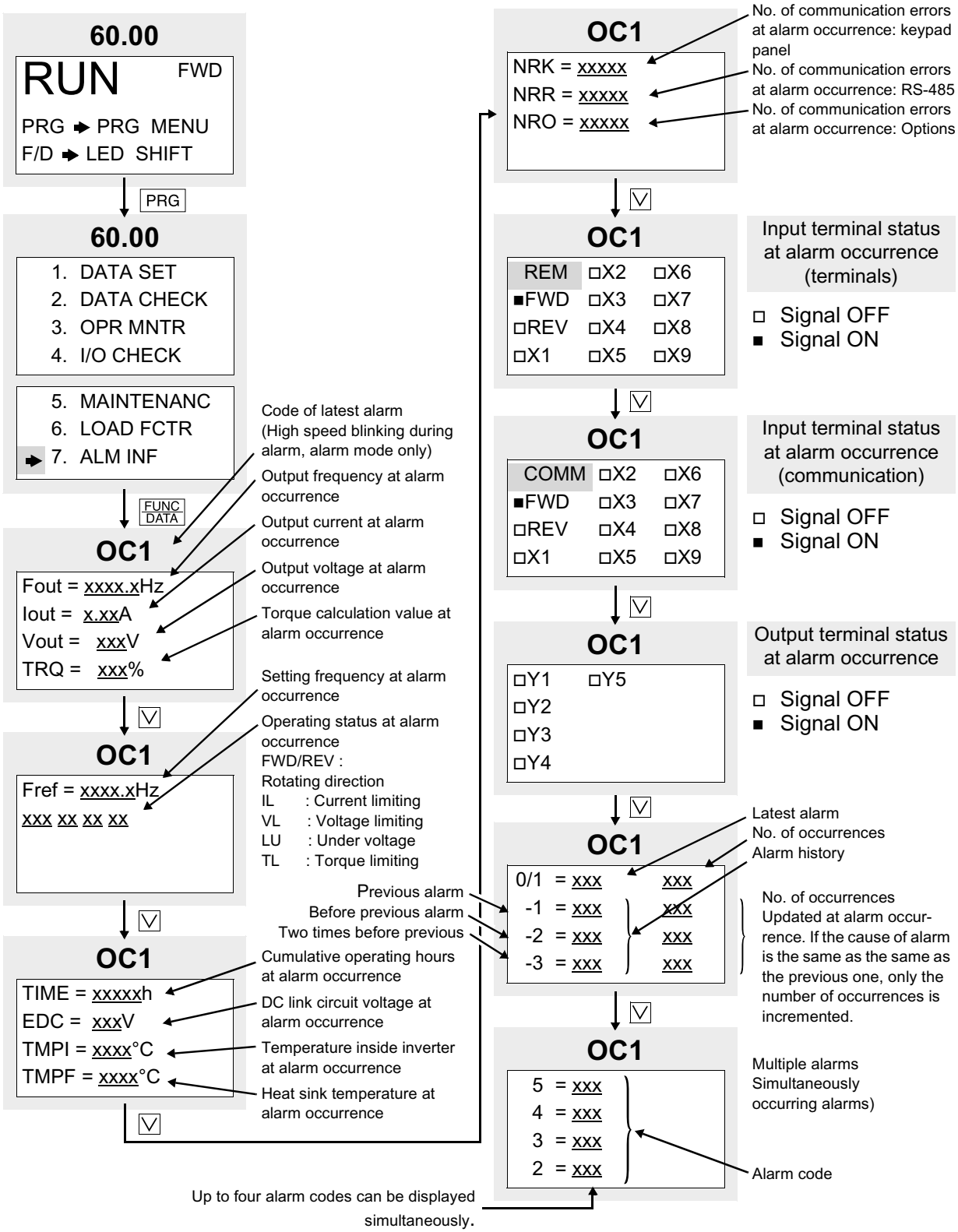
4-3-10 Load rate measurement

On the "Program menu" screen, select **"6. LOAD FCTR"**. On the "Load rate measurement" screen, the maximum current, average current, and average breaking power during the set measuring time are measured and displayed.



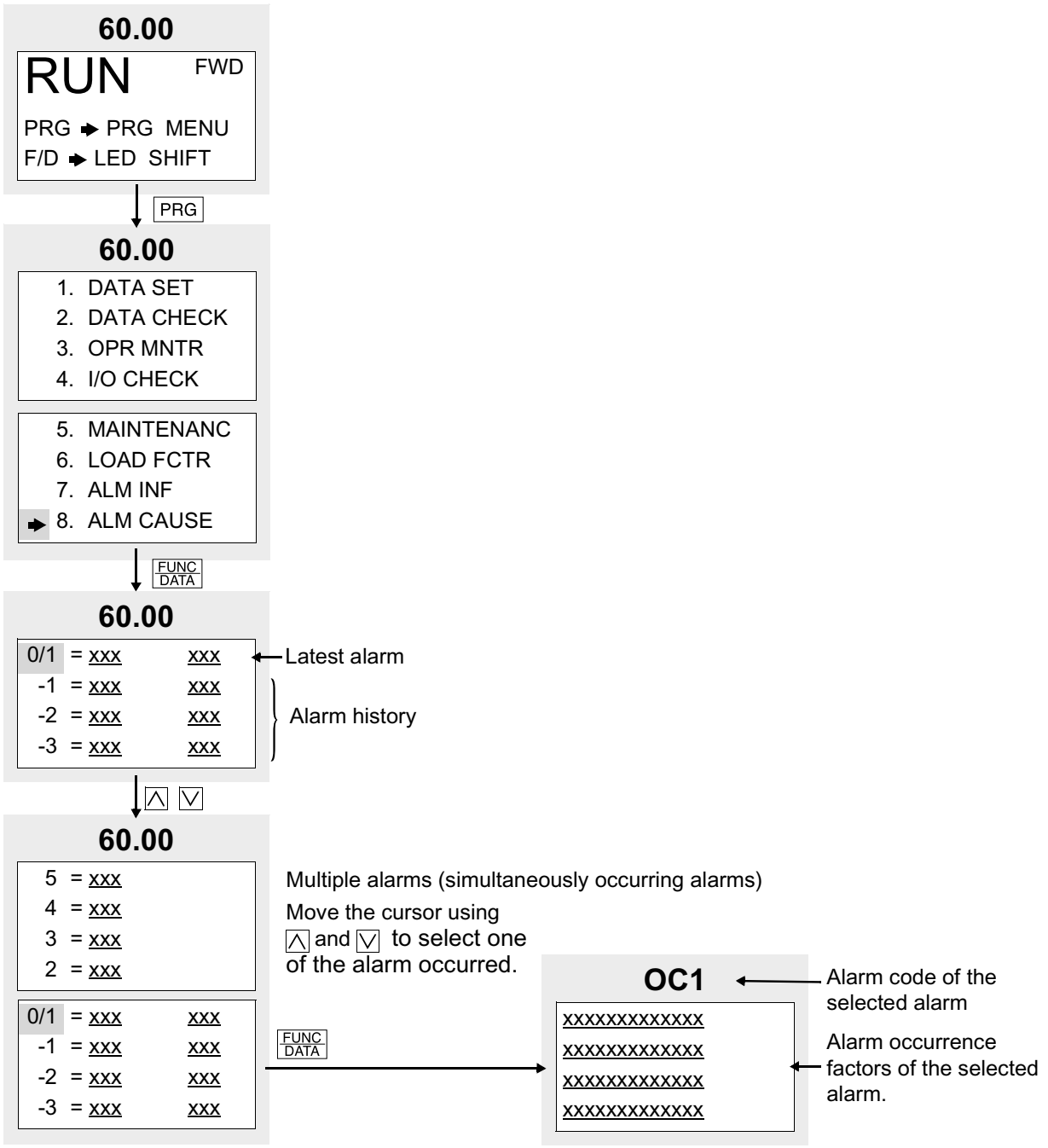
4-3-11 Alarm information

On the "Program menu" screen, select "7. ALM INF". Various operating data when the latest alarm occurred is displayed. Use ⋀ and ⋁ to switch between the nine screens of alarm information data.



4-3-12 Alarm history and factors

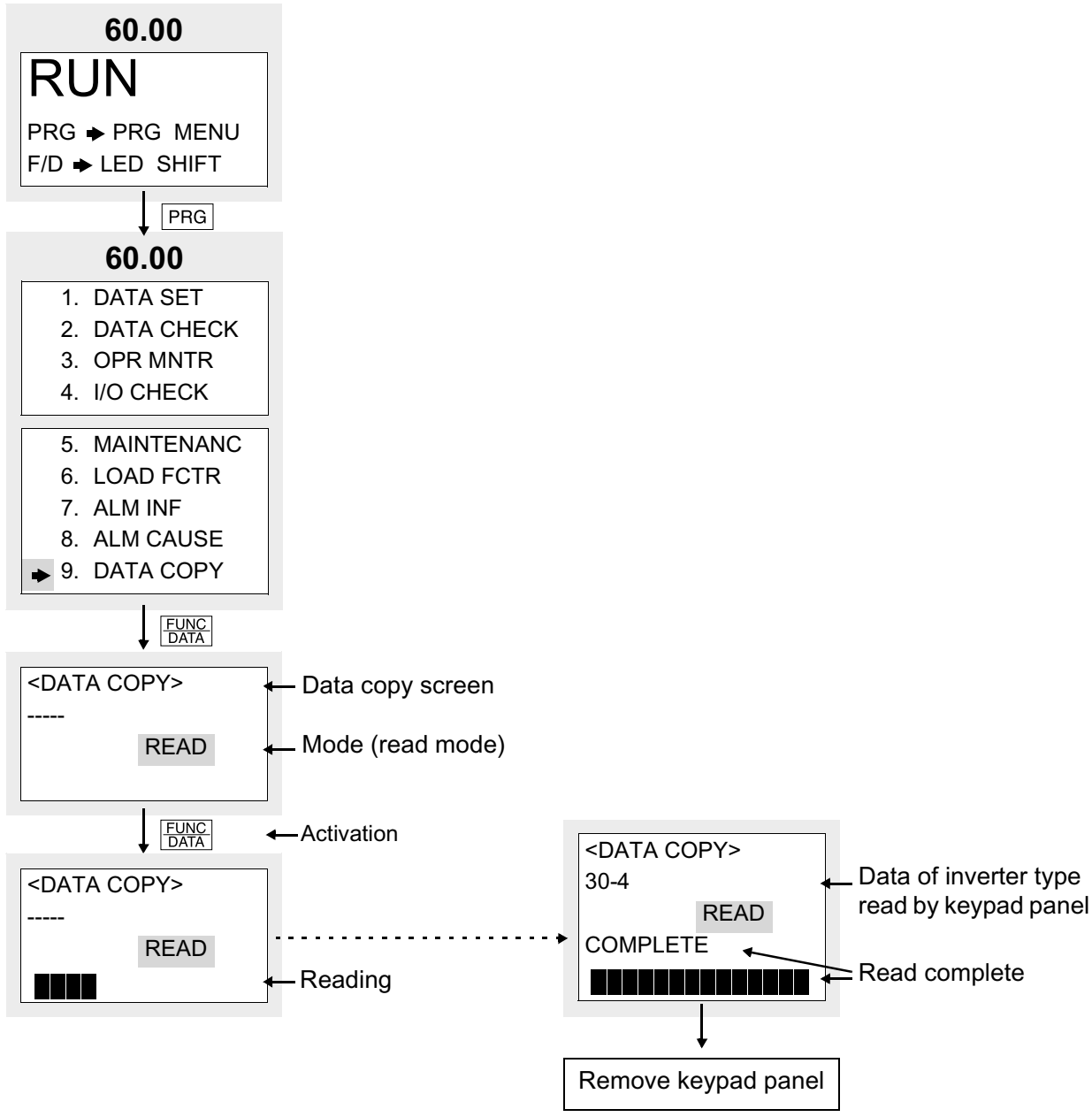
On the "Program menu" screen, select **"8. ALM CAUSE"** to display the alarm history.
Press FUNC DATA to display troubleshooting information for the alarm selected.

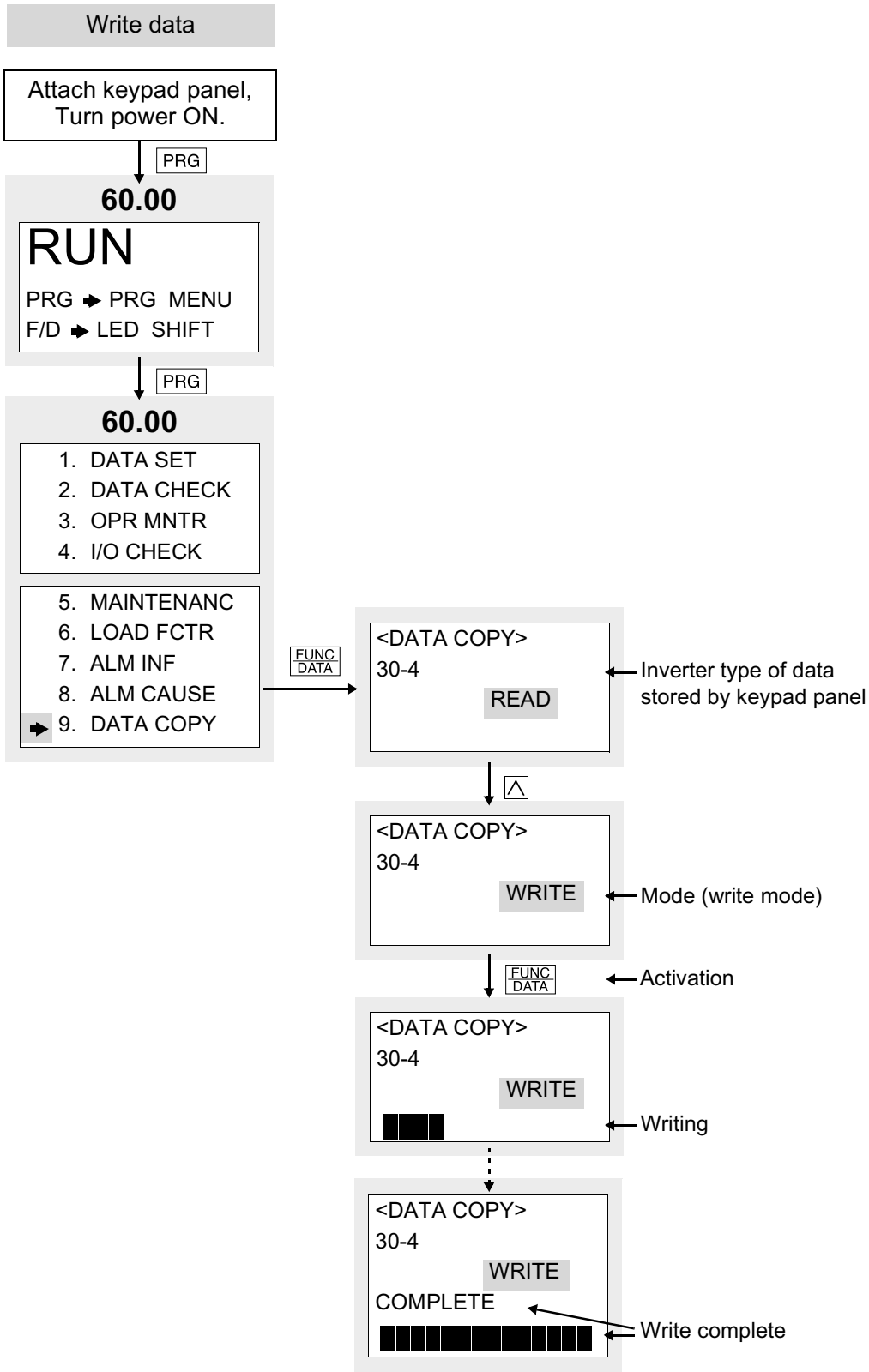


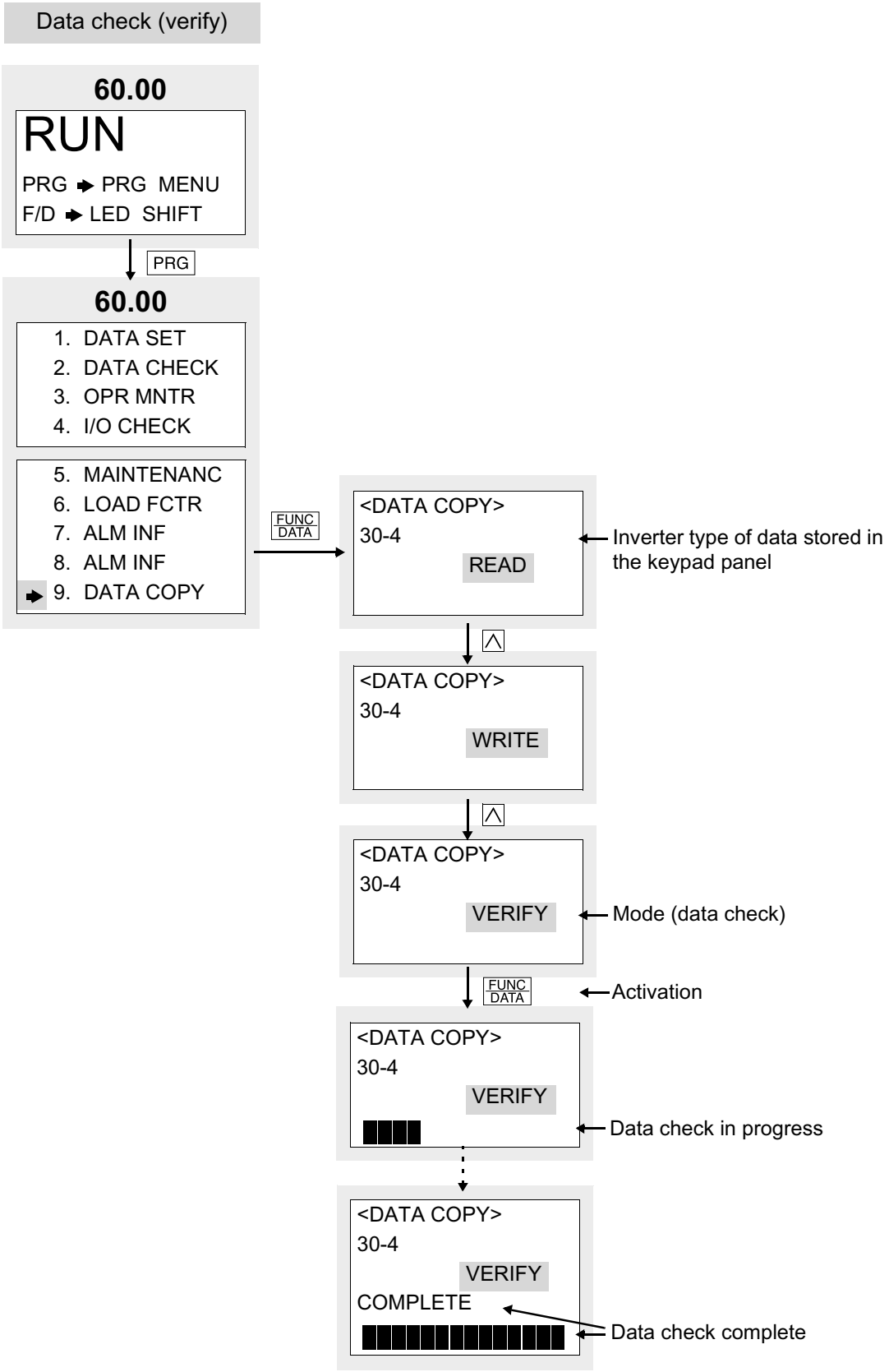
4-3-13 Data copy

On the "Program menu" screen, select **"9. DATA COPY"** to display the data copy read screen. A copy operation is then performed in the following order; reading inverter function data, removing the keypad panel, attaching the keypad panel to another inverter, and writing the data to the inverter.
The "verify" feature also makes it possible to compare and check differences in the data stored in the keypad panel and the data stored in the inverter.

Read data




Write data
Attach keypad panel,
Turn power ON.
PRG
60.00
RUN
PRG ➡ PRG MENU
F/D ➡ LED SHIFT
PRG
60.00
1. DATA SET
2. DATA CHECK
3. OPR MNTR
4. I/O CHECK
5. MAINTENANC
6. LOAD FCTR
7. ALM INF
8. ALM CAUSE
➡ 9. DATA COPY
FUNC DATA
<DATA COPY>
30-4
READ
Inverter type of data stored by keypad panel
<DATA COPY>
30-4
WRITE
Mode (write mode)
FUNC DATA
Activation
<DATA COPY>
30-4
WRITE
Writing
<DATA COPY>
30-4
WRITE
COMPLETE
Write complete


Data check (verify)
60.00
RUN
PRG ➡ PRG MENU
F/D ➡ LED SHIFT
PRG
60.00
1. DATA SET
2. DATA CHECK
3. OPR MNTR
4. I/O CHECK
5. MAINTENANC
6. LOAD FCTR
7. ALM INF
8. ALM INF
9. DATA COPY
FUNC DATA
<DATA COPY>
30-4
READ
Inverter type of data stored in the keypad panel
<DATA COPY>
30-4
WRITE
<DATA COPY>
30-4
VERIFY
Mode (data check)
FUNC DATA
Activation
<DATA COPY>
30-4
VERIFY
Data check in progress
<DATA COPY>
30-4
VERIFY
COMPLETE
Data check complete

Error processing

1) Change disabled during operation
If a write operation is attempted during an inverter operation, or vice versa, the error message below will appear.
After stopping the inverter and pressing RESET , retry the write operation.

<DATA COPY>
30-4
WRITE
INV RUNNING

2) Memory error
If a write operation is attempted while data has not been saved (i.e., no data) in the keypad panel data memory during the read mode or when the inverter type of data read by keypad panel is different from the inverter type to which data is to be written, the following error message will appear:

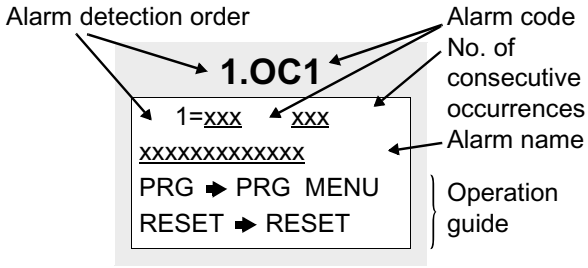
<DATA COPY>
WRITE
MEMORY ERROR

3) Verify error
During a data check (verify) operation, if data stored in the keypad panel differs from data stored in the inverter, the following error message is displayed to indicate the function No. The data check is suspended.
To continue the data check and check for other mismatching data, press FUNC DATA. To stop the data check and switch to another operation, press RESET.

<DATA COPY>
30-4
VERIFY
ERR:F25
■■■■

4-3-14 Alarm mode

If an alarm occurs, the "Alarm screen" indicating the alarm contents is displayed. Use ∧ and ∨ to display alarm history and multiple alarms (if more than two alarms occur simultaneously).



Alarm detection order

Operation method		LED display	LCD display	Description
∧	∨	5.	5	No. 5 alarm
		4.	4	No. 4 alarm
		3.	3	No. 3 alarm
		2.	2	No. 2 alarm
		1.	1	No. 1 alarm (more than two alarms occurred)
		Blank	0	Latest alarm (only one alarm occurred/alarm released)
		Blank	-1	Previous alarm history
		Blank	-2	Alarm history before previous alarm
		Blank	-3	Alarm history two times before previous alarm

Alarm code: See Table 6-1-1