TOSHIBA

E6581748

TOSVERT VF-MB1

Logic sequence Function Instruction Manual

Jane 2010

Toshiba Schneider Inverter Corporation

Contents

1. Introduction

Logic sequence function adds programming capability to inverter's input/output signals without external relays or a PLC (programmable logic controller) in some cases.
The function makes it possible to reduce the space and cost required for the system.

2. Parameters used

Logic sequence function uses the parameters A900 to A977.
⇒ For details of each parameter, refer to the relevant section.

3. Summary of Logic sequence function

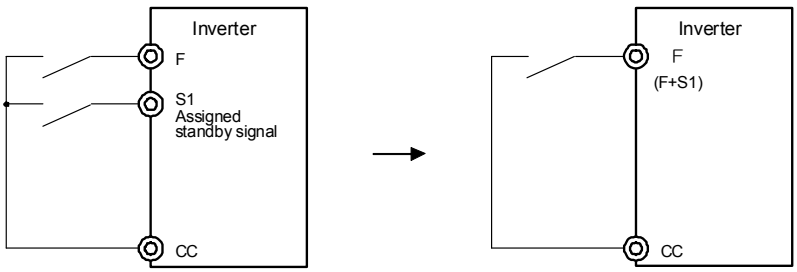
Logic sequence function has the combined terminal function that combines the functions of the inverter's input and output terminals and the relay sequence function that combines logic operation functions.

■ Combined terminal function

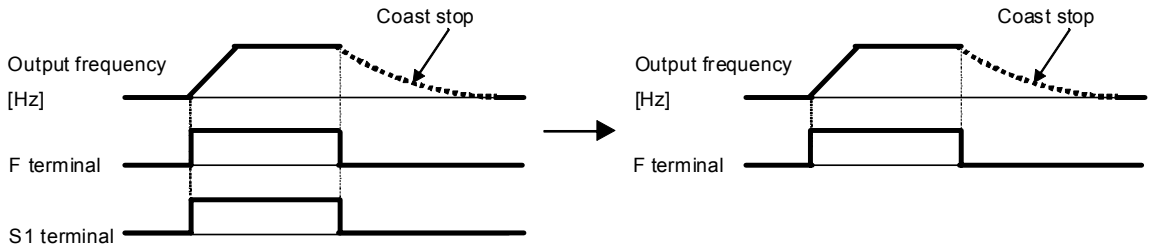
The combined terminal function works to assign two or more functions to one terminal.
The function can reduce the numbers of terminals and cables for your required operations.
And it is possible to process some circuit without external circuit.

For example, you can assign the standby signal (default setting: always active) and the forward run command signal (default setting: F terminal) to one terminal(F terminal).
F terminal can perform the two functions. .
See Example 1 in Chapter 5 for details.

<Standard> <Logic sequence function>

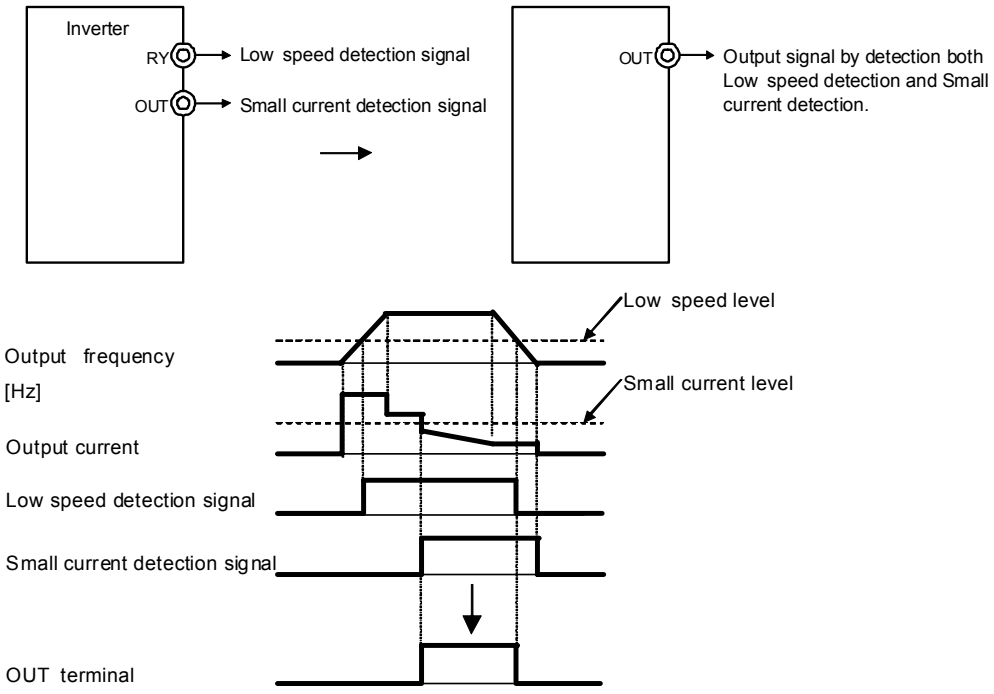


<Standard> <Logic sequence function>



The combined terminal function can be used for output signals.
For example, you can assign the low speed detection signal (function No: 4) and small current detection (function No: 26) to one terminal (OUT terminal).
See Example 4 in Chapter 5 for details.

<Standard> <Logic sequence function>



■ Relay sequence function

In case that an inverter is controled by a PLC (programmable logic controller), the PLC receives some signals and processes, and sends the signals as processing result to the inverter.
(See Fig 3-1.)
The relay sequence function enables the inverter to perform itself without a PLC.
Because the function uses internal data and signal directly, the processing speed is faster than control with the PLC.
Furthermore, the 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.

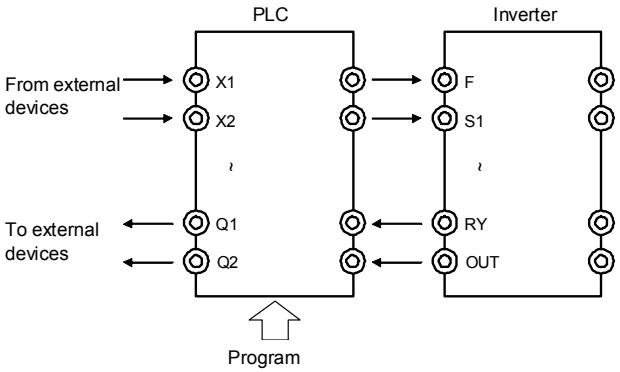


Fig. 3-1 Signal flow between PCL and inverter

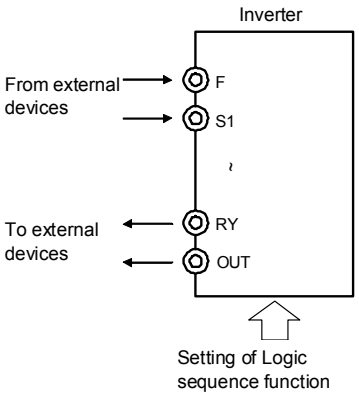
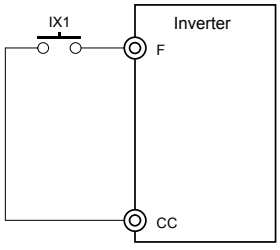


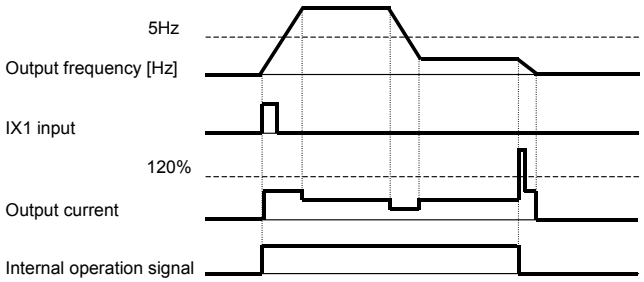
Fig. 3-2 Signal flow of inverter with Logic sequence function

«Example» Start of forward run with a push switch (non self hold switch).
Stop automatically if the output current is 120% or more of the rated current when the output frequency is 5Hz or less.
For the sake of simplicity, stop signal input terminals are omitted here.
See Example 6 in Chapter 5 for details.

● Input and output symbols



● Timing chart

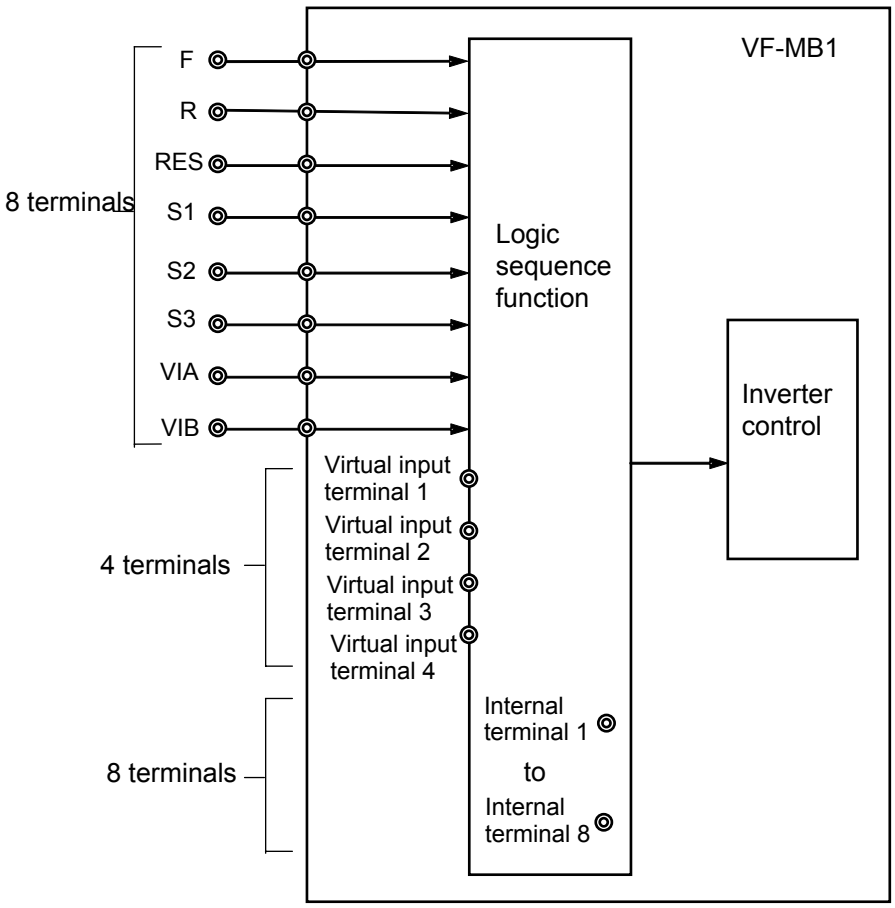


4. Setting parameters

This chapter explains how to set parameters related to the Logic sequence function using the composition of the Logic sequence function and the rules.

■ Input terminals

Input signal terminals that can be used with the Logic sequence function are following.



● Input terminals (8 terminals: F, R, RES, S1, S2, S3, VIA, VIB)

VF-MB1 has 8 input terminals.

The input terminals are used for following 2 ways.

1) Input terminals assigned multipule function

2) Simple ON-OFF signal input terminals like a PLC

In this manual, such input terminals are referred to as X1, X2 to X8 to distinguish them from case 1).

● Virtual input terminals (4 terminals)

They are nonexistent terminals.

You can assign the multipule function as same as actual input terminals.

For example: If you input signal into one input terinal, some virtual input terminals are inputted automatically.

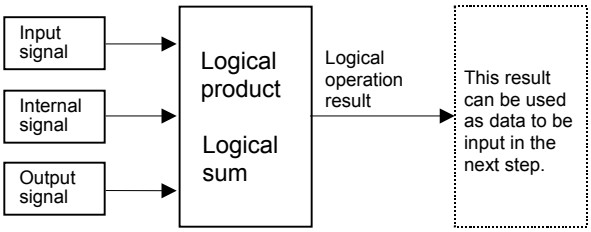
● Internal terminals (8 terminals)

They are nonexistent terminals.
They can be used to link signals. You can not assign the multipule function as 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.

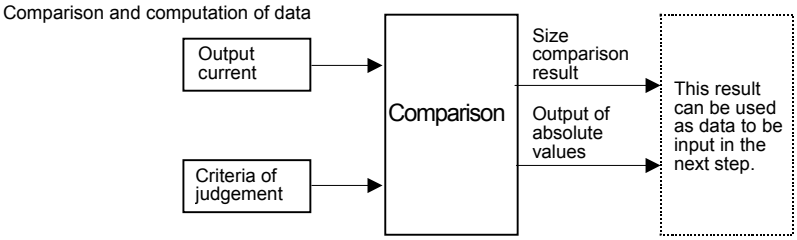
■ Computing function

The Logic sequence function can perform logical operations on input/output signals and compares and computes some datas, such as frequency, current and torque datas, that the inverter detects.
A table of computing functions is shown in Appendix 2.
Data items that inverter detects available are listed in Appendix 5.

● Logical comparison

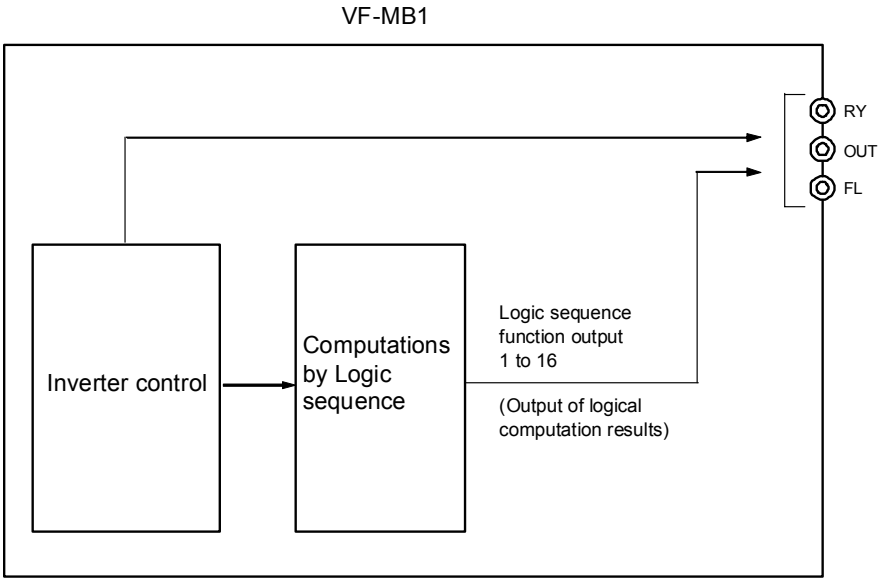


● Commutation



■ Output terminals

Onput signal terminals that can be used with the Logic sequence function are following.



● Output terminals (3 terminals: RY, OUT, FL)

VF-MB1 has 3 output terminals.

You can assign the multipule function to the output terminals.

A table of output terminal functions is showing in Appendix 4. Positive logic settings are used for the Logic sequence function.

Note) Negative-logic settings of output terminal functions cannot be used for the Logic sequnece function.

If you assign the logic sequence output to the output terminals, it is possible to output the computation results.

■ Setting parameters

The Logic sequence function consists of 7 units of the same composition. Each unit consists of 4 steps, and therefore there are 28 steps in total. See Fig.4-1 for the composition of each unit. Each step consists of one command. Each unit begins a data read (LD) command as step 1 and ends a data transfer (ST) command as step 4. You set the commands and objects of requested function to step 2 and 3.

Unit 1		
Step 1	LD	A900
Step 2	A901	A902
Step 3	A903	A904
Step 4	ST	A905

→

Unit 2		
Step 1	LD	A906
Step 2	A907	A908
Step 3	A909	A910
Step 4	ST	A911

→→

Unit 7		
Step 1	LD	A953
Step 2	A954	A955
Step 3	A956	A957
Step 4	ST	A958

Fig. 4-1 Logic sequence function block diagram

■ **Parameters**

Table 4-1 is the Logic sequence function parameters.

Table 4-1 Table of Logic sequence function parameters

		Title	Function	Adjustment range	Default setting
Unit 1	Step 1 (Objects)	A900	Input function target 11	Input terminal number 0: No function 1: Terminal F 2: Terminal R 3: Terminal RES 4: Terminal S1 5: Terminal S2 6: Terminal S3 7: Terminal VIB 8: Terminal VIA 9 to 20: - 21 to 24: Virtual input terminal 1 to 4 25 to 32: Internal terminal 1 to 8 918 to 934: Logic sequence output data number. 1000 to 1255: Output selection number (Note 1) 2000 to 2099: FD00~FD99 (Note 2) 3000 to 3099: FE00~FE99 (Note 2)	0
	Step 2 (Commands)	A901	Input function command 12	0: NOP (not operation) 1: ST (move) 2: STN (move (inversion)) 3: AND (logical product ($A \cap B$)) 4: ANDN (logical product ($A \cap \overline{B}$)) 5: OR (logical sum ($A \cup B$)) 6: ORN (logical sum ($A \cup \overline{B}$)) 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) 21: CLR(clear) 22: CLRN(clear (inversion))	0
	Step 2 (Objects)	A902	Input function target 12	Same as A900	0
	Step 3 (Commands)	A903	Input function command 13	Same as A901	0
	Step 3 (Objects)	A904	Input function target 13	Same as A900	0
	Step 4 (Output to)	A905	Output function assigned object 1	Same as A900	0

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

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

		Title	Function	Adjustment range	Default setting
Unit 2	Step 1 (Objects)	A906	Input function target 21	Same as A900	0
	Step 2 (Commands)	A907	Input function target 22	Same as A901	0
	Step 2 (Objects)	A908	Input function target 22	Same as A900	0
	Step 3 (Commands)	A909	Input function target 23	Same as A901	0
	Step 3 (Objects)	A910	Input function target 23	Same as A900	0
	Step 4 (Output to)	A911	Output function assigned object 2	Same as A900	0
Unit 3	Step 1 (Objects)	A912	Input function target 31	Same as A900	0
	Step 2 (Commands)	A913	Input function target	Same as A901	0
	Step 2 (Objects)	A914	Input function target 32	Same as A900	0
	Step 3 (Commands)	A915	Input function target	Same as A901	0
	Step 3 (Objects)	A916	Input function target 33	Same as A900	0
	Step 4 (Output to)	A917	Output function assigned object 3	Same as A900	0
Unit 4	Step 1 (Objects)	A935	Input function target 41	Same as A900	0
	Step 2 (Commands)	A936	Input function target 42	Same as A901	0
	Step 2 (Objects)	A937	Input function target 42	Same as A900	0
	Step 3 (Commands)	A938	Input function target 43	Same as A901	0
	Step 3 (Objects)	A939	Input function target 43	Same as A900	0
	Step 4 (Output to)	A940	Output function assigned object 4	Same as A900	0
Unit 5	Step 1 (Objects)	A941	Input function target 51	Same as A900	0
	Step 2 (Commands)	A942	Input function target 52	Same as A901	0
	Step 2 (Objects)	A943	Input function target 52	Same as A900	0
	Step 3 (Commands)	A944	Input function target 53	Same as A901	0
	Step 3 (Objects)	A945	Input function target 53	Same as A900	0
	Step 4 (Output to)	A946	Output function assigned object 5	Same as A900	0
Unit 6	Step 1 (Objects)	A947	Input function target 61	Same as A900	0
	Step 2 (Commands)	A948	Input function target 62	Same as A901	0
	Step 2 (Objects)	A949	Input function target 62	Same as A900	0
	Step 3 (Commands)	A950	Input function target 63	Same as A901	0
	Step 3 (Objects)	A951	Input function target 63	Same as A900	0
	Step 4 (Output to)	A952	Output function assigned object 6	Same as A900	0

		Title	Function	Adjustment range	Default setting
Unit 7	Step 1 (Objects)	A953	Input function target 71	Same as A900	0
	Step 2 (Commands)	A954	Input function target 72	Same as A901	0
	Step 2 (Objects)	A955	Input function target 72	Same as A900	0
	Step 3 (Commands)	A956	Input function target 73	Same as A901	0
	Step 3 (Objects)	A957	Input function target 73	Same as A900	0
	Step 4 (Output to)	A958	Output function assigned object 7	Same as A900	0

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
A918	Output percent data 1	0.00 - 200.0%	0.00
A919	Output percent data 2	0.00 - 200.0%	0.00
A920	Output percent data 3	0.00 - 200.0%	0.00
A921	Output percent data 4	0.00 - 200.0%	0.00
A922	Output percent data 5	0.00 - 200.0%	0.00
A923	Output frequency data 1	0.0 - 500.0Hz	0.0
A924	Output frequency data 2	0.0 - 500.0Hz	0.0
A925	Output frequency data 3	0.0 - 500.0Hz	0.0
A926	Output frequency data 4	0.0 - 500.0Hz	0.0
A927	Output frequency data 5	0.0 - 500.0Hz	0.0
A928	Output time data 1	0.0 1 - 600.0s	0.0 1
A929	Output time data 2	0.0 1 - 600.0s	0.0 1
A930	Output time data 3	0.0 1 - 600.0s	0.0 1
A931	Output time data 4	0.0 1 - 600.0s	0.0 1
A932	Output time data 5	0.0 1 - 600.0s	0.0 1
A933	Nnmber of times of output data 1	0 - 9999 times	0
A934	Nnmber of times of output data 2	0 - 9999 times	0

The table below lists the four virtual input terminals available.

Title	Function	Adjustment range (Note 1)	Default setting
A973	Virtual input terminal selection 1	0 - 203	0
A974	Virtual input terminal selection 2	0 - 203	0
A975	Virtual input terminal selection 3	0 - 203	0
A976	Virtual input terminal selection 4	0 - 203	0

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

■ **Valid or Invalid state of Logic sequence function**

You can set valid or invalid state of the Logic sequence function

When you set the Logic sequence function parameters, be sure to set A977 = 0 (disabled) to prevent the system from starting accidentally.

After setting the Logic sequence function parameters, change A977 to 1 (Logic sequence function + permission signal) or 2 (Logic sequence function always ON) to make Logic sequence function ready to work. (If you set A977 = 1, Logic sequence function is activated when a permission signal is issued.)

Note: It takes a maximum of 0.5 second for a change the Logic sequence function parameters to take effect. Keep standby state at least 0.5 second after setting the parameters.

Title	Function	Adjustment range	Default setting
A977	Logic sequence function selection	0: Disabled 1: Logic sequence function + permission signal 2: Logic sequence function always ON	0

0 (Disabled):
Logic sequence function does not work.

1 (Logic sequence function + permission signal):
Logic sequence function is standby state.
When you put input signal into the input terminal assigned functions 64 or 65 (Logic sequence function trgger signal), the Logic sequnence function works.

2 (Logic sequence function always ON):
The Logic sequence works when the inverter is turned on.

Note: You cannot change the parameter A977 during inverter operation.

● **In case that the Logic sequence function is disabled**
The Logic sequence function settings are invarid.
If the input terminals are turned on, the inverter operates by the input terminal function.

● **In case that the Logic sequnence function is in a standby state**
All signals (except following signals) are recognized as OFF signals inside of the inverter.
1. Logic sequence function trgger signal
2. Emergency stop and reset command

Note: Don't use the input terminals assigned the abouve functions in the Logic sequence function. Or the Logic sequence function permission, the emergency stop function, etc might not work normally.

● **In case that Logic sequence function is enabled**
If the input terminals are turned on, the inverter operates by the Logic sequence function.

5. Examples of setting

This chapter gives some examples of setting.
Note that the settings described below are examples and there are other ways to set a function for some examples.

● Examples of the setting of the combined terminal function

Example 1: Performing 2 functions by 1 terminal.
Standby signal is connected with F terminal (Forward run command). (F+ST)
Standby signal is connected with R terminal (Reverse run command). (R+ST)

Example 2: Performing 2 functions by 1 terminal.
Performing standby and forward run command by the S1 terminal. (ST+F)

Example 3: Performing 3 functions by 1 terminal.
Performing standby, forward run command and preset-speed command 1 by the S1 terminal. (ST+F+SS1)

Example 4: Output signal by logical product of 2 functions.
Output the signal on condition that detection both a low-speed signal and a small current signal

● Examples of the setting of the relay sequence function

Example 5: Operation with a combination of 2 input signals
Forward run: Either input terminal is turned on.
Reverse run: Both input terminals are turned on.
Stop : Both input terminas are turned off.

Example 6: Operation with push type switch.

Example 7: Automatic stop by some conditions.
Automatically stop on condition that 5Hz or less and 120% of current or more.

■ Examples of the setting of the combined terminal function

<Example 1: Performing 2 functions by 1 terminal>

Standby signal is connected with F terminal (Forward run command). (F+ST)
Standby signal is connected with R terminal (Reverse run command). (R+ST)

See Fig 5-1 for wiring diagram and Fig.5-2 for block diagram.
Assign the forward run command (F) to F terminal and reverse run command (R) to R terminal. (Default setting)
Assign the standby (ST) to virtual input terminal.
If the F (R) terminal is turned on, the virtual terminal is turned on automatically.
And F (R) +ST functions are performed.

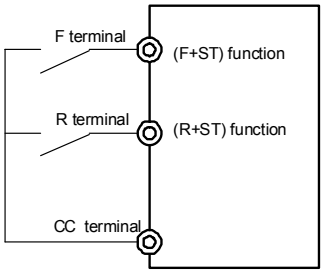


Fig. 5-1 Wiring diagram for Example 1

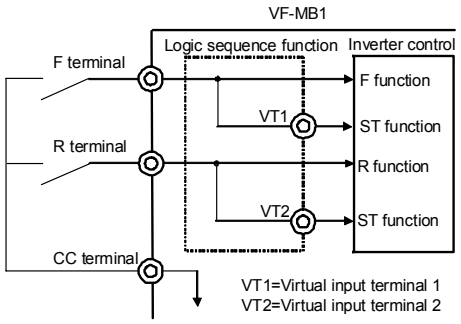


Fig. 5-2 Block diagram for Example 1

Parameter setting

		Title	Parameter setting	Description
Prior setting		A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F111	2 (Default)	Assign the forward run command to the F terminal.
		F112	4 (Default)	Assign the reverse run command to the R terminal.
		A973	6	Assign the standby to the virtual input terminal 1.
		A974	6	Assign the standby to the virtual input terminal 2.
Unit 1	Step 1	A900	1	Read F terminal input signal (LD F).
	Step 2	A901	0 (Default)	NOP command (not operation)
		A902	0 (Default)	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	21	Transfer the result to the virtual input terminal 1.
Unit 2	Step 1	A906	2	Read R terminal input signal (LD R).
	Step 2	A907	0 (Default)	NOP command (not operation)
		A908	0 (Default)	
	Step 3	A909	0 (Default)	NOP command (not operation)
		A910	0 (Default)	
	Step 4	A911	22	Transfer the result to the virtual input terminal 2.
–	–	A977	2	Set to “Logic sequence function always ON”.

<Example 2: Performing 2 functions by 1 terminal>

Performing standby and forward run command by the S1 terminal. (ST+F)

See Fig 5-3 for wiring diagram and Fig.5-4 for block diagram.
Assign the standby (ST) to S1 terminal.
Assign the forward run command (F) to virtual input terminal 1.
If the S1 terminal is turned on, the virtual terminal is turned on automatically.
And ST+F functions are performed.

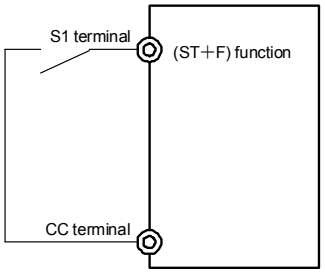


Fig. 5-3 Wiring diagram for Example 2

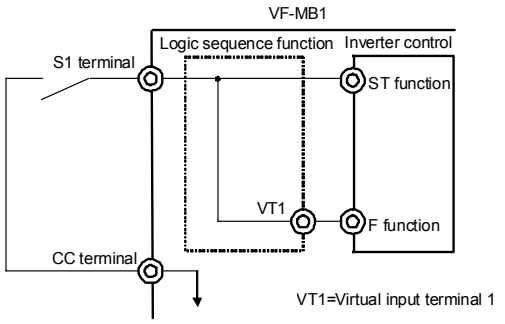


Fig. 5-4 Block diagram for Example 2

Paramerter setting

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F114	6	Assign the standby to the S1 terminal.
		A973	2	Assign the forward run command to the virtual input terminal 1.
Unit 1	Step 1	A900	4	Read S1 terminal input signal (LD S1).
	Step 2	A901	0 (Default)	NOP command (not operation)
		A902	0 (Default)	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	21	Transfer the result to the virtual input terminal 1.
–	–	A977	2	Set to “Logic sequence function always ON”.

<Example 3: Performing 3 functions by 1 terminal>

Performing standby, forward run command and preset-speed command 1 by the S1 terminal. (ST+F+SS1)

See Fig 5-5 for wiring diagram and Fig.5-6 for block diagram.
Assign the standby (ST) to S1 terminal.
Assign the forward run command (F) to virtual input terminal 1.
Assign the preset-speed command 1 (SS1) to virtual input terminal 2.
If the S1 terminal is turned on, the virtual terminals are turned on automatically.
And ST+F+SS1 functions are performed.

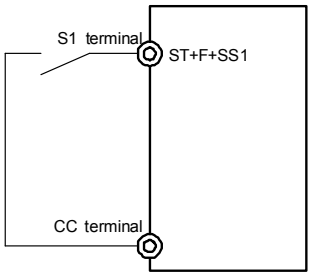


Fig. 5-5 Wiring diagram for Example 3

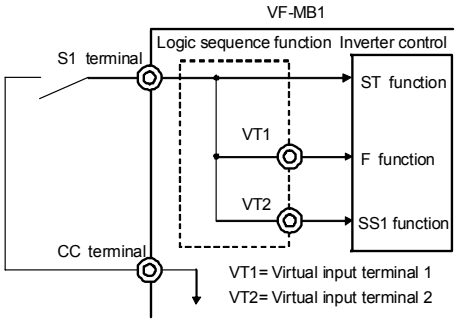


Fig. 5-6 Block diagram for Example 3

Paramerter setting

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F114	6	Assign the standby to the S1 terminal.
		A973	2	Assign the forward run command to the virtual input terminal 1.
		A974	10	Assign the preset-speed command 1 to the virtual input terminal 2.
Unit 1	Step 1	A900	4	Read S1 terminal input signal (LD S1).
	Step 2	A901	1	Transfer command
		A902	21	Tsansfer the result to the virtual input terminal 1.
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	22	Transfer the result to the virtual input terminal 2.
–	–	A977	2	Set to “Logic sequence function always ON”.

<Example 4: Output signal by logical product of 2 functions>

Output the signal on condition that detection both a low-speed signal and a small current signal.

See Fig 5-7 for block diagram.
Compute by logical product (AND) of a low-speed signal and a small current signal.
Transfer the result to the logic sequence function output1, and output signal from OUT terminal.

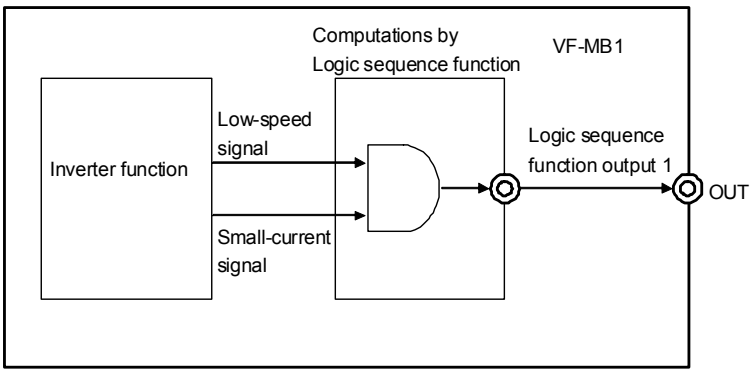


Fig. 5-7 Block diagram for Example 4

Paramerter setting

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F131	222	Assign the logic sequence function output 1 to the OUT terminal.
Unit 1	Step 1	A900	1004	Read the low speed signal (LD LOW)
	Step 2	A901	3	AND command
		A902	1026	The logical product of low speed signal and small current signal.
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	1222	Transfer the logical product to the logic sequence function output 1.
–	–	A977	2	Set to “Logic sequence function always ON”.

■ Examples of the setting of the relay sequence function

This chapter gives an explanation of the relay sequence function using ladder diagrams.
1 unit consists of maximum 4 steps. If your sequence consists of 5 steps or more, you need to change the composition to 4 steps or less.

<Example 5: Operation with a combination of 2 input signals>

Input terminals are used as ON/OFF signal lilke a PLC in this example.
Forward run: Either input terminal is turned on.
Reverse run: Both input terminals are turned on.
Stop : Both input terminas are turned off.

See Fig 5-8 for wiring diagram and timing chart.

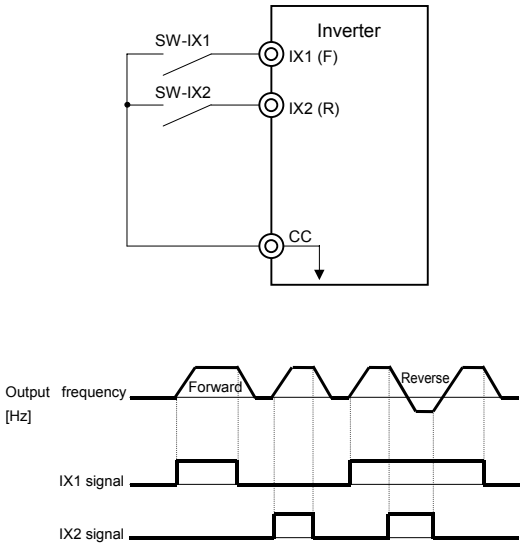
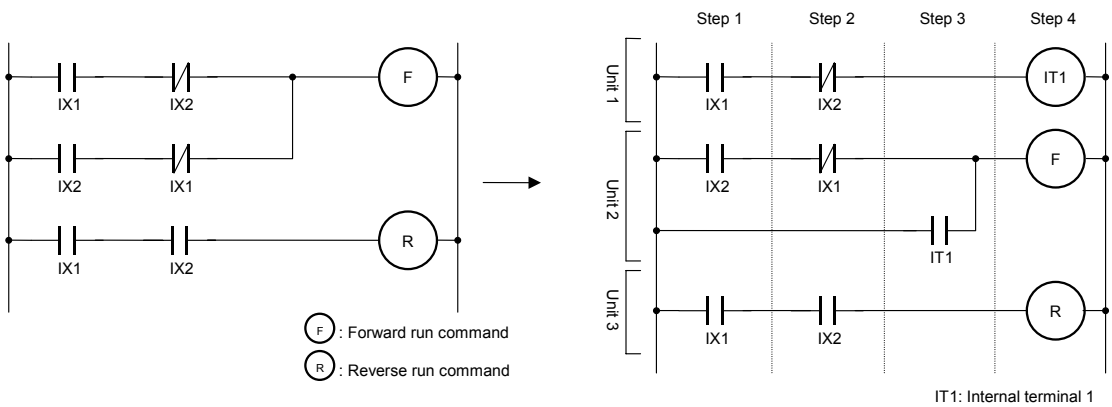


Fig. 5-8 Wiring diagram and timing chart for Example 5

The ladder diagram is following.
The left is general sequence.The sequence of forward run command consists of 5 steps.
You need to change the composition to 4 setps as the right for the Logic sequence function.



Parameter setting

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F111	0	Assign the “no function” to the F terminal. Use the F terminal as a simple input terminal (IX1).
		F112	0	Assign the “no function” to the R terminal. Use the R terminal as a simple input terminal (IX1).
		A973	2	Assign the forward run command to the virtual input terminal 1 (VT1).
		A974	4	Assign the reverse run command to the virtual input terminal 2 (VT2).
Unit 1	Step 1	A900	1	Read IX1 (F) terminal input signal. (LD IX1)
	Step 2	A901	4	ANDN command (IX1 ∩ $\overline{\text{IX2}}$)
		A902	2	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	25	Transfer the result to the internal terminal 1. (IX1 ∩ $\overline{\text{IX2}}$ ⇒ IT1)
Unit 2	Step 1	A906	2	Read IX2 (R) terminal input signal. (LD IX2)
	Step 2	A907	4	ANDN command (IX2 ∩ $\overline{\text{IX1}}$)
		A908	1	
	Step 3	A909	5	OR command ((IX2 ∩ $\overline{\text{IX1}}$) ∪ IT1)
		A910	25	
	Step 4	A911	21	Transfer the result to the virtual input terminal 1. ((IX2 ∩ $\overline{\text{IX1}}$) ∪ IT1 ⇒ VT1)
Unit 3	Step 1	A912	1	Read IX1 (F) terminal input signal. (LD IX1)
	Step 2	A913	3	AND command (IX1 ∩ IX2)
		A914	2	
	Step 3	A915	0 (Default)	NOP command (not operation)
		A916	0 (Default)	
	Step 4	A917	22	Transfer the result to the virtual input terminal 2. (IX2 ∩ IX1 ⇒ VT2)
–	–	A977	2	Set to “Logic sequence function always ON”.

NEQ (mismatch) command enables to combine the steps of unit 1 and 2.
If the signal of input terminal 1 and 2 don’t match, forward run command is valid.

		Title	Parameter setting	Description
Unit 1	Step 1	A900	1	Read IX1 (F) terminal input signal. (LD IX1)
	Step 2	A901	8	NEQ command ((IX1 ∩ $\overline{\text{IX2}}$) ∪ ($\overline{\text{IX1}}$ ∩ IX2))
		A902	2	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	21	Transfer the result to the virtual input terminal 1. ((IX1 ∩ $\overline{\text{IX2}}$) ∪ ($\overline{\text{IX1}}$ ∩ IX2) ⇒ VT1)

<Example 6: Operation with push type switch>

Start and stop by push type (non self-hold type) switches.

Start with the forward run command (reverse run command), and stop with the stop command.

See Fig 5-9 for wiring diagram and timing chart.

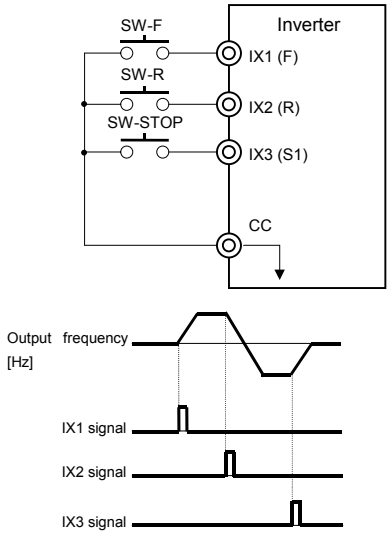


Fig. 5-9 Wiring diagram and timing chart for Example 6

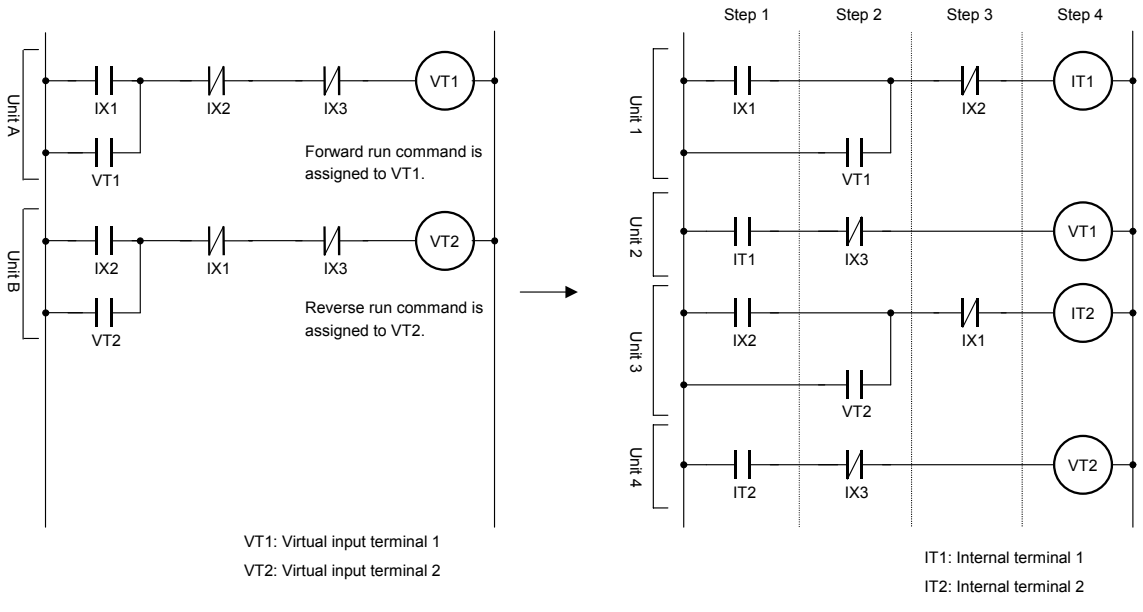
Construct each self-hold circuit for a forward run command and a reverse run command.

Break the self-hold by the other command or a stop command.

The ladder diagram is following.

The left is general sequence of self-hold circuit. Each unit consists of 5 steps.

You need to change the unit 1 and unit 2 to two units each other, and consists 4 setps for the Logic sequence function.



VT1: Virtual input terminal 1

VT2: Virtual input terminal 2

IT1: Internal terminal 1

IT2: Internal terminal 2

Parameter setting

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F111	0	Assign the “no function” to the F terminal. Use the F terminal as a simple input terminal (IX1).
		F112	0	Assign the “no function” to the R terminal. Use the R terminal as a simple input terminal (IX2).
		F114	0	Assign the “no function” to the S1 terminal. Use the S1 terminal as a simple input terminal (IX3).
		A973	2	Assign the forward run command to the virtual input terminal 1 (VT1)
		A974	4	Assign the reverse run command to the virtual input terminal 2 (VT2)
Unit 1	Step 1	A900	1	Read IX1 (F) terminal input signal. (LD IX1)
	Step 2	A901	5	OR command (IX1 ∪ VT1) self-hold circuit
		A902	21	
	Step 3	A903	4	ANDN command (IX1 ∪ VT1 ∩ $\overline{IX2}$)
		A904	2	
	Step 4	A905	25	Transfer the result to the internal terminal 1 (IX1 ∪ VT1 ∩ $\overline{IX2}$ ⇒ IT1)
Unit 2	Step 1	A906	25	Read IT1 (Internal terminal 1) signal (LD IT1).
	Step 2	A907	4	ANDN command (IT1 ∩ $\overline{IX3}$)
		A908	4	
	Step 3	A909	0 (Default)	NOP command (not operation)
		A910	0 (Default)	
	Step 4	A911	21	Transfer the result to the virtual input terminal 1 (VT1) (IT1 ∩ $\overline{IX3}$ ⇒ VT1)
Unit 3	Step 1	A912	2	Read IX2(R) terminal input signal. (LD IX2)
	Step 2	A913	5	OR command (IX2 ∪ VT2) self-hold circuit
		A914	22	
	Step 3	A915	4	ANDN command (IX2 ∪ VT2 ∩ $\overline{IX1}$)
		A916	1	
	Step 4	A917	26	Transfer the result to the internal terminal 2 (IT2) (IX2 ∪ VT2 ∩ $\overline{IX1}$ ⇒ IT2)
Unit 4	Step 1	A935	26	Read IT2 (Internal terminal 2) signal (LD IT2)
	Step 2	A936	4	ANDN command (IT2 ∩ $\overline{IX3}$)
		A937	4	
	Step 3	A938	0 (Default)	NOP command (not operation)
		A939	0 (Default)	
	Step 4	A940	22	Transfer the result to the virtual input terminal 2 (VT2) (IT2 ∩ $\overline{IX3}$ ⇒ VT2)
–	–	A977	2	Set to “Logic sequence function always ON”.

〈Example 7: Automatic stop by some conditions>

Automatically stop on condition that 5Hz or less and 120% of current or more.
Start by push type (non self-hold type) switch.

See Fig 5-10 for wiring diagram and timing chart.

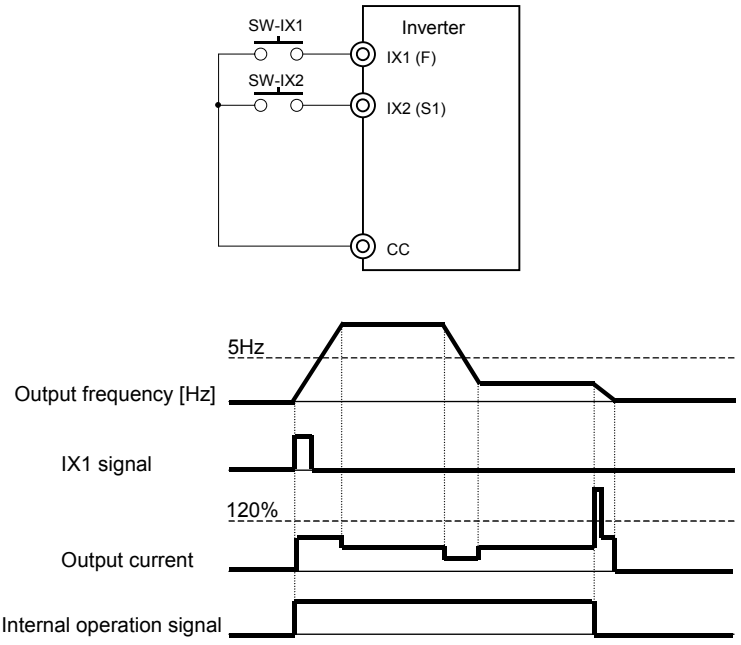
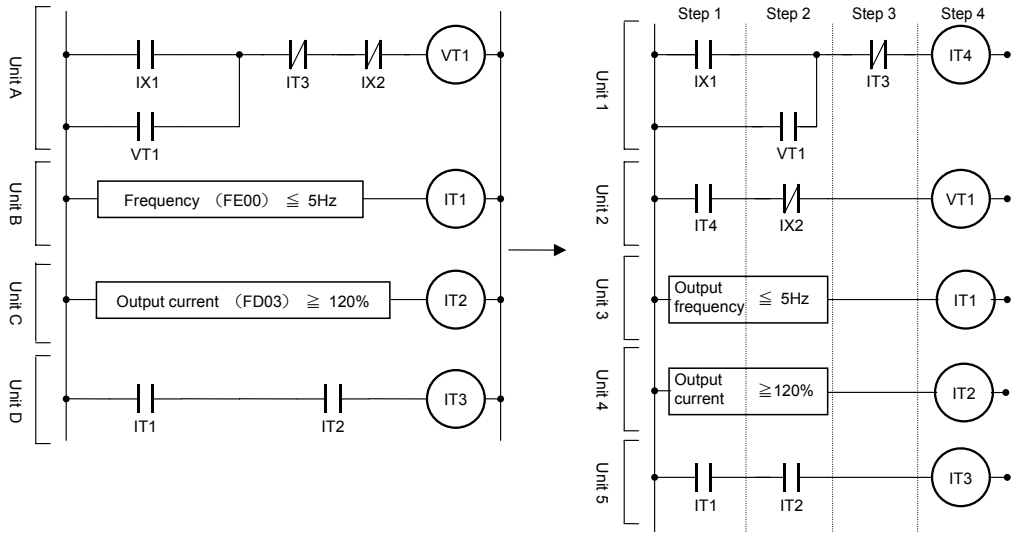


Fig. 5-10 Wiring diagram and timing chart for Example 7

- F terminal is used as forward command with push type (non self-hold type) switch.
- Break the forward run command in case that the output frequency is 5Hz or less and the output current is 120% or less of the rated.
- Forced stop by input signal from S1 terminal.

The ladder diagram is following.
The left is general sequencef of self-hold circuit. Unit A consists of 5 steps.
You need to change the unit to two units, and consists 4 setps for the Logic sequence function



VT1: Virtual input terminal (forward run command)

IT1: Internal terminal 1
IT2: Internal terminal 2
IT3: Internal terminal 3
IT4: Internal terminal 4

Parameter setting

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F111	0	Assign the “no function” to the F terminal. Use the F terminal as a simple input terminal (IX1).
		F114	0	Assign the “no function” to the S1 terminal. Use the S1 terminal as a simple input terminal (IX2).
		A918	120	Set the limit at 120% to use it as a reference value when comparing and computing currents.
		A923	5	Set the limit at 5Hz to use it as a reference value when comparing and computing frequencies.
		A973	2	Assign the forward run command to the virtual input terminal 1 (VT1)
Unit 1	Step 1	A900	1	Read IX1(F) terminal input signal (LD IX1)
	Step 2	A901	5	OR command (IX1 ∪ VT1)
		A902	21	
	Step 3	A903	4	ANDN command (IX1 ∪ VT1 ∩ $\overline{\text{IT3}}$)
		A904	27	
	Step 4	A905	28	Transfer the result to the internal terminal 4 (IT4) (IX1 ∪ VT1 ∩ $\overline{\text{IT3}}$ ⇒ IT4)
Unit 2	Step 1	A906	28	Read IT4(Internal terminal 4) signal (LD IT4)
	Step 2	A907	4	ANDN command (IT4 ∩ $\overline{\text{IX2}}$)
		A908	4	
	Step 3	A909	0 (Default)	NOP command (not operation)
		A910	0 (Default)	
	Step 4	A911	21	Ttansfer the result to the virtual input terminal 1 (VT1). (IT4 ∩ $\overline{\text{IX2}}$ ⇒ VT1)

		Title	Parameter setting	Description
Unit 3	Step 1	A912	3000	Read the output frequency (LD Output frequency)
	Step 2	A913	12	LE command (Comparison to 5Hz)
		A914	923	
	Step 3	A915	0 (Default)	NOP command (not operation)
		A916	0 (Default)	
	Step 4	A917	25	Transfer the result to the internal terminal 1 (IT1) (Comparison to 5Hz ⇒ IT1)
Unit 4	Step 1	A935	2003	Read the output current (LD Output current)
	Step 2	A936	10	GE command (Comparison to 120%)
		A937	918	
	Step 3	A938	0 (Default)	NOP command (not operation)
		A939	0 (Default)	
	Step 4	A940	26	Transfer the result to the internal terminal 2 (IT2) (Comparison to 120% ⇒ IT2)
Unit 5	Step 1	A941	25	Read IT1 (Internal terminal 1) signal (LD IT1)
	Step 2	A942	3	AND command (IT1 ∩ IT2)
		A943	26	
	Step 3	A944	0 (Default)	NOP command (not operation)
		A945	0 (Default)	
	Step 4	A946	27	Transfer the result to the internal terminal 3 (IT3) (IT1 ∩ IT2 ⇒ IT3)
–	–	A977	2	Set to “Logic sequence function always ON”.

Appendix 1
Table of Logic sequence function parameters

Table 8-1 is the Logic sequence function parameters.

Table 8-1 Table of Logic sequence function parameters

Title	Function	Adjustment range	Default setting
A900	Input function target 11	Input terminal number 0: No function 1: Terminal F 2: Terminal R 3: Terminal RES 4: Terminal S1 5: Terminal S2 6: Terminal S3 7: Terminal VIB 8: Terminal VIA 9 to 20: - 21 to 24: Virtual input terminal 1 to 4 25 to 32: Internal terminal 1 to 8 918 to 934: Logic sequence output data number 1000 to 1255: Output selection number (Note 1) 2000 to 2099: FD00~FD99 (Note 2) 3000 to 3099: FE00~FE99 (Note 2)	0
A901	Input function command 12	0: NOP (not operation) 1: ST (move) 2: STN (move (inversion)) 3: AND (logical product (A∩B)) 4: ANDN (logical product (A∩B)) 5: OR (logical sum (A∪B)) 6: ORN (logical sum (A∪B)) 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) 21: CLR(clear) 22: CLRN(clear (inversion))	0
A902	Input function target 12	Same as A900	0
A903	Input function command 13	Same as A901	0
A904	Input function target 13	Same as A900	0
A905	Output function assigned object 1	Same as A900	0
A906	Input function target 21	Same as A900	0
A907	Input function target 22	Same as A901	0
A908	Input function target 22	Same as A900	0
A909	Input function target 23	Same as A901	0
A910	Input function target 23	Same as A900	0
A911	Output function assigned object 2	Same as A900	0

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

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

Title	Function	Adjustment range	Default setting
A912	Input function target 31	Same as A900	0
A913	Input function target	Same as A901	0
A914	Input function target 32	Same as A900	0
A915	Input function target	Same as A901	0
A916	Input function target 33	Same as A900	0
A917	Output function assigned object 3	Same as A900	0
A918	Output percent data 1	0.00~200.0%	0.00
A919	Output percent data 2	0.00~200.0%	0.00
A920	Output percent data 3	0.00~200.0%	0.00
A921	Output percent data 4	0.00~200.0%	0.00
A922	Output percent data 5	0.00~200.0%	0.00
A923	Output frequency data 1	0.0~500.0Hz	0.0
A924	Output frequency data 2	0.0~500.0Hz	0.0
A925	Output frequency data 3	0.0~500.0Hz	0.0
A926	Output frequency data 4	0.0~500.0Hz	0.0
A927	Output frequency data 5	0.0~500.0Hz	0.0
A928	Output time data 1	0.0 1~600.0s	0.0 1
A929	Output time data 2	0.0 1~600.0s	0.0 1
A930	Output time data 3	0.0 1~600.0s	0.0 1
A931	Output time data 4	0.0 1~600.0s	0.0 1
A932	Output time data 5	0.0 1~600.0s	0.0 1
A933	Number of times of output data 1	0~9999 times	0
A934	Number of times of output data 2	0~9999 times	0
A935	Input function target 41	Same as A900	0
A936	Input function target 42	Same as A901	0
A937	Input function target 42	Same as A900	0
A938	Input function target 43	Same as A901	0
A939	Input function target 43	Same as A900	0
A940	Output function assigned object 4	Same as A900	0
A941	Input function target 51	Same as A900	0
A942	Input function target 52	Same as A901	0
A943	Input function target 52	Same as A900	0
A944	Input function target 53	Same as A901	0
A945	Input function target 53	Same as A900	0
A946	Output function assigned object 5	Same as A900	0
A947	Input function target 61	Same as A900	0
A948	Input function target 62	Same as A901	0
A949	Input function target 62	Same as A900	0
A950	Input function target 63	Same as A901	0
A951	Input function target 63	Same as A900	0
A952	Output function assigned object 6	Same as A900	0
A953	Input function target 71	Same as A900	0
A954	Input function target 72	Same as A901	0
A955	Input function target 72	Same as A900	0
A956	Input function target 73	Same as A901	0
A957	Input function target 73	Same as A900	0
A958	Output function assigned object 7	Same as A900	0
A973	Virtual input terminal selection 1	0- 203 (Note3)	0
A974	Virtual input terminal selection 2	0- 203 (Note3)	0
A975	Virtual input terminal selection 3	0- 203 (Note3)	0
A976	Virtual input terminal selection 4	0- 203 (Note3)	0
A977	Logic sequence function selection	0: Disabled 1: Logic sequence function + permission signal 2: Logic sequence function always ON	0

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

Appendix 2 Computing functions

Table 8-2 is the computing functions provided by the Logic sequence function.

Table 8-2 Computing functions

Input function command	Computation name	Function	Description
0	NOP	Disabling	Unnecessary sections (columns) of the Logic sequence 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 ∩ B)
4	ANDN	Logical product (inversion of right side)	Logical product of data (A ∩ $\overline{B}$)
5	OR	Logical sum	Logical product of data (A ∪ B)
6	ORN	Logical sum (inversion of right side)	Logical product of data (A ∪ $\overline{B}$)
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≦B)
10	GE	Comparison of sizes (A≧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≧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≧B)
12	LE	Comparison of sizes (A≦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≦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. IA—BI
14 (Note 1)	ON (ON timer)	ON delay	Delays the timing of turning data ON by the time specified with A928 to A932.
15 (Note 1)	OFF (ON timer)	OFF delay	Delays the timing of turning data OFF by the time specified with A928 to A932.
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 A933 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.
21 (Note 1)	CLR	Clear	Clear data.
22 (Note 1)	CLRN	Clear (Inversion)	Clear data (Inversion).

Note 1: For details of computing functions 14 to 22, see Appendix 6.

Appendix 3
Input terminal function selection parameters

Table 8-3 is the select functions of 12 input terminals (including 4 virtual input terminals).
Table 8-4 is the input terminal functions.

Table 8-3 Input terminal function selection parameters

Title	Communication No.	Function	Adjustment range (Note 1)	Default setting
F104	0104	Always ON function selection 1	0～153	0
F108	0108	Always ON function selection 2	0～153	0
F110	0110	Always ON function selection 3	0～153	6
F111	0111	Input terminal selection 1A (F)	0～203	2
F112	0112	Input terminal selection 2A (R)	0～203	4
F113	0113	Input terminal selection 3A (RES)	0～203	8
F114	0114	Input terminal selection 4A (S1)	0～203	10
F115	0115	Input terminal selection 5 (S2)	0～203	12
F116	0116	Input terminal selection 6 (S3)	0～203	14
F117	0117	Input terminal selection 7 (VIB)	8～55	16
F118	0118	Input terminal function selection 8 (VIA)	8～55	24
F151	0151	Input terminal function selection 1B (F)	0～203	0
F152	0152	Input terminal function selection 2B (R)	0～203	0
F153	0153	Input terminal selection 3B (RES)	0～203	0
F154	0154	Input terminal selection 4B (S1)	0～203	0
F155	0155	Input terminal selection 1C (F)	0～203	0
F156	0156	Input terminal selection 2C (R)	0～203	0
A973	A973	Virtual input terminal selection 1	0～203	0
A974	A974	Virtual input terminal selection 2	0～203	0
A975	A975	Virtual input terminal selection 3	0～203	0
A976	A976	Virtual input terminal selection 4	0～203	0

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	88	89	Frequency UP
2	3	F: Forward run command	90	91	Frequency DOWN
4	5	R: Reverse run command	92	93	Clear frequency UP/DOWN
6	7	ST: Standby	96	97	Coast stop command
8	9	RES: Reset command	98	99	Forward/reverse selection
10	11	SS1: Preset-speed command 1	100	101	Run/stop command
12	13	SS2: Preset-speed command 2	104	105	Frequency reference command forced switching
14	15	SS3: Preset-speed command 3	106	107	Frequency setting mode terminal board
16	17	SS4: Preset-speed command 4	108	109	Command mode terminal board
18	19	Jog run mode	110	111	Parameter editing permission
20	21	Emergency stop by external signal	120	121	Fast stop command 1
22	23	DC braking command	122	123	Fast stop command 2
24	25	2nd acceleration/deceleration	134	135	Traverse permission signal
26	27	3rd acceleration/deceleration	136	137	Factory specific coefficient (Note1)
28	29	2nd V/F control switching	140	141	Forward deceleration
32	33	2nd stall prevention level	142	143	Forward stop
36	37	PID control prohibition	144	145	Reverse deceleration
46	47	External thermal error input	146	147	Reverse stop
48	49	Forced local from communication	148	149	Factory specific coefficient (Note1)
50	51	Operation hold (hold of 3-wire operation)	150	151	Factory specific coefficient (Note1)
52	53	PID integral/differential clear	200	201	Parameter editing prohibition
54	55	PID characteristics switching	202	203	Parameter reading prohibition
56	57	Forced run operation			
58	59	Fire speed operation			
60	61	Acceleration/deceleration suspend signal			
62	63	Power failure synchronized signal			
64	65	Logic sequence function trigger signal			
70	71	Factory specific coefficient (Note1)			
74	75	Integrating wattmeter(kWh) display clear			
76	77	Trace back trigger signal			
78	79	Light-load high-speed operation prohibitive signal			
80	81	Holding of RY-RC terminal output			
82	83	Holding of OUT terminal output			

Note1: Do not set the value. The function is for manufactuer setting.

Appendix 4
Output terminal function selection parameters

Table 8-5 is the select functions of 3 output terminals.

Table 8-6 is the output terminal functions.

Table 8-5 Output terminal function selection parameters

Title	Communication No.	Function	Adjustment range (Note 1)	Default setting
F130	0130	Output terminal selection 1A (RY-RC)	0~255	4
F131	0131	Output terminal selection 2A (OUT)	0~255	6
F132	0132	Output terminal selection 3 (FL)	0~255	10
F137	0137	Output terminal selection 1A (RY-RC)	0~255	255
F138	0138	Output terminal selection 1B (OUT)	0~255	255

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

Table 8-6 Output terminal functions

Select the positive-logic of the output terminal functions for the Logic sequence function.

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)
1000	0	Frequency lower limit	ON: Output frequency is more than LL OFF: LL or less
1002	2	Frequency upper limit	ON: Output frequency is UL or more OFF: less than UL
1004	4	Low-speed detection signal	ON: Output frequency is F100 or more OFF: less than F100
1006	6	Output frequency attainment signal (acceleration/deceleration completed)	ON: Output frequency is within command frequency ± F102 OFF: more than command frequency ± F102
1008	8	Set frequency attainment signal	ON: Output frequency is within F101± F102 OFF: more than F101± F102
1010	10	Fault signal (trip output)	ON: Inverter tripped OFF: Inverter not tripped
1014	14	Over-current pre-alarm	ON: Output current is F601 or more OFF: less than F601
1016	16	Overload detection pre-alarm	ON: F657(%) or more of calculated value of overload protection level OFF: Less than F657(%)
1020	20	Overheat pre-alarm	ON: Approx. 95°C or more of IGBT element OFF: Less than approx. 95°C (90°C or less after detection is turned on)
1022	22	Overvoltage pre-alarm	ON: Overvoltage limit in operation
1024	24	Power circuit undervoltage detection	ON: Power circuit undervoltage (nOFF) detected OFF: Undervoltage detection canceled
1026	26	Small current detection	ON: After output current comes to F611 or less, value of less than F611+F609 for F612 set time OFF: more than F611 (F611+F609 or more after detection turns on)
1028	28	Over-torque detection	ON: After torque comes to F616 or more, value of more than F616 – F619 for F618 set time OFF: less than F616 (F616 – F619 or less after detection turns on)

Input setting	Parameter setting	Function	Operation output specifications (in case of positive logic)
1030	30	Braking resistor overload pre-alarm	ON: 50% or more of calculated value of F309 set overload protection level OFF: Less than 50%
1040	40	Run/stop	ON: While operation frequency is output or DC braking is in operation (db) OFF: Operation stopped
1042	42	Heavy fault	ON: At trip (OCA,OCL,OL,E,EEP1,ELn,EPH0,Err2~5,OH2, UP1,EF2,UC,ELY0,EPH1) OFF: Other than those trip above
1044	44	Light fault	ON: At trip (OC1~3,OP1~3,OH,OL1~3,OLr) OFF: Other than those trip above
1050	50	Cooling fan ON/OFF	ON: Cooling fan is in operation OFF: Cooling fan is off operation
1052	52	In jogging operation	ON: In jogging operation OFF: Other than jogging operation
1054	54	Operation panel / terminal board operation	ON: At terminal board operation command OFF: Other than those operation above
1056	56	Cumulative operation time alarm	ON: Cumulative operation time is F621 or more OFF: less than F621
1058	58	Communication option communication error	ON: Communication error of communication option occurs OFF: Other than those above
1060	60	Forward/reverse run	ON: Reverse run OFF: Forward run (Operation command state is output while motor operation is stopped. No command is to OFF.)
1062	62	Ready for operation 1	ON: Ready for operation (with ST / RUN)
1064	64	Ready for operation 2	ON: Ready for operation (without ST / RUN)
1068	68	Brake release	ON: Brake exciting signal OFF: Brake releasing signal
1070	70	Pre-alarm	ON: One of the following is turned on Pre-alarm of over load, over heat, or over torque. Undervoltage, small current, over torque, lower limit frequency stop, cumulative operation time or momentary power failure deceleration stop. Alaram of E, P or H
1078	78	RS485 communication error	ON: Communication error occurred OFF: Communication works
1092	92	Designated data output 1	ON: bit0 of FA50 is ON OFF: bit0 of FA50 is OFF
1094	94	Designated data output 2	ON: bit1 of FA50 is ON OFF: bit1 of FA50 is OFF
1106	106	Light load output	ON: Less than heavy load torque (F335~F338) OFF: (F335~F338) or more
1108	108	Heavy load output	ON: Heavy load torque (F335~F338) or more OFF: Less than (F335~F338)
1120	120	Lower limit frequency stop	ON: Lower limit frequency continuous operation
1122	122	Power failure synchronized operation	ON: Power failure synchronized operation
1124	124	Traverse in progress	ON: Traverse in progress
1126	126	Traverse deceleration in progress	ON: Traverse deceleration in progress

Input setting	Parameter setting	Function	Operation output specifications (in case of positive logic)
1128	128	Part replacement alarm	ON: Any one of cooling fan, control board capacitor, or main circuit capacitor reaches parts replacement time
1130	130	Over-torque detection pre-alarm	ON: Torque current is 70% of F616 setting value or more OFF: less than F616x70%-F619
1132	132	Frequency setting mode selection 1/2	ON: Select frequency setting mode selection 2 (F207) OFF: Select frequency setting mode selection 1 (FMOd)
1136	136	Panel / remote selection	ON: Operation command is panel
1138	138	Forced continuous operation in progress	ON: Forced continuous operation in progress
1140	140	Specified frequency operation in progress	ON: Specified Frequency operation in progress
1144	144	Signal in accordance of frequency command	ON: Frequency commanded by F389 and F369 are within ±F167
1146	146	Fault signal (output also at a retry waiting)	ON: While inverter is tripped or retried
1150	150	PTC input alarm signal	ON: PTC thermal input value is 60% of F646 or more OFF: less than 60% of F646
1152	152	Safe torque off signal	ON: Safe torque off signal output
1154	154	Analog input break detection alarm	ON: VIB terminal input value is F633 or less OFF: more than F633
1156	156	F terminal state	ON: F terminal is ON state
1158	158	R terminal status	ON: R terminal is ON state
1160	160	Cooling fan replacement alarm	ON: Cooling fan reaches parts replacement time
1162	162	Number of starting alarm	ON: Number of starting is F648 or more
1166	166	Acceleration operation in progress	ON: Acceleration operation in progress
1168	168	Deceleration operation in progress	ON: Deceleration operation in progress
1170	170	Constant speed operation in progress	ON: Constant speed operation in progress
1172	172	DC braking in progress	ON: DC braking in progress
1174	174	Factory specific coefficient	Do not set the value. The function is for manufactuer setting.
1176	176		
1176	176		

Input setting	Parameter setting	Function	Operation output specifications (in case of positive logic)
1222	222	Logic sequence function output 1	ON: Logic sequence function output 1 is ON.
1224	224	Logic sequence function output 2	ON: Logic sequence function output 2 is ON.
1226	226	Logic sequence function output 3	ON: Logic sequence function output 3 is ON.
1228	228	Logic sequence function output 4	ON: Logic sequence function output 4 is ON.
1230	230	Logic sequence function output 5	ON: Logic sequence function output 5 is ON.
1232	232	Logic sequence function output 6	ON: Logic sequence function output 6 is ON.
1234	234	Logic sequence function output 7	ON: Logic sequence function output 7 is ON.
1236	236	Logic sequence function output 8	ON: Logic sequence function output 8 is ON.
1238	238	Logic sequence function output 9	ON: Logic sequence function output 9 is ON.
1240	240	Logic sequence function output 10	ON: Logic sequence function output 10 is ON.
1242	242	Logic sequence function output 11	ON: Logic sequence function output 11 is ON.
1244	244	Logic sequence function output 12	ON: Logic sequence function output 12 is ON.
1246	246	Logic sequence function output 13	ON: Logic sequence function output 13 is ON.
1248	248	Logic sequence function output 14	ON: Logic sequence function output 14 is ON.
1250	250	Logic sequence function output 15	ON: Logic sequence function output 15 is ON.
1252	252	Logic sequence function output 16	ON: Logic sequence function output 16 is ON.
1254	254	Always OFF (for terminal signal tests)	Output signal always OFF

Appendix 5 Internal data

Table 8-7 is the internal data that the Logic sequence 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 Logic sequence function can handle

	Input setting	Communication No.	Function	Unit (Communication)
Monitor display output value	3000	FE00	Operation frequency	0.01Hz
	3002	FE02	Frequency setting value	0.01Hz
	3003	FE03	Output current	0.01%
	3004	FE04	Input voltage (DC detection)	0.01%
	3005	FE05	Output voltage	0.01%
	3014	FE14	Comulative operation time	100hours
	3015	FE15	Frequency setting value (after compensation)	0.01Hz
	3018	FE18	Torque	0.01%
	3022	FE22	PID feedback value	0.01Hz
	3023	FE23	Motor cumulative load factor	0.01%
	3024	FE24	Inverter cumulative load factor	0.01%
	3025	FE25	Braking resistance cumlative load factor	1%
	3026	FE26	Motor load factor	0.01%
	3027	FE27	Inverter load factor	0.01%
	3029	FE29	Input power	0.01kW
	3030	FE30	Output power	0.01kW
	3035	FE35	VIA input	0.01%
	3036	FE36	VIB input value	0.01%
	3037	FE37	VIC input value	0.01%
	3040	FE40	FM output value	1
	3070	FE70	Inverter rated current	0.1A
	3076	FE76	Integral input power	0.01kW
	3077	FE77	Integral output power	0.01kW
	3080	FE80	Cumulative power ON time	100hours
	2032	FD32	Number of starting	10000times
	2033	FD33	Number of forward starting	10000times
	2034	FD34	Number of reverse starting	10000times
	2040	FD40	Pulse train output value	0.01kpps
	2041	FD41	Cumulative fan operation time	100hours
	2070	FD70	Inverter rated current (Carrier frequency corrected)	0.1A

	Input setting	Communication No.	Function	Unit (Communication)
FM/AM output Pulse train output	2000	FD00	Output frequency	0.01Hz
	2002	FD02	Frequency reference	0.01Hz
	2003	FD03	Output current	0.01%
	2004	FD04	Input voltage (DC detection)	0.01%
	2005	FD05	Output voltage	0.01%
	2015	FD15	Frequency setting value (after compensation)	0.01Hz
	2022	FD22	PID feedback value	0.01Hz
	2023	FD23	Motor cumulative load factor	0.01%
	2024	FD24	Inverter cumulative load factor	0.01%
	2025	FD25	Braking resistance cumlative load factor	1%
	2029	FD29	Input power	0.01kW
	2030	FD30	Output power	0.01kW
	2040	FD40	Pulse train input value	0.01kpps
	3035	FE35	VIA input value	0.01%
	3036	FE36	VIB input value	0.01%
	3037	FE37	VIC input value	0.01%
	3040	FE40	FM output value	1
	3050	FE50	Fixed output 2	-
	3051	FE51	Fixed output 1	-
	3052	FE52	Fixed output 3	-

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, set & reset function, and clear function. And gives examples of their settings.

■ Input function command 14: ON (ON timer)

When the input signal is turned ON, the ON command delays the timing of putting out an ON signal by the setting time of 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.

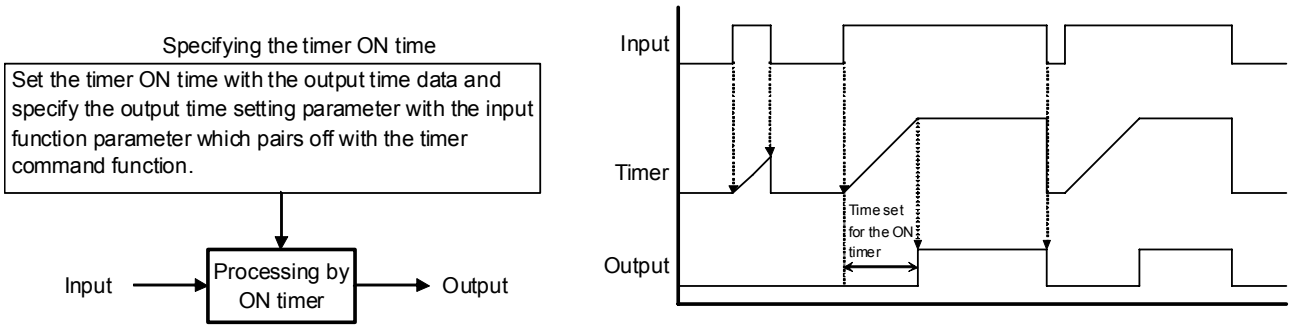


Fig. 8-1 Processing by ON timer

＜Example＞ Input a signal to the S1 terminal, and output the signal with a delay time (timer ON time) of 1 second from the RY-RC terminal.

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F114	0	Assign the “no function” to the S1 terminal.
		F130	222	Assign the logic sequence function output 1 to the RY-RC terminal.
		A928	1.0	Set a delay time (timer ON time) of 1.0 second for the output time data 1.
Unit 1	Step 1	A900	4	Read S1 terminal input signal. (LD S1)
	Step 2	A901	14	Activate the ON timer setted by A928.
		A902	928	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	1222	Transfer the result to the logic sequence function output 1.
–	–	A977	2	Set to “Logic sequence function always ON”.

■ **Input function command 15: OFF (OFF timer)**

When the input signal is turned OFF, the OFF command delays the timing of putting out an OFF signal by the setting time of 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.

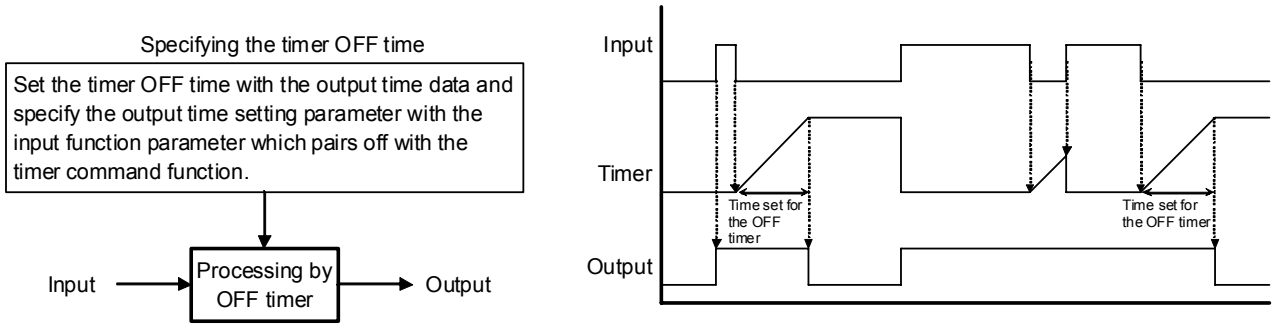


Fig. 8-2 Processing by OFF timer

＜Example＞ Input a signal to the S1 terminal, and output the signal with a delay time (timer OFF time) of 1 second from the RY-RC terminal.

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F114	0	Assign the “no function” to the S1 terminal.
		F130	222	Assign the logic sequence function output 1 to the RY-RC terminal.
		A928	1.0	Set a delay time (timer OFF time) of 1.0 second for the output time data 1.
Unit 1	Step 1	A900	4	Read S1 terminal input signal. (LD S1)
	Step 2	A901	15	Activate the OFF timer setted by A928
		A902	928	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	1222	Transfer the result to the logic sequence function output 1.
–	–	A977	2	Set to “Logic sequence function always ON”.

■ **Input function command 16: COUNT 1 (counter), Input function command 17: COUNT 2 (counter)**

COUNT1 and COUNT2 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 SETt and RESET commands described later.

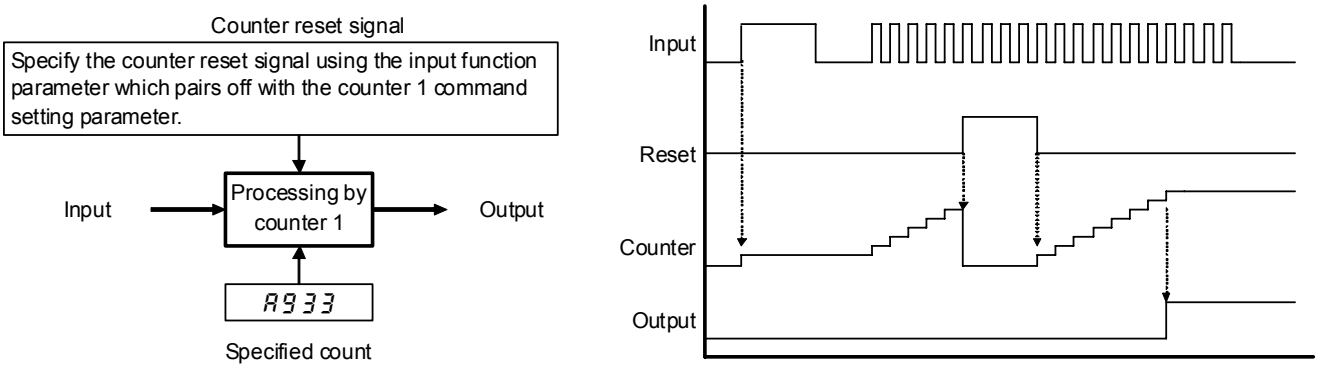


Fig. 8-3 Processing by counter

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 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.

<Example> Input count signal from S1 terminal and input reset signal from S2 terminal.
When the count of 10 has been reached, ouput the signal from RY-RC terminal.

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F114	0	Assign the “no function” to the S1 terminal.
		F115	0	Assign the “no function” to the S2 terminal.
		F130	222	Assign the logic sequence function output 1 to the RY-RC terminal.
		A933	10	Set the count of 10 times for COUNT 1.
Unit 1	Step 1	A900	4	Read S1 terminal input signal (LD S1)
	Step 2	A901	16	Count the number of pulse signals from the S1 terminal.
		A902	5	Assign the reset signal output function to the S2 terminal.
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	1222	Transfer the result to the logic sequence function output 1.
–	–	A977	2	Set to “Logic sequence function always ON”.

Input function command 17 (COUNT 2 (counter)) is the same function as COUNT 1.
For command 17, however, the parameter A934 is used to set the count.

■ **Input function command 18: HOLD (peak hold)**

The HOLD command makes the inverter hold the peak value of anlog input signal and monitor date, as illustrated in the timing chart below.

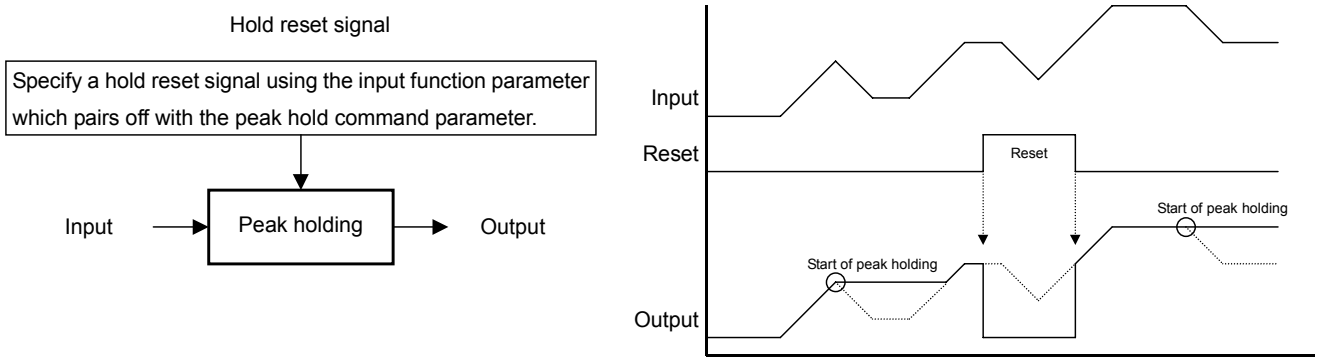


Fig. 8-4 Processing by peak hold

＜Example＞ Hold the peak output current. When the output current ecceeds 120% of the rated current, output the signal from RY-RC terminal. Reset the holding by the signal from S1 terminal.

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F114	0	Assign the “no function” to the S1 terminal.
		F130	222	Assign the logic sequence function output 1 to the RY-RC terminal.
		A918	120	Assign a reference value of 120% to the output percent data 1.
Unit 1	Step 1	A900	3003	Read the output current. (LD Output current)
	Step 2	A901	18	Start holding the peak output current.
		A902	4	Assign the reset signal output function to the S1 terminal.
	Step 3	A903	9	Output a signal if the peak value reaches 120% of the rated current.
		A904	918	
	Step 4	A905	1222	Transfer the result to the logic sequence function output 1.
–	–	A977	2	Set to “Logic sequence function always ON”.

■ **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 if the input signal is turned off. The RESET command is used to turn off the output signal.

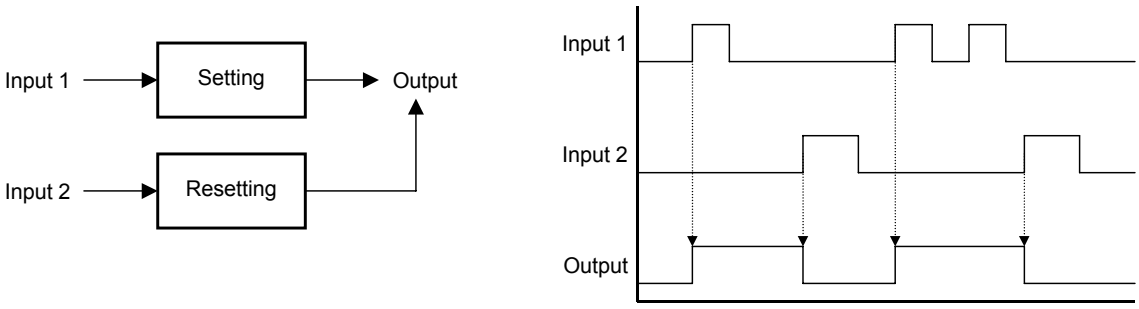


Fig. 8-5 Setting and resetting

<Example> Input a signal to F terminal, and output the hold signal by SET command from RY-RC terminal. Reset the output signal by the signal from S1 terminal.

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F111	0	Assign the “no function” to the F terminal.
		F114	0	Assign the “no function” to the S1 terminal.
		F130	222	Assign the logic sequence function output 1 to the RY-RC terminal.
Unit 1	Step 1	A900	1	Read F input terminal signal. (LD F)
	Step 2	A901	19	Send a signal to the logic sequence function output 1 by the SET command , and output a hold signal from the RY-RC terminal.
		A902	1222	
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	0 (Default)	NOP command (not operation)
Unit 2	Step 1	A906	4	Read S1 input terminal signal. (LD S1)
	Step 2	A907	20	Cancel the hold command of the logic sequence function output 1 by the RESET command.
		A908	1222	
	Step 3	A909	0 (Default)	NOP command (not operation)
		A910	0 (Default)	
	Step 4	A911	0 (Default)	NOP command (not operation)
–	–	A977	2	Set to “Logic sequence function always ON”.

■ **Input function command 21: CLR (clear)**

■ **Input function command 22: CLRN (clear (inversion))**

The CLR command turns off the input signal setted by the logic sequence function when the clear signal is turned on, as shown in the figure below. The CLRN command turns off the input signal when the clear signal is turned off.

Fig. 8-6 Processing by clear

<Example> Turn off the input signal from F terminal by the clear command from R terminal.

		Title	Parameter setting	Description
Prior setting	–	A977	0 (Default)	Set to “Disabled” of the Logic sequence function.
		F111	0	Assign the “no function” to the F terminal.
		F112	0	Assign the “no function” to the R terminal.
		F130	222	Assign the logic sequence function output 1 to the RY-RC terminal.
Unit 1	Step 1	A900	1	Read F input terminal signal. (LD F)
	Step 2	A901	21	CLR command for the F terminal.
		A902	2	Assing the reset command to the R terminal
	Step 3	A903	0 (Default)	NOP command (not operation)
		A904	0 (Default)	
	Step 4	A905	1222	Transfer the result to the logic sequence function output 1.
–	–	A977	2	Set to “Logic sequence function always ON”.