

TOSVERT VF-AS1

My Function Instruction Manual

January 2006

Toshiba Schneider Inverter Corporation

**(C) Toshiba Schneider Inverter Corporation 2006
All rights reserved.**

Contents

CONTENTS 1

1. INTRODUCTION 2

2. PARAMETERS USED 2

3. LOGIC INPUT/OUTPUT MY FUNCTION 2

4. SETTING PARAMETERS 5

5. EXAMPLES OF SETTING 12

6. ANALOG INPUT MY FUNCTION 26

7. ANALOG OUTPUT MY FUNCTION 30

APPENDIX 1 TABLE OF MY FUNCTION PARAMETERS 31

APPENDIX 2 COMPUTING FUNCTIONS 33

APPENDIX 3 INPUT TERMINAL FUNCTION SELECTION PARAMETERS 34

APPENDIX 4 OUTPUT TERMINAL FUNCTION SELECTION PARAMETERS 36

APPENDIX 5 INTERNAL DATA 40

APPENDIX 6 EXAMPLES OF COMPUTING FUNCTION SETTINGS 42

1. Introduction

VFAS1's My function adds programming capability to inverter's input/output signals to respond to customer needs without external relays or a PLC (programmable logic controller) in some cases.

Therefore, My function makes it possible to reduce the space and cost required for the system.

My function has three types in below:

1. Logic input/output My function simplifies relay sequence operations.
2. Analog input My function changes parameter settings by the analog input signals.
3. Analog output My function gets the analog output signals of the maximum and minimum values displayed by the monitor function.

⇒ For details of each function, refer to the relevant section.

2. Parameters used

My functions use the parameters *F 900* to *F 977*.

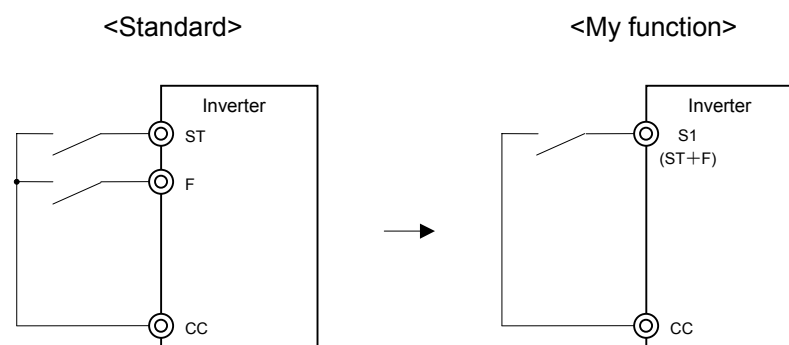
⇒ For details of each parameter, refer to the relevant section.

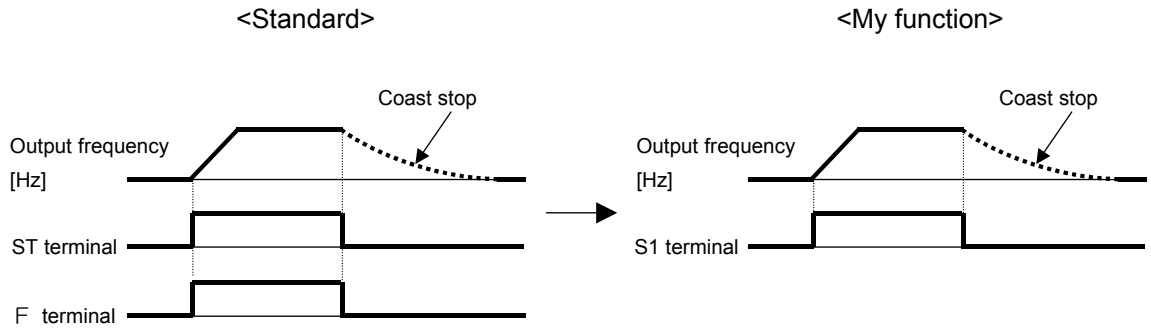
3. Logic input/output My function

This chapter explains the logic input/output My function, which is typified by the combined terminal function that combines the functions of the inverter's input and output terminals and the relay sequence function that combines logic operation functions.

■ Combined terminal function

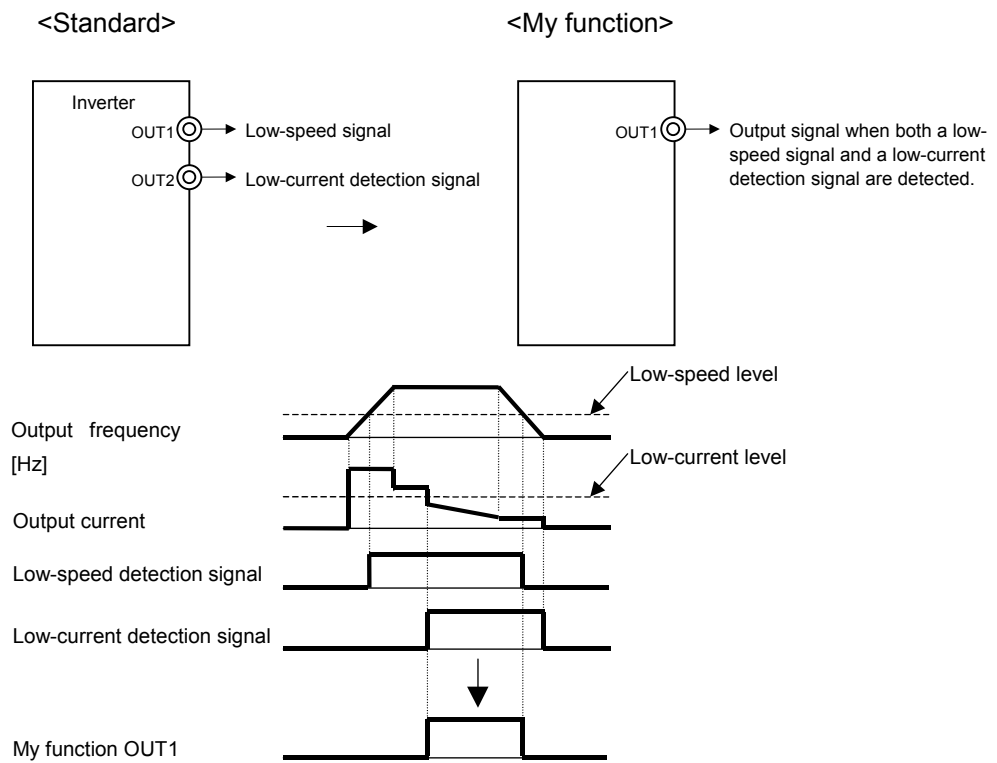
The combined terminal function works to assign two or more functions to one terminal. Using this function, you can assign, for example, the operation ready signal input function (this function is set to the ST terminal by default) and the forward run start signal input function (this function is set to the S1 terminal by default) to one terminal. This enables the S1 terminal to perform the same function that the two terminals, ST and F, perform when they are turned on and off (for an explanation of the actual program, see Example 1 in Chapter 5). This function, therefore, makes it possible to reduce the numbers of terminals and cables required for the desired operations.





The combined terminal function can be used with both signal input terminals and signal output terminals.

For example, this function works to set the OUT1 output terminal so as to put out a signal in the condition that both a low-speed signal (output terminal function 4) and a low-current detection signal (output terminal function 26) are detected. (For an explanation of the actual program, see Example 3 in Chapter 5).



My function sets output signals to be combined together, and therefore enables the inverter to perform additional operations itself that have been carried out conventionally with a sequence for the operation of external relays.

■ Relay sequence function

Assume that an inverter and a PLC (programmable logic controller) are used to operate a system. In that case, the PLC receives several signals from external devices, processes the received signals according to the program in it, and sends the signals as processing result to the inverter. (See Figure 3-1.)

The relay sequence function enables the inverter to perform all steps of operation itself without the help of a PLC. This means that this function allows the inverter to directly process data and signals in it, and therefore increases its speed of response by eliminating the need to exchange data with the PLC.

Furthermore, this function enables the inverter to use its multi-function input and output signals at the same time, and thus to perform various operations in a reduced number of steps.

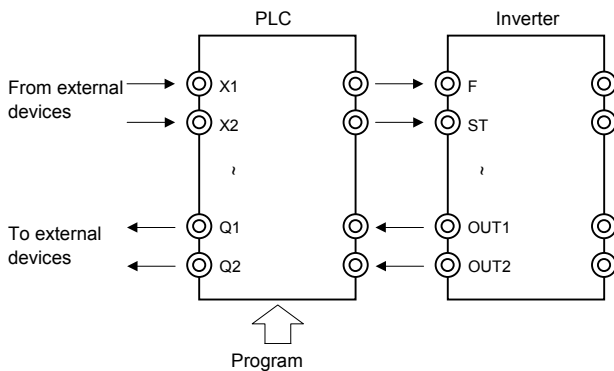


Fig. 3-1 Signal flow between PCL and inverter

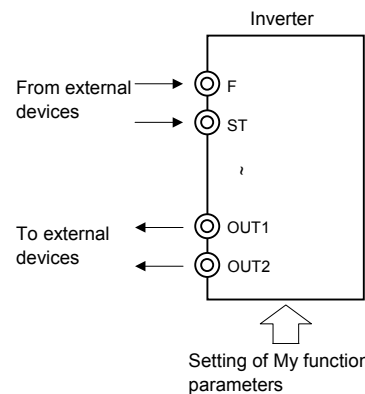
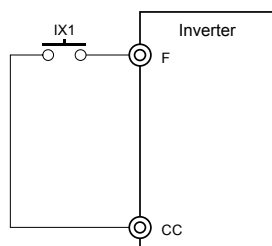


Fig. 3-2 Signal flow of inverter with My function

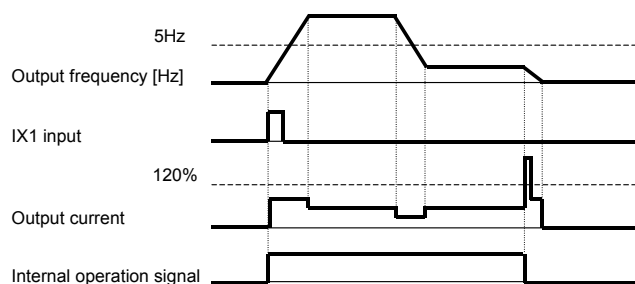
An example is shown the relay sequence function in below. For the steps to be followed when creating a program, a concrete explanation is given in the next and subsequent chapters.

«Example» To set the inverter so that it will start operation when receiving a forward run signal in push mode (in which signals received are held effective) and stop operation automatically if the output current increases to 120% or more of the specified current when the operation frequency is 5Hz or below.
 For the sake of simplicity, stop signal input terminals are omitted here.
 (For an explanation of the actual program, see Example 6 in Chapter 5.)

● Input and output symbols



● Timing chart

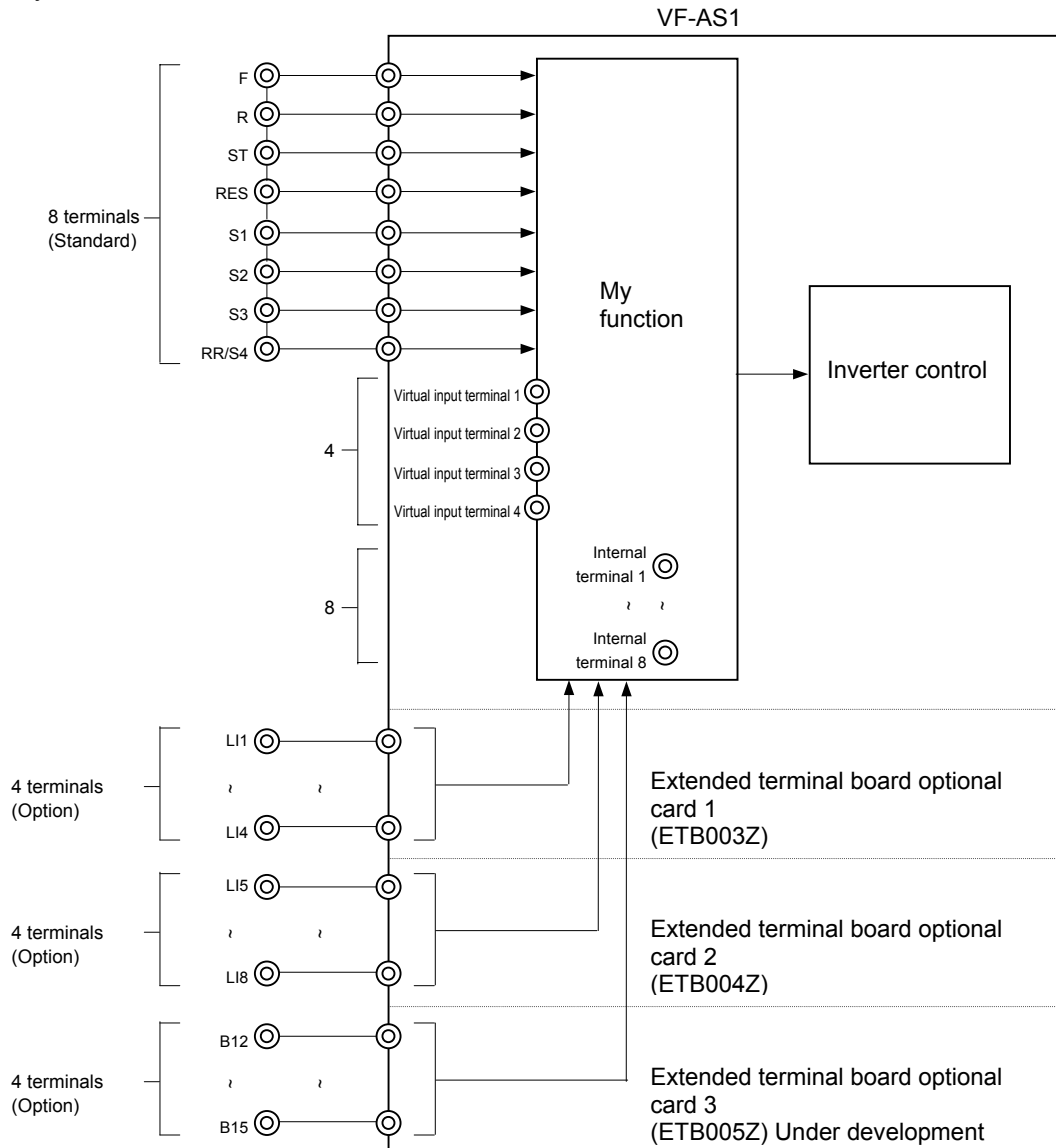


4. Setting parameters

This chapter explains how to set parameters related to the logic input/output My function using examples of setting, the composition of My functions, and the rules for them.

■ Types and applications of input terminals

Here is the composition of the input signal terminals that can be used with the logic input/output My function.



● **Input terminals (20 terminals: F, R, ST, RES, S1 to S3, RR/S4, L11 to L18 and B12 to B15)**

There are two methods of assigning My functions to input terminals: assigning only ON-OFF signal input functions to input terminals, as with a PLC, but not multiple functions (such input terminals are referred to as X1, X2 to X20 to distinguish them from those to which multiple functions are assigned, although they are the same terminals), and assigning multiple functions to input terminals (assigning functions listed in Table 8-4 of Appendix 3 to input terminals) to use them along with My functions.

The combined terminal function described in the previous chapter uses mainly the former method, whereas the relay sequence function uses both the former and latter methods in some cases.

• **Virtual input terminals (4 terminals)**

VFAS1 has 4 virtual input terminals for My function.

Although these terminals do not actually exist, input terminal functions (0 to 135. See Table 8-4 in Appendix 3) can be assigned to them, just as with actual input terminals. A virtual terminal can be used, for example, as the ST+F terminal, if a value read from the actual terminal is written on it.

• **Internal terminals (8 terminals)**

VFAS1 has 8 internal terminals for My function.

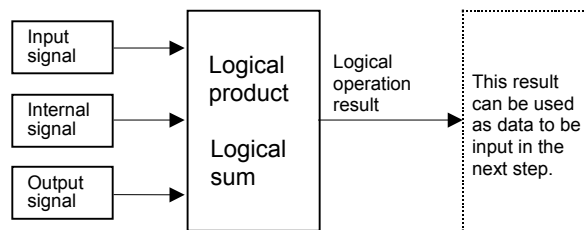
Actually, these terminals do not exist either but they can be used to link signals. These internal terminals aren't same as the virtual input terminals. They are used, for example, to link signals logically to allow the inverter to proceed with the next process.

■ **Computing function**

My function performs logical operations on input/output signals and compares and computes some data, such as frequency, current and torque data, that the inverter detects. The figures below show the outline.

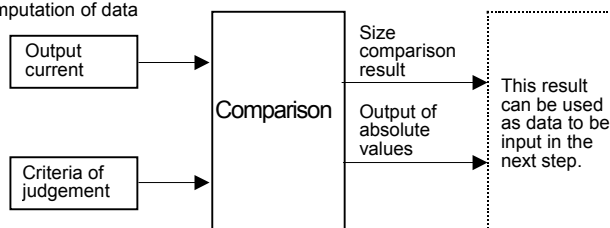
A table of computing functions is shown in Appendix 2. Data items that inverter detects available are listed in Appendix 5. The computing function enhances the speed of analog data processing, which is a problem with data processing by a PLC.

• **Logical comparison**



• **Commutation**

Comparison and computation of data

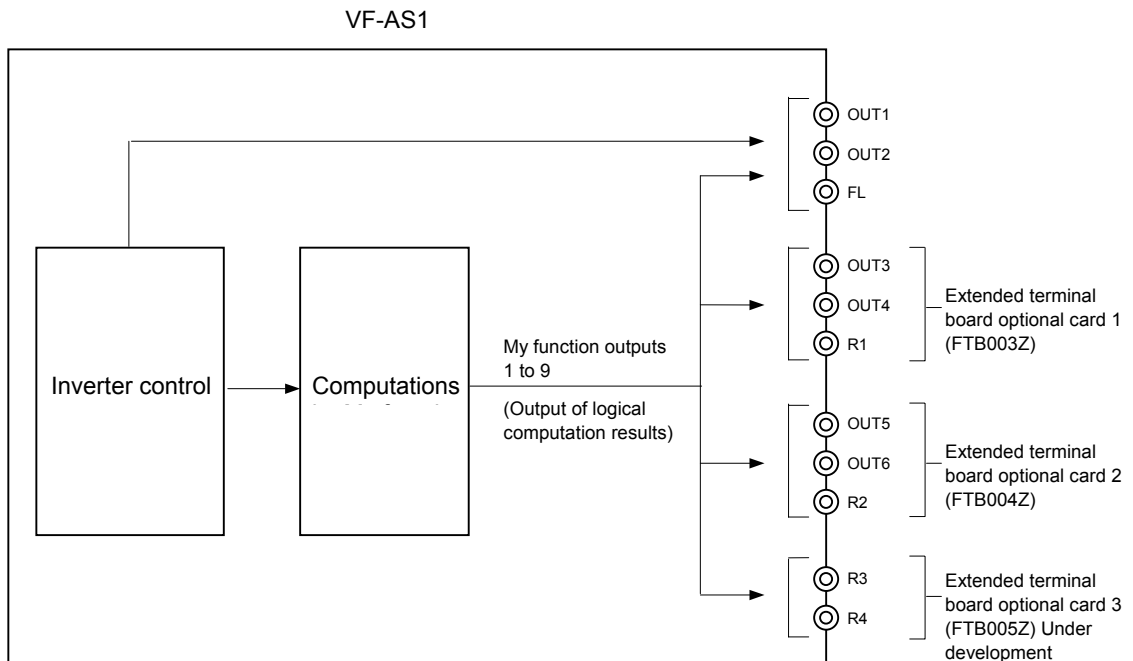


■ **Functions and applications of output terminals**

Functions to be assigned to the output terminals OUT1 to OUT6, FL and R1 to R4 have to be selected from among the positive-logic options for the output terminal functions (0 to 255) listed in Appendix 4. Note that negative-logic settings cannot be used for the output terminals.

My function adds My function output terminal functions to the output multiple-functions (222 to 253), as shown in Appendix 4. These functions let the inverter put out computation results mentioned in the above section through its output terminals and allows My function to use the computation results for itself.

Here is a block diagram of My function with output terminals used with it.



■ Setting parameters

This section explains concretely how to set My function parameters to use the desired function. The logic input/output My function consists of 7 units of the same composition. Each unit consists of 4 steps, and therefore there are 28 steps in total. See 4-1 for the composition of each unit.

Each step consists of one command, and each unit begins with a data read (LD) command (step 1) and ends with a data transfer (ST) command (step 4). These two commands are already incorporated into each unit. The command for performing the desired function and the object to which the command is issued are specified for the two steps (steps 2 and 3) in between them. This is a rule for using My function.

| Unit 1 | | | Unit 2 | | | Unit 7 | |
|--------|-------------------------|---|--------|-------------------------|----|--------|-------------------------|
| Step 1 | LD <i>F900</i> | | Step 1 | LD <i>F906</i> | | Step 1 | LD <i>F953</i> |
| Step 2 | <i>F901</i> <i>F902</i> | → | Step 2 | <i>F907</i> <i>F908</i> | →→ | Step 2 | <i>F954</i> <i>F955</i> |
| Step 3 | <i>F903</i> <i>F904</i> | | Step 3 | <i>F909</i> <i>F910</i> | | Step 3 | <i>F956</i> <i>F957</i> |
| Step 4 | ST <i>F905</i> | | Step 4 | ST <i>F911</i> | | Step 4 | ST <i>F958</i> |

Fig. 4-1 My function block diagram

■ Parameters used

The table below lists the parameters shown in My function block diagram.

Table 4-1 Table of My function parameters

| | Title | Function | Adjustment range | Default setting | |
|--------|-----------------------|--------------|-----------------------------------|---|---|
| Unit 1 | Step 1 (Objects) | <i>F 900</i> | Input function target 11 | Input terminal number 0: Deselect 1: F terminal 2: R terminal 3: ST terminal 4: RES terminal 5: S1 terminal 6: S2 terminal 7: S3 terminal 8: RR/S4 terminal 9: LI1 terminal 10: LI2 terminal 11: LI3 terminal 12: LI4 terminal 13: LI5 terminal 14: LI6 terminal 15: LI7 terminal 16: LI8 terminal 17: B12 terminal 18: B13 terminal 19: B14 terminal 20: B15 terminal 21: Virtual input terminal 1 22: Virtual input terminal 2 23: Virtual input terminal 3 24: Virtual input terminal 4 25~32: Internal terminal 1~8 918~934: My output data No. 1000~1255: Output selection number (Note 1) 2000~2099: FD00~FD99 (Note 2) 3000~3099: FE00~FE99 (Note 2) | 0 |
| | Step 2 (Commands) | <i>F 901</i> | Input function target 12 | 0: NOP (disabling) 1: ST (move) 2: STN (move (inversion)) 3: AND (logical product (A∩B)) 4: ANDN (logical product (A∩B̄)) 5: OR (logical sum (A∪B)) 6: ORN (logical sum (A∪B̄)) 7: EQ (equal) 8: NE (not equal) 9: GT (greater than) 10: GE (greater or equal) 11: LT (less than) 12: LE (less or equal) 13: ASUB (absolute) 14: ON (on delay timer) 15: OFF (off delay timer) 16: COUNT1 (counter 1) 17: COUNT2 (counter 2) 18: HOLD (hold) 19: SET (set) 20: RESET (reset) | 0 |
| | Step 2 (Objects) | <i>F 902</i> | Input function target 12 | Same as <i>F 900</i> | 0 |
| | Step 3 (Commands) | <i>F 903</i> | Input function command 13 | Same as <i>F 901</i> | 0 |
| | Step 3 (Objects) | <i>F 904</i> | Input function target 13 | Same as <i>F 900</i> | 0 |
| | Step 4 (Output to) | <i>F 905</i> | Output function assigned object 1 | Same as <i>F 900</i> | 0 |

| | | Title | Function | Adjustment range | Default setting |
|--------|-----------------------|-------|-----------------------------------|------------------|-----------------|
| Unit 2 | Step 1 (Objects) | F906 | Input function target 21 | Same as F900 | 0 |
| | Step 2 (Commands) | F907 | Input function target 22 | Same as F901 | 0 |
| | Step 2 (Objects) | F908 | Input function target 22 | Same as F900 | 0 |
| | Step 3 (Commands) | F909 | Input function target 23 | Same as F901 | 0 |
| | Step 3 (Objects) | F910 | Input function target 23 | Same as F900 | 0 |
| | Step 4 (Output to) | F911 | Output function assigned object 2 | Same as F900 | 0 |
| Unit 3 | Step 1 (Objects) | F912 | Input function target 31 | Same as F900 | 0 |
| | Step 2 (Commands) | F913 | Input function target | Same as F901 | 0 |
| | Step 2 (Objects) | F914 | Input function target 32 | Same as F900 | 0 |
| | Step 3 (Commands) | F915 | Input function target | Same as F901 | 0 |
| | Step 3 (Objects) | F916 | Input function target 33 | Same as F900 | 0 |
| | Step 4 (Output to) | F917 | Output function assigned object 3 | Same as F900 | 0 |
| Unit 4 | Step 1 (Objects) | F935 | Input function target 41 | Same as F900 | 0 |
| | Step 2 (Commands) | F936 | Input function target 42 | Same as F901 | 0 |
| | Step 2 (Objects) | F937 | Input function target 42 | Same as F900 | 0 |
| | Step 3 (Commands) | F938 | Input function target 43 | Same as F901 | 0 |
| | Step 3 (Objects) | F939 | Input function target 43 | Same as F900 | 0 |
| | Step 4 (Output to) | F940 | Output function assigned object 4 | Same as F900 | 0 |
| Unit 5 | Step 1 (Objects) | F941 | Input function target 51 | Same as F900 | 0 |
| | Step 2 (Commands) | F942 | Input function target 52 | Same as F901 | 0 |
| | Step 2 (Objects) | F943 | Input function target 52 | Same as F900 | 0 |
| | Step 3 (Commands) | F944 | Input function target 53 | Same as F901 | 0 |
| | Step 3 (Objects) | F945 | Input function target 53 | Same as F900 | 0 |
| | Step 4 (Output to) | F946 | Output function assigned object 5 | Same as F900 | 0 |
| Unit 6 | Step 1 (Objects) | F947 | Input function target 61 | Same as F900 | 0 |
| | Step 2 (Commands) | F948 | Input function target 62 | Same as F901 | 0 |
| | Step 2 (Objects) | F949 | Input function target 62 | Same as F900 | 0 |
| | Step 3 (Commands) | F950 | Input function target 63 | Same as F901 | 0 |
| | Step 3 (Objects) | F951 | Input function target 63 | Same as F900 | 0 |
| | Step 4 (Output to) | F952 | Output function assigned object 6 | Same as F900 | 0 |

| | | Title | Function | Adjustment range | Default setting |
|--------|--------------------|--------------|-----------------------------------|----------------------|-----------------|
| Unit 7 | Step 1 (Objects) | <i>F 953</i> | Input function target 71 | Same as <i>F 900</i> | <i>0</i> |
| | Step 2 (Commands) | <i>F 954</i> | Input function target 72 | Same as <i>F 901</i> | <i>0</i> |
| | Step 2 (Objects) | <i>F 955</i> | Input function target 72 | Same as <i>F 900</i> | <i>0</i> |
| | Step 3 (Commands) | <i>F 956</i> | Input function target 73 | Same as <i>F 901</i> | <i>0</i> |
| | Step 3 (Objects) | <i>F 957</i> | Input function target 73 | Same as <i>F 900</i> | <i>0</i> |
| | Step 4 (Output to) | <i>F 958</i> | Output function assigned object 7 | Same as <i>F 900</i> | <i>0</i> |

Note 1: See Table 8-6 “Output terminal functions” in Appendix 4.

Note 2: See Table 8-7 “Data that My function can handle” in Appendix 5.

The four kinds of data in the table below: percent, frequency, time (second) and count, can be compared and computed, and they are specified with parameters for the object to which commands are issued.

| Title | Function | Adjustment range | Default setting |
|--------------|----------------------------------|---------------------|-----------------|
| <i>F 918</i> | My output percent data 1 | <i>0.00~200.0%</i> | <i>0.00</i> |
| <i>F 919</i> | My output percent data 2 | <i>0.00~200.0%</i> | <i>0.00</i> |
| <i>F 920</i> | My output percent data 3 | <i>0.00~200.0%</i> | <i>0.00</i> |
| <i>F 921</i> | My output percent data 4 | <i>0.00~200.0%</i> | <i>0.00</i> |
| <i>F 922</i> | My output percent data 5 | <i>0.00~200.0%</i> | <i>0.00</i> |
| <i>F 923</i> | My output frequency data 1 | <i>0.0~500.0Hz</i> | <i>0.0</i> |
| <i>F 924</i> | My output frequency data 2 | <i>0.0~500.0Hz</i> | <i>0.0</i> |
| <i>F 925</i> | My output frequency data 3 | <i>0.0~500.0Hz</i> | <i>0.0</i> |
| <i>F 926</i> | My output frequency data 4 | <i>0.0~500.0Hz</i> | <i>0.0</i> |
| <i>F 927</i> | My output frequency data 5 | <i>0.0~500.0Hz</i> | <i>0.0</i> |
| <i>F 928</i> | My output time data 1 | <i>0.0 1~600.0s</i> | <i>0.0 1</i> |
| <i>F 929</i> | My output time data 2 | <i>0.0 1~600.0s</i> | <i>0.0 1</i> |
| <i>F 930</i> | My output time data 3 | <i>0.0 1~600.0s</i> | <i>0.0 1</i> |
| <i>F 931</i> | My output time data 4 | <i>0.0 1~600.0s</i> | <i>0.0 1</i> |
| <i>F 932</i> | My output time data 5 | <i>0.0 1~600.0s</i> | <i>0.0 1</i> |
| <i>F 933</i> | No. of times of My output data 1 | <i>0~9999 times</i> | <i>0</i> |
| <i>F 934</i> | No. of times of My output data 2 | <i>0~9999 times</i> | <i>0</i> |

The table below lists the four virtual input terminals available.

| Title | Function | Adjustment range (Note 1) | Default setting |
|--------------|------------------------------------|---------------------------|-----------------|
| <i>F 973</i> | Virtual input terminal selection 1 | <i>0~135</i> | <i>0</i> |
| <i>F 974</i> | Virtual input terminal selection 2 | <i>0~135</i> | <i>0</i> |
| <i>F 975</i> | Virtual input terminal selection 3 | <i>0~135</i> | <i>0</i> |
| <i>F 976</i> | Virtual input terminal selection 4 | <i>0~135</i> | <i>0</i> |

Note 1: See Table 8-4 “Input terminal functions” in Appendix 3.

■ Enabling or disabling MY function

A parameter for enabling or disabling My function is provided to prevent the system from starting accidentally during the setting of My function parameters. This parameter is $F 9 7 7$ described below. When setting My function parameters, be sure to set $F 9 7 7$ to \square (unselected) to disable My function.

After setting necessary My function parameters, change the setting to $/$ (My function + enabling signal) or $\bar{2}$ (My function always enabled) to make My function ready to work. (If $F 9 7 7$ is set to $/$, MY function is activated when an enabling signal is issued.)

Note: It takes a maximum of 0.5 second for a change to a logic input/output My function-related parameter to take effect. Therefore, the inverter must be held in a standby state for at least 0.5 second after the setting of necessary My function parameters.

| Title | Function | Adjustment range | Default setting |
|-----------|-----------------------|--|-----------------|
| $F 9 7 7$ | My function selection | \square : Deselect $/$: My function + permission signal $\bar{2}$: My function always ON | \square |

\square (Unselected): Disables My function.

$/$ (My function + enabling signal): Puts My function into a standby state. My function starts working when an ON signal is sent to the terminals to which the input terminal functions $5 4$ and $5 5$ (My function RUN signal) are assigned.

$\bar{2}$ (My function always enabled): Enables My function as soon as the inverter is turned on.

Note: The setting of the parameter $F 9 7 7$ cannot be changed when the inverter is in operation.

● When MY function is disabled

All My function settings are ineffective. Instead, original input terminal settings are effective and the inverter operates in the usual way.

● When MY function is in a standby state

All signals (except some signals) coming in through input terminals are turned OFF in the inverter and recognized as OFF signals. This does not hold true for the following functions.

1. My function enabling function
2. Emergency stop function and reset function

Note: Using My function, do not operate the input terminals to which the above functions are assigned. Or My function enabling function, the emergency stop function, etc might not work normally.

● When MY function is enabled

Signals coming in through input terminals are rewritten in the inverter according to the settings of My function and the inverter operates under the rewritten signals.

5. Examples of setting

This chapter gives several examples of setting.

Note that the settings described below are examples and there are several ways to set a function.

Here are the examples of setting given in this chapter.

- **Examples of the setting of the combined terminal function**

Example 1: Performing the ST+F function by sending a signal to one terminal

Example 2: Performing the ST+F+Sr function by sending a signal to one terminal

Example 3: Putting out the logical product of a low-speed signal and a low-current signal

- **Examples of the setting of the relay sequence function**

Example 4: Operation with a combination of 2 input signals

Example 5: Push type operation

Example 6: Operation with the automatic stop function

■ Examples of the setting of the combined terminal function

«Example 1: Performing the ST+F function by sending a signal to one terminal»

Here is an example of the assignment of the ST+F combined function referred to in Chapter 3 to the S1 terminal, including the setting of related parameters. Figure 5-1 illustrates this example. To perform this function, the inverter needs to be configured, as shown in Figure 5-2. The ST function is assigned to the S1 terminal as an ordinary input terminal function, and the F function is assigned to a virtual input terminal of MY function. If a signal to the S1 terminal is transferred to the virtual input terminal under these conditions, the S1 terminal turns on and performs the ST+F function.

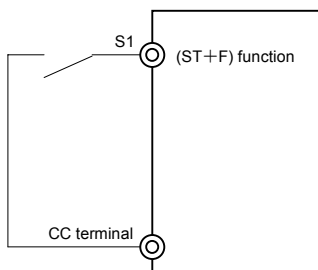


Fig. 5-1 Wiring diagram for Example 1

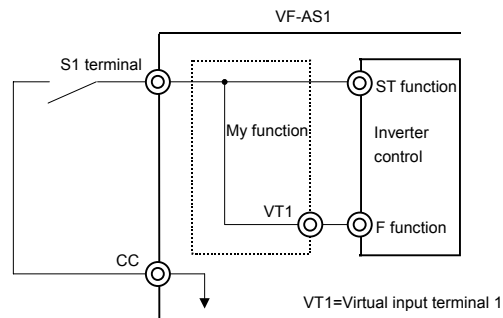


Fig. 5-2 Block diagram for Example 1

Follow these steps to set parameters.

1. First, disable My function to prevent the system from starting accidentally during the setting of My function parameters. (Factory default setting)
 $F 9 7 7 = 0$ (Disables MY function)
2. Assign the ST function to the S1 terminal to which the preset speed command 1 function (S1) is currently assigned by factory default.
 $F 1 1 5 = 6$ (S1 terminal = Ready for ST operation)
3. Using $F 9 7 3$, assign forward run command F to virtual input terminal 1.
 $F 9 7 3 = 2$ (Virtual input terminal 1 = Forward run command F)

4. Then specify commands in accordance with MY function block diagram, and objects to which the commands are issued.

| | | | |
|----------|---------------|-----------------|--|
| «Unit 1» | Commands | Objects | |
| Step 1 | LD | <i>F900=5</i> | Command for reading S1 terminal input signals |
| Step 2 | <i>F901=0</i> | <i>F902=0</i> | Disabling command, because there is no need to specify this in this example. |
| Step 3 | <i>F903=0</i> | <i>F904=0</i> | Disabling command, because there is no need to specify this in this example. |
| Step 4 | ST | <i>F905=2 1</i> | Command for writing signals read in step 1 to virtual input terminal 1 |

5. After setting the above My function parameters, set My function ON/OFF selection parameter to 2 (always enabled) to enable My function.

F977=2 (My function always enabled)

These settings are summarized in the table below.

| | | Title | Parameter setting | Description |
|---------------|-------------|-------------|--|--|
| Prior setting | - | <i>F977</i> | <i>0</i> (Default) | Disables My function. |
| | | <i>F115</i> | <i>6</i> | Assigns the ST terminal function to the S1 terminal. |
| | | <i>F973</i> | <i>2</i> | Assigns the F terminal function to virtual input terminal 1. |
| Unit 1 | Step 1 | <i>F900</i> | <i>5</i> | Reads S1 terminal input signals (LD S1). |
| | Step 2 | <i>F901</i> | <i>0</i> (Default) | NOP command (Disabling) |
| | | <i>F902</i> | <i>0</i> (Default) | |
| | Step 3 | <i>F903</i> | <i>0</i> (Default) | NOP command (Disabling) |
| | | <i>F904</i> | <i>0</i> (Default) | |
| Step 4 | <i>F905</i> | <i>2 1</i> | Incorporates the result into virtual input terminal 1. | |
| - | - | <i>F977</i> | <i>2</i> | Sets My function ON/OFF selection parameter to Always enabled. |

«Example 2: Performing the ST+F+Sr function by sending a signal to one terminal»

This section explains how to set parameters to perform three input terminal functions (ST+F+Sr1) by sending a signal to one terminal (S1 terminal).

Figure 5-3 illustrates this example. To perform this function, the inverter needs to be configured, as shown in Figure 5-4. The ST function, a multi-function input terminal function, is assigned to the S1 terminal, just as with Example 1. In addition, the F function and the preset speed command 1 function are assigned to virtual input terminals 1 and 2 of MY function, respectively. If a signal to the S1 terminal is transferred to the virtual terminals under these conditions, the S1 terminal turns on and performs the ST+F+Sr1 function.

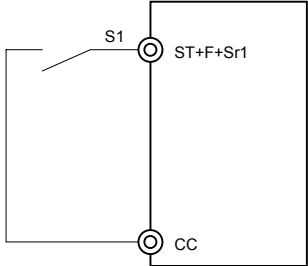


Fig. 5-3 Wiring diagram for Example 2

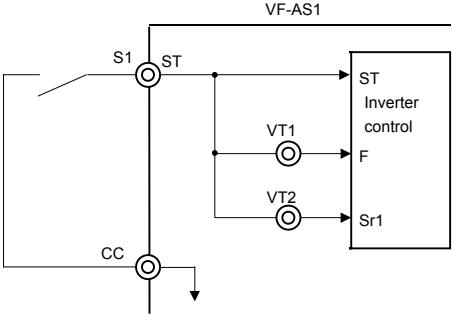


Fig. 5-4 Block diagram for Example 2

Follow these steps to set parameters.

1. As with the above example, disable My function first to prevent the system from starting accidentally during the setting of My function parameters.
F 9 7 7=0 (Disables MY function)
2. Assign the ST function to the S1 terminal to which the preset speed command 1 function (S1) is currently assigned by factory default.
F 1 1 5=6 (S1 terminal = Ready for ST operation)
3. Using *F 9 7 3*, assign forward run command F to virtual input terminal 1.
F 9 7 3=2 (VT1 (Virtual input terminal 1) = Forward run command F)
4. Using *F 9 7 4*, assign preset speed command 1 to virtual input terminal 2.
F 9 7 4= 10 (VT2 (Virtual input terminal 2) = Preset speed command 1)
5. Then specify commands in accordance with My function block diagram, and objects to which the commands are issued.

| «Unit 1» | Commands | Objects | |
|----------|-------------------|--------------------|--|
| Step 1 | LD | <i>F 9 0 0=5</i> | Command for reading S1 terminal input signals |
| Step 2 | <i>F 9 0 1= 1</i> | <i>F 9 0 2=2 1</i> | Command for writing signals read in step 1 to virtual input terminal 1 |
| Step 3 | <i>F 9 0 3=0</i> | <i>F 9 0 4=0</i> | NOP command |
| Step 4 | ST | <i>F 9 0 5=2 2</i> | Command for writing signals read in step 1 to virtual input terminal 2 |

6. After setting the above My function parameters, set My function ON/OFF selection parameter to 2 (always enabled) to enable MY function.
F 9 7 7=2 (My function always enabled)

These settings are summarized in the table below.

| | | Title | Parameter setting | Description |
|---------------|----------------|----------------|--|---|
| Prior setting | - | <i>F 9 7 7</i> | 0 (Default) | Disables My function. |
| | | <i>F 1 1 5</i> | 6 | Assigns the ST terminal function to the S1 terminal. |
| | | <i>F 9 7 3</i> | 2 | Assigns the F terminal function to virtual input terminal 1. |
| | | <i>F 9 7 4</i> | 10 | Assigns the preset speed command 1 to virtual input terminal 2. |
| Unit 1 | Step 1 | <i>F 9 0 0</i> | 5 | Reads S1 terminal input signals (LD S1). |
| | Step 2 | <i>F 9 0 1</i> | 1 | Transfer command |
| | | <i>F 9 0 2</i> | 2 1 | Incorporates the result into virtual input terminal 1. |
| | Step 3 | <i>F 9 0 3</i> | 0 (Default) | NOP command (Disabling) |
| | | <i>F 9 0 4</i> | 0 (Default) | |
| Step 4 | <i>F 9 0 5</i> | 2 2 | Incorporates the result into virtual input terminal 2. | |
| - | - | <i>F 9 7 7</i> | 2 | Sets My function ON/OFF selection parameter to Always enabled. |

«Example 3: Putting out the logical product of a low-speed signal and a low-current signal»

Here is an example of the combining of output signals referred to in Chapter 3. Only when both a low-speed signal and a low-current detection signal are received, a signal is sent out through an output terminal (OUT1).

Logical operations are performed, as shown in Fig. 5-5, to determine the logical product (AND) of a low-speed signal and a low-current detection signal included among multi-function output signals. To put out the computing result to the OUT1 output terminal, the logical product (AND) is temporarily written to My function output 1, and then My function output 1 sends the logical product to OUT1.

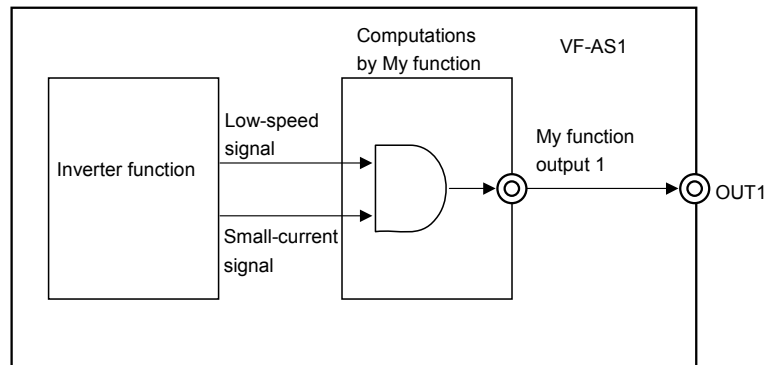


Fig. 5-5 Block diagram for Example 3

Follow these steps to set parameters.

1. As with the above example, disable My function first to prevent the system from starting accidentally during the setting of My function parameters.
 $F977=0$ (Disables MY function)
2. Assign My function output 1 to the OUT1 output terminal to which the low-speed signal function is currently assigned by factory default.
 $F130=222$ (Assigns My function output 1 to the OUT1 output terminal.)

3. Then set parameters in accordance with MY function block diagram.

| «Unit 1» | Commands | Objects | |
|----------|----------|-------------|--|
| Step 1 | LD | $F900=1004$ | Reads low-speed signals. |
| Step 2 | $F901=3$ | $F902=1026$ | Determines the logical product of a low-speed signal and low-current signal. |
| Step 3 | $F903=0$ | $F904=0$ | NOP command |
| Step 4 | ST | $F905=1222$ | Incorporates the logical product into My function output 1. |

4. After setting the above My function parameters, set My function ON/OFF selection parameter to 2 (always enabled) to enable My function.
 $F977=2$ (My function always enabled)

These settings are summarized in the table below.

| | | Title | Parameter setting | Description |
|---------------|-------------|-------------|--|--|
| Prior setting | - | <i>F977</i> | <i>0</i> (Default) | Disables My function. |
| | | <i>F130</i> | <i>222</i> | Assigns My function output 1 to the OUT1 terminal. |
| Unit 1 | Step 1 | <i>F900</i> | <i>1004</i> | Reads low-speed signals (LD LOW) |
| | Step 2 | <i>F901</i> | <i>3</i> | AND command |
| | | <i>F902</i> | <i>1026</i> | Determines the logical product of a low-speed signal and low-current signal. |
| | Step 3 | <i>F903</i> | <i>0</i> (Default) | NOP command (Disabling) |
| | | <i>F904</i> | <i>0</i> (Default) | |
| Step 4 | <i>F905</i> | <i>1222</i> | Incorporates the logical product into My function output 1. (ST My function output 1) | |
| - | - | <i>F977</i> | <i>2</i> | Sets My function ON/OFF selection parameter to Always enabled. |

■ Examples of the setting of the relay sequence function

Since the steps to be followed to set the relay terminal function are much larger in number than those for the combined terminal function described earlier in this chapter, an explanation is given in the following order, using ladder diagrams.

Desired function ⇒ Input/output terminal wiring diagram ⇒ Timing chart ⇒ Ladder diagram
⇒ Setting of parameters

First cited is an example of using input terminals as simple ON/OFF signal input terminals but not as multi-function signal input terminals.

«Example 4: Operation with a combination of 2 input signals»

The inverter is programmed with My function so that it will issue a forward run command if either input terminal 1 (F terminal in this example) or input terminal 2 (R terminal in this example) is turned on, or a reverse run command if both the input terminals are turned on, or a stop command if both the terminals are turned off.

Figure 5-6 illustrates a wiring diagram and a timing chart for this example.

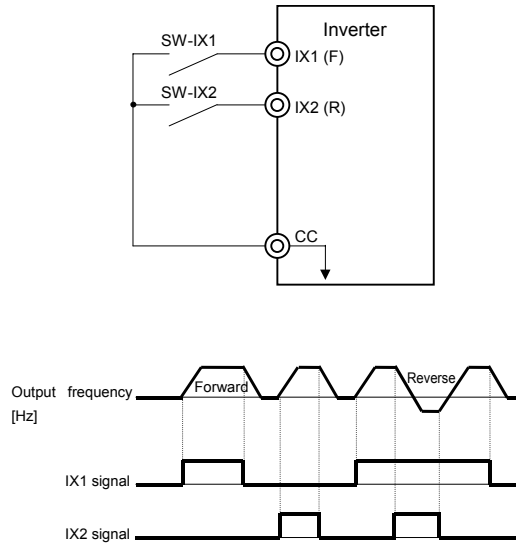
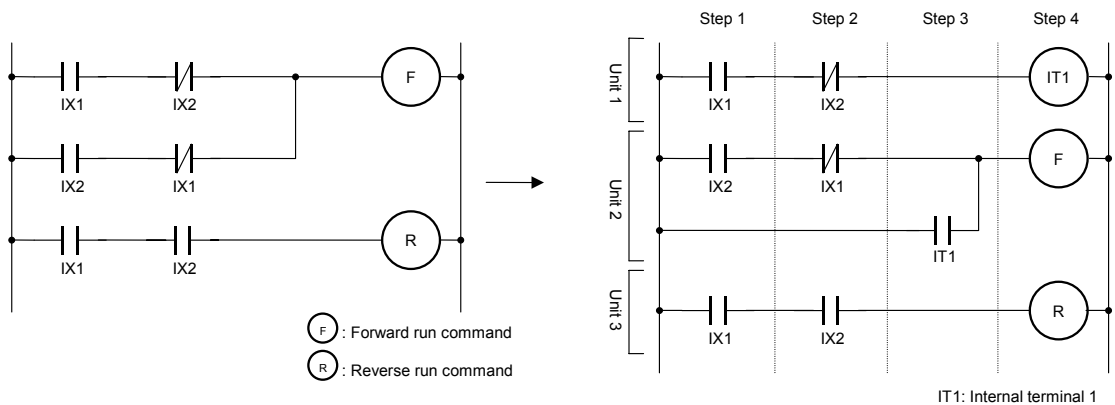


Fig. 5-6 Wiring diagram and timing chart for Example 4

To facilitate the setting of parameters, these relationships are illustrated in the ladder diagram below.



Unit 1 of My function consists of up to 4 steps. The sequence for issuing a reverse run command shown in the ladder diagram on the left consists of 5 steps. If these steps are divided between two units and recomposed, as shown in the diagram on the right, the same function can be performed with My function.

The above ladder diagram suggests that My function parameters listed in the table below need to be set.

| | | Title | Parameter setting | Description |
|---------------|-------------|-------------|---|---|
| Prior setting | - | <i>F977</i> | 0 (Default) | Disables My function to prevent the system from starting accidentally during the setting of parameters. |
| | | <i>F111</i> | 0 | Uses the F terminal as a simple input terminal (IX1) but not as a multi-function terminal. |
| | | <i>F112</i> | 0 | Uses the R terminal as a simple input terminal (IX2) but not as a multi-function terminal. |
| | | <i>F973</i> | 2 | Assigns the forward run command function to virtual input terminal 1 (VT1). |
| | | <i>F974</i> | 4 | Assigns the reverse run command function to virtual input terminal 2 (VT2). |
| Unit 1 | Step 1 | <i>F900</i> | 1 | Reads IX1(F) terminal input signals. (LD IX1) |
| | Step 2 | <i>F901</i> | 4 | ANDN command ($IX1 \cap \overline{IX2}$) |
| | | <i>F902</i> | 2 | |
| | Step 3 | <i>F903</i> | 0 (Default) | NOP command (Disabling) |
| | | <i>F904</i> | 0 (Default) | |
| Step 4 | <i>F905</i> | 25 | Incorporates the result into internal terminal 1. ($IX1 \cap \Rightarrow IT1$) | |
| Unit 2 | Step 1 | <i>F906</i> | 2 | Reads IX2(R) terminal input signals. (LD IX2) |
| | Step 2 | <i>F907</i> | 4 | ANDN command ($IX2 \cap \overline{IX1}$) |
| | | <i>F908</i> | 1 | |
| | Step 3 | <i>F909</i> | 5 | OR command ($(IX2 \cap \overline{IX1}) \cup IT1$) |
| | | <i>F910</i> | 25 | |
| Step 4 | <i>F911</i> | 21 | Incorporates the result into virtual input terminal 1. ($(IX2 \cap \overline{IX1}) \cup IT1 \Rightarrow VT1$) | |
| Unit 3 | Step 1 | <i>F912</i> | 1 | Reads IX1(F) terminal input signals. (LD IX1) |
| | Step 2 | <i>F913</i> | 3 | AND command ($IX1 \cap IX2$) |
| | | <i>F914</i> | 2 | |
| | Step 3 | <i>F915</i> | 0 (Default) | NOP command (Disabling) |
| | | <i>F916</i> | 0 (Default) | |
| Step 4 | <i>F917</i> | 22 | Incorporates the result into virtual input terminal 2. ($IX2 \cap IX1 \Rightarrow VT2$) | |
| - | - | <i>F977</i> | 2 | After setting all the above parameters, set this parameter to 2 to enable My function. |

In this example, the number of steps can be reduced by using an NEQ (mismatch) command. That is, if the inverter is programmed so that it will issue a forward run command when the signal to input terminal 1 and the signal to input terminal 2 do not match (mismatch), the above units 1 and 2 can be combined into one (unit 1 shown below).

| | | Title | Parameter setting | Description |
|--------|-------------|-------------|---|--|
| Unit 1 | Step 1 | <i>F900</i> | <i>1</i> | Reads IX1(F) terminal input signals. (LD IX1) |
| | Step 2 | <i>F901</i> | <i>8</i> | NEQ command $((IX1 \cap \overline{IX2}) \cup \overline{(IX1 \cap IX2)})$ |
| | | <i>F902</i> | <i>2</i> | |
| | Step 3 | <i>F903</i> | <i>0</i> (Default) | NOP command (Disabling) |
| | | <i>F904</i> | <i>0</i> (Default) | |
| Step 4 | <i>F905</i> | <i>2 1</i> | Incorporates the result into virtual input terminal 1. $((IX1 \cap \overline{IX2}) \cup \overline{(IX1 \cap IX2)} \Rightarrow VT1)$ | |

«Example 5: Push type operation»

This operation requires the function of starting and stopping operation by simply issuing a forward run command or a stop command to an input terminal, respectively. For reverse run, the function must also be able to start operation by executing a single reverse run command. In addition to this function, self-holding switches are used for this operation.

Figure 5-7 illustrates a wiring diagram and a timing chart. Operation is performed under the control of trigger signals to the input terminals IX1 to IX3.

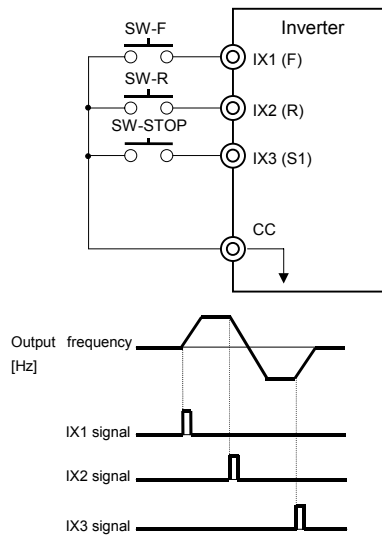
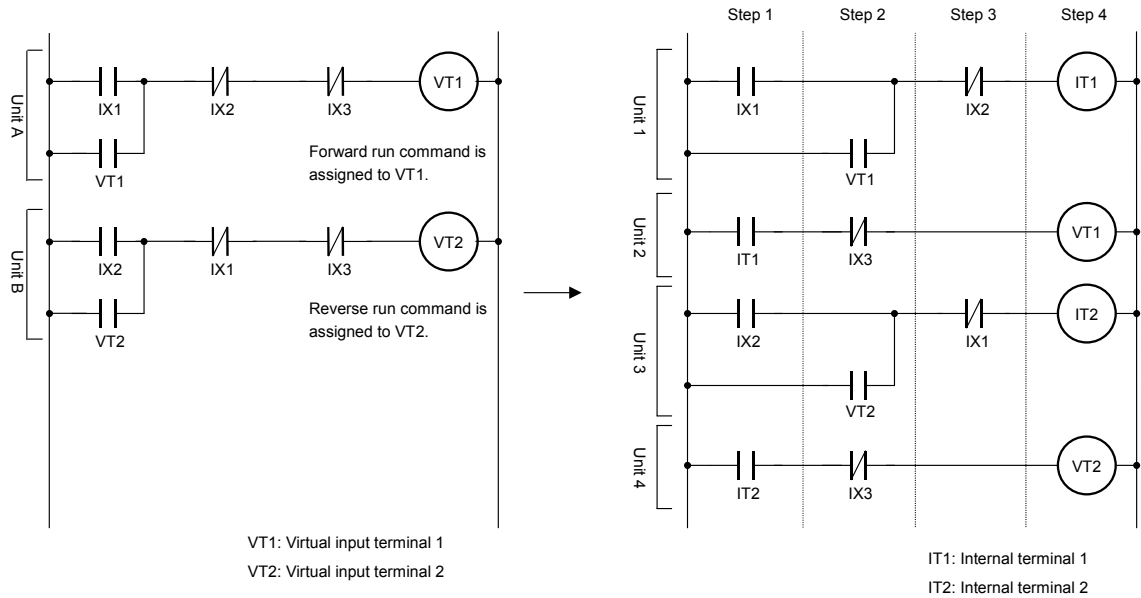


Fig. 5-7 Wiring diagram and timing chart for Example 5

To perform this function, a self-holding function (function of continuing operation by executing a single run command) is needed, as illustrated in the ladder diagram below. A forward run command and a reverse run command establish their respective self-holding circuits, and the self-holding circuit established by one of them is broken by the other or a stop command.



To set this function with My function, each unit (units A and B in the ladder diagram on the left), which consists of 5 steps, just as with the previous example, is divided, as illustrated in ladder diagram on the right, and changed to a unit consisting of 4 steps or less.

The above ladder diagram suggests that My function parameters listed in the table below need to be set.

| | | Title | Parameter setting | Description |
|---------------|--------|-------|--|---|
| Prior setting | - | F977 | 0 (Default) | Disables My function to prevent the system from starting accidentally during the setting of parameters. |
| | | F111 | 0 | Assigns no function to the F terminal (to use it as an input terminal (push type input terminal 1)). |
| | | F112 | 0 | Assigns no function to the R terminal (to use it as an input terminal (push type input terminal 2)). |
| | | F115 | 0 | Assigns no function to the S1 terminal (to use it as an input terminal (push type input terminal 3)). |
| | | F973 | 2 | Assigns the forward run command function to virtual input terminal 1 (VT1 = F command). |
| | | F974 | 4 | Assigns the reverse run command function to virtual input terminal 2 (VT2 = R command). |
| Unit 1 | Step 1 | F900 | 1 | Reads IX1(F) terminal input signals. (LD IX1) |
| | Step 2 | F901 | 5 | OR command (IX1 U VT1) self-holding circuit |
| | | F902 | 2 1 | |
| | Step 3 | F903 | 4 | ANDN command (IX1 U VT1 ∩ $\overline{IX2}$) |
| | | F904 | 2 | |
| Step 4 | F905 | 25 | Incorporates the result into internal terminal 1. (IX1 U VT1 ∩ $\overline{IX2}$ ⇒ IT1) | |

| | | Title | Parameter setting | Description |
|--------|--------|-------------|--|--|
| Unit 2 | Step 1 | F906 | 25 | Reads internal terminal 1 signals (LD IT1). |
| | Step 2 | F907 | 4 | ANDN command ($IT1 \cap \overline{IX3}$) |
| | | F908 | 5 | |
| | Step 3 | F909 | 0 (Default) | NOP command (Disabling) |
| F910 | | 0 (Default) | | |
| Step 4 | F911 | 21 | Incorporates the result into virtual input terminal 1 to let it issue a forward run command. ($IT1 \cap \overline{IX3} \Rightarrow VT1$) | |
| Unit 3 | Step 1 | F912 | 2 | Reads IX2(R) terminal input signals. (LD IX2) |
| | Step 2 | F913 | 5 | OR command ($IX2 \cup VT2$) self-holding circuit |
| | | F914 | 22 | |
| | Step 3 | F915 | 4 | ANDN command ($IX2 \cup VT2 \cap \overline{IX1}$) |
| F916 | | 1 | | |
| Step 4 | F917 | 26 | Incorporates the result into internal terminal 2 ($IX2 \cup VT2 \cap \overline{IX1} \Rightarrow IT2$) | |
| Unit 4 | Step 1 | F935 | 26 | Reads internal terminal 2 signals (LD IT2) |
| | Step 2 | F936 | 4 | ANDN command ($IT2 \cap \overline{IX3}$) |
| | | F937 | 5 | |
| | Step 3 | F938 | 0 (Default) | NOP command (Disabling) |
| F939 | | 0 (Default) | | |
| Step 4 | F940 | 21 | Incorporates the result into virtual input terminal 2 to let it issue a reverse run command. ($IT2 \cap \overline{IX3} \Rightarrow VT2$) | |
| - | - | F977 | 2 | After setting all the above parameters, set this parameter to 2 to enable My function. |

«Example 6: Operation with the automatic stop function»

This chapter explains how to set parameters for the relay sequence function described in Chapter 3.

This operation requires the function of receiving a push type signal, starting operation by issuing a forward run command, and stopping operation if the output current increases to 120% or more of the specified current when the operation frequency is 5Hz or less.

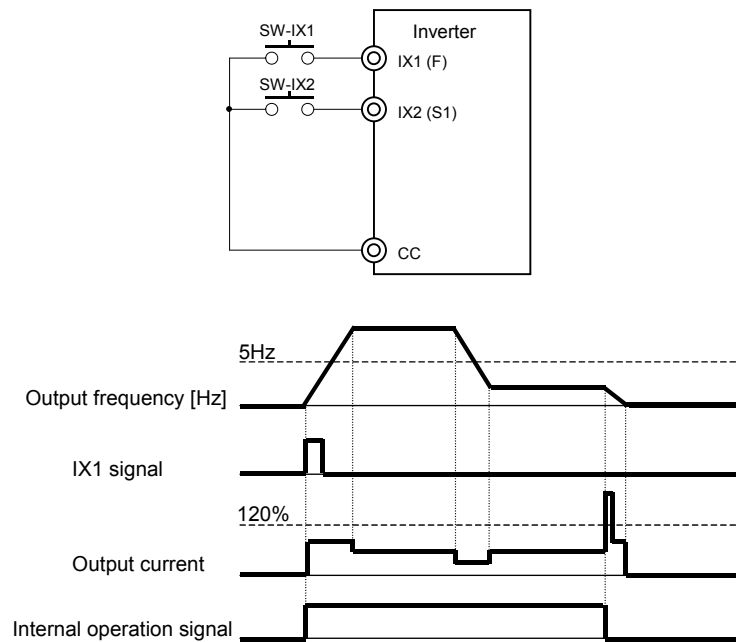
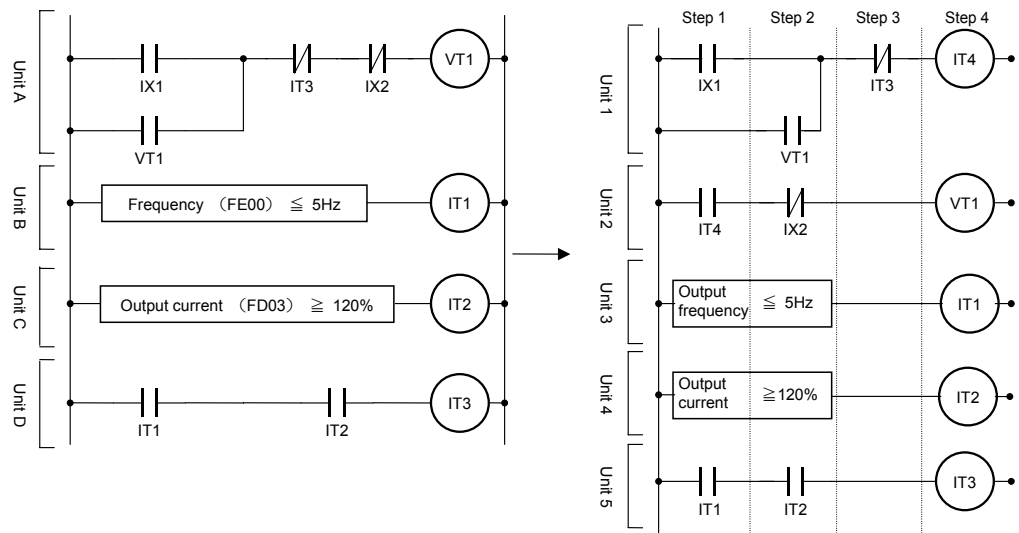


Fig. 5-7 Wiring diagram and timing chart for Example 6

- An input terminal is used as a terminal for issuing push type forward run commands (commands that are held effective once executed).
- Criteria for judging whether the operation frequency is 5Hz or below and whether the output current is 120% or less of the specified current are set with MY function.
- A program is written so that it will cancel a forward run command if both the above conditions are satisfied.
- Since the function of stopping operation forcibly is required, the program should be such that it will cancel a forward run command and stop operation if the S1 terminal receives even a single command.

These are illustrated in the ladder diagrams below.



VT1: Virtual input terminal (forward run command) IT1: Internal terminal 1
 IT2: Internal terminal 2
 IT3: Internal terminal 3
 IT4: Internal terminal 4

As unit A in the ladder diagram on the left consists of 5 steps, as with the previous example, it is divided and changed to a unit consisting of 4 steps or less, as illustrated in the ladder diagram on the right.

The above ladder diagrams suggest that My function parameters listed in the table below need to be set.

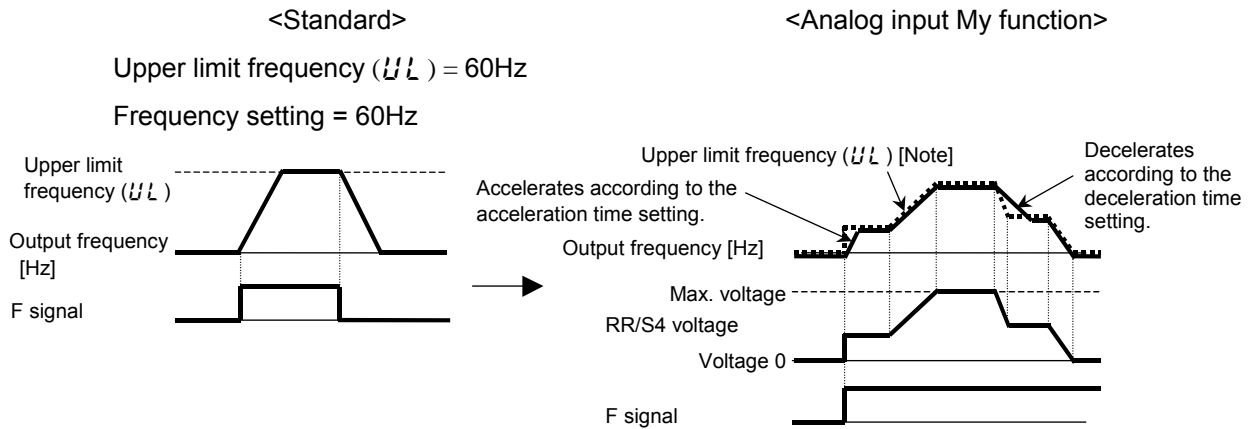
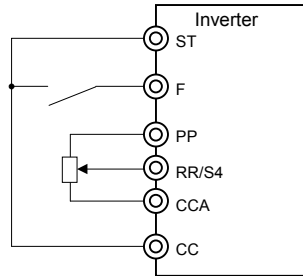
| | | Title | Parameter setting | Description |
|---------------|---|-------|-------------------|--|
| Prior setting | - | F977 | 0 (Default) | Disables My function to prevent the system from starting accidentally during the setting of parameters. |
| | | F111 | 0 | Assign no function to the F terminal to use it as an input terminal 1 (IX1) for issuing push type run commands. |
| | | F115 | 0 | Assign no function to the S1 terminal to use it as an input terminal 2 (IX2) for issuing push type stop commands. |
| | | F918 | 120 | Sets the limit at 120% to use it as a reference value when comparing and computing currents. |
| | | F923 | 5 | Sets the limit at 5Hz to use it as a reference value when comparing and computing frequencies. |
| | | F973 | 2 | Assigns the forward run command function to virtual input terminal 1 to let it issue a forward run command when it is turned on. |

| | | Title | Parameter setting | Description |
|-------------|-------------|--------------------|--|--|
| Unit 1 | Step 1 | <i>F900</i> | <i>1</i> | Reads IX1(F) terminal input signals (LD IX1) |
| | Step 2 | <i>F901</i> | <i>5</i> | OR command ($IX1 \cup VT1$) |
| | | <i>F902</i> | <i>25</i> | |
| | Step 3 | <i>F903</i> | <i>4</i> | ANDN command ($IX1 \cup VT1 \cap \overline{IT3}$) |
| <i>F904</i> | | <i>27</i> | | |
| Step 4 | <i>F905</i> | <i>28</i> | Incorporates the result into internal terminal 4 ($IX1 \cup VT1 \cap \overline{IT3} \Rightarrow IT4$) | |
| Unit 2 | Step 1 | <i>F906</i> | <i>28</i> | Reads internal terminal 4 signals (LD IT4) |
| | Step 2 | <i>F907</i> | <i>4</i> | ANDN command ($IT4 \cap \overline{IX2}$) |
| | | <i>F908</i> | <i>5</i> | |
| | Step 3 | <i>F909</i> | <i>0</i> (Default) | NOP command (Disabling) |
| <i>F910</i> | | <i>0</i> (Default) | | |
| Step 4 | <i>F911</i> | <i>21</i> | Incorporates the result into VT1. ($IT4 \cap \overline{IX2} \Rightarrow VT1$) | |
| Unit 3 | Step 1 | <i>F912</i> | <i>3000</i> | Reads output frequency (LD Output frequency) |
| | Step 2 | <i>F913</i> | <i>12</i> | LE command (Comparison to a frequency of 5Hz) |
| | | <i>F914</i> | <i>923</i> | |
| | Step 3 | <i>F915</i> | <i>0</i> (Default) | NOP command (Disabling) |
| <i>F916</i> | | <i>0</i> (Default) | | |
| Step 4 | <i>F917</i> | <i>25</i> | Incorporates the result into internal terminal 1 (Comparison to a frequency of 5Hz \Rightarrow IT1) | |
| Unit 4 | Step 1 | <i>F935</i> | <i>2003</i> | Reads output frequency (LD Output current) |
| | Step 2 | <i>F936</i> | <i>10</i> | GE command (Comparison to 120%) |
| | | <i>F937</i> | <i>918</i> | |
| | Step 3 | <i>F938</i> | <i>0</i> (Default) | NOP command (Disabling) |
| <i>F939</i> | | <i>0</i> (Default) | | |
| Step 4 | <i>F940</i> | <i>26</i> | Incorporates the result into internal terminal 2 (Comparison to 120% \Rightarrow IT2) | |
| Unit 5 | Step 1 | <i>F941</i> | <i>25</i> | Reads internal terminal 1 signals (LD IT1) |
| | Step 2 | <i>F942</i> | <i>3</i> | AND command ($IT1 \cap IT2$) |
| | | <i>F943</i> | <i>26</i> | |
| | Step 3 | <i>F944</i> | <i>0</i> (Default) | NOP command (Disabling) |
| <i>F945</i> | | <i>0</i> (Default) | | |
| Step 4 | <i>F946</i> | <i>27</i> | Incorporates the result into internal terminal 3 ($IT1 \cap IT2 \Rightarrow IT3$) | |
| - | - | <i>F977</i> | <i>2</i> | After setting all the above parameters, set this parameter to 2 to enable My function. |

6. Analog input My function

The control panel is usually used to set parameters, but the analog input My function allows specific parameters and functions to be set continuously using an external control device.

The figure below illustrates an inverter that sets the upper-limit frequency (f_{UL}) by means of analog signals.



Note: Adjustments are made by the inverter itself, so no changes are made to parameter settings.

The acceleration and deceleration time can be adjusted by changing the analog input value to the RR/S4 terminal. The analog input My function is applicable to the 9 objects in $F951$ and $F954$ (object for which analog function is used) of the table below. Terminals to which the analog input My function is assigned can be specified with the parameters $F959$ and $F962$ (object to which analog input function is assigned).

■ **Parameters used**

| Title | Function | Adjustment range | Default setting |
|--------------|------------------------------------|---|-----------------|
| <i>F 959</i> | Analog input function target 11 | <i>0</i> : Deselect <i>1</i> : VI/II <i>2</i> : RR/S4 <i>3</i> : RX <i>4</i> : Optional AI1+, Optional AI1- <i>5</i> : Optional AI2 | <i>0</i> |
| <i>F 961</i> | Analog function assigned object 11 | <i>0</i> : Disabled <i>1</i> : Acceleration rate <i>2</i> : Upper limit frequency (<i>UL</i>) <i>3</i> : Acceleration multiplication factor <i>4</i> : Deceleration multiplication factor <i>5</i> : Manual torque boost (<i>ub</i>) <i>6</i> : OC stall (<i>F 601</i>) <i>7</i> : Thermal protection (<i>t Hr</i>) <i>8</i> : Speed loop P gain (<i>F 460</i>) <i>9</i> : Drooping gain (<i>F 320</i>) <i>10</i> : PID P gain (<i>F 362</i>) | <i>0</i> |
| <i>F 962</i> | Analog input function target 21 | Same as <i>F 959</i> | <i>0</i> |
| <i>F 964</i> | Analog function assigned object 21 | Same as <i>F 961</i> | <i>0</i> |

The analog input My function can be set in two ways.

If the analog input value specified with *F 959* is set so as to vary from 0 to the maximum value, the parameter for the object selected with *F 961* can be adjusted within a range of 0 to parameter setting * variable factor. The same goes for *F 962* and *F 964*.

This analog value adjustment range can be adjusted by changing input points (F201 to F203, AIF2, F212 to F231, and AvF2) and the maximum frequency setting.

To be more specific, if the analog input voltage varies from 0 to 10V, the value set with the parameter *F 961* changes by a factor of:

$$\frac{F1}{FH} \text{ to } \frac{F2}{FH}$$

Where, FH is the maximum frequency (Hz), F1 is the frequency (Hz) at 0V, and F2 is the frequency (Hz) at 10V.

Option 1: Acceleration/deceleration rate

This option allows the acceleration/deceleration rate to change in proportion to the analog input value.

An example of using the RR/S4 terminal is given below.

F H = 80 (Sets the maximum frequency at 80Hz.)

F 959 = 2 (Selects the RR/S4 terminal.)

F 961 = 1 (Selects acceleration/deceleration rate.)

F 210 = 0 (Selects 0%.)

F 211 = 20.0 (Selects 20Hz.)

F 2 1 2 = 100 (Selects 100%)

R 1 F 2 = 80.0 (Selects 80Hz.)

$$0V \quad \text{acceleration/deceleration rate} = \frac{20 \text{ (Hz)}}{80 \text{ (Hz)}} = 0.25$$

$$10V \quad \text{acceleration/deceleration rate} = \frac{80 \text{ (Hz)}}{80 \text{ (Hz)}} = 1.00$$

If the RR/S4 input value varies from 0 to the maximum value, the acceleration/deceleration rate changes by a factor of 0.25 to 1.

Note: A decrease in acceleration/deceleration rate by a factor of 0.25 means that the time elapsing before the completion of acceleration or deceleration increases by a factor of 4.

Option 2: Upper-limit frequency (*U L*)

This option allows the upper-limit frequency (*U L*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F 9 5 1* is set to 2 (upper-limit frequency), the upper-limit frequency set with the parameter *U L* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 3: Acceleration multiplication factor

The acceleration time is determined by multiplying acceleration time 1 to acceleration time 4 (*A C C*, *F 5 0 0*, *F 5 1 0* and *F 5 1 4*) by the factor that varies with the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F 9 5 1* is set to 3 (acceleration multiplication factor (*A C C*)), acceleration time 1 to acceleration time 4 set with the parameters *A C C*, *F 5 0 0*, *F 5 1 0* and *F 5 1 4*, respectively, change by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 4: Deceleration multiplication factor

The deceleration multiplication factor has the same function as the acceleration multiplication factor described above. It is used with deceleration time 1 to deceleration time 4 (*D E C*, *F 5 0 1*, *F 5 1 1* and *F 5 1 5*).

Option 5: Manual torque boost (*u b*)

This option allows the amount of boosted torque (*u b*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F 9 5 1* is set to 5 (manual torque boost (*u b*)), the amount of manually boosted torque *u b* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 6: OC stall (*F 6 0 1*)

This option allows the stall prevention level (*F 6 0 1*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In

this example, if *F961* is set to *6* (OC stall (*F601*)), the OC stall value set with *F601* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 7: Electronic thermal (*LHr*)

This option allows the electronic thermal value (*LHr*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F961* is set to *7* (electronic thermal (*LHr*)), the electronic thermal value set with the parameter *LHr* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 8: Speed loop P gain (*F460*)

This option allows the speed loop P gain (*F460*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F961* is set to *8* (speed loop P gain (*F460*)), the speed loop P gain set with *F460* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 9: Drooping gain (*F320*)

This option allows the droop gain (*F320*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F961* is set to *9* (droop gain (*F320*)), the droop gain set with *F320* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

Option 10: PID P gain (*F362*)

This option allows the PID P gain (*F362*) to change in proportion to the analog input value.

The settings to be made are the same as those for option 1: acceleration/deceleration rate. In this example, if *F961* is set to *10* (PID P gain (*F362*)), the PID P gain set with *F362* changes by a factor of 0.25 to 1 according to the RR/S4 input value (0 to maximum value).

7. Analog output My function

This function puts out a parameter set value monitored, its peak value and minimum value through an analog output terminal. This function lets you know mainly the maximum and minimum values in a given period of time.

■ Parameters used

| Title | Function | Adjustment range | Default setting |
|-------------|------------------------------------|--|-----------------|
| <i>F965</i> | Monitor output function target 11 | <i>2000~2099</i> : FD00~FD99 (Note 1) <i>3000~3099</i> : FE00~FE99 (Note 1) | <i>2000</i> |
| <i>F966</i> | Monitor output function command 11 | <i>0</i> : Normal monitor <i>1</i> : Max. value <i>2</i> : Min. value | <i>0</i> |
| <i>F967</i> | Monitor output function target 21 | <i>2000~2099</i> : FD00~FD99 (Note 1) <i>3000~3099</i> : FE00~FE99 (Note 1) | <i>2000</i> |
| <i>F968</i> | Monitor output function command 21 | <i>0</i> : Normal monitor <i>1</i> : Max. value <i>2</i> : Min. value | <i>0</i> |
| <i>F969</i> | Monitor output function target 31 | <i>2000~2099</i> : FD00~FD99 (Note 1) <i>3000~3099</i> : FE00~FE99 (Note 1) | <i>2000</i> |
| <i>F970</i> | Monitor output function command 31 | <i>0</i> : Normal monitor <i>1</i> : Max. value <i>2</i> : Min. value | <i>0</i> |
| <i>F971</i> | Monitor output function target 41 | <i>2000~2099</i> : FD00~FD99 (Note 1) <i>3000~3099</i> : FE00~FE99 (Note 1) | <i>2000</i> |
| <i>F972</i> | Monitor output function command 41 | <i>0</i> : Normal monitor <i>1</i> : Max. value <i>2</i> : Min. value | <i>0</i> |

Note 1: See Table 8-7 "Data that My function can handle" in Appendix 5.

Appendix 1 Table of My function parameters

The table below lists the parameters used for My function.

Table 8-1 Table of My function parameters

| Title | Function | Adjustment range | Default setting |
|--------------|-----------------------------------|---|-----------------|
| <i>F 900</i> | Input function target 11 | Input terminal number <i>0</i> : Deselect <i>1</i> : F terminal <i>2</i> : R terminal <i>3</i> : ST terminal <i>4</i> : RES terminal <i>5</i> : S1 terminal <i>6</i> : S2 terminal <i>7</i> : S3 terminal <i>8</i> : RR/S4 terminal <i>9</i> : LI1 terminal <i>10</i> : LI2 terminal <i>11</i> : LI3 terminal <i>12</i> : LI4 terminal <i>13</i> : LI5 terminal <i>14</i> : LI6 terminal <i>15</i> : LI7 terminal <i>16</i> : LI8 terminal <i>17</i> : B12 terminal <i>18</i> : B13 terminal <i>19</i> : B14 terminal <i>20</i> : B15 terminal <i>21</i> : Virtual input terminal 1 <i>22</i> : Virtual input terminal 2 <i>23</i> : Virtual input terminal 3 <i>24</i> : Virtual input terminal 4 <i>25~32</i> : Internal terminal 1~8 <i>918~934</i> : My output data No. <i>1000~1255</i> : Output selection number (Note 1) <i>2000~2099</i> : FD00~FD99 (Note 2) <i>3000~3099</i> : FE00~FE99 (Note 2) | <i>0</i> |
| <i>F 901</i> | Input function command 12 | <i>0</i> : NOP (disabling) <i>1</i> : ST (move) <i>2</i> : STN (move (inversion)) <i>3</i> : AND (logical product ($A \cap B$)) <i>4</i> : ANDN (logical product ($A \cap \overline{B}$)) <i>5</i> : OR (logical sum ($A \cup B$)) <i>6</i> : ORN (logical sum ($A \cup \overline{B}$)) <i>7</i> : EQ (equal) <i>8</i> : NE (not equal) <i>9</i> : GT (greater than) <i>10</i> : GE (greater or equal) <i>11</i> : LT (less than) <i>12</i> : LE (less or equal) <i>13</i> : ASUB (absolute) <i>14</i> : ON (on delay timer) <i>15</i> : OFF (off delay timer) <i>16</i> : COUNT1 (counter 1) <i>17</i> : COUNT2 (counter 2) <i>18</i> : HOLD (hold) <i>19</i> : SET (set) <i>20</i> : RESET (reset) | <i>0</i> |
| <i>F 902</i> | Input function target 12 | Same as <i>F 900</i> | <i>0</i> |
| <i>F 903</i> | Input function command 13 | Same as <i>F 901</i> | <i>0</i> |
| <i>F 904</i> | Input function target 13 | Same as <i>F 900</i> | <i>0</i> |
| <i>F 905</i> | Output function assigned object 1 | Same as <i>F 900</i> | <i>0</i> |

Note 1: See Table 8-6 "Output terminal functions" in Appendix 4.

Note 2: See Table 8-7 “Data that My function can handle” in Appendix 5.

| Title | Function | Adjustment range | Default setting |
|-------|------------------------------------|---|-----------------|
| F906 | Input function target 21 | Same as F900 | 0 |
| F907 | Input function command 22 | Same as F901 | 0 |
| F908 | Input function target 22 | Same as F900 | 0 |
| F909 | Input function command 23 | Same as F901 | 0 |
| F910 | Input function target 23 | Same as F900 | 0 |
| F911 | Output function assigned object 2 | Same as F900 | 0 |
| F912 | Input function target 31 | Same as F900 | 0 |
| F913 | Input function command 32 | Same as F901 | 0 |
| F914 | Input function target 32 | Same as F900 | 0 |
| F915 | Input function command 33 | Same as F901 | 0 |
| F916 | Input function target 33 | Same as F900 | 0 |
| F917 | Output function assigned object 3 | Same as F900 | 0 |
| F918 | My output percent data 1 | 0.00~200.0% | 0.00 |
| F919 | My output percent data 2 | 0.00~200.0% | 0.00 |
| F920 | My output percent data 3 | 0.00~200.0% | 0.00 |
| F921 | My output percent data 4 | 0.00~200.0% | 0.00 |
| F922 | My output percent data 5 | 0.00~200.0% | 0.00 |
| F923 | My output frequency data 1 | 0.0~500.0Hz | 0.0 |
| F924 | My output frequency data 2 | 0.0~500.0Hz | 0.0 |
| F925 | My output frequency data 3 | 0.0~500.0Hz | 0.0 |
| F926 | My output frequency data 4 | 0.0~500.0Hz | 0.0 |
| F927 | My output frequency data 5 | 0.0~500.0Hz | 0.0 |
| F928 | My output time data 1 | 0.01~600.0s | 0.01 |
| F929 | My output time data 2 | 0.01~600.0s | 0.01 |
| F930 | My output time data 3 | 0.01~600.0s | 0.01 |
| F931 | My output time data 4 | 0.01~600.0s | 0.01 |
| F932 | My output time data 5 | 0.01~600.0s | 0.01 |
| F933 | No. of times of My output data 1 | 0~9999 times | 0 |
| F934 | No. of times of My output data 2 | 0~9999 times | 0 |
| F935 | Input function target 41 | Same as F900 | 0 |
| F936 | Input function command 42 | Same as F901 | 0 |
| F937 | Input function target 42 | Same as F900 | 0 |
| F938 | Input function command 43 | Same as F901 | 0 |
| F939 | Input function target 43 | Same as F900 | 0 |
| F940 | Output function assigned object 4 | Same as F900 | 0 |
| F941 | Input function target 51 | Same as F900 | 0 |
| F942 | Input function command 52 | Same as F901 | 0 |
| F943 | Input function target 52 | Same as F900 | 0 |
| F944 | Input function command 53 | Same as F901 | 0 |
| F945 | Input function target 53 | Same as F900 | 0 |
| F946 | Output function assigned object 5 | Same as F900 | 0 |
| F947 | Input function target 61 | Same as F900 | 0 |
| F948 | Input function command 62 | Same as F901 | 0 |
| F949 | Input function target 62 | Same as F900 | 0 |
| F950 | Input function command 63 | Same as F901 | 0 |
| F951 | Input function target 63 | Same as F900 | 0 |
| F952 | Output function assigned object 6 | Same as F900 | 0 |
| F953 | Input function target 71 | Same as F900 | 0 |
| F954 | Input function command 72 | Same as F901 | 0 |
| F955 | Input function target 72 | Same as F900 | 0 |
| F956 | Input function command 73 | Same as F901 | 0 |
| F957 | Input function target 73 | Same as F900 | 0 |
| F958 | Output function assigned object 7 | Same as F900 | 0 |
| F973 | Virtual input terminal selection 1 | 0~135 (Note 1) | 0 |
| F974 | Virtual input terminal selection 2 | 0~135 | 0 |
| F975 | Virtual input terminal selection 3 | 0~135 | 0 |
| F976 | Virtual input terminal selection 4 | 0~135 | 0 |
| F977 | My function selection | 0: Deselect 1: My function + permission signal 2: My function always ON | 0 |

Note 1: See Table 8-4 “Input terminal functions” in Appendix 3.

Appendix 2 Computing functions

The table below lists the computing functions provided by My function.

Table 8-2 Computing functions

| Input function command | Computation name | Function | Description |
|------------------------|-------------------|---|--|
| 0 | NOP | Disabling | Used to disable the unnecessary sections (columns) of My function program. |
| 1 | ST | Transfer | Used mainly to read data. |
| 2 | STN | Transfer (inversion) | Used mainly to invert data and read inverted data. |
| 3 | AND | Logical product | Logical product of data ($A \cap B$) |
| 4 | ANDN | Logical product (inversion of right side) | Logical product of data ($A \cap \overline{B}$) |
| 5 | OR | Logical sum | Logical product of data ($A \cup B$) |
| 6 | ORN | Logical sum (inversion of right side) | Logical product of data ($A \cup \overline{B}$) |
| 7 | EQ | Comparison of data for matching | Compare two pieces of data, and puts out a 1 if they match each other or a 0 if not. |
| 8 | NE | Comparison of data for mismatch | Compare two pieces of data, and puts out a 0 if they match each other or a 1 if not. |
| 9 | GT | Comparison of sizes ($A > B$) | Compares the sizes of two pieces of data (A_GT_B), and puts out a 1 if A is larger than B ($A > B$) or a 0 if A is equal to or smaller than B ($A \leq B$) |
| 10 | GE | Comparison of sizes ($A \geq B$) | Compares the sizes of two pieces of data (A_GT_B), and puts out a 1 if A is equal to or larger than B ($A \geq B$) or a 0 if A is smaller than B ($A < B$) |
| 11 | LT | Comparison of sizes ($A < B$) | Compares the sizes of two pieces of data (A_GT_B), and puts out a 1 if A is smaller than B ($A < B$) or a 0 if A is equal to or larger than B ($A \geq B$) |
| 12 | LE | Comparison of sizes ($A \leq B$) | Compares the sizes of two pieces of data (A_GT_B), and puts out a 1 if A is equal to or smaller than B ($A \leq B$) or a 0 if A is larger than B ($A > B$) |
| 13 | ASUB | Absolute value of difference | Puts out the absolute value of the difference between two pieces of data. $ A - B $ |
| 14 [Note 1] | ON (ON timer) | ON delay | Delays the timing of turning data ON by the time specified with $F928$ to $F932$. |
| 15 [Note 1] | OFF (ON timer) | OFF delay | Delays the timing of turning data OFF by the time specified with $F928$ to $F932$. |
| 16 [Note 1] | COUNT1 (ON timer) | Counter | Counts the number of input pulses (counts the number of rising edges) and puts out a 1 when the pulse count specified with $F933$ has been reached. |
| 17 [Note 1] | COUNT2 (ON timer) | Counter | Counts the number of input pulses (counts the number of rising edges) and puts out a 1 when the pulse count specified with $F934$ has been reached. |
| 18 [Note 1] | HOLD | Peak hold | Puts out the peak input value. |
| 19 [Note 1] | SET | Set | Sets data. |
| 20 [Note 1] | RESET | Reset | Resets data. |

Note 1: For details of computing functions 14 to 20, see Appendix 6.

Appendix 3 Input terminal function selection parameters

The table below lists the parameters used to select functions for 20 input terminals (including 4 virtual input terminals) and the functions available.

Table 8-3 Input terminal function selection parameters

| Title | Communication No. | Function | Adjustment range (Note 1) | Default setting |
|--------------|-------------------|---|---------------------------|-----------------|
| <i>F 110</i> | 0110 | Always ON function selection 1 | <i>0~135</i> | <i>0</i> |
| <i>F 111</i> | 0111 | Input terminal function selection 1 (F) | <i>0~135</i> | <i>2</i> |
| <i>F 112</i> | 0112 | Input terminal function selection 2 (R) | <i>0~135</i> | <i>4</i> |
| <i>F 113</i> | 0113 | Input terminal function selection 3 (ST) | <i>0~135</i> | <i>6</i> |
| <i>F 114</i> | 0114 | Input terminal function selection 4 (RES) | <i>0~135</i> | <i>8</i> |
| <i>F 115</i> | 0115 | Input terminal function selection 5 (S1) | <i>0~135</i> | <i>10</i> |
| <i>F 116</i> | 0116 | Input terminal function selection 6 (S2) | <i>0~135</i> | <i>12</i> |
| <i>F 117</i> | 0117 | Input terminal function selection 7 (S3) | <i>0~135</i> | <i>14</i> |
| <i>F 118</i> | 0118 | Input terminal function selection 8 (RR/S4) | <i>0~135</i> | <i>72</i> |
| <i>F 119</i> | 0119 | Input terminal function selection 9 (LI1) | <i>0~135</i> | <i>0</i> |
| <i>F 120</i> | 0120 | Input terminal function selection 10 (LI2) | <i>0~135</i> | <i>0</i> |
| <i>F 121</i> | 0121 | Input terminal selection 11 (LI3) | <i>0~135</i> | <i>0</i> |
| <i>F 122</i> | 0122 | Input terminal selection 12 (LI4) | <i>0~135</i> | <i>0</i> |
| <i>F 123</i> | 0123 | Input terminal selection 13 (LI5) | <i>0~135</i> | <i>0</i> |
| <i>F 124</i> | 0124 | Input terminal selection 14 (LI6) | <i>0~135</i> | <i>0</i> |
| <i>F 125</i> | 0125 | Input terminal selection 15 (LI7) | <i>0~135</i> | <i>0</i> |
| <i>F 126</i> | 0126 | Input terminal selection 16 (LI8) | <i>0~135</i> | <i>0</i> |
| <i>F 164</i> | 0164 | Input terminal selection 17(B12) | <i>0~135</i> | <i>0</i> |
| <i>F 165</i> | 0165 | Input terminal selection 18(B13) | <i>0~135</i> | <i>0</i> |
| <i>F 166</i> | 0166 | Input terminal selection 19(B14) | <i>0~135</i> | <i>0</i> |
| <i>F 167</i> | 0167 | Input terminal selection 20(B15) | <i>0~135</i> | <i>0</i> |
| <i>F 973</i> | 0973 | Virtual input terminal selection 1 | <i>0~135</i> | <i>0</i> |
| <i>F 974</i> | 0974 | Virtual input terminal selection 2 | <i>0~135</i> | <i>0</i> |
| <i>F 975</i> | 0975 | Virtual input terminal selection 3 | <i>0~135</i> | <i>0</i> |
| <i>F 976</i> | 0976 | Virtual input terminal selection 4 | <i>0~135</i> | <i>0</i> |

Note 1: For an explanation of the adjustment range, see Table 8-4 "Input terminal functions."

Table 8-4 Input terminal functions

| Parameter setting | | Function | Parameter setting | | Function |
|-------------------|----------------|--|-------------------|----------------|--|
| Positive logic | Negative logic | | Positive logic | Negative logic | |
| 0 | 1 | No function is assigned | 70 | 71 | Servo lock signal |
| 2 | 3 | F: Forward run command | 72 | 73 | Simple positioning (positioning loop) |
| 4 | 5 | R: Reverse run command | 74 | 75 | Integrating wattmeter display clear |
| 6 | 7 | ST: Standby | 76 | 77 | Trace back trigger signal |
| 8 | 9 | RES: Reset | 78 | 79 | Light-load high-speed operation prohibitive signal |
| 10 | 11 | S1: Preset speed 1 | 80 | 81 | No function assigned |
| 12 | 13 | S2: Preset speed 2 | 82 | 83 | No function assigned |
| 14 | 15 | S3: Preset speed 3 | 84 | 85 | No function assigned |
| 16 | 17 | S4: Preset speed 4 | 86 | 87 | Binary data write |
| 18 | 19 | Jog run | 88 | 89 | Up/down frequency (up) |
| 20 | 21 | Emergency stop | 90 | 91 | Up/down frequency (down) |
| 22 | 23 | DC braking | 92 | 93 | Up/down frequency (clear) |
| 24 | 25 | Acceleration/deceleration switching 1 | 94 | 95 | No function assigned |
| 26 | 27 | Acceleration/deceleration switching 2 | 96 | 97 | No function assigned |
| 28 | 29 | V/f switching signal 1 | 98 | 99 | Forward/reverse selection |
| 30 | 31 | V/f switching signal 2 | 100 | 101 | Run/stop command |
| 32 | 33 | Torque limit switching signal 1 | 102 | 103 | Commercial power/INV switching |
| 34 | 35 | Torque limit switching signal 2 | 104 | 105 | Frequency reference priority switching |
| 36 | 37 | PID control OFF selection | 106 | 107 | VI/II terminal priority |
| 38 | 39 | Pattern operation group 1 | 108 | 109 | Command terminal board priority |
| 40 | 41 | Pattern operation selection 2 | 110 | 111 | Permission of parameter editing |
| 42 | 43 | Pattern operation continuation signal | 112 | 113 | Speed/Torque switching |
| 44 | 45 | Pattern operation trigger signal | 114 | 115 | No function assigned |
| 46 | 47 | External thermal error | 116 | 117 | No function assigned |
| 48 | 49 | Forced switching from communication to local | 118 | 119 | No function assigned |
| 50 | 51 | HD operation retention | 120 | 121 | No function assigned |
| 52 | 53 | PID differentiation/integration clear | 122 | 123 | Rapidest deceleration command |
| 54 | 55 | PID forward/reverse switching | 124 | 125 | Preliminary excitation |
| 56 | 57 | Forced continuous operation | 126 | 127 | Braking request |
| 58 | 59 | Specified speed operation | 128 | 129 | No function assigned |
| 60 | 61 | Acceleration/deceleration suspend signal | 130 | 131 | Brake answer back input |
| 62 | 63 | Power failure synchronized signal | 132 | 133 | No function assigned |
| 64 | 65 | My function RUN signal | 134 | 135 | Traverse permission signal |
| 66 | 67 | Auto-tuning signal | | | |
| 68 | 69 | Speed gain switching | | | |

Appendix 4 Output terminal function selection parameters

The table below lists the parameters used to select functions for 11 output terminals and the functions available.

Table 8-5 Output terminal function selection parameters

| Title | Communication No. | Function | Adjustment range (Note 1) | Default setting |
|--------------|-------------------|---|---------------------------|-----------------|
| <i>F 130</i> | 0130 | Output terminal function selection 1 (OUT1) | <i>0~255</i> | <i>4</i> |
| <i>F 131</i> | 0131 | Output terminal function selection 2 (OUT2) | <i>0~255</i> | <i>6</i> |
| <i>F 132</i> | 0132 | Output terminal function selection 3 (FL) | <i>0~255</i> | <i>10</i> |
| <i>F 133</i> | 0133 | Output terminal function selection 4 (OUT3) | <i>0~255</i> | <i>254</i> |
| <i>F 134</i> | 0134 | Output terminal function selection 5 (OUT4) | <i>0~255</i> | <i>254</i> |
| <i>F 135</i> | 0135 | Output terminal function selection 6 (R1) | <i>0~255</i> | <i>254</i> |
| <i>F 136</i> | 0136 | Output terminal function selection 7 (OUT5) | <i>0~255</i> | <i>254</i> |
| <i>F 137</i> | 0137 | Output terminal function selection 8 (OUT6) | <i>0~255</i> | <i>254</i> |
| <i>F 138</i> | 0138 | Output terminal function selection 9 (R2) | <i>0~255</i> | <i>254</i> |
| <i>F 168</i> | 0168 | Output terminal function selection 10 (R3) | <i>0~255</i> | <i>254</i> |
| <i>F 169</i> | 0169 | Output terminal function selection 11 (R4) | <i>0~255</i> | <i>254</i> |

Note 1: For an explanation of the adjustment range, see Table 8-6 "Output terminal functions."

Table 8-6 Output terminal functions

When using My function, select functions from among the positive-logic options for the output terminal functions. Note that negative-logic settings cannot be used for the output terminals.

| Input setting | Parameter setting | Function | Operation output specifications (in case of positive logic) |
|---------------|-------------------|--------------------------------------|--|
| <i>1000</i> | <i>0</i> | Lower limit frequency (LL) | ON: The running frequency is equal to or higher than the setting of <i>LL</i> (Lower limit frequency) OFF: The running frequency is lower than the setting of <i>LL</i> . |
| <i>1002</i> | <i>2</i> | Upper limit frequency (UL) | ON: The running frequency is equal to or higher than the setting of <i>UL</i> (Upper limit frequency) OFF: The running frequency is lower than the setting of <i>UL</i> . |
| <i>1004</i> | <i>4</i> | Low-speed signal | ON: The running frequency is equal to or higher than the setting of <i>F 100</i> (low-speed signal output frequency) OFF: The running frequency is lower than the setting of <i>F 100</i> . |
| <i>1006</i> | <i>6</i> | Acceleration/deceleration completion | ON: The difference between the frequency command and the running frequency is within the setting of <i>F 102</i> . OFF: In acceleration or deceleration. |
| <i>1008</i> | <i>8</i> | Speed reach signal | ON: The running frequency is in the range of $F 101 \pm F 102$. OFF: The running frequency is out of the range of $F 101 \pm F 102$. |
| <i>1010</i> | <i>10</i> | Failure FL (All trips) | ON: Inverter is tripped. OFF: Inverter trip is canceled. |
| <i>1012</i> | <i>12</i> | Failure FL (Except EF, OCL) | ON: Inverter is tripped (except <i>EF</i> and <i>OCL</i>) OFF: Inverter trip is canceled. (reset) |
| <i>1014</i> | <i>14</i> | Overcurrent (OC) pre-alarm | ON: Inverter output current is over the <i>F 601</i> (Stall prevention level) set value. OFF: Inverter output current is under the <i>F 601</i> . |

| Input setting | Parameter setting | Function | Operation output specifications (in case of positive logic) |
|---------------|-------------------|---|---|
| 1016 | 16 | Inverter overload (OL1) pre-alarm | ON: A certain rate of inverter overload ($OL1$) detection time is over. OFF: The detection time is within a certain limit. |
| 1018 | 18 | Motor overload (OL2) pre-alarm | ON: A certain rate of inverter overload ($OL2$) detection time is over. OFF: The detection time is within a certain limit. |
| 1020 | 20 | Overheat pre-alarm | ON: The temperature of the cooling fin is 95°C or higher inside the inverter. OFF: The temperature drops to 90°C or lower after overheat pre-alarm was on. |
| 1022 | 22 | Overvoltage pre-alarm | Overvoltage control operation or PB operation in progress. ON: PB operation level + 3% (200V class: Approx. 370Vdc, 400V class :Approx. 740Vdc) |
| 1024 | 24 | Undervoltage in main circuit (MOFF) detection | ON: The main circuit voltage is lower than the main circuit undervoltage detection ($MOFF$) level. (200V class: Approx. 170Vdc, 400V class: Approx. 340Vdc) |
| 1026 | 26 | Low current detection | ON: The state that inverter output current is $F611$ set value or larger continued more than $F612$ set value. |
| 1028 | 28 | Over-torque detection | ON: The state that torque component is $F616$, $F617$ set value or larger continued more than $F618$ set value. |
| 1030 | 30 | Braking resistor overload pre-alarm | ON: A certain rate of braking resistor overload trip (OLr) detection time is over. OFF: The detection time is within a certain limit. |
| 1032 | 32 | In emergency stop | ON: In emergency stop operation (E is indicated). OFF: The detection time is within a certain limit. |
| 1034 | 34 | In retry | ON: In retry operation (rtr is indicated). OFF: No retry operation is performed. |
| 1036 | 36 | Pattern operation switching output | ON: In normal operation or pattern operation has finished. OFF: In pattern operation. |
| 1038 | 38 | PID deviation limit | ON: PID deviation is in $F364$ or $F365$ set value. |
| 1040 | 40 | Run/Stop | ON: Running frequency is output or DC injection braking (db) is performed. |
| 1042 | 42 | Serious failure (OCA, OCL, EF, phase failure, etc.) | ON: Serious failure ($OCRA$, OCL , EF , phase failure, abnormal output, short-circuit) is detected. OFF: Inverter has recovered from serious failure. (Serious failure has been reset) |
| 1044 | 44 | Light failure (OL, OC1, 2, 3, OP) | ON: Light failure (OL , $OC1$, $OC2$, $OC3$, OP) is detected. OFF: Inverter has recovered from light failure. (Light failure has been reset) |
| 1046 | 46 | Commercial power/inverter switching output 1 | Refer to Section 6.19 in the VF-AS1 Instruction Manual. |
| 1048 | 48 | Commercial power/inverter switching output 2 | Refer to Section 6.19 in the VF-AS1 Instruction Manual. |
| 1050 | 50 | Cooling fan ON/OFF | ON: Cooling fan is in operation. OFF: Cooling fan is off operation. |
| 1052 | 52 | In jogging operation (In jog run) | ON: In jog run OFF: In normal operation |
| 1054 | 54 | Operation panel/terminal board operation switching | ON: In operation by terminal board. OFF: In operation by operation panel. |
| 1056 | 56 | Cumulative operation time alarm | ON: Cumulative operation time is beyond the $F621$ set value. OFF: Cumulative operation time is less than the $F621$ set value. |
| 1058 | 58 | PROFIBUS/DeviceNet/CC-Link communication error | ON: Communication error occurred. OFF: Communication error is canceled (reset). |

| Input setting | Parameter setting | Function | Operation output specifications (in case of positive logic) |
|---------------|-------------------|--|--|
| 1060 | 60 | Forward/reverse switching | OFF: In forward operation. ON: In reverse operation. (The last status is held while operation is suspended.) |
| 1062 | 62 | Ready for operation 1 | ON: In operable status or operation can be started with frequency command input as an operation switching answer-back. OFF: In inoperable status. |
| 1064 | 64 | Ready for operation 2 | ON: In operable status or operation can be started with ST and RUN signals and frequency command input. OFF: In inoperable status. |
| 1068 | 68 | Brake release (BR) | Output the braking signal according to the brake sequence. |
| 1070 | 70 | In (pre-)alarm status | ON: More than one of alarm, pre-alarm, undervoltage, low current over-torque, poor control power supply, PID deviation limit, abnormal frequency setting or torque limit have occurred or detected. OFF: All the alarms above are canceled. |
| 1072 | 72 | Forward speed limit (torque control) | ON: Forward operation speed is $F426$ set value or over. OFF: Forward operation speed is less than $F426$ set value. |
| 1074 | 74 | Reverse speed limit (torque control) | ON: Reverse operation speed is $F428$ set value or over. OFF: Reverse operation speed is less than $F428$ set value. |
| 1076 | 76 | Inverter healthy output | ON and OFF are alternately output at intervals of 1 second. |
| 1078 | 78 | RS485 communication error | ON: Communication error occurred. OFF: Communication error is canceled (reset). |
| 1080 | 80 | Error code output 1 | Output the error code in 6-bit. |
| 1082 | 82 | Error code output 2 | |
| 1084 | 84 | Error code output 3 | |
| 1086 | 86 | Error code output 4 | |
| 1088 | 88 | Error code output 5 | |
| 1090 | 90 | Error code output 6 | |
| 1092 | 92 | Specified data output 1 | Output of the designated data in 7-bit. |
| 1094 | 94 | Specified data output 2 | |
| 1096 | 96 | Specified data output 3 | |
| 1098 | 98 | Specified data output 4 | |
| 1100 | 100 | Specified data output 5 | |
| 1102 | 102 | Specified data output 6 | |
| 1104 | 104 | Specified data output 7 | |
| 1106 | 106 | Light load output | ON: Load is equal to $F335$ ~ $F338$ set values or less. |
| 1108 | 108 | Heavy load output | ON: Load is larger than $F335$ ~ $F338$ set value. |
| 1110 | 110 | Positive torque limit | ON: Positive torque is over the positive torque limit level. |
| 1112 | 112 | Negative torque limit | ON: Negative torque is over the positive torque limit level. |
| 1114 | 114 | Output for external rush suppression relay | ON: External rush suppression relay is actuated. |
| 1118 | 118 | Completion of stop positioning | ON: Stop positioning has been completed. |
| 1120 | 120 | L-STOP | ON: Operation at the lower limit frequency is performed continuously. |
| 1122 | 122 | Power failure synchronized operation | ON: Power failure synchronized operation is performed. |
| 1124 | 124 | Traverse in progress | ON: Traverse operation is performed. |
| 1126 | 126 | Traverse deceleration in progress | ON: Traverse deceleration operation is performed. |

| Input setting | Parameter setting | Function | Operation output specifications (in case of positive logic) |
|---------------|-------------------|--|---|
| 1128 | 128 | Part replacement alarm | Alarm: The time of replacement of parts is approaching. |
| 1130 | 130 | Over-torque pre-alarm | ON: Over-torque is detected. |
| 1132 | 132 | Frequency command 1/2 selection | ON: Frequency command selection 2 is selected. |
| 1134 | 134 | Failure FL (Except emergency stop) | ON: A trip other than emergency stop has occurred. |
| 1222 | 222 | My function output 1 | ON: My function output 1 is ON. |
| 1224 | 224 | My function output 2 | ON: My function output 2 is ON. |
| 1226 | 226 | My function output 3 | ON: My function output 3 is ON. |
| 1228 | 228 | My function output 4 | ON: My function output 4 is ON. |
| 1230 | 230 | My function output 5 | ON: My function output 5 is ON. |
| 1232 | 232 | My function output 6 | ON: My function output 6 is ON. |
| 1234 | 234 | My function output 7 | ON: My function output 7 is ON. |
| 1236 | 236 | My function output 8 | ON: My function output 8 is ON. |
| 1238 | 238 | My function output 9 | ON: My function output 9 is ON. |
| 1240 | 240 | My function output 10 | ON: My function output 10 is ON. |
| 1242 | 242 | My function output 11 | ON: My function output 11 is ON. |
| 1244 | 244 | My function output 12 | ON: My function output 12 is ON. |
| 1246 | 246 | My function output 13 | ON: My function output 13 is ON. |
| 1248 | 248 | My function output 14 | ON: My function output 14 is ON. |
| 1250 | 250 | My function output 15 | ON: My function output 15 is ON. |
| 1252 | 252 | My function output 16 | ON: My function output 16 is ON. |
| 1254 | 254 | Always OFF (for terminal signal tests) | Output signal always OFF |

Appendix 5 Internal data

The table below lists the internal data that My function can handle.

This data is not rewritable. It can be used only as input data for comparison and computation.

Table 8-7 Data that MY function can handle

| | Input setting | Communication No. | Function | Unit (Communication) |
|------------------------------|---------------|----------------------------|--|----------------------|
| Monitor display output value | 3000 | FE00 | Output frequency | 0.01Hz |
| | 3002 | FE02 | Frequency command value | 0.01Hz |
| | 3003 | FE03 | Output current | 0.01% |
| | 3004 | FE04 | Input voltage (DC detection) | 0.01% |
| | 3005 | FE05 | Output voltage | 0.01% |
| | 3015 | FE15 | Compensated frequency | 0.01Hz |
| | 3016 | FE16 | Speed feedback (real-time value)(Note 1) | 0.01Hz |
| | 3017 | FE17 | Speed feedback (1-second filter)(Note 1) | 0.01Hz |
| | 3018 | FE18 | Torque (Note 4) | 0.01% |
| | 3019 | FE19 | Torque command (Note 4) | 0.01% |
| | 3020 | FE20 | Torque current (Note 4) | 0.01% |
| | 3021 | FE21 | Exciting current | 0.01% |
| | 3022 | FE22 | PID feedback value | 0.01Hz |
| | 3023 | FE23 | Motor overload factor (OL2 data) | 0.01% |
| | 3024 | FE24 | Inverter overload factor (OL1 data) | 0.01% |
| | 3025 | FE25 | Regenerative braking resistance overload factor (OLr data) | 1% |
| | 3028 | FE28 | Regenerative braking resistor load factor (% ED) | 1% |
| | 3029 | FE29 | Input power | 0.01kW |
| | 3030 | FE30 | Output power | 0.01kW |
| | 3031 | FE31 | Pattern operation group number | 0.1 |
| | 3032 | FE32 | Remaining no. of cycles for which pattern operation is continued | 1 |
| | 3033 | FE33 | Pattern operation preset speed numbers | 1 |
| | 3034 | FE34 | Remaining time for which pattern operation is continued | 0.1 |
| | 3035 | FE35 | RR/S4 input | (Note 2) |
| | 3036 | FE36 | VI/II input | (Note 2) |
| | 3037 | FE37 | RX input (Note 4) | (Note 2) |
| | 3038 | FE38 | Optional AI1 input (Note 4) | (Note 3) |
| | 3039 | FE39 | Optional AI2 input | (Note 3) |
| | 3040 | FE40 | FM output | 1 |
| | 3041 | FE41 | AM output | 1 |
| | 3066 | FE66 | Attached to expansion I/O card 1 CPU version | - |
| | 3067 | FE67 | Attached to expansion I/O card 2 CPU version | - |
| 3076 | FE76 | Integral input power | 0.01kW | |
| 3077 | FE77 | Integral output power | 0.01kW | |
| 3084 | FE84 | 16-bit BIN/BCD input value | 1 | |

Note 1: If there is no PG feedback, an estimated speed is displayed. If a PG feedback option is used as a pulse command input device, the frequency equivalent to the speed is displayed.

Note 2: The actual analog input value is the analog input value × monitored value/2047.

Note 3: The actual analog input value is the analog input value × monitored value/1023.

Note 4: If the value is negative, it should be converted into an absolute value, because My function cannot handle negative values correctly.

| | Input setting | Communication No. | Function | Unit (Communication) | |
|------------------------------|---------------|---|--|----------------------|--|
| FM/AM output Pulse output | <i>2000</i> | FD00 | Output frequency | 0.01Hz | |
| | <i>2002</i> | FD02 | Frequency command value | 0.01Hz | |
| | <i>2003</i> | FD03 | Output current | 0.01% | |
| | <i>2004</i> | FD04 | Input voltage (DC detection) | 0.01% | |
| | <i>2005</i> | FD05 | Output voltage | 0.01% | |
| | <i>2015</i> | FD15 | Compensated frequency | 0.01Hz | |
| | <i>2016</i> | FD16 | Speed feedback (real-time value)(Note 1) | 0.01Hz | |
| | <i>2017</i> | FD17 | Speed feedback (1-second filter)(Note 1) | 0.01Hz | |
| | <i>2018</i> | FD18 | Torque (Note 2) | 0.01% | |
| | <i>2019</i> | FD19 | Torque command (Note 2) | 0.01% | |
| | <i>2020</i> | FD20 | Torque current (Note 2) | 0.01% | |
| | <i>2021</i> | FD21 | Exciting current | 0.01% | |
| | <i>2022</i> | FD22 | PID feedback value | 0.01Hz | |
| | <i>2023</i> | FD23 | Motor overload factor (OL2 data) | 0.01% | |
| | <i>2024</i> | FD24 | Inverter overload factor (OL1 data) | 0.01% | |
| | <i>2025</i> | FD25 | Regenerative braking resistance overload factor (OLr data) | 1% | |
| | <i>2028</i> | FD28 | Regenerative braking resistor load factor (% ED) | 1% | |
| | <i>2029</i> | FD29 | Input power | 0.01kW | |
| | <i>2030</i> | FD30 | Output power | 0.01kW | |
| | <i>2050</i> | FD50 | Light-load high-speed load torque monitor 1 (Note 2) | 0.01% | |
| | <i>2051</i> | FD51 | Light-load high-speed load torque monitor 2 (Note 2) | 0.01% | |
| | | | | | |
| | <i>3050</i> | FE50 | Communication data output 2 | - | |
| | <i>3051</i> | FE51 | Communication data output 1 | - | |
| | <i>3052</i> | FE52 | Communication data output 3 | - | |
| | <i>3060</i> | FE60 | My function monitor 1 (Output of unsigned value) | 1 | |
| | <i>3061</i> | FE61 | My function monitor 2 (Output of unsigned value) | 1 | |
| | <i>3062</i> | FE62 | My function monitor 3 (Output of signed value) (Note 2) | 1 | |
| <i>3063</i> | FE63 | My function monitor 4 (Output of signed value) (Note 2) | 1 | | |

Note 1: If there is no PG feedback, an estimated speed is displayed. If used as pulse input command with PG feedback option, frequency is displayed as in the PG feedback.

Note 2: If the value is negative, it should be converted into an absolute value, because My function cannot handle negative values correctly.

Appendix 6 Examples of computing function settings

Of the computing functions listed in Appendix 2, this chapter explains in detail the timer function, counter function, peak hold function, setting function and reset function and gives examples of their settings.

■ Input function command 14: ON (ON timer)

When the input signal is turned ON, this command delays the timing of putting out an ON signal by the time set for the ON timer, as shown in the figure below. The timer is turned on only when it receives an ON signal, as illustrated in the timing chart, so no ON signal is put out if the input signal ON time is shorter than the timer ON time (time during which the timer is activated). Conversely, when the input signal is turned OFF, an OFF signal is put out immediately and the timer is reset.

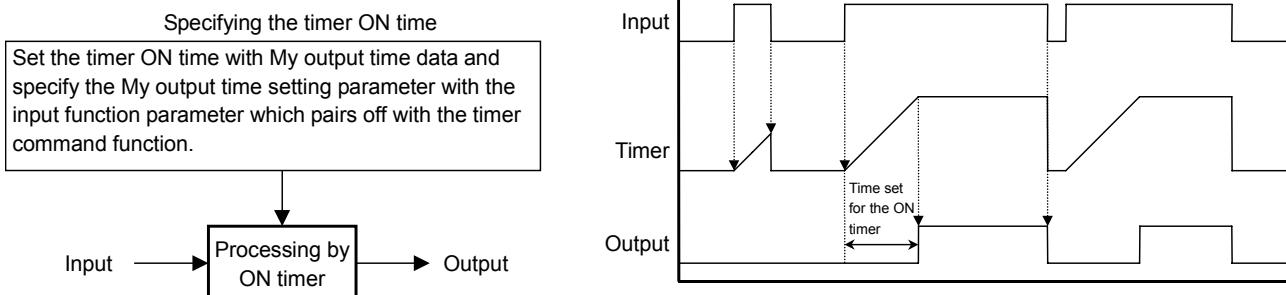


Fig. 8-1 Processing by ON timer

The table below shows an example of the setting to be made to send an ON signal from the S1 terminal to the OUT1 output terminal with a delay time (timer ON time) of 1 second.

| | | Title | Parameter setting | Description |
|---------------|--------|-------|--|---|
| Prior setting | - | F 977 | 0 (Default) | Disables My function. |
| | | F 115 | 0 | Assigns no function to the S1 terminal. |
| | | F 130 | 222 | Assigns My function out 1 to the OUT1 output terminal. |
| | | F 928 | 1.0 | Specify a delay time (timer ON time) of 1.0 second for My output time data 1. |
| Unit 1 | Step 1 | F 900 | 5 | Reads S1 terminal input signals. |
| | Step 2 | F 901 | 14 | Activates the ON timer when the S1 terminal receives a signal. |
| | | F 902 | 928 | Adjusts the setting of F928 to the timer ON time. |
| | Step 3 | F 903 | 0 (Default) | NOP command (Disabling) |
| | | F 904 | 0 (Default) | |
| Step 4 | F 905 | 1222 | Incorporates the result into My function output 1. | |
| - | - | F 977 | 2 | Sets My function ON/OFF selection parameter to Always enabled. |

■ Input function command 15: OFF (OFF timer)

When the input signal is turned OFF, this command delays the timing of putting out an OFF signal by the time set for the OFF timer, as shown in the figure below. The timer is activated only when it receives an OFF signal, as illustrated in the timing chart.

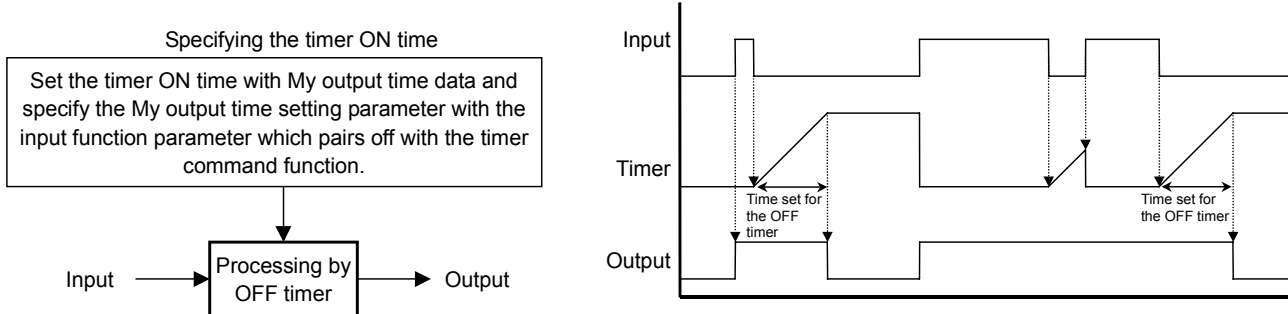


Fig. 8-2 Processing by OFF timer

The table below shows an example of the setting to be made to send an OFF signal from the S1 terminal to the OUT1 output terminal with a delay time (timer OFF time) of 1 second.

| | | Title | Parameter setting | Description |
|---------------|--------|-------|--|---|
| Prior setting | - | F 977 | 0 (Default) | Disables My function. |
| | | F 115 | 0 | Assigns no function to the S1 terminal. |
| | | F 130 | 222 | Assigns My function out 1 to the OUT1 output terminal. |
| | | F 928 | 1.0 | Specify a delay time (timer ON time) of 1.0 second for My output time data 1. |
| Unit 1 | Step 1 | F 900 | 5 | Reads S1 terminal input signals. |
| | Step 2 | F 901 | 15 | Activates the OFF timer when the S1 terminal receives a signal. |
| | | F 902 | 928 | Adjusts the setting of F928 to the timer ON time. |
| | Step 3 | F 903 | 0 (Default) | NOP command (Disabling) |
| | | F 904 | 0 (Default) | |
| Step 4 | F 905 | 1222 | Incorporates the result into My function output 1. | |
| - | - | F 977 | 2 | Sets My function ON/OFF selection parameter to Always enabled. |

■ Input function command 16: Count 1 (counter)

This command makes the inverter count the number of times the input signal is turned on and off, as shown in the figure below, and put out a signal when the specified count has been reached. The count is reset to zero using the signal specified with the input function parameter which pairs off with the count command parameter. Note that this command has no relation to the set and reset commands described later.

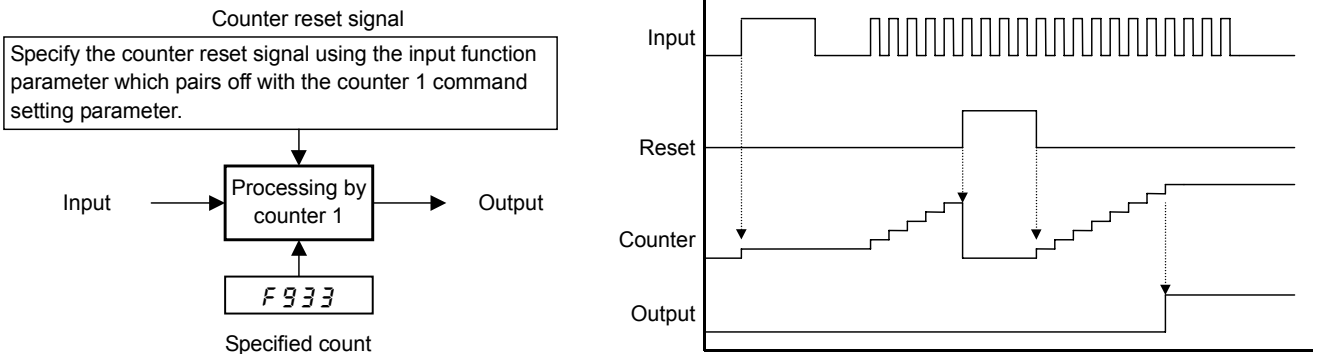


Fig. 8-3 Processing by counter

Note 1: Specify a pulse width of at least 5 ms for both ON and OFF pulse input signals.

Note 2: Reset commands have priority over count 1 commands. Therefore, if a reset command is entered the instant the specified count has been reached, the count is reset to zero and no signal is put out.

The table below shows an example of the setting to be made to send signals from the S1 terminal to the counter, to use signals from the S2 terminal as reset signals, and to put out a signal via the OUT1 output terminal when the count of 10 has been reached.

| | | Title | Parameter setting | Description |
|---------------|--------|-------|--|--|
| Prior setting | - | F977 | 0 (Default) | Disables My function. |
| | | F115 | 0 | Assigns no function to the S1 terminal. |
| | | F116 | 0 | Assigns no function to the S2 terminal. |
| | | F130 | 222 | Assigns My function out 1 to the OUT1 output terminal. |
| | | F933 | 10 | Specifies the count of 10 for Count 1. |
| Unit 1 | Step 1 | F900 | 5 | Reads S1 terminal input signals. |
| | Step 2 | F901 | 16 | Counts the number of pulse signals to the S1 terminal. |
| | | F902 | 6 | Assigns the reset signal output function to the S2 terminal. |
| | Step 3 | F903 | 0 (Default) | NOP command (Disabling) |
| | | F904 | 0 (Default) | |
| Step 4 | F905 | 1222 | Incorporates the result into My function output 1. | |
| - | - | F977 | 2 | Sets My function ON/OFF selection parameter to Always enabled. |

Input function command 17 (Count 2 (counter)) has the same function as this command. For command 17, however, the parameter F934 is used to specify the count.

■ Input function command 18: Hold 1 (peak hold)

This command makes the inverter hold the peak value (usually, an analog values is used) of the input signal, as illustrated in the timing chart below.

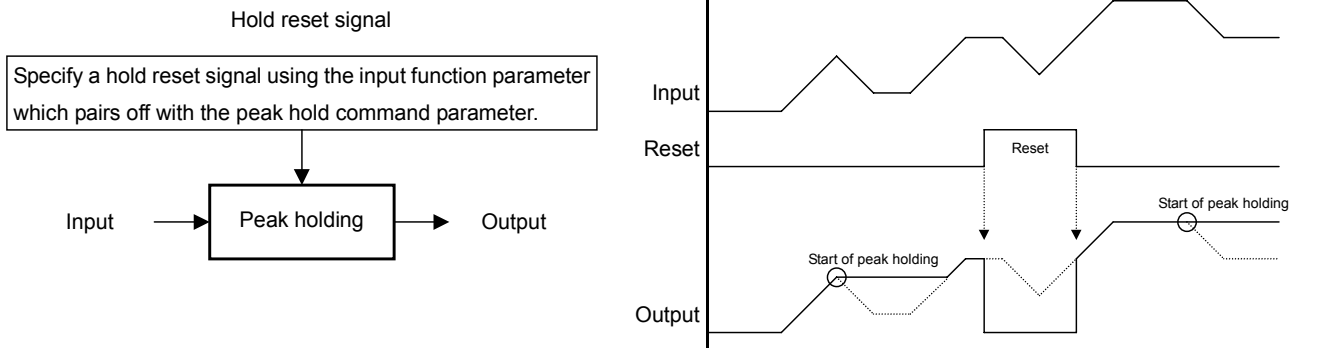


Fig. 8-4 Processing by peak hold

The table below shows an example of the setting to be made to hold the peak output current and to put out a signal via the OUT1 output terminal if the output current exceeds 120% of the specified current.

In this example, the count is reset to zero when a signal is received from the S1 terminal.

| | | Title | Parameter setting | Description |
|---------------|--------|-------|--|---|
| Prior setting | - | F977 | 0 (Default) | Disables My function. |
| | | F115 | 0 | Assigns no function to the S1 terminal. |
| | | F130 | 222 | Assigns My function out 1 to the OUT1 output terminal. |
| | | F918 | 120 | Assigns a reference value of 120% to My output percent data 1. |
| Unit 1 | Step 1 | F900 | 3003 | Reads the output current. |
| | Step 2 | F901 | 18 | Starts holding the peak output current. |
| | | F902 | 5 | Assigns the reset signal output function to the S1 terminal. |
| | Step 3 | F903 | 9 | Puts out a signal if the peak value held reaches 120% of the specified value. |
| | | F904 | 918 | |
| Step 4 | F905 | 1222 | Incorporates the result into My function output 1. | |
| - | - | F977 | 2 | Sets My function ON/OFF selection parameter to Always enabled. |

- Input function command 19: Set
- Input function command 20: Reset

The set command turns on (sets) the output signal when the input signal is turned on, as shown in the figure below, and holds the output signal ON even after the input signal is turned off (reset). The reset command is used to turn off the output signal.

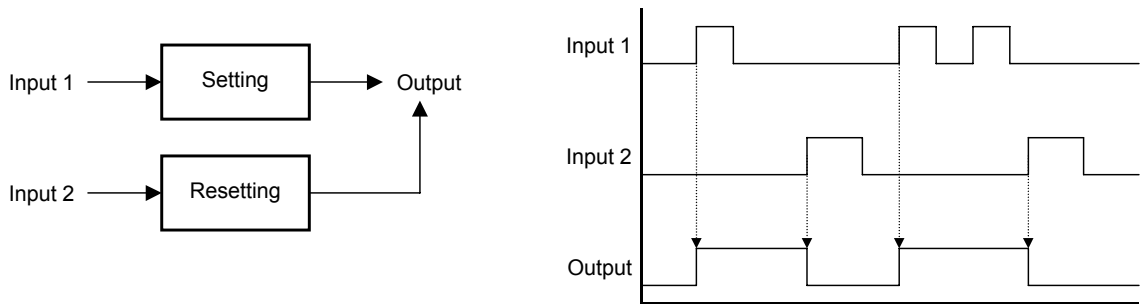


Fig. 8-5 Setting and resetting

Putting out a hold signal via the OUT1 output terminal when receiving a set command from the F input terminal.

Turning off (resetting) the output signal when receiving a signal from the S1 input terminal. The table below shows an example of the setting to be made for these operations.

| | | Title | Parameter setting | Description |
|---------------|--------------|--------------------|-------------------------|---|
| Prior setting | - | <i>F 977</i> | <i>0</i> (Default) | Disables My function. |
| | | <i>F 111</i> | <i>0</i> | Assigns no function to the F terminal. |
| | | <i>F 115</i> | <i>0</i> | Assigns no function to the S1 terminal. |
| | | <i>F 130</i> | <i>222</i> | Assigns My function out 1 to the OUT1 output terminal. |
| Unit 1 | Step 1 | <i>F 900</i> | <i>1</i> | Reads signals to the F input terminal. |
| | Step 2 | <i>F 901</i> | <i>19</i> | Sends a signal to My function output 1 when receiving a set command to put out a hold signal via the OUT1 terminal. |
| | | <i>F 902</i> | <i>1222</i> | |
| | Step 3 | <i>F 903</i> | <i>0</i> (Default) | NOP command (Disabling) |
| | | <i>F 904</i> | <i>0</i> (Default) | |
| Step 4 | <i>F 905</i> | <i>0</i> (Default) | NOP command (Disabling) | |
| Unit 2 | Step 1 | <i>F 906</i> | <i>5</i> | Reads signals to the S1 input terminal. |
| | Step 2 | <i>F 907</i> | <i>20</i> | Cancels the hold command from My function output 1 when receiving a reset command. |
| | | <i>F 908</i> | <i>1222</i> | |
| | Step 3 | <i>F 909</i> | <i>0</i> (Default) | NOP command (Disabling) |
| | | <i>F 910</i> | <i>0</i> (Default) | |
| Step 4 | <i>F 911</i> | <i>0</i> (Default) | NOP command (Disabling) | |
| - | - | <i>F 977</i> | <i>2</i> | Sets My function ON/OFF selection parameter to Always enabled. |