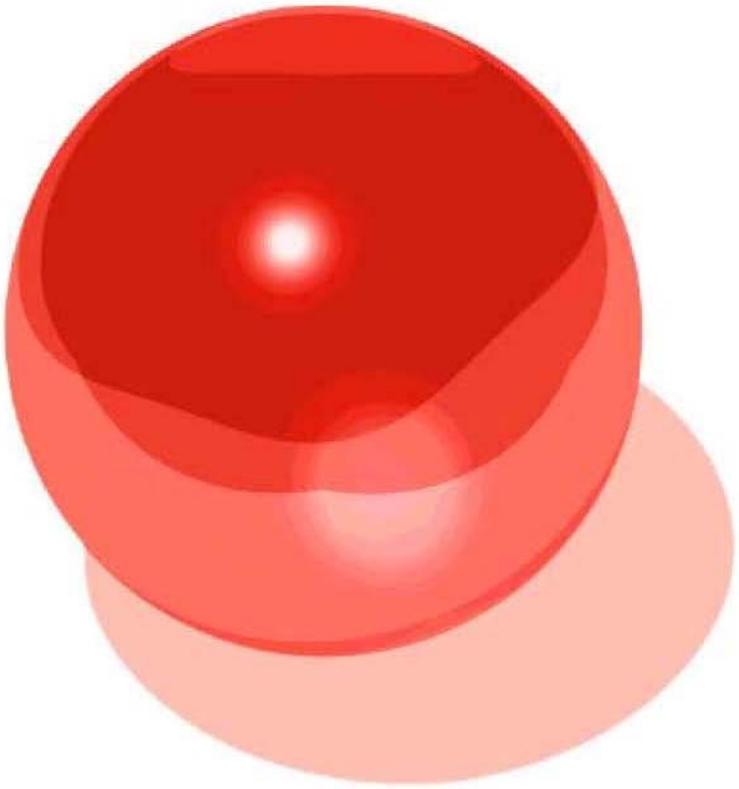
TOYODENKI

μGPCsx

Series

Programming Manual
Instruction Word



IGE007A

Thank you very much for purchasing TOYO FA Digital Controller μGPCsx.

This Programming Manual –Instruction word is to explain the way of thinking in programming, relays and registers, and each instruction word. Read this Programming Manual carefully to use the μGPCsx properly.

Also, read the relevant manuals given in the following table as well.

Description	Manual Number	Contents
μGPCsx Series Programming Manual (Operation)	IGJ058A	Explanations of the menus, icons, etc. of the TdsxEditor as well as of all the operations of the TdsxEditor.
μGPCsx Series Programming Manual (Technique)	IGJ059A	It explains how to configure and prepare programs.
μGPCsx User's Manual (Hardware)	IGJ060A	It explains the system configuration, specifications of hardware of each module, etc. of the μGPCsx Series

Caution

(1) Reprint and reproduction of this manual in part, or in its entirety are prohibited.

(2) Please note that the contents of this manual are subject to change without prior notice for improvements.

(3) Regarding the contents of this manual, we have tried to make them as much complete as possible, but if you have noticed any ambiguities and/or errors etc., please do not hesitate to contact our sales office stated at the back of this manual. When you do so, please inform us of the manual number indicated on the front cover.

Read the “Safety Notice” carefully before using the product, and use it properly.

In this manual, matters that require attention for safety are divided into “Danger” and “Caution”, which have the following meanings.

Danger : Mishandling may cause death or serious injury.

Caution Mishandling may cause intermediate bodily injury, minor injury or damage to property.

Note that the matter described with Caution may cause serious results depending on the circumstances.

Each of the above describes important contents, which must strictly be observed.

Matters requiring special attention are given below, which are also indicated by the above marks in the text of this manual.

Danger
• Emergency stop circuit, interlock circuit etc. must be configured outside of the PC. Failure to observe this may result in breakage in machines or accidents caused by a fault of the PC.

Caution
• Change of a program, forced output, start, stop etc. while in operation must be made after making sure that safety has been secured. Failure to observe this may cause breakage in machines or an accident as a result of functioning of machines by misoperation.

* Manual number is indicated at the right side of the bottom of the cover sheet of this manual.

Printed date	* Manual number	Contents of revision
May, 2001	IGJ060A	Printing of the First Edition (Temporary Edition)

Chapter 1
Outline

Chapter 1 Outline

In the μGPCsx series, we have developed a new language for the μGPC as a control language for application programs, without using computer languages (assembly language, C-language, etc.).

The μGPC language employs the ladder network that has been conventionally used in sequencers, etc. for logic operations, and D-F-S (data-flow-symbol) that has been used in analog computers, etc. for numerical operations, and is a new programming technique that enables the visual programming on programming tools that make use of personal computers.

The μGPC language features the following.

(1) It has an optimum language system that has revolutionized the concept of computer languages.
(It does not describe the processing procedure of a microprocessor, but describes the processing procedure of data.)

(2) It is a graphic display language and makes a program very easy to understand, thus enabling a programming with minimum errors.
(It is possible to program both logic operations and data processing on the same screen.)

(3) Since it automatically converts the types of data handled (integer, BCD type, real number, etc.), there is no need to use type conversion instructions in a program.
(If a data is used by dividing it, conversion instructions can be used.)

(4) Since abundant time series functions for control such as S-letter operation, etc. can be utilized, a function that has been realized by means of multiple ladder symbols can be described with 1 symbol, thus enabling anyone to create programs.
(Because it automatically adjusts the time spent for the execution of a program while measuring it, you do not need to pay attention to the time at all.

(5) With it, you can make index decorations by means of 3 index registers (X, Y and Z), and also can create flexible programs typical of computers.
(It also helps decrease the number of steps by means of a program loop using jump instructions.)

(6) It enables you to prepare structured programs using subprograms with ease.
(It is best suited to the reuse and standardization of application programs.)

(7) With it, you can create 2 multi-task programs, thereby constructing an efficient system.
(Since the execution cycle time can independently set, the execution cycle can be divided into 2, a fast one and a slow one.)

(8) Because all the information regarding programs is stored in CPU main body, even if the personal computer that was used at the time of development has been damaged, you can maintain it by using another personal computer.
(Since the comments on programs can also be recovered, maintenance can be carried out as a set of programs, comments and execution data.)

(9) By mean of a programming tool (TDsxEditor) that has a rich supply of convenient functions, the changing work at the time of a system change can be carried out in a very short time, with minimized errors and surely.
(For the details of loader, monitor, debugger, trend, trace back functions, etc. while in the state of being RUN, refer to the TdsxEditor Operation Manual.)

Chapter 2
Programming Method Using the -GPC Language

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Programming Method Using the -GPC Language

In the μGPCsx, programs loaded on 1 CPU is constructed using a concept of project.

A project is given a name that can be changed freely. (You should determine the most appropriate name.)

1 project can be divided into 4 parts: system definition, task 1, task 2 and subroutine.

(1) System definition

This is to define the hardware related conditions of CPU, consisting of 4 parts: system configuration definition (I/O assignment), system operation definition, CPU operation definition and redundancy definition.

(2) Task 1, task 2

A task having higher priority is made to be task 1, which consists of scan time, memory transfer definition, trace back setting and other multiple programs. Each subprogram is given a program name (it shall be NoName if no designation is made), which can be changed to any appropriate processing name, etc. that it handles within a program.

1 subprogram should be written on a programming sheet comprising 12 horizontal columns and 19 vertical rows. 1 programming sheet is made to be 1 page, and pages can be added successively.

Within a subprogram, local symbols can be used, but a handing over between subprograms can only be effected by the global memory.

(3) Subroutine

It is a subroutine commonly used, in the same way as the subprograms in task 1 and task 2.

The name of a subroutine (in 6 English alphanumeric codes) should be determined and added.

(4) Programming sheet

Of the 12 horizontal columns, each column comprises a symbol insertion part and a crosspoint part. By placing symbols in these parts and inputting label names, a program is completed.

(There are not END instruction or compiling operation, with a compilation being automatically made at the time of quitting the editor.)

In columns 1 - 11, the contact using the ladder symbols and data flow symbols can be placed.

Column 12 is dedicated to a coil using the ladder symbols, and nothing can be placed except a coil.

Also, there is no crosspoint in column 11, and therefore no intersection of addition instructions or ladder symbols can be inserted.

Usually, 2-term operators (addition, subtraction, multiplication, etc) are placed at a cross point, but as for the C-contact, since its contact name is input, it is to be placed in the symbol insertion part.

Of the 19 vertical rows, each row (line) comprises a label name part, a symbol insertion part and a data comment part.

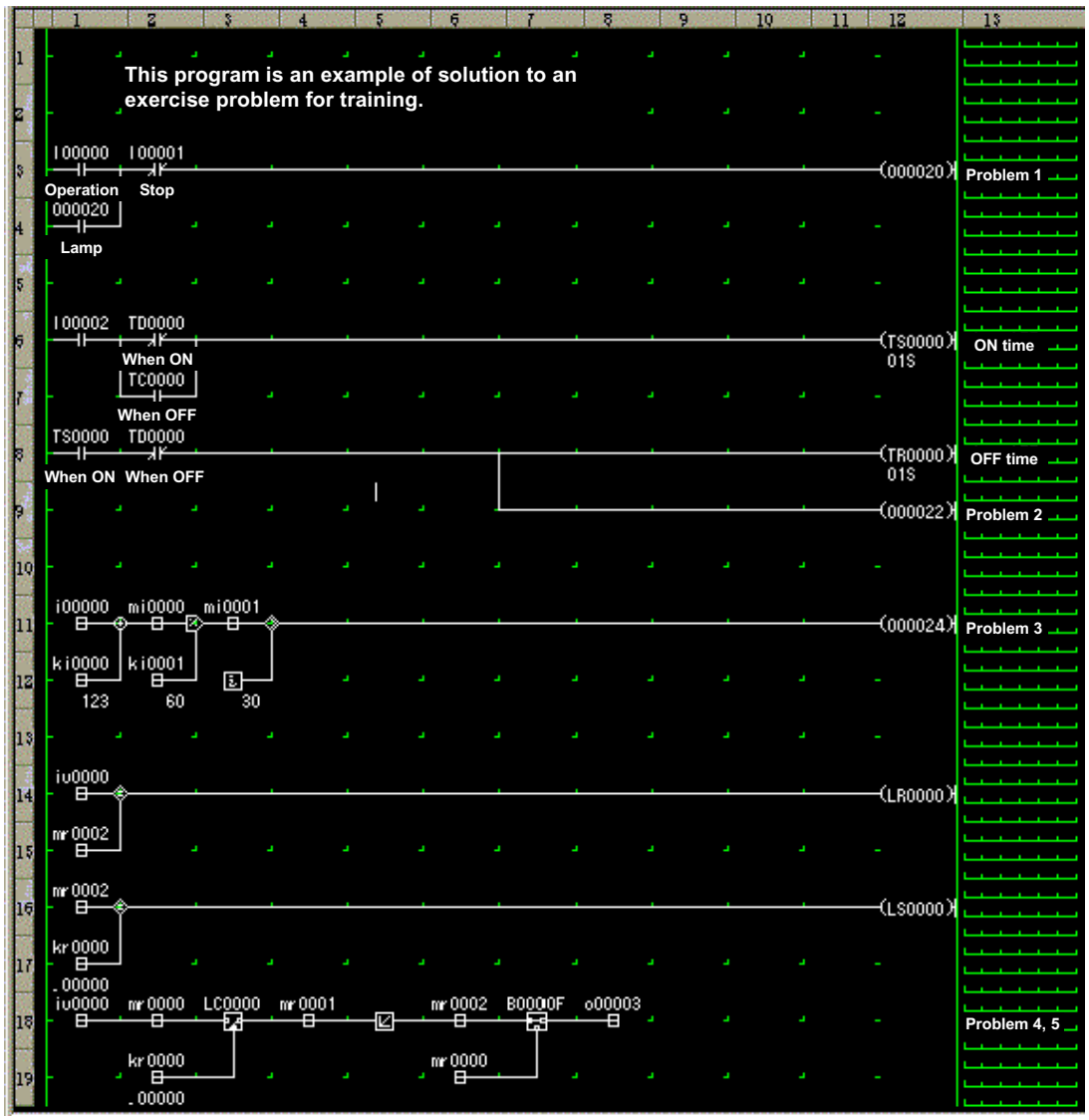
In a program that uses crosspoints, a programming is made over multiple rows, but a program exceeding 19 lines shall be divided in multiple pages using a temporary label.

(5) Program comment

In the programming sheet, column 13 can be used for comments as shown in the programming example in the figure below, and if a coil is placed with a ladder symbol, it is reflected to the position of comment at the applicable contact point. (It is automatically displayed, unless it is input at the contact side.)

Note, however, that the maximum characters that can be input are three 2-byte characters (six 1-byte characters), and hence consider a character string that is best suited to your identification of it.

Also, as in the first line, the position for comments bearing no symbols can be used for comments in its entirety.



(6) Explanations on the sample program

For your reference, explanations are given of the example of programming for the exercise problem for training mentioned above.

The 1st line is a comment line. As shown in this example, the contents of the program, etc. should be described beforehand.

The 2nd line is a blank line. It is inserted, where necessary, to make the program list easier to read.

The 3rd - 4th lines are ladder symbols of a HOLD circuit that uses a typical 2-operation switch.

By turning the input switch I00000 ON, the lamp circuit O00020 is turned on to light up, and the status is kept on HOLD.

I00001 is a B-contact input switch to release the above HOLD. If it is ON, the above lamp is turned off.

The 5th line is a blank line.

The 6th - 9th lines are a flash circuit of a lamp in which an on-delay timer and an off-delay timer are combined. Each of the on-time and off-time can independently be changed.

The setting time of each timer should be specified at the lower side of the coil in column 12 for time setting. In the example above it is set at 1.0 S (second), but the setting can be made up to 2 hours, representing the hour by H, the minute by M, and the second by S. The minimum unit is 10 mS, which should be written as 0.01 S.

The 10th line is a blank line.

The 11th - 12th lines are a circuit to read a numerical data from the 16-bit input module, add a constant 123 to it, divide the added value by 60 to obtain a remainder, and turn the lamp on if the remainder exceeds 30.

Since the results of operations in the process are stored in registers, when debugging you can monitor the result while checking these. At the right side of the comparison instruction symbol comes the logic operation symbol.

The 13th line is a blank line.

The 14th - 19th lines show an example of a pattern generation circuit that uses a latch relay and a change ratio limitation function (we call it ARC). It generates triangular waves continuously. The wave height value can be set from the input module using numerical values of BCD type. The cycle can be changed indirectly by changing the alteration ratio parameters of the ARC function. In the 18th line and the 19th line, real number operation, integer operation and BCD operation are mingled, and the patterns are continuously generated by switching the input value of ARC by means of the C-contact.

The C-contact at B0000F is for test use, and it directly output the input value by turning it on using a debugger.

Chapter 3
Data Type and Range That Can Be Handled

Chapter 3 Data Type and Range That Can Be Handled

The data handled in the μGPCsx is represented by a label name of 2-digit type plus 4-digit hexadecimal number.

Also, the foremost 1 digit of the hexadecimal number can be replaced by the index label X, Y, Z.

Examples of a label: IOX123 b0y234 mr02AF

3-1 Kinds of Data

The data handled in the μGPCsx can roughly be divided into 2 kinds: "logic data" and "numerical data".

3-1-1Logic Data

- Logic data is a data that represents logic of 1 bit, namely "1" or "0".
- Logic data is processed by logic operations, etc.
- Logic data is stored in a "relay", and it can be referred to in a program by designating a "relay number".
- The result of operation of the comparison operation symbol is a logic data.

Points

- In the μGPCsx, that which stores logic data is called a "relay".
- "1" in logic data corresponds to the state of "ON" of a relay, and "0" in logic data corresponds to the state of "OFF" of a relay.

3-1-2Numerical Data

- Numerical data is a data that represents 16 bits (1 word) or 32 bits (2 words) as 1 unit.
- Numerical data is stored in a "register", and it can be referred to in a program by designating a "register number".
- The input condition of the comparison operation symbol is a logic data.

Point

- In the μGPCsx, that which stores numerical data is called a "register".

An uppercase character should be used as the initial letter of the relay number of a logic data.

(e.g) I00000

A lowercase character should be used as the initial letter of the register number of a numerical data.

(e.g) i00000

3-2 Kinds of Data Types

3-2-1Types of Logic Data

There is no particular distinction of types.

The data that can be handled is 1 (ON) or 0 (OFF).

3-2-2Types of Numerical Data

There are the following 5 kinds, which will be explained in 3-3 and thereafter.

[1] 16-bit integer type (i-form)

[2] 16-bit BCD type (u-form)

[3] 32-bit integer type (w-form)

[4] 32-bit BCD type (v-form)

[5] 32-bit real number type (r-form)

3-3 16-bit integer type (i-form)

It represents a 16-bit integer value signed data as 1 unit (1 word).

The range of data that is handled internally is:

-32,768 - 32,767 (8000H - 7FFFH)

Such a numerical data is called a “16-bit integer data”.

3-4 16-bit BCD type (u-form)

It represents a 16-bit BCD (binary coded decimal) data of 4-digit as 1 unit (1 word).

The range of data that is handled internally is:

0000 - 9999 (0000H - 270FH)

Such a numerical data is called a “16-bit BCD data”.

Note: The 16-bit BCD data can only be used with regard to a data exchanged with an input and output (I/O) unit (I/O data).

3-5 32-bit integer type (w-form)

It represents a 32-bit integer value signed data as 1 unit (2 words occupied).

The range of data that is handled internally is:

-2147483648 - 2147483647 (80000000H - 7FFFFFFFH)

Such a numerical data is called a “32-bit integer data”.

Note: The 32-bit integer data can only be used with regard to a data exchanged with an input and output (I/O) unit (I/O data).

3-6 32-bit BCD type (v-form)

It represents a 32-bit BCD (binary coded decimal) data of 8-digit as 1 unit (2 words occupied).

The range of data that is handled internally is:

00000000 - 99999999 (00000000H - 05F5E0FFH)

Such a numerical data is called a “32-bit BCD data”.

Note: The 32-bit BCD data can only be used with regard to a data exchanged with an input and output (I/O) unit (I/O data).

3-7 32-bit real number type (r-form)

It represents a 32-bit floating-point format data as 1 unit (2 words occupied).

The range of data that is handled internally is:

$-6.2573187 \times 10^{38}$ - 6.2573187×10^{38}

Such a numerical data is called a “32-bit real number data”.

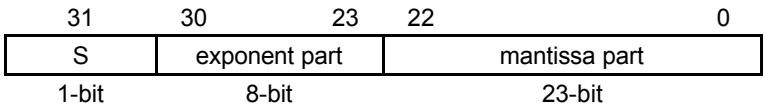
For reference: The 32-bit real number data is handled internally as follows.
(There is no need for a user to pay attention to it.)

$(-1)^{S} \times 2^{e-127} \times 1.f$

s: value of the sign part

e: value of the exponent part

f: value of the mantissa part (normalized to a 23-bit binary number)



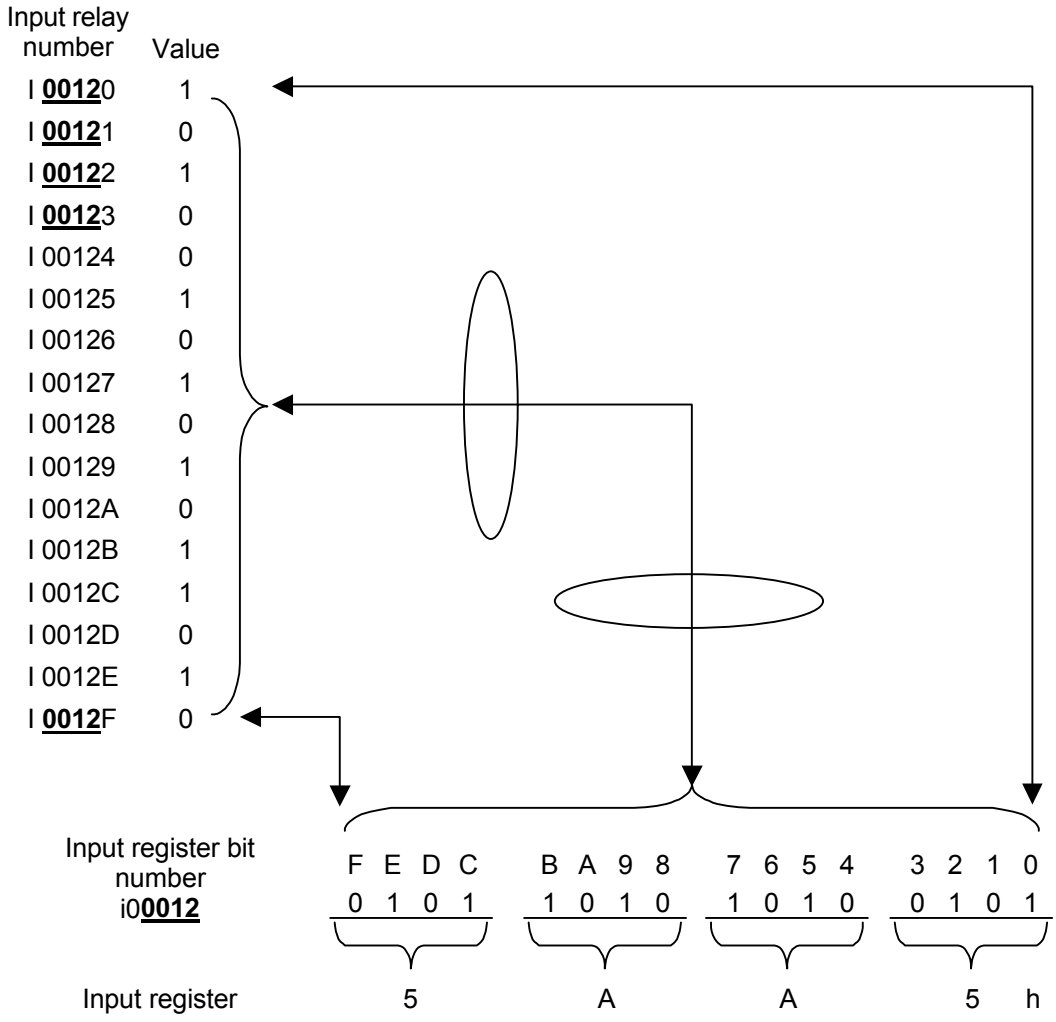
3-8 Relation Between the Logic Data and the 16-Bit Integer Data (i-Form)

The "logic data" handled in the μGPCsx can be put together into a group of 16 bits that is put in correspondence with one "16-bit integer (i-form) data".

In this case, there are the following relations among the logic data and 16-bit integer data, and the relay and register that store these data, and the relay number and register number.

(Example) Continuous relay numbers I00120, I00121, - I0012F are in correspondence with the input relays that contain 16 pieces of logic data. Meanwhile, register number i00012 is in correspondence with the input register that contains 1 piece of 16-bit integer data. The relation between both of these can be illustrated as Fig. 3.1.

This figure represents how the content of input register i00012: 5AA5 (hexadecimal) is developed in input registers I00120, I00121, - I0012F.



Likewise, the relation of correspondence between the input relays that are put into a group of 16 bit and the input register is as follows.

Input relay number	Input register bit number
I00000, I00001, -, I0000F	i00000
I00010, I00011, -, I0001F	i00001
I00020, I00021, -, I0002F	i00002

Aside from these, each kind of relays such as output relays, link relays, auxiliary relays, etc. can likewise be put in correspondence with the output register, link register, auxiliary register, etc.

Point: Relation of correspondence between the relay number and the register number

(Example)

Relay number I00123 represents bit number 3 of register number i00012.

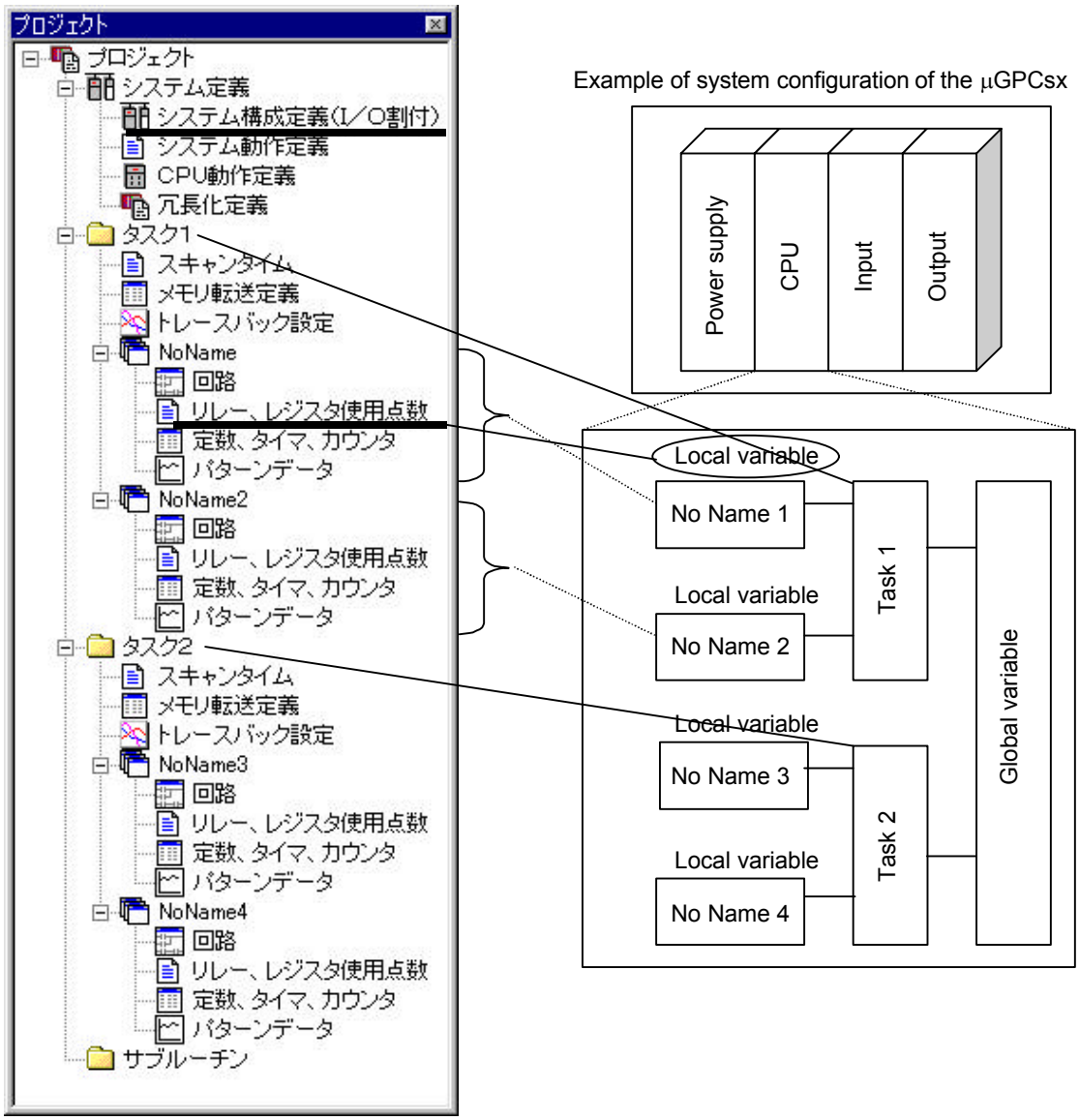
Note: The range of relay numbers and register numbers depends on the kinds of relays and registers.

Some registers will make no sense when developed in relays, and hence they cannot be developed (kr, mr, mi, etc.)

Chapter 4
Kinds of Relays and Registers

Chapter 4 Kinds of Relays and Registers

4-1 Relation Between the Local Variable and Global Variable and the Subprogram



- Local variable ---- A variable that can be referred to within 1 subprogram only (it cannot be referred to from other subprograms).

  The number used should be set by the "number of relays and registers" in each subprogram.

  It should be prepared by dividing it depending on the processing function.

  (Example) mi, B0, etc.

- Global variable -- A variable that can be referred to from any subprogram within 1 project.

  The number used should be set by the parameters of CPU in the "system configuration definition".

  (Example) G0, fi, RI, etc.

4-2 Number of Relays and Registers That Can Be Used

[1] Global variable

The maximum number of variables that can be used in any POU (program) within a project is given in the table below.

Name	Number used (Maximum)	Kind	Data number	Data direction	Remarks
Input relay	8,192	Contact	I00000 - I01FFF	Load	*1
Input register	512	Input data	i□0000 - i□01FF		*3
Output relay	(8,192)	Coil, contact	O00000 - O01FFF	Store	*1
Output register	(512)	Output data	o□0000 - o□01FF		*3
Announcing relay	32,768	System information	Z00000 - Z07FFF	Load	
Announcing register	2,048		z00000 - z007FF		
Global relay	131,072	Coil, contact	G00000 - G1FFFF	Load Store	
Global register	8,192	Global data	g00000 - g01FFF		
	4,096		gr0000 - gr1FFE		*2
Retain relay Retain register	65,536	Coil, contact	RI0000 - RIFFFF	Load Store	
	4,096	Retain data	ri0000 - ri0FFF		
	2,048		rr0000 - rr0FFF		*2
Network relay Network register	65,536	Coil, contact	FI0000 - FIFFFF	Load Store	
	4,096	Network data	fi0000 - fi0FFF		
	2,048		fr0000 - fr0FFE		*2

*1: The number used should be a total number of inputs and outputs.

*2: No odd number can be used.

*3: In the □, u (BCD 4-digit), v (BCD 8-digit) or w (32-bit integer) is to be indicated, which represents the type of an I/O register.

[2] Local variable

The maximum number that can be used in each subprogram is given in the table below.

Name	Number used (Maximum)	Kind	Data number	Data direction	Remarks
Auxiliary relay	512	Coil, contact	B00000 - B001FF	Load	
Auxiliary register	32	Auxiliary data	b00000 - b0001F	Store	
Latch relay Latch register	512 32	Set coil	LS0000 - LS01FF	Load	
			ls0000 - ls001F	Store	
		Reset coil	LR0000 - LR01FF	Load	
			lr0000 - lr001F	Store	
		Latch contact	LC0000 - LC01FF	Load	
			lc0000 - lc001F		
ON differential relay ON differential register	512 32	Coil	US0000 - US01FF	Load	
			us0000 - us001F	Store	
		Differential contact	UC0000 - UC01FF	Load	
			uc0000 - uc001F		
OFF differential relay OFF differential register	512 32	Coil	DS0000 - DS01FF	Load	
			ds0000 - ds001F	Store	
		Differential contact	DC0000 - DC01FF	Load	
			ds0000 - ds001F		
ON timer ON timer register	224 14	Coil, instantaneous contact	TS0000 - TS00DF	Load	
			ts0000 - ts0009	Store	
		Timing contact	TD0000 - TD00DF	Load	
			td0000 - td0009		
	224	Lapse of time	tn0000 - tn00DF	Load	
OFF timer OFF timer register	224 14	Coil, instantaneous contact	TR0000 - TR00DF	Load	
			tr0000 - tr0009	Store	
		Timing contact	TC0000 - TC00DF	Load	
			tc0000 - tc0009		
	224	Lapse of time	tf0000 - tf00DF	Load	

Name	Number used (Maximum)	Kind	Data number	Data direction	Remarks
Counter	192	Reset coil	NR0000 - NR00BF	Load	
			nr0000 - nr000B	Store	
		Preset coil	NP0000 - NP00BF	Load	
			np0000 - np000B	Store	
		UP coil	NU0000 - NU00BF	Load	
			nu0000 - nu000B	Store	
		DOWN coil	ND0000 - ND00BF	Load	
			nd0000 - nd000B	Store	
	12	Zero detection contact	NZ0000 - NZ00BF	Load	
			nz0000 - nz000B		
Counter register	192	Present value of the count		Load	
			N00000 - n000BF		
Operation data	512	Integer	mi0000 - mi01FF	Load	
	256	Real number	mr0000 - mr00FF	Store	
Constant data	512	Integer	ki0000 - ki01FF	Load	
	256	Real number	kr0000 - kr00FF		
Pattern data	10	Integer	pi0000 - pi0009	Load	*1
	10	Real number	pr0000 - pr0009		*1
Stack register	256	Integer	si0000 - si00FF	Load	
	128	Real number	sr0000 - sr007F	Store	*2
Index register	3	Integer	indx_x, indx_y, indx_z	Load Store	

*1: The number of patters that can be used varies depending on the setting of the number of points of pattern data.

*2: No odd number can be used.

(3) Shared structure of registers

The global register and stack register are in the relation of a shared body to realize the ease of handling.

The relation of a shared body between the relays, integer registers and real number registers of the global memory is given in the table below.

Among them, sr0000 represents a live line data, and sr0002 represents the first argument.

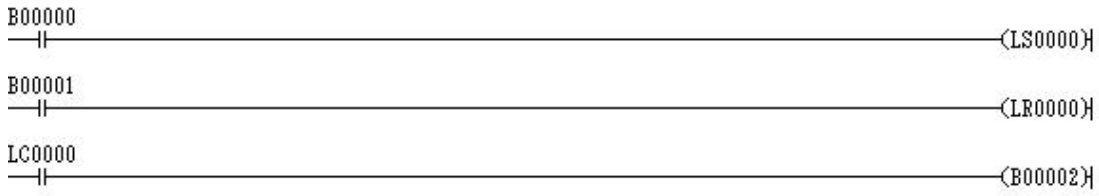
<table>
<tr><th>Relay name</th><th>Integer register</th><th>Real number register</th></tr>
<tr><td>G00000</td><td rowspan="3">g00000</td><td rowspan="6">gr0000</td></tr>
<tr><td>G00001</td></tr>
<tr><td>G00002
~
G0000F</td></tr>
<tr><td>G00010</td><td rowspan="3">g00001</td></tr>
<tr><td>G00011</td></tr>
<tr><td>G00012
~
G0001F</td></tr>
<tr><td>G00020
~
G0002F</td><td>g00002</td><td rowspan="2">gr0002</td></tr>
<tr><td>g00030
~
G0003F</td><td>g00003</td></tr>
</table>

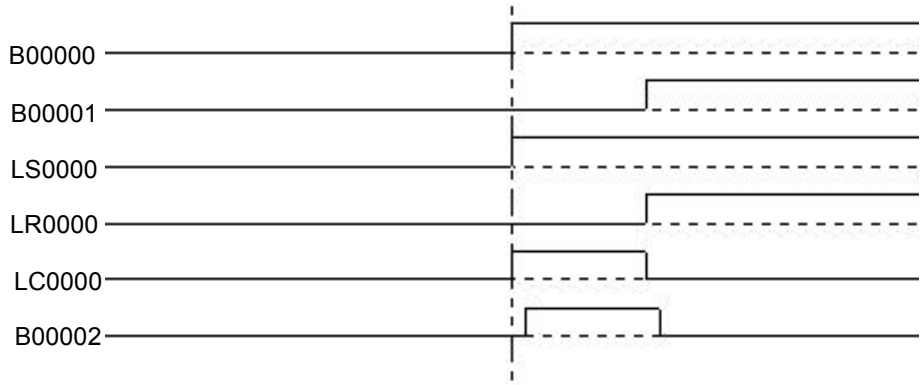
<table>
<tr><th>Relay name</th><th>Integer register</th><th>Real number register</th></tr>
<tr><td>SI0000</td><td rowspan="3">Si0000</td><td rowspan="6">sr0000</td></tr>
<tr><td rowspan="5"></td></tr>
<tr><td rowspan="4"></td></tr>
<tr><td rowspan="4"></td></tr>
<tr><td rowspan="4"></td></tr>
<tr><td>SI0020</td><td rowspan="3">Si0002</td><td rowspan="3">sr0002</td></tr>
<tr><td rowspan="3"></td></tr>
<tr><td rowspan="3"></td></tr>
</table>

Note: Since the relation of a shared body allows an operation from any register, special attention should be paid when using it.

4-3 Outline of the Special Relay

[1] latch relay/register





When set coil LS0000 is turned ON, latch contact LC0000 is turned ON, and 000020 is kept turned ON.

When reset coil LR0000 is turned ON, latch contact LC0000 is turned OFF, and 000020 is kept turned OFF.

The latch contact LC0000 delay for 1 scan from latch coil.

The latch coil is usually turned OFF when power supply is made open.

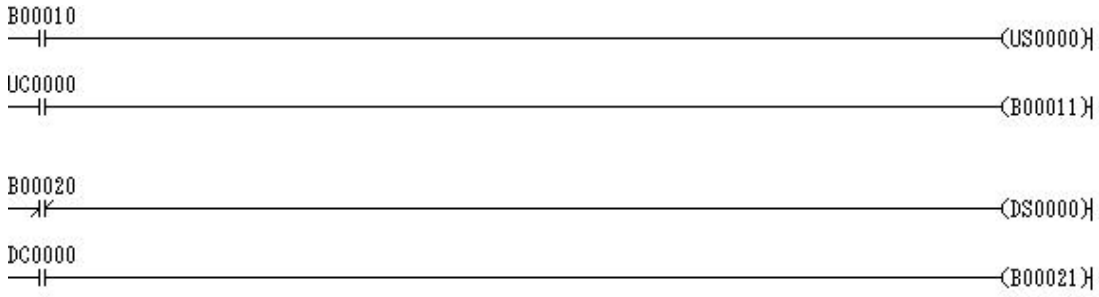
If you wish to retain the latch coil even when power supply is open, use the retain memory to transfer by means of the memory transfer definition, or use SET RESET functions (set the retain relay as a parameter).

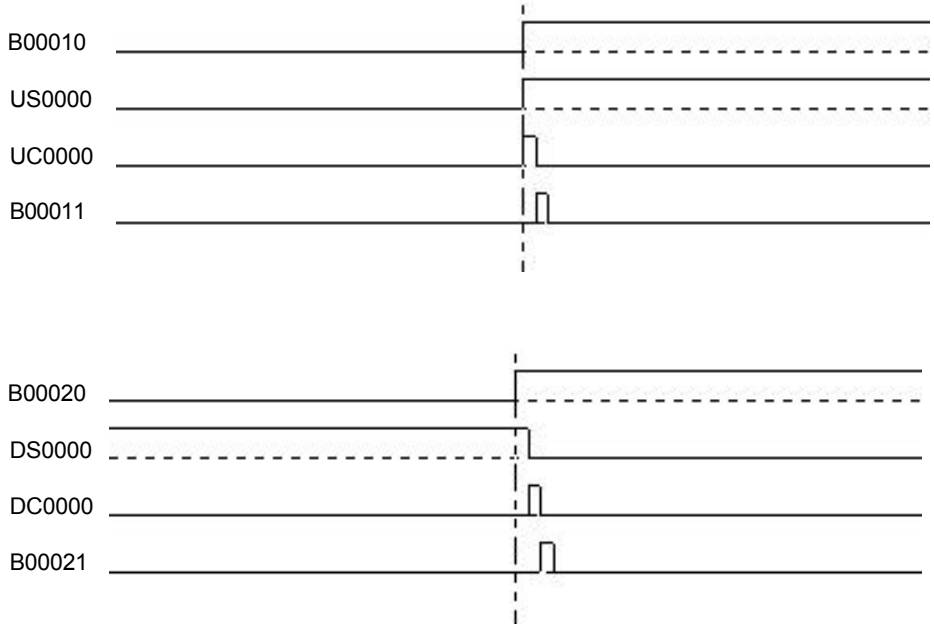
(Memory transfer definition: before operation) RI0000 → LC0000

(Memory transfer definition: after operation) LC0000 → RI0000

In order to realize the same functions within the subroutine, use SET RESET functions by means of SI0000 in the subroutine.

(2) ON/OFF differential relay/register



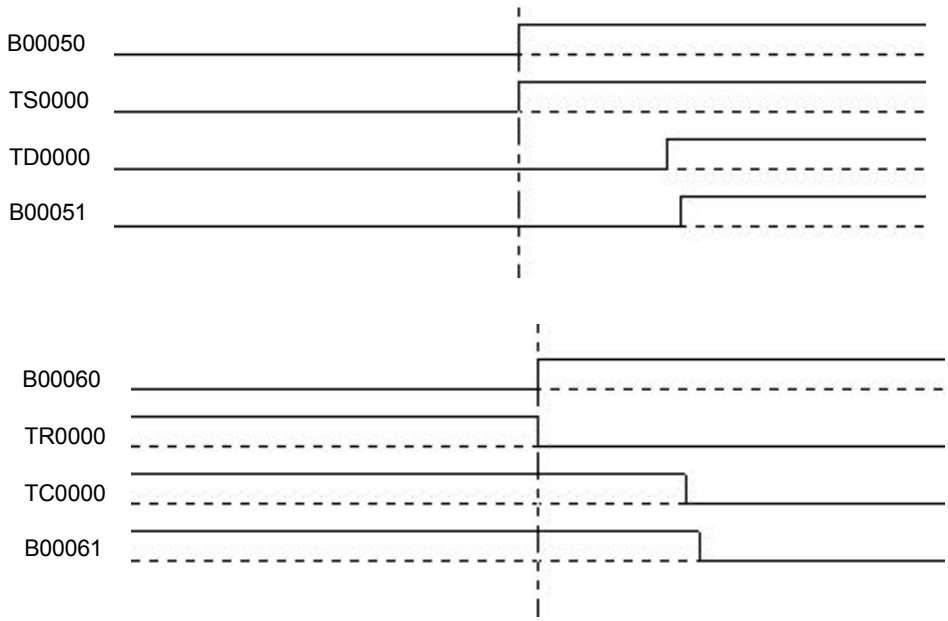


When coil US0000 is turned ON, after a delay for 1 scan, differential contact UC0000 is turned ON for 1 scan.

When coil DS0000 is turned OFF, after a delay for 1 scan, differential contact DC0000 is turned ON for 1 scan.

Aside from these, there are USUC function and DSDC function to realize the same functions.

[3] ON/OFF timer relay/register



When coil TS0000 is turned ON, after the set time has lapsed, timing contact TD0000 is turned ON. TD0000 is turned OFF within 1 scan after TS0000 has been turned OFF.

(The timer setting value should be input at the lower side of the TS coil.)

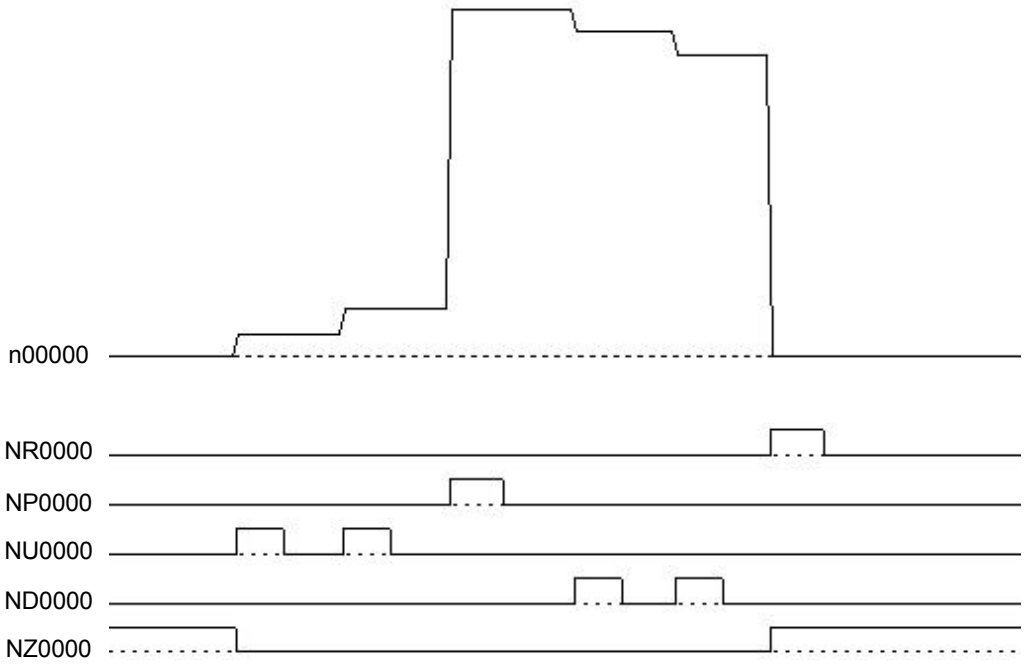
Where, S stands for second, M for minute and H for hour, and the setting can be made from 0.01 seconds to 2 hours.

When coil TR0000 is turned ON, timing contact TD0000 is turned ON within 1 scan after TR0000 has been turned ON. TD0000 is turned OFF after the set time has lapsed.

(The timer setting value should be input at the lower side of the TR coil.)

Where, S stands for second, M for minute and H for hour, and the setting can be made from 0.01 seconds to 2 hours.

[4] Counter relay/register



The initial value of the counter is 0. Next, the up coil is turned ON, and the counter value is increased by 1. Also, the zero detection contact is turned ON at 0 initially, but since 1 has been added, it is not 0, so it is turned OFF.

And in addition, the up coil is turned ON, and the counter value is increased by 1 to become 2.

The preset coil is turned ON, and the counter value becomes 15.

The preset value should be set at the lower side of the NP coil.

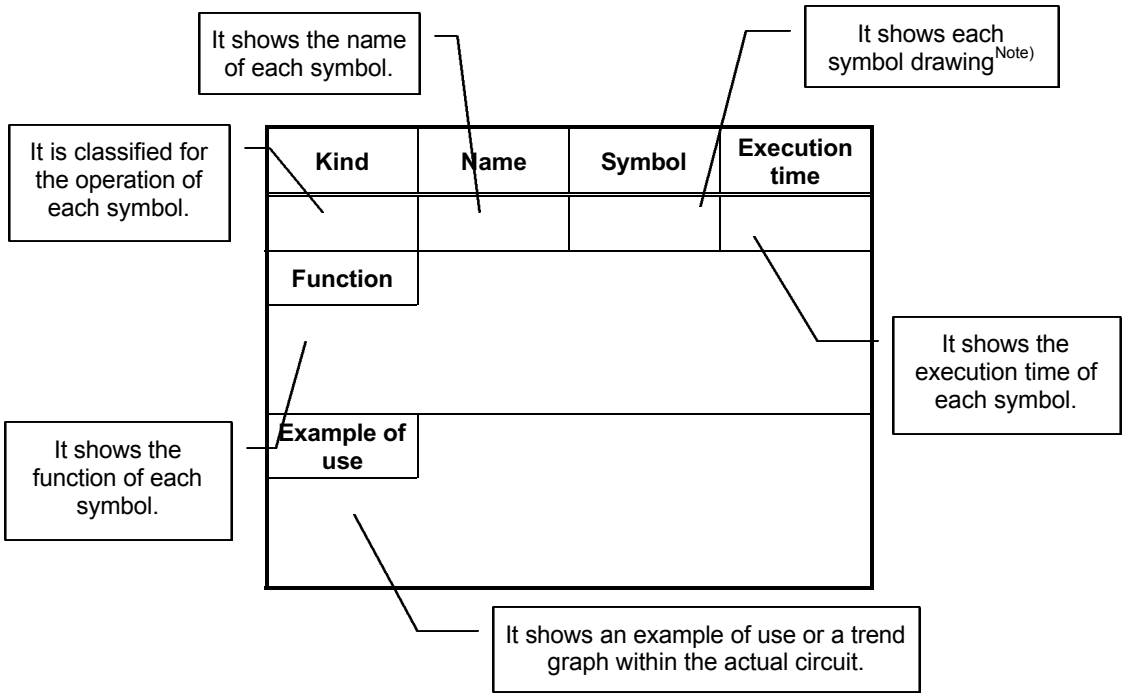
The down coil is turned ON, and the counter value is decreased by 1.

The reset coil is turned ON, and the counter value becomes 0, and the zero detection contact is turned ON.

Chapter 5
Explanations of Instruction Words

Chapter 5 Explanations of Instruction Words

How to read the table



Note) Relay and Reg that are displayed in the symbol column hereafter are explained herein.

The figure on the left shows a relay. Herein it is represented by the word RELAY for simplification. All the relays such as G0, I0, B0, etc. can be set to RELAY.

The figure on the left shows a register. Herein it is represented by the word REG for simplification. All the registers such as g0, mi, kr, etc. can be set to REG.

Kind	Name	Symbol	Execution time
LD language	A-contact	RELAY	0.02 [μs]
Function	If RELAY is ON, the input logic value is output. If it is OFF, the output logic value is turned OFF.		

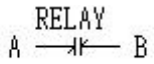
RELAY	A	B
ON	ON	ON
ON	OFF	OFF
OFF	X	OFF

X: don't care

Example of use

When both of relay B00000 and relay B00001 are ON, relay B00010 is turned ON.
In other cases than this, relay B00010 is turned OFF.

Kind	Name	Symbol	Execution time
LD language	B-contact	RELAY	0.02 [μs]
Function	If RELAY is OFF, the input logic value is output. If it is ON, the output logic value is turned OFF.		



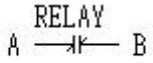
RELAY	A	B
OFF	ON	ON
OFF	OFF	OFF
ON	X	OFF

X: don't care

Example of use

When relay B00000 is ON and relay B00001 is OFF, relay B00010 is turned ON.
In other cases than this, relay B00010 is turned OFF.

Kind	Name	Symbol	Execution time
LD language	B-contact	RELAY	0.02 [μs]
Function	If RELAY is OFF, the input logic value is output. If it is ON, the output logic value is turned OFF.		



RELAY	A	B
OFF	ON	ON
OFF	OFF	OFF
ON	X	OFF

X: don't care

Example of use

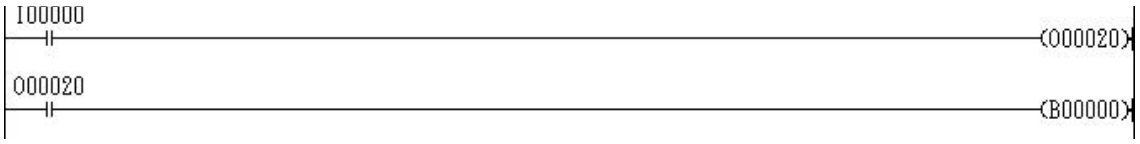
When relay B00000 is ON and relay B00001 is OFF, relay B00010 is turned ON.
In other cases than this, relay B00010 is turned OFF.

Kind	Name	Symbol	Execution time
LD language	Coil	—(RELAY)|	0.10 [μs]
Function	It outputs the input logic value to RELAY.		

A —(RELAY)|

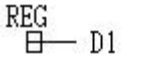
A	RELAY
ON	ON
OFF	OFF

Example of use

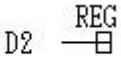


When relay I00000 is ON, both relay 000020 = 0N and relay B00000 are turned ON.
When relay I00000 is OFF, both relay 000020 and relay B00000 are turned OFF.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Load		Integer 0.48 [μs]
	Store		Real number 0.45 [μs]
Function	Load: The data in REG is made to be the output numerical value. Store: The input numerical value is output to REG.		

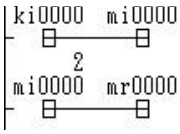


D1 = REG



REG = D2

Example of use



The data in register ki0000 (2) is loaded and stored in register mi0000.

Next, the data in register mi0000 is loaded and stored in register mr0000.

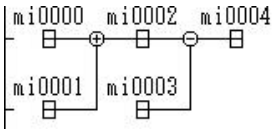
Since register mr0000 is a register of the real number type, type conversion from an integer to a real number is carried out and a data (2.0) is stored.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Store & load store	REG	Integer 0.48 [μs] Real number 0.45 [μs]
Function	The input numerical value is output to REG, and the data of REG is made to be the output numerical value. It is used when data in the midst of operation should be retained in REG.		

REG = D1

D2 = REG

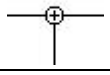
Example of use

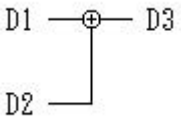


The data in register mi0000 and the data in register mi0001 are added and the result is stored in register mi0002.

Next, the data in register mi0003 is subtracted from the data in register mi0002 and the result is stored in register mi0004.

In register mi0002, the addition data in the midst of operation is stored.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Addition		Integer 1.15 [μs] Real number 1.13 [μs]
Function	Two input numerical values are added and the result is output. The operation can be made even if their types are different. However, an integer is converted to a real number, which is then subjected to the real number operation.		



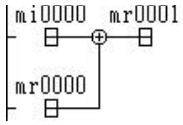
D3 = D1 + D2

On type conversion

If the type of the register being used in 1 operation block is the integer type or the 16-bit BCD type, the data are converted to the 16-bit integer type before subjected to operation, whereas if a register of the real number type, 32-bit integer type or 32-bit BCD type is used, it is converted to the real number type before subjected to operation.

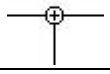
(After this, type conversion is also carried out for subtraction, multiplication, division, remainder, priority given to a higher-level, and priority given to a lower-level.)

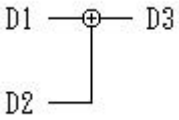
Example of use



The data in register mi0000 and the data in register mr0000 are added and the result is stored in register mr0001.

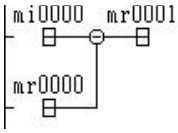
Although the data in register mi0000 is an integer, since the data in register mr0000 is a real number, addition is made after type conversion of integer/real number has been made.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Subtraction		Integer 1.27 [μs] Real number 1.25 [μs]
Function	Subtraction is made with two input numerical values and the result is output. Operation can be carried out even if the types are different. However, an integer is converted to a real number, which is then subjected to the real number operation.		



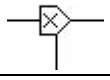
D3 = D1 - D2

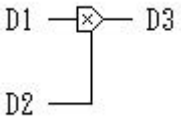
Example of use



The data in register mr0000 is subtracted from the data in register mi0000 and the result is stored in register mr0001.

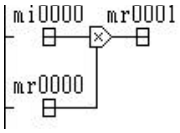
Although the data in register mi0000 is an integer, since the data in register mr0000 is a real number, subtraction is made after type conversion of integer/real number has been made.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Multiplication		Integer 1.17 [μs] Real number 1.13 [μs]
Function	Two input numerical values are multiplied and the result is output. Operation can be carried out even if the types are different. However, an integer is converted to a real number, which is then subjected to the real number operation.		



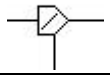
D3 = D1 * D2

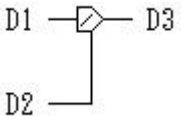
Example of use



Multiplication of the data in register mi0000 and the data in register mr0000 is performed and the result is stored in register mr0001.

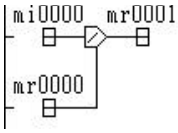
Although the data in register mi0000 is an integer, since the data in register mr0000 is a real number, multiplication is made after type conversion of integer/real number has been made.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Division		Integer 2.48 [μs] Real number 2.32 [μs]
Function	Division of two input numerical values is performed and the result is output. Operation can be carried out even if the types are different. However, an integer is converted to a real number, which is then subjected to the real number operation.		



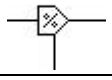
D3 = D1 / D2

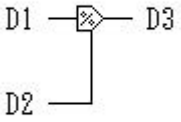
Example of use



Division of the data in register mi0000 and the data in register mr0000 is performed and the result is stored in register mr0001.

Although the data in register mi0000 is an integer, since the data in register mr0000 is a real number, division is made after type conversion of integer/real number has been made.

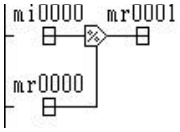
Kind	Name	Symbol	Execution time
Data flow language (Basics)	Remainder		2.48 [μs]
Function	Division of two input numerical values is performed and the result (remainder) is output.		



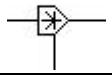
D3 = D1 % D2

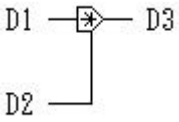
Note) Only operation with integers is valid.

Example of use



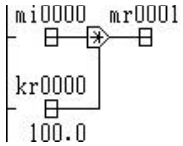
The data in register mi0000 is divided by the data in register mi0001 and the result (remainder) is stored in register mi0002.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Priority given to a higher-level		Integer 1.52 [μs] Real number 1.45 [μs]
Function	Two input numerical values are compared and a larger numerical value is output. Operation can be carried out even if the types are different. However, an integer is converted to a real number, which is then subjected to the real number operation.		



If D1 > D2, D3 = D1
If D1 ≤ D2, D3 = D2

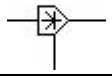
Example of use

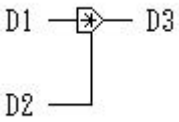


The data in register mi0000 and the data in register kr0000, 100.0 is compared and a larger data is stored in register mr0001.

Although the data in register mi0000 is an integer, since the data in register kr0000 is a real number, comparison is made after type conversion of integer/real number has been made.

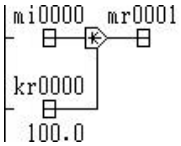
It serves as a limiter of which lower limt value is the data in register kr0000 (100.0).

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Priority given to a lower-level		Integer 1.43 [μs] Real number 1.64 [μs]
Function	Two input numerical values are compared and a smaller numerical value is output. Operation can be carried out even if the types are different. However, an integer is converted to a real number, which is then subjected to the real number operation.		



If D1 > D2, D3 = D2
If D1 ≤ D2, D3 = D1

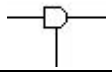
Example of use

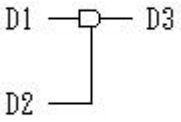


The data in register mi0000 and the data in register kr0000, 100.0 is compared and a smaller data is stored in register mr0001.

Although the data in register mi0000 is an integer, since the data in register kr0000 is a real number, comparison is made after type conversion of integer/real number has been made.

It serves as a limiter of which upper limit value is the data in register kr0000 (100.0).

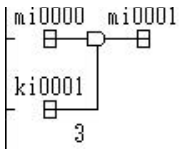
Kind	Name	Symbol	Execution time
Data flow language (Basics)	Product of numerical values		1.15 [μs]
Function	Logical multiplication operation of two input numerical values is performed and the result is output.		



D3 = D1 & D2

Note) Only operation with integers is valid.

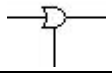
Example of use

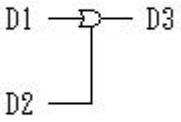


Logical multiplication operation of the data in register mi0000 and the data in register ki0001 (3) is performed and the result is stored in register mi0001.

If the data in register mi0000 is (10), then (2) is stored in register mi0001.

mi0000	0000	0000	0000	1010	(10)
ki0000	0000	0000	0000	0011	(3)
mi0001	0000	0000	0000	0000	(2)

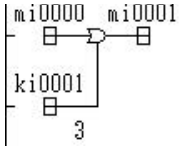
Kind	Name	Symbol	Execution time
Data flow language (Basics)	Sum of numerical values		1.15 [μs]
Function	Logical sum operation of two input numerical values is performed and the result is output.		



D3 = D1 | D2

Note) Only operation with integers is valid.

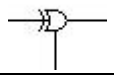
Example of use

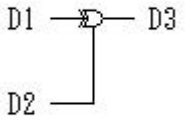


Logical sum operation of the data in register mi0000 and the data in register ki0001 (3) is performed and the result is stored in register mi0001.

If the data in register mi0000 is (10), then (11) is stored in register mi0001.

mi0000	0000	0000	0000	1010	(10)
ki0000	0000	0000	0000	0011	(3)
mi0001	0000	0000	0000	1011	(11)

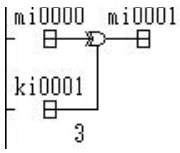
Kind	Name	Symbol	Execution time
Data flow language (Basics)	Exclusive OR of numerical values		1.15 [μs]
Function	Exclusive OR operation of two input numerical values is performed and the result is output.		



D3 = D1 ^ D2

Note) Only operation with integers is valid.

Example of use



Exclusive OR operation of the data in register mi0000 and the data in register ki0001 (3) is performed and the result is stored in register mi0001.

If the data in register mi0000 is (10), then (9) is stored in register mi0001.

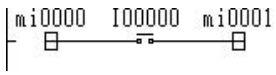
mi0000	0000	0000	0000	1010	(10)
ki0000	0000	0000	0000	0011	(3)
mi0001	0000	0000	0000	1001	(9)

Kind	Name	Symbol	Execution time
Data flow language (Basics)	a-contact	RELAY	Integer 1.52 [μs] Real number 1.33 [μs]
Function	If RELAY is ON, the input numerical value is output. If it is OFF, the output numerical value is made to be 0.		

D1 RELAY D2

If RELAY = ON, D2 = D1
If RELAY = OFF, D2 = 0

Example of use



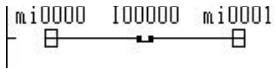
When relay I00000 is ON, the data in register mi0000 is stored in register mi0001.
When relay I00000 is OFF, (0) is stored in register mi0001.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	b-contact	RELAY	Integer 1.52 [μs] Real number 1.33 [μs]
Function	If RELAY is OFF, the input numerical value is output. If it is ON, the output numerical value is made to be 0.		

D1 RELAY D2

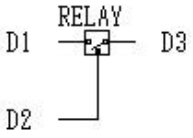
If RELAY = ON, D2 = 0
If RELAY = OFF, D2 = D1

Example of use

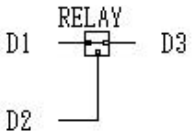


When relay I00000 is OFF, the data in register mi0000 is stored in register mi0001.
When relay I00000 is ON, (0) is stored in register mi0001.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	c-contact	RELAY RELAY	Integer 1.31 [μs] Real number 1.15 [μs]
Function	Depending on the logical value of RELAY, either of the two input numerical values is selected and output.		

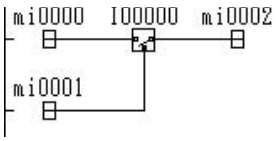


If RELAY = ON, D3 = D1
If RELAY = OFF, D3 = D2

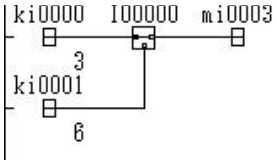


If RELAY = ON, D3 = D2
If RELAY = OFF, D3 = D1

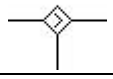
Example of use

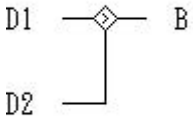


When relay I00000 is OFF, the data in register mi0001 is stored in register mi0002.
When relay I00000 is ON, the data in register mi0000 is stored in register mi0002.



When relay I00000 is OFF, the data in register ki0000 (3) is stored in register mi0003.
When relay I00000 is ON, the data in register ki0001 (6) is stored in register mi0003.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Compare high		Integer 1.17 [μs] Real number 1.21 [μs]
Function	Comparison of two input numerical values is performed and the result of decision is output as a logical value.		

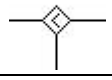


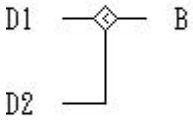
If D1 > D2, B = ON
If D1 ≤ D2, B = OFF

Example of use

If the data in register mi0000 is greater than the data in mi0001, relay 000020 is turned ON.
Otherwise relay 00020 is turned OFF.

It can change the logic in combination with the logical reversal.
If the data in register mi0002 is equal to the data in mi0003 or smaller than the data in mi0003, then relay 000021 is turned ON.
Otherwise relay 00020 is turned OFF.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Compare low		Integer 1.17 [μs] Real number 1.21 [μs]
Function	Comparison of two input numerical values is performed and the result of decision is output as a logical value.		

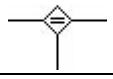


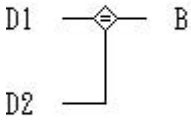
If D1 < D2, B = ON
If D1 >= D2, B = OFF

Example of use

If the data in register mi0000 is smaller than the data in mi0001, relay 000020 is turned ON.
Otherwise relay 00020 is turned OFF.

It can change the logic in combination with the logical reversal.
If the data in register mi0002 is equal to the data in mi0003 or greater than the data in mi0003, then relay 000021 is turned ON.
Otherwise relay 00020 is turned OFF.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Compare equal		Integer 1.17 [μs] Real number 1.21 [μs]
Function	Comparison of two input numerical values is performed and the result of decision is output as a logical value.		



If D1 = D2, B = ON
If D1 ≠ D2, B = OFF

Note) If a real number is in the register used, then in some cases the result may not be turned ON due to the minute numerical value that is not displayed.

Example of use

If the data in register mi0000 is equal to the data in mi0001, then relay 000020 is turned ON.
Otherwise relay 00020 is turned OFF.

It can change the logic in combination with the logical reversal.
If the data in register mi0002 is not equal to the data in mi0003, then relay 000021 is turned ON.
Otherwise relay 00021 is turned OFF.

Kind	Name	Symbol	Execution time
Data flow language (Basics)	Load local constant (integer, real number)		Integer 0.91 [μs] Real number 0.85 [μs]
Function	It loads a local constant (integer, real number).		

The constant is secured within the program (instead of the parameter).

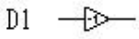
The load local constant (integer) can be used within the operation block of i-form only.

(Integer) and (real number) cannot mingle within 1 operation block.

Example of use

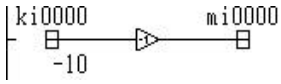
In register mi0000, the integer value (10) is loaded.
In register mr0000, the real number value (5.0000) is loaded.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Code conversion		Integer 0.38 [μs] Real number 0.15 [μs]
Function	Reversal of the positive/negative sign of input numerical values is performed and output.		

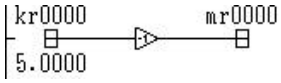


D2 = - (D1)

Example of use



The sign of the data in register ki0000 (-10) is converted to positive and (10) is stored in register mi0000.

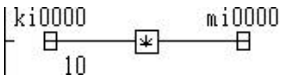


The sign of the data in register kr0000 (5.0000) is converted to negative and (-5.0000) is stored in register mr0000.

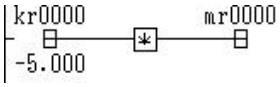
Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Absolute value conversion		Integer 0.40 [μs] Real number 0.15 [μs]
Function	It obtains the absolute value of the input numerical value and output it.		

If D1 < 0, D2 = - (D1)
If D1 >= 0, D2 = D1

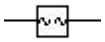
Example of use



Absolute value conversion is performed to the data in register ki0000 (10) and (10) is stored in register mi0000.



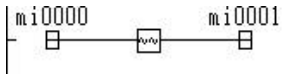
Absolute value conversion is performed to the data in register kr0000 (-5.0000) and (5.0000) is stored in register mr0000.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	1 'complement		0.40 [μs]
Function	Complement operation of the input numerical value is performed and the result is output.		

D2 = NOT (D1)

Note) Only operation with integers is valid.

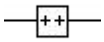
Example of use

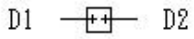


Complement operation of the data in register mi0000 is performed and the result is stored in register mi0001.

If the data in register mi0000 is (10), (-11) is stored in register mi0002.

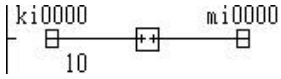
mi0000	0000	0000	0000	1010	(10)
mi0001	1111	1111	1111	0101	(-11)

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Increment		Integer 0.04 [μs] Real number 0.17 [μs]
Function	1 is added to the input numerical value and the result is output.		

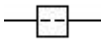


D2 = D1 + 1
(D2 = D1 + +)

Example of use

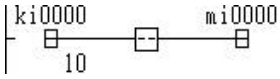


(1) is added to the data in register ki0000 (10) and the operation result (11) is stored in register mi0000.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Decrement		Integer 0.04 [μs] Real number 0.17 [μs]
Function	1 is subtracted from the input numerical value and the result is output.		

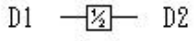
D2 = D1 - 1
(D2 = D1 - -)

Example of use



(1) is subtracted from the data in register ki0000 (10) and the result of operation (9) is stored in register mi0000.

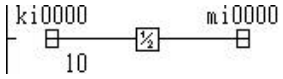
Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Half		0.42 [μs]
Function	The result of multiplying the input numerical value by one half is output.		



D2 = D1 / 2

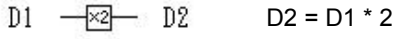
Note) Only operation with integers is valid.

Example of use



The data in register ki0000 (10) is halved and the result of operation (5) is stored in register mi0000. This instruction is used when the data in an integer register is to be multiplied by one half with the sign being retained.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Two times		0.08 [μs]
Function	The result of multiplying the input numerical value by two is output.		



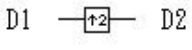
D2 = D1 * 2

Note) Only operation with integers is valid.

Example of use

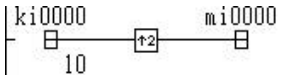
The data in register ki0000 (10) is multiplied by two and the result of operation (20) is stored in register mi0000. This instruction is used when the data in an integer register is to be multiplied by two with the sign being retained.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Second power		Integer 0.16 [μs] Real number 0.27 [μs]
Function	The result of obtaining the second power of the input numerical value is output.		



D2 = D1 * * 1
($D2 = D1^2$)

Example of use



The data in register ki0000 (10) is multiplied by itself and the result of operation (100) is stored in register mi0000.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Square root		Integer 2.04 [μs] Real number 1.10 [μs]
Function	Square root of the input numerical value is output.		

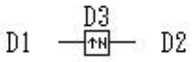
D2 = SQRT (D1)

Note) When the input value is a negative value, the output also takes a negative value.

Example of use

Square root of the data in register ki0000 (9) is obtained and the result of operation (3) is stored in register mi0000.

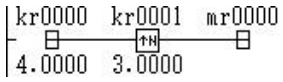
Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Exponential function		3.74 [μs]
Function	Exponential operation of the input numerical value is performed and the result is output.		



D2 = D3 * * D1
(D2 = $D3^{D1}$)

Note) This is valid for a real number operation only.

Example of use

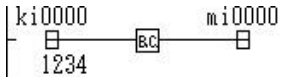


Exponential operation of the data in register kr0000 (4.0000) is performed with the data in register kr0001 (3.0000) as its exponent and the result of operation (64) is stored in register mr0000.

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Bit count		2.99 [μs]
Function	It reads the input numerical value as a 16-bit binary number, and outputs the number of bits that are ON.		

Note) Only operation with integers is valid.

Example of use



The data in register ki0000 (1234) is read as a 16-bit binary number, the number of bits that are ON (each of them is 1) is calculated, and the result of operation (5) is stored in register mi0000.

ki0000	0000	0001	1010	1010	(1234)
mi0001	0 +	1 +	2 +	2 =	(5)

Kind	Name	Symbol	Execution time
Data flow language (Function 1)	Gray code binary		15.1 [μs]
Function	The input numerical value (Gray code) is converted and the result is output in a binary number.		

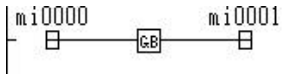
Since in the Gray code, only 1 bit changes as the numerical value changes, it is used in positioning control, etc.

The bit pattern of 0 - 15 is as follows.

D2 Integer	D1 Gray	D2 Integer	D1 Gray	D2 Integer	D1 Gray	D2 Integer	D1 Gray
0000	0000	0100	0110	1000	1100	1100	1010
0001	0001	0101	0111	1001	1101	1101	1011
0010	0011	0110	0101	1010	1111	1110	1001
0011	0010	0111	0100	1011	1110	1111	1000

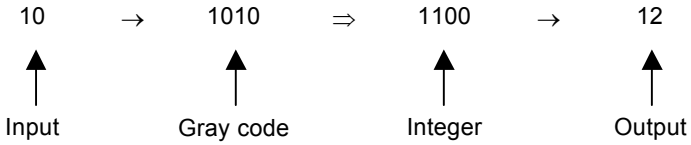
Note) Only operation with integers is valid.

Example of use

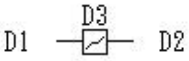


Gray code conversion of the data in register mi0000 is performed and the result of operation is stored in mi0001.

If the data in register mi0000 is (10), (12) is stored in register mi0001.



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Insensitive band		Integer 7.06 [μs] Real number 6.50 [μs]
Function	If the input numerical value is within the range of the insensitive band, 0 is output. If the input numerical value is out of the range of the insensitive band, then the insensitive value (absolute value) is subtracted from it and the result is output.		



If -D3 < D1 <, D2 = 0
+D3
If +D3 ≤ D1, D2 = D1 - D3
If -D3 ≥ D1, D2 = D1 + D3

Example of use

If the data in register mi0000 is greater than the data obtained by sign conversion from the data in register ki0000 (-10), and is smaller the positive data (10), then (0) is stored in register mi0001.

If the data in register mi0000 is equal to, or greater than the data in register ki0000 (10), then the result of subtracting the data in register ki0000 (10) from the data in register mi0000 is stored in register mi0001.

If the data in register mi0000 is equal to, or smaller than the data obtained by sign conversion from the data in register ki0000(-10), then the result of adding the data in register ki0000(-10) from the data in register mi0000 is stored in register mi0001.

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Pattern		Integer 12.4 [μs] Real number 15.3 [μs]
Function	Approximation conversion of the input numerical value by line segmentation with pattern memory is performed and the result is output.		

The pattern data should be set beforehand by the pattern data in the tool.

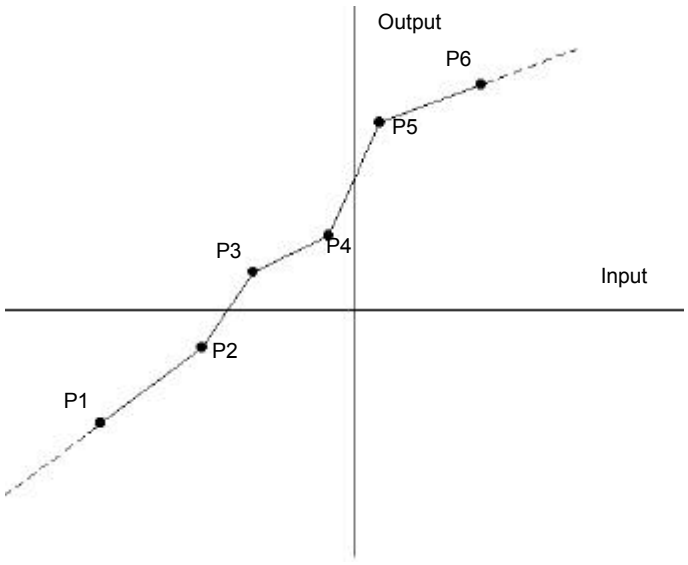
The data for the horizontal axis should be arranged without fail in the order of the value starting from the smaller data followed by the greater data.

The horizontal axis corresponds to the input value of a function, and even if the data that has deviated from the pattern data has been input, it is converted by extending the line having the inclination of the pattern data, being then output.

Graph

If the input is smaller than P1, it is converted to the approximation straight line that has been obtained by extending straight line P1-P2 and the result is output.

If it is greater than P6, it is likewise converted to the approximation straight line that has been obtained by extending straight line P5-P6 and the result is output.



	Input	Output
P1/Q1	-10	-3
P2/Q2	-6	-1
P3/Q3	-4	1
P4/Q4	-1	2
P5/Q5	1	5
P6/Q6	5	6

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Differential compensation		10.2 [μs]
Function	Three times averaging of differentiation values of the input numerical value is performed and the result is output.		

The setting contents of the function argument

(1) Differential gain: differential coefficient in the second unit system (when the change in input is 1.0 per second, 1.0 is output.)

For the sake of safety, averaging is made against a rapid change.

As the operation parameter, mrxxxx can also be used in addition to krxxxx, in which case each parameter should be set by the user program.

Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

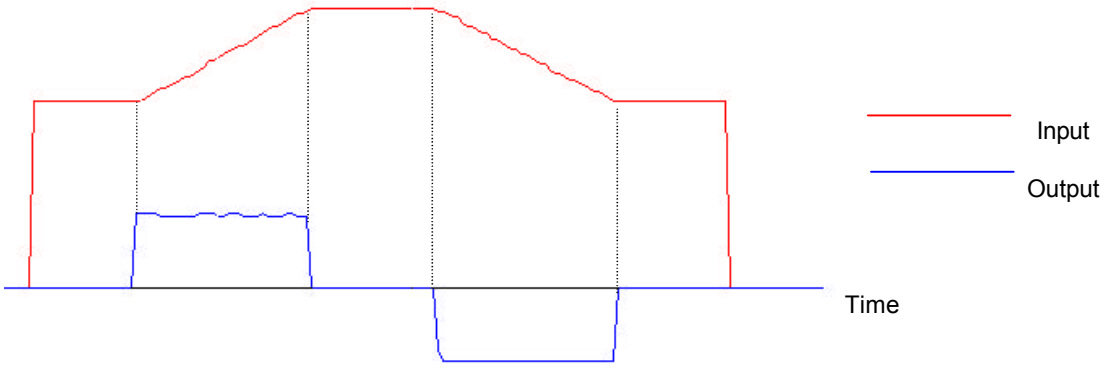
Differential compensation

Differential gain	kr0000	10.000

In a place where the input value is constant (inclination equaling to 0), the differential value is also 0, and thence the output becomes 0.

The output value changes only in a part where the input value is always changing.

Note) In the trend graph given below, the rapidly changing part is not displayed on the graph.



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Phase compensation		10.2 [μs]
Function	Phase compensation for the input numerical value is performed and the result is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Phase gain (A): Depending on whether being greater than 1.0 or not, advanced phase or lagged phase is set.

(3) Time gain (T): Time coefficient in seconds (the time during which the output value reaches the input value: second)

As the operation parameter, mrxxxx can also be used in addition to krxxxx, in which case each parameter should be set by the user program.

When the reset is turned ON, short-circuiting between the input and output is performed, whereby an arbitrary value can be preset.

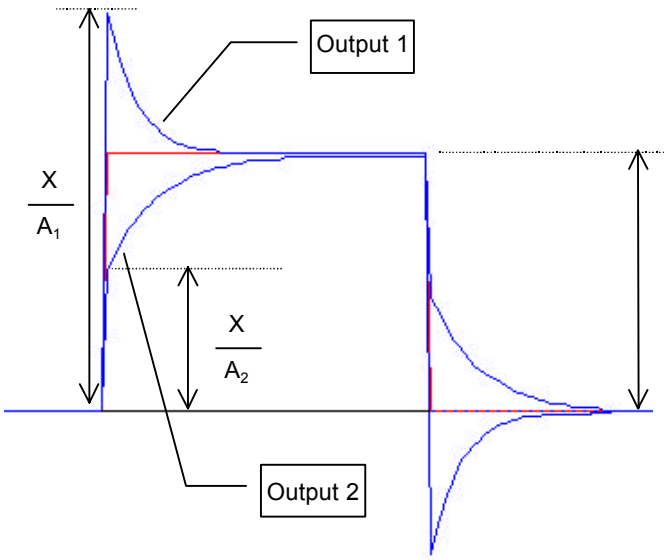
Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

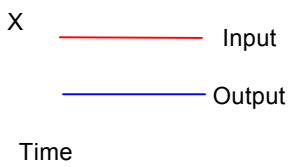
Depending on the time gain, the size of the curve changes that represents the output value that is coming closer to the input value.

When the gain is small, a small arc is drawn, and when it is large, a large arc is drawn.



Phase compensation		Output 1
Reset	G00000	
Phase gain (A_1)	kr0000	2.0000
Time gain	kr0001	-0.8000

Phase compensation		Output 2
Reset		
Phase gain (A_2)	kr0002	0.6000
Time gain	kr0003	1.0000



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	PI compensation		12.6 [μs]
Function	PI compensation (proportioning, integration) for the input numerical value is performed and the result is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.
(2) Hold: Integration hold SW (stopping the integration)
(3) Proportioning gain:
(4) Integral gain: Integral coefficient in the second unit system (the time during which the output value reaches the input value: second)
(5) Upper limit value: The upper limit value to be output should be designated.
(6) Lower limit value: The lower limit value to be output should be designated.

As the operation parameter, mrxxxx can also be used in addition to krxxxx, in which case each parameter should be set by the user program.

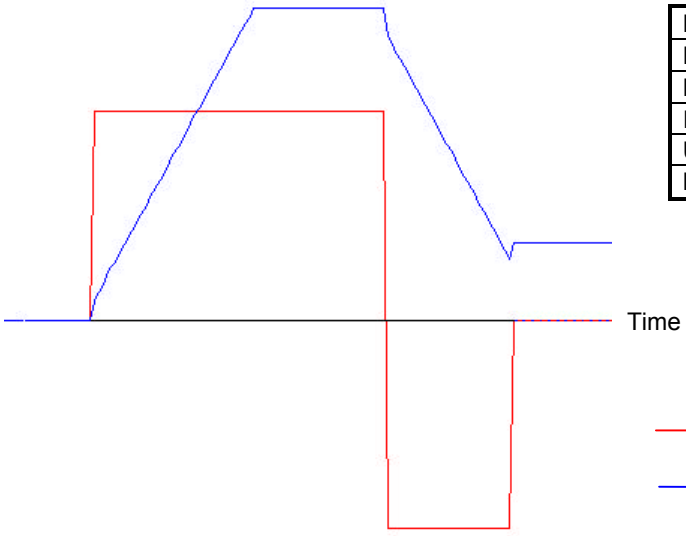
When the reset is turned ON, short-circuiting between the input and output is performed, whereby an arbitrary value can be preset.

Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Depending on the proportioning gain, the output value at the start changes, and depending on the integral gain, the inclination of the output value changes.



PI compensation

Reset	G00000	
Hold	G00001	
Proportioning gain	kr0000	0.1000
Integral gain	kr0001	3.0000
Upper limit value	kr0002	30.000
Lower limit value	kr0003	-30.000

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Limitation on the change ratio in a straight line form		8.4 [μs]
Function	Change ratio limitation on the input numerical value is performed and the result is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Maximum rising ratio: (> 0.0: positive value):
limitation value of the rising ratio of output per second
(Example: 10.0 = permitting a rising of 10 or less per second)

(3) Maximum falling ratio: (< 0.0: negative value):
limitation value of the falling ratio of output per second
(Example: -10.0 = permitting a falling of 10 or less per second)

As the operation parameter, mrxxxx can also be used in addition to krxxxx, in which case each parameter should be set by the user program.

When the reset is turned ON, short-circuiting between the input and output is performed, whereby an arbitrary value can be preset.

Note) Only operation with real numbers is valid.

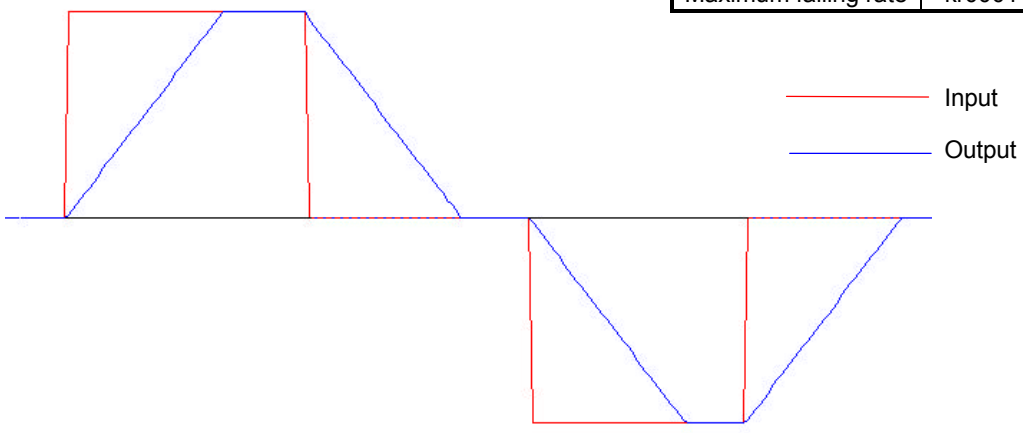
Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Depending on the rising or falling ratio, the inclination of the output value can be set. (in the case of the step input having been added)

Limitation on the change ratio in a straight line form

Reset	G00000	
Maximum rising rate	kr0000	0.1000
Maximum falling rate	kr0001	-0.1000



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	S-form change ratio limitation (S-ARC)		23.4 [μs]
Function	S-form change ratio limitation on the input numerical value is performed and the result is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.
(2) Maximum rising ratio: (> 0.0): limitation value of the rising ratio of output per second
(3) Maximum falling ratio: (< 0.0): limitation value of the falling ratio of output per second
(4) Increasing-rising ratio (> 0.0):
Acceleration increasing value per second when acceleration starts
(5) Decreasing-rising ratio (< 0.0):
Acceleration decreasing value per second when acceleration ceases
(6) Decreasing-decreasing ratio (> 0.0):
Deceleration decreasing value per second when deceleration ceases
(7) Increasing-decreasing ratio (< 0.0):
Deceleration increasing value per second when deceleration starts
(8) S-form acceleration/deceleration ceasing coefficient (>0.0):
Change ratio limitation value when the acceleration/deceleration has ceased
Usually, it should be set at twice the value as obtained by choosing the largest of the absolute values of (4) - (7).

When the reset is turned ON, short-circuiting between the input and output is performed, whereby an arbitrary value can be preset.

Note) Only operation with real numbers is valid.

Graph	

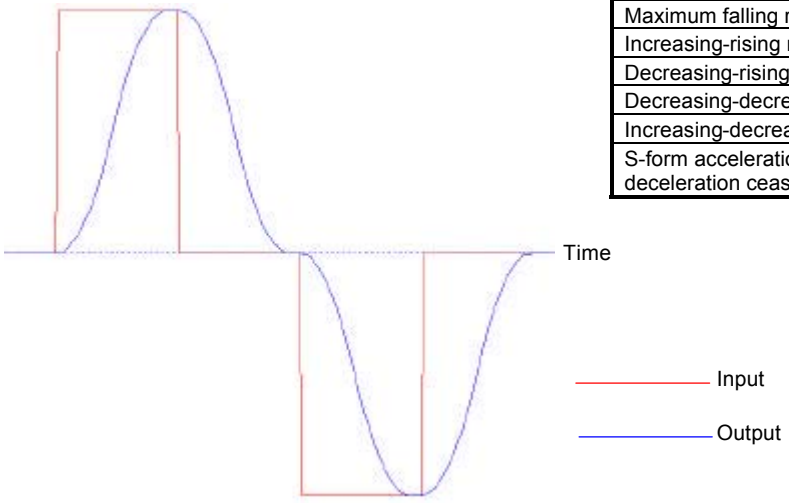
When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Although the graph is the same as ARC, since the curve right before the straight line (B1 - 4) is also set, a waveform like an S-form is output.

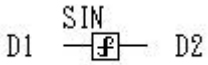
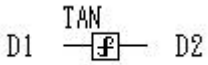
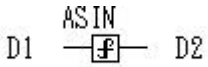
(Note) If the input value is changed while accelerating or decelerating, an overshooting may occur.

S-form limitation on the change ratio

Reset	G00000	
Maximum rising rate	kr0000	10.000
Maximum falling rate	kr0001	-10.000
Increasing-rising ratio	kr0002	0.020
Decreasing-rising ratio	kr0003	-0.020
Decreasing-decreasing ratio	kr0004	0.0020
Increasing-decreasing ratio	kr0005	-0.0020
S-form acceleration/ deceleration ceasing coefficient	kr0006	0.0040

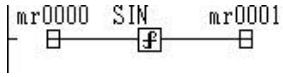


Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Trigonometric function Inverse trigonometric function		SIN 18.6 [μs] COS 16.8 [μs] TAN 30.4 [μs] ATAN 20.5 [μs]
Function	Trigonometric function (inverse trigonometric function) operation is performed on the input numerical value and the result is output.		

sin function		D2 = sin (D1)
cos function		D2 = cos (D1)
tan function		D2 = tan (D1)
asin function		D2 = $\sin^{-1}$ (D1)
acos function		D2 = $\cos^{-1}$ (D1)
atan function		D2 = $\tan^{-1}$ (D1)

Note) Only operation with real numbers is valid.

Example of use



mr0001 = SIN(mr0000)

Sine of the data in register mr0000 is obtained and the result of operation is stored in register mr0001.

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Unconditional subroutine	XXXXXX Sb	14.0 [μs]
Function	A subroutine is executed unconditionally.		

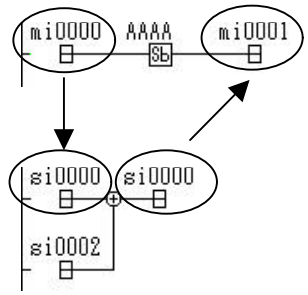
By double clicking on the symbol, a screen for setting an argument appears and the user can set an argument for the subroutine.

In the subroutine, exchange of data is carried out by means of the stack registers (sr0000, si0000, SI0000). The setting of stack registers should be made on the screen for setting an argument.

The actual data flow shall be as follows.

Input data		Stack register		Output data
Integer data	→	si0000	→	Integer data
Real number data	→	sr0000	→	Real number data
Relay/coil	→	SI0000	→	Relay/coil
Calling side		Subroutine		Calling side

Example of use



Subroutine AAAA is executed unconditionally. Registers mi0000, mi0001 are customarily used, and if you wish to use these data as well, the data in register mi0000 is passed to stack register si0000 of subroutine AAAA. And when the data that has been calculated in subroutine AAAA is stored in stack register si0000, the data is stored in register mi0001.

However, if they are not used in subroutine AAAA, the data in mi0000 is stored in mi0001.

Kind	Name	Symbol	Execution time
LD language	Jump instruction	—(JPXXXX)—	---
	Label instruction	XXXXXX L—	
Function	Jump: Jump to the designated circuit or designated label is performed. Label: It is used for a label to which a jump is made.		

It is regarded as one of the logic circuits.

XXXX stands for the circuit number of label name (4 digits).

Note 1) A jump cannot be performed between subprograms or subroutines.
Note 2) A program that loops at one point can also be created, but it must not be a permanent loop.
Note 3) On the right side of the label there should be a storing in a register.

Example of use

When relay B00000 is ON, a jump is made to the line of label ABCD, and the programs between it and label ABCD are not executed.

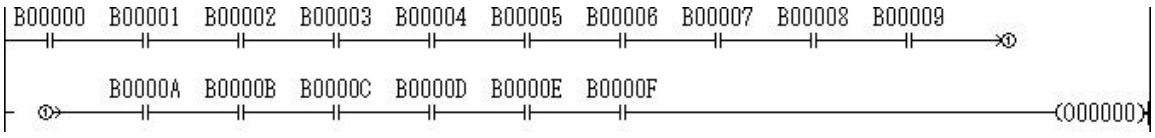
When relay B00000 is ON, the data in register kr0000 (10.000) is stored in register mr0000 and 1 is stored in register mi0000.
When relay B00000 is OFF, the data in register kr0000 (10.000) is not stored in register mr0000 and 0 is stored in register mi0000.

Kind	Name	Symbol	Execution time
LD language	Connective (Store)	—→①	0.10 [μs]
	Connective (Load)	①→—	0.06 [μs]
Function	Storing and loading of the result of logical operation and numerical operation, to and from the intermediate memory is performed.		

It is used when there are 12 or more logical codes or numerical codes arranged in series.
It must be placed between networks without fail.

While 10 sets of symbols can be inserted into 1 circuit, the loading must always be made after the storing.

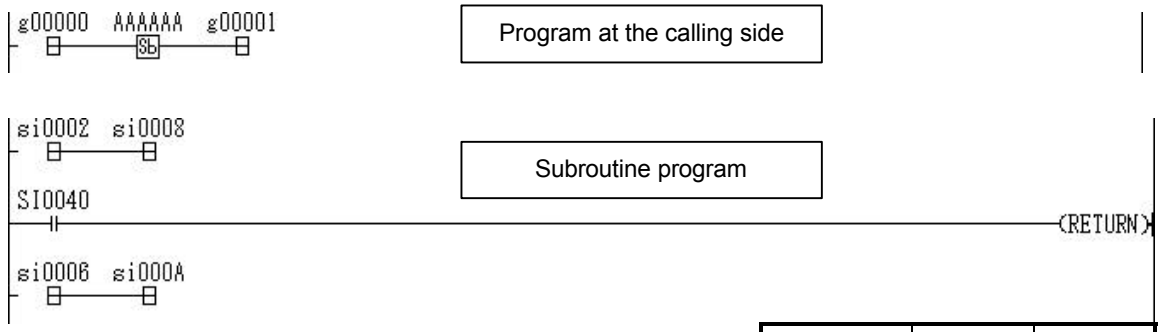
Example of use



Kind	Name	Symbol	Execution time
LD language	Termination of the processing of a subroutine program	—(RETURN)—	14.0 [μs]
Function	The subroutine program is terminated.		

It is used when in a subroutine program you wish to terminate it under a certain condition.

Example of use



Argument	Label	Value
si0002	ki0000	5
SI0040	I00000	
si0006	Z00009	
si0008	mi0000	
si000A	mi0001	

When relay I00000 is OFF, the data in register si0002 = the data in ki0000 (5) is stored in register si0008 and data (5) is loaded to register mi0000. The data in stack register si0006 = the data in z0009 is stored in register si000A and loaded to register mi0001.

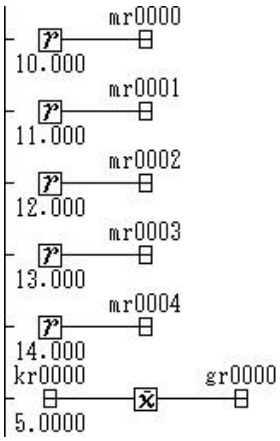
However, when relay I00000 is ON, although the data(5) in stack register si0002 is stored in stack register si0008 as it is, the data in stack register si0006 at the time of I0000 has been turned ON is stored in si000A and remains there. (Since z00009 is a 1-mili-counter, if the relay is turned ON when it is 100, then 100 is stored in si000A. And if I0000 is turned ON, then the data in si0006 is stored there.)

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	(Arithmetic) average		---
Function	The arithmetic average value of the data corresponding to the input numerical value that start at the foremost address as has been set by the argument is obtained and the result is output.		

The setting contents of the function argument

(1) The foremost part of buffer addresses (mrXXXX):
If the input is smaller than 1, then it is regarded as 1, and the value of the first data is returned.

Example of use



Argument of arithmetic average

Foremost part of buffer addresses: mr0000

If the setting is made as above, the arithmetic average reads the data in register kr0000 (5.0000) and the argument, and the result of the operation(12,000):

(mr0000 + mr0001 + mr0002 + mr0003 + mr0004)/5

is stored in register gr0000.

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Filter		18.8 [μs]
Function	Frequency limitation to the input numerical value is performed and the result is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Lower limit frequency (>0.0 : positive value):
Lower limit frequency of 3 db decrease

(3) Upper limit frequency (>0.0 : positive value):
Upper limit frequency of 3 db decrease

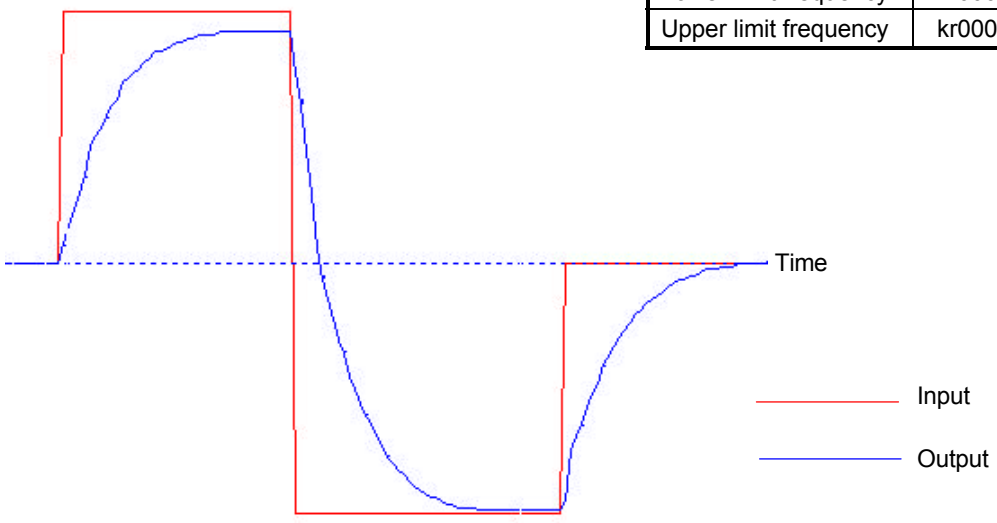
Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Filter

Reset	G00000	
Lower limit frequency	kr0000	0.0001
Upper limit frequency	kr0001	0.0500



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	PID compensation		14.8 [μs]
Function	PID compensation for the input numerical value is performed and the result is output.		

The setting contents of the function argument

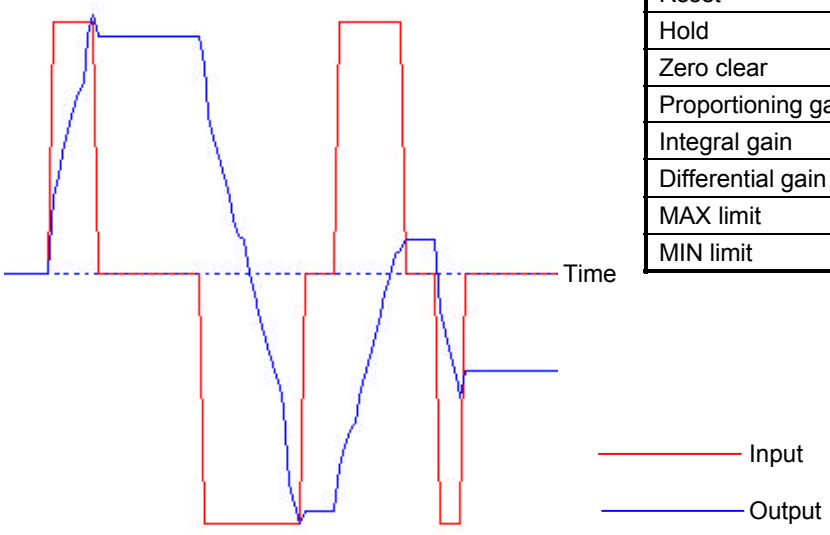
(1) Reset: Reset operation of input and output short-circuiting is commanded.
(2) Hold: Integration stop SW
(3) Zero clear: A relay is designated that commands the zero reset.
(4) Proportioning gain:
(5) Integral gain: Integral coefficient in the second unit system (the time during which the output value reaches the input value: second)
(6) Differential gain: Differential coefficient in the second unit system (when the change in input is 1.0 per second, 1.0 is output)
(7) MAX limit: The upper limit value output is designated.
(8) MIN limit: The lower limit value output is designated.

When the reset is turned ON, short-circuiting between the input and output is performed, whereby an arbitrary value can be preset.

Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.



Filter

Reset	G00000	
Hold	G00001	
Zero clear	G00002	
Proportioning gain	kr0000	0.1000
Integral gain	kr0001	3.0000
Differential gain	kr0002	0.0100
MAX limit	kr0003	30.000
MIN limit	kr0004	-30.000

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Temporary delay		9.8 [μs]
Function	Temporary delay response to the input numerical value is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Time constant: T second

Turn the reset SW ON without fail at the time of starting operation.

Note) Only operation with real numbers is valid.

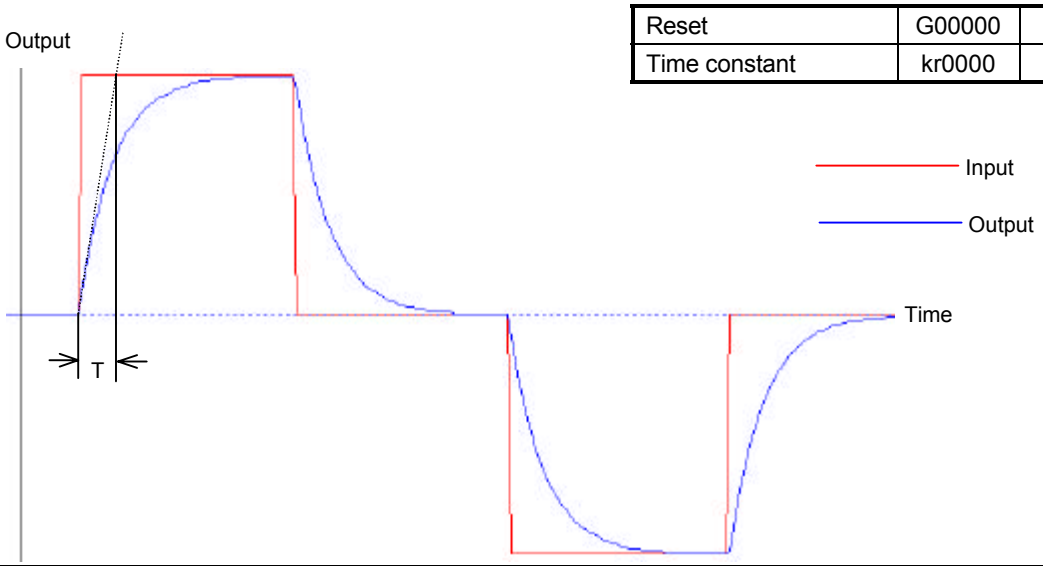
Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

During the period in which the input has been changed by the time constant, the output values are plotted to draw an arc.

Filter

Reset	G00000	
Time constant	kr0000	1.0000



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Delay (Time delay)		9.6 [μs]
Function	The delay time that has been set is added to the input numerical value and the result is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Delay time: T (second)

(3) Sampling time: ⊿T (second)
The number of samples (T/⊿T) is valid when it is 1000 or less.

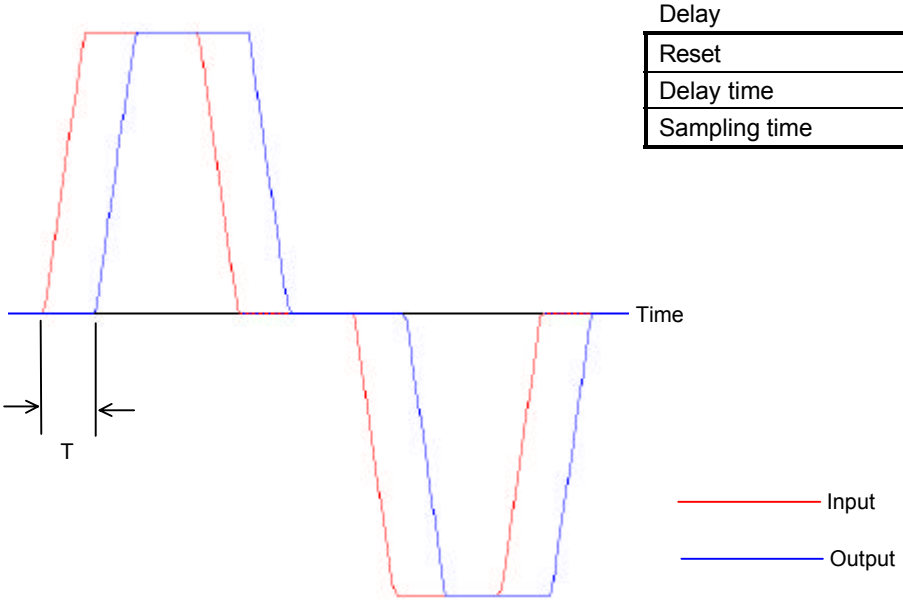
The delay is gone when the reset SW is turned ON.

Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Depending on the delay time, the input waveform is delayed by T (second) and then output.



Delay

Reset		
Delay time	kr0000	5.0000
Sampling time	kr0001	1.0000

Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Constant frequency pulse		8.0 [μs]
Function	The input numerical value is turned ON/OFF at set intervals and then is output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.
(2) ON time (second): The time for turning the output ON should be designated.
(3) OFF time (second): The time for turning the output OFF should be designated.

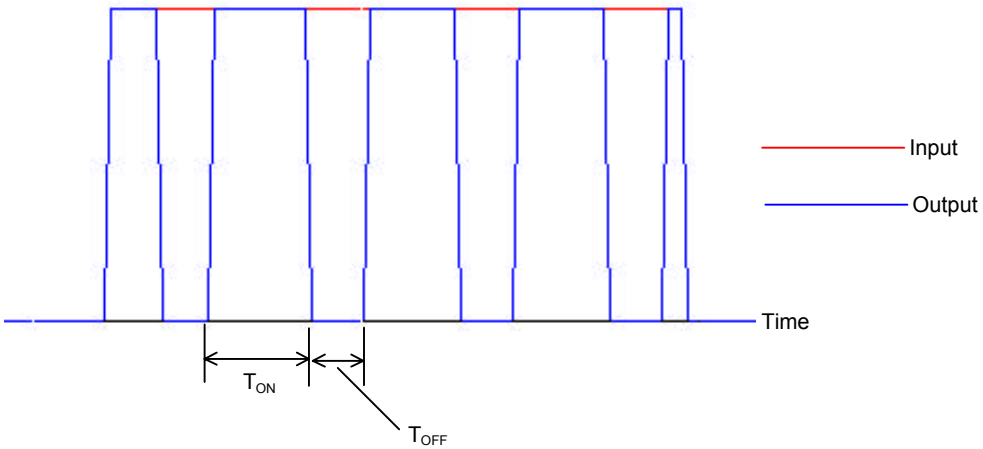
Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.
Depending on the ON/OFF time, the input waveform is output.

Constant frequency pulse

Reset	G00000	
ON time	kr0000	5.0000
OFF time	kr0001	3.0000



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Variable setting pattern		12.7 [μs]
Function	Approximation conversion of the input numerical value by line segmentation with pattern memory is performed and the result is output.		

The setting contents of the function argument

(1) Number of points (> = 2: integer):
Number of input patterns

(2) Foremost of the pattern buffer (mrXXXX):
the foremost address of the input buffer

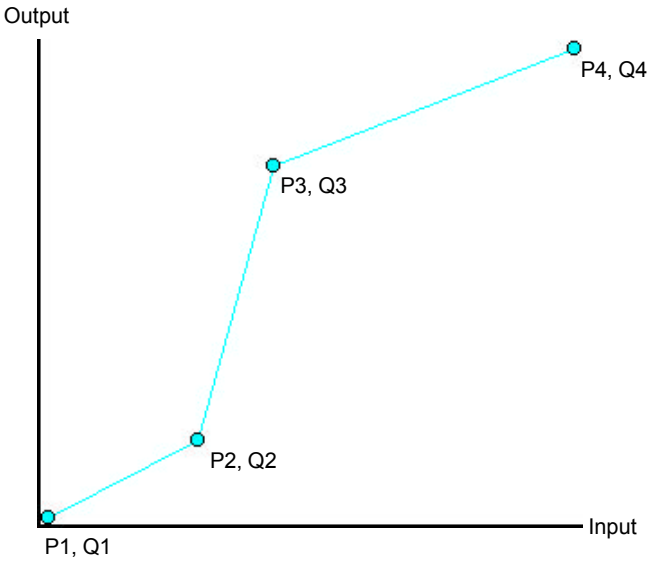
While in the pattern, an initial value was set beforehand by means of the pattern data, the real number value in a circuit can be changed herein.

By accumulating the data that has been obtained in the process control, it can be applied to the learning control.

Note) Only operation with real numbers is valid.

Graph

P1/Q1	mr0000	mr0001
P2/Q2	mr0002	mr0003
P3/Q3	mr0004	mr0005
P4/Q4	mr0006	mr0007



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Upper and lower limiters		7.45 [μs]
Function	Upper and lower limiters are added to the input numerical value and it is then output.		

The setting contents of the function argument

(1) Upper limit: It designates the upper limit value of the output.

(2) Lower limit: It designates the lower limit value of the output.

Note) Only operation with real numbers is valid.

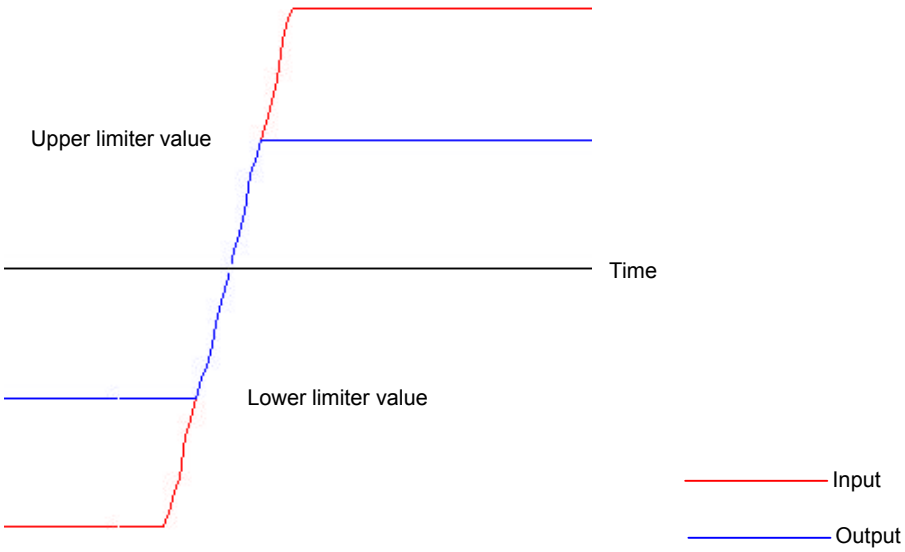
Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

The input waveform is output by means of the upper and lower limit values.

Upper and lower limiters

Upper limiter value	kr0000	10.000
Lower limiter value	kr0001	-10.000



Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Hysteresis		8.4 [μs]
Function	Hysteresis (2-gain amplifier at the time of rising and falling) is added to the input numerical value and it is then output.		

The setting contents of the function argument

(1) Reset: It makes: Output value = Input value × G1

(2) Gain at the low side: G1 (0.0 < G1 < G2)

(3) Gain at the high side: G2 (0.0 < G1 < G2)

When the input data is rising, G1 is valid, and when falling G2 is valid.

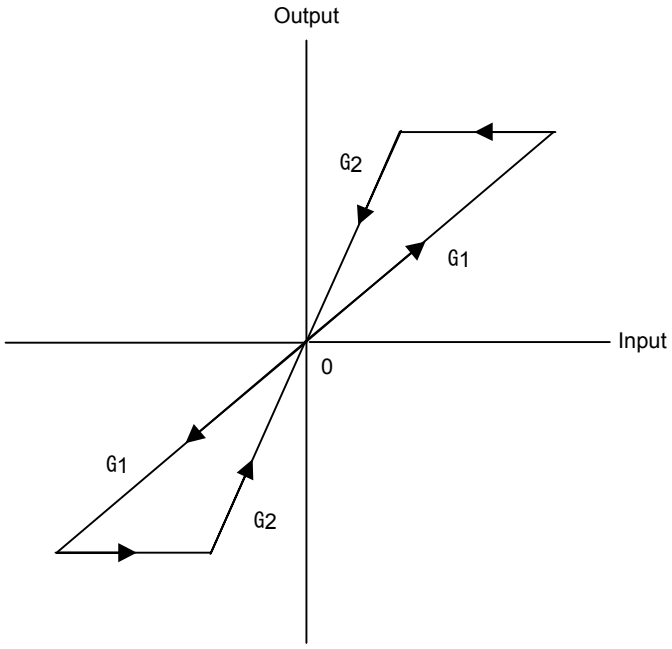
The output remains at a certain value at the time of switching from rising to falling, or from falling to rising.

Turn the reset SW ON without fail at the time of starting operation.

Note) Only operation with real numbers is valid.

Graph

According to the history of changes in the input data, the output data is plotted as the curve given in the figure below.



Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Scaling	SCAL	7.27 [μs]
Function	Scaling (sum of product operation) is added to the input numerical value and it is then output.		

The setting contents of the function argument

(1) Gain: multiplication coefficient of the sum of product operation

(2) Offset: addition coefficient of the sum of product

Output = Input * Gain + Offset

Note) Only operation with real numbers is valid.

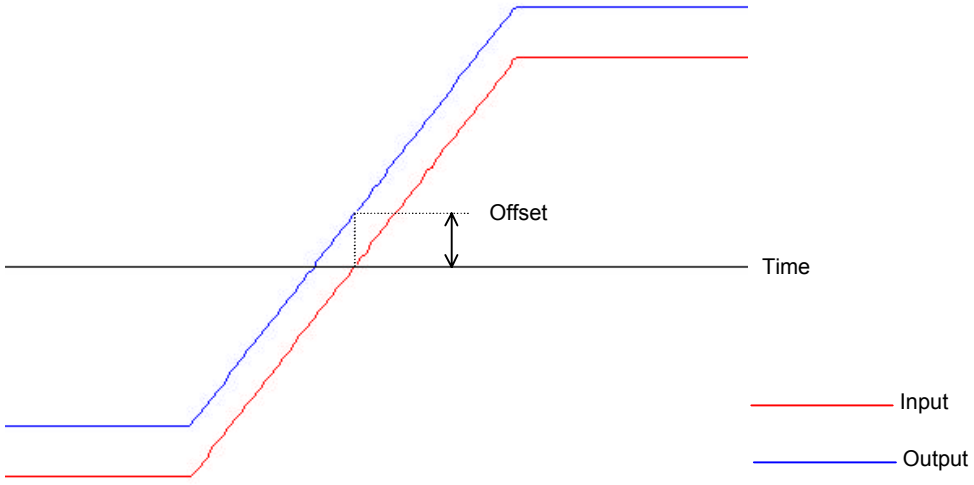
Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

The input waveform is output by means of the gain/offset.

Scaling

Gain	kr0000	1.0000
Offset	kr0001	5.0000



Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Backlash	BKLS f	8.8 [μs]
Function	Backlash (a kind of integral compensation) is added to the input numerical value and it is then output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Width of backlash: W

Turn the reset SW ON without fail at the time of starting operation.

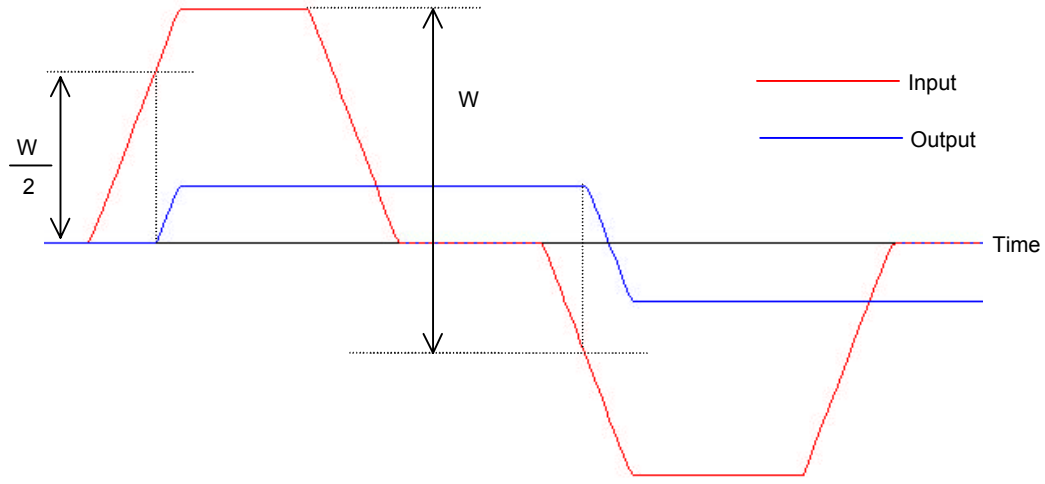
Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Backlash

Reset	G00001	
Width of backlash	kr0000	20.000



Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Backlash compensation	BKLC	8.2 [μs]
Function	Backlash compensation (a kind of differential compensation) is performed to the input numerical value and it is then output.		

The setting contents of the function argument

(1) Reset: Reset operation of input and output short-circuiting is commanded.

(2) Width of backlash: W

Turn the reset SW ON without fail at the time of starting operation.

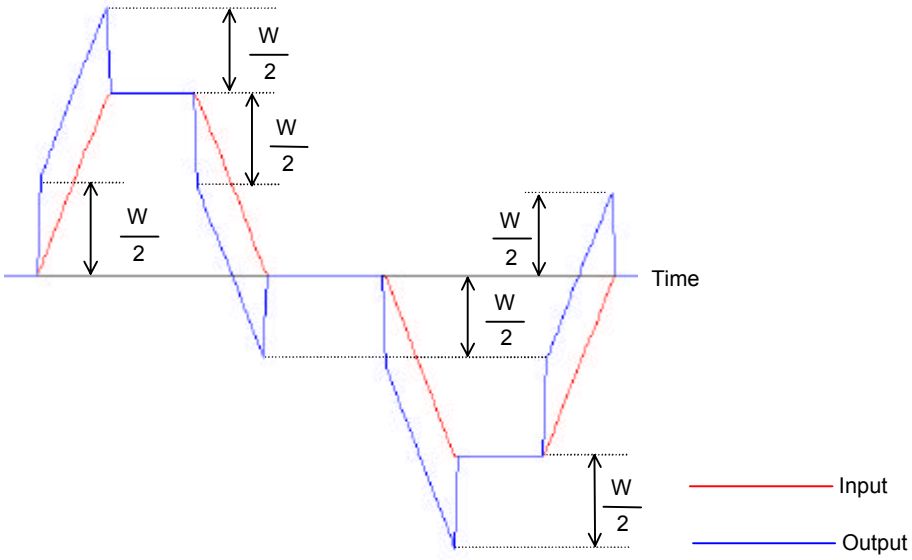
Note) Only operation with real numbers is valid.

Graph

When the function argument has been set as shown on the right, the trend graph taken from it is given below.

Backlash compensation

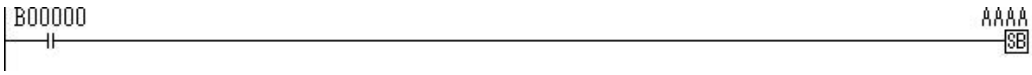
Reset	G00001	
Width of backlash	kr0000	20.000



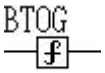
Kind	Name	Symbol	Execution time
Data flow language (Function 2)	Conditional subroutine	XXXXXX SB	--
Function	A subroutine is executed depending on the logical condition of the input.		

When the input is ON, the subroutine is executed, and not executed when OFF.
Other contents are the same as those of the unconditional subroutine.

Example of use

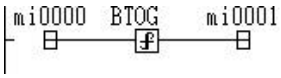


When relay B00000 is ON, subroutine AAAA is executed.
When relay B00000 is OFF, subroutine AAAA is not executed.

Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Binary Gray code		--
Function	The input numerical is read as an integer data, converted to a Gray code, and it is then output.		

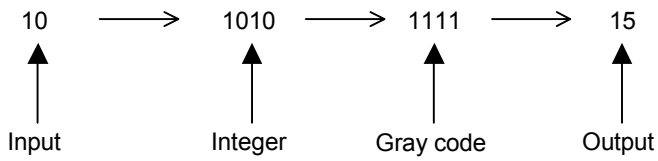
Note) It performs the reverse operation of the Gray code conversion . Pay attention not to mix them up.

Example of use



The data in register mi0000 is read as a 16-bit integer, converted to a Gray code, and it is then output.
If the data in register mi0000 is (10), then (15) is stored in mi0001.

D1 Integer	D2 Gray	D1 Integer	D2 Gray	D1 Integer	D2 Gray	D1 Integer	D2 Gray
0000	0000	0100	0110	1000	1100	1100	1010
0001	0001	0101	0111	1001	1101	1101	1011
0010	0011	0110	0101	1010	1111	1110	1001
0011	0010	0111	0100	1011	1110	1111	1000

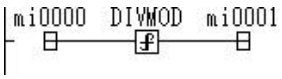


Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Divisor and remainder	DIVMOD	--
Function	The divisor for the input numerical value and the remainder are output.		

The setting contents of the function argument

(1) Divisor (integer): Number to divide the input numerical value
(2) Remainder (integer): Register to store the remainder

Example of use



If the argument of DIVMOD is set as shown on the right, the remainder when the data in register mi0000 is divided by the divisor ki0000 (7) is stored in register mi0002. Also, the quotient is stored in register mi0001.

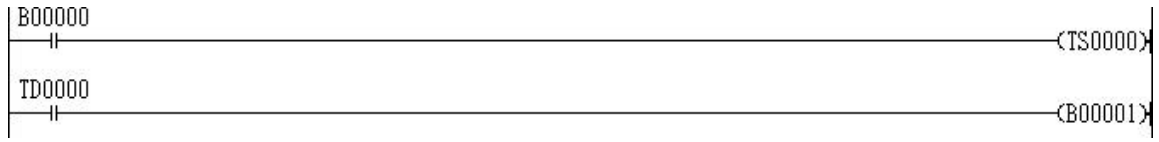
DIVMOD

Argument	Label	Value
Divisor (integer)	ki0000	7
Remainder (integer)	mi0002	

If the data in register mi0000 is (10), then (1) is stored in register mi0001 as the quotient, and (3) is stored in register mi0002 as the remainder.

Kind	Name	Symbol	Execution time
Data flow language (Function 3)	ON timer (TSTD)	TSTD	--
	OFF timer (TRTC)	TRTC	
Function	It has gathered the ON timer relay (TS, TD) and the OFF timer relay (TR, TC) in one line, and the operation is the same.		

TSTD: If the input bit is turned ON, the coil is turned ON after the time set by the argument has lapsed.

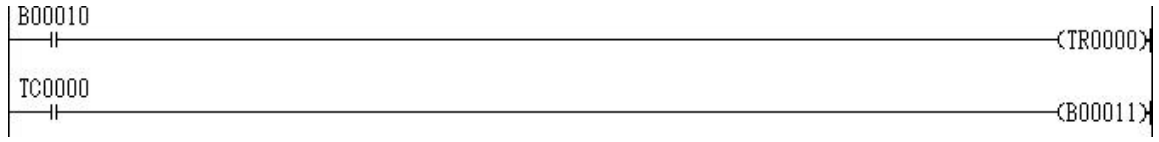


↓ With this, what was written in 2 lines can be written in 1 line.

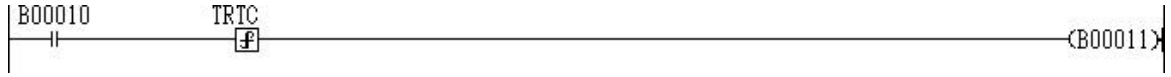
The setting contents of the function argument

[1] Timer value (real number): It sets the time for turning the coil ON after the designated time has lapsed.

TRTC: If the input bit is turned OFF, the coil is turned OFF after the time set by the argument has lapsed.



↓ With this, what was written in 2 lines can be written in 1 line.

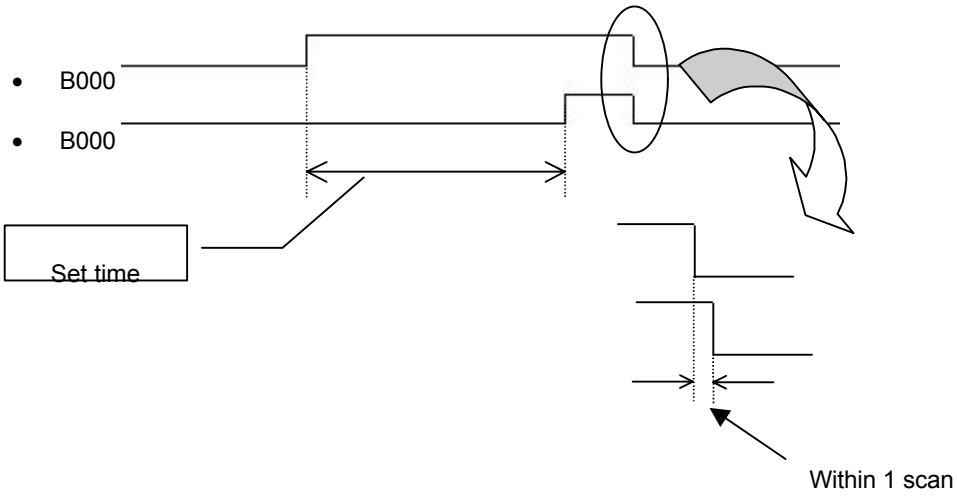


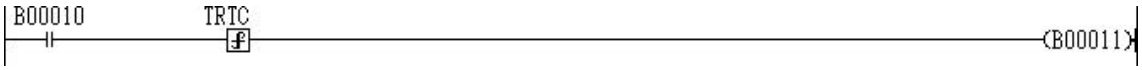
The setting contents of the function argument

[1] Timer value (real number): It sets the time for turning the coil OFF after the designated time has lapsed.

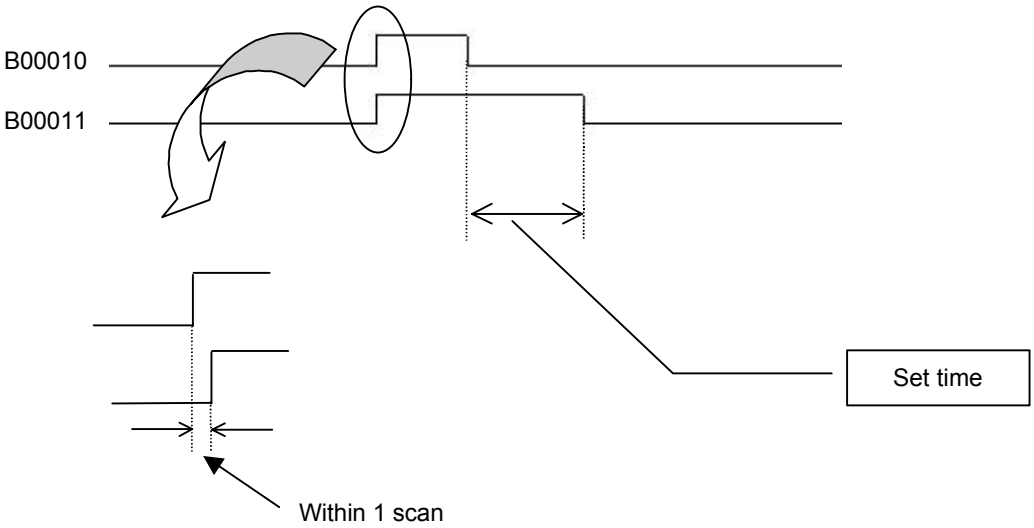
Example of use

After relay B00000 is turned ON, upon lapse of the time set by TSTD, relay B00001 is turned ON.



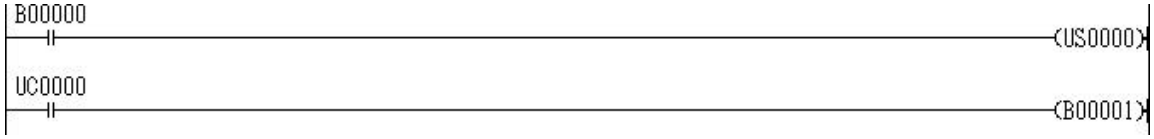


After relay B00010 is turned OFF, upon lapse of the time set by TRTC, relay B00011 is turned OFF.

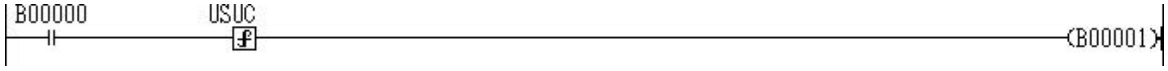


Kind	Name	Symbol	Execution time
Data flow language (Function 3)	ON differential (USUC)	USUC	--
	OFF differential (DSDC)	DSDC	
Function	It has gathered the ON differential relay (US, UC) and the OFF differential relay (DS, DC) in one line, and the operation is the same except that it is without the 1 scan delay.		

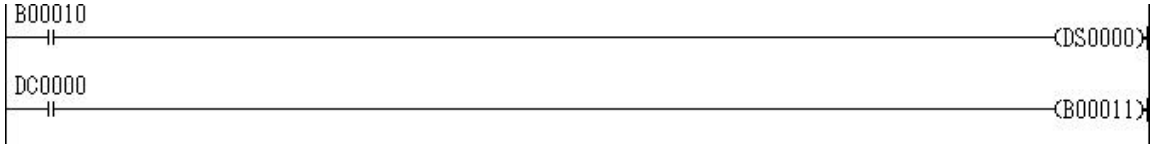
USUC: If the input bit is turned ON, 1 scan is turned ON without the 1 scan delay.



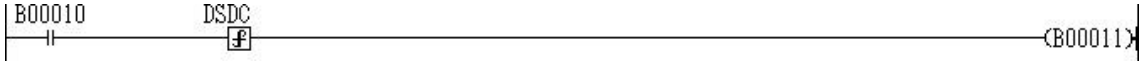
↓ With this, what was written in 2 lines can be written in 1 line.



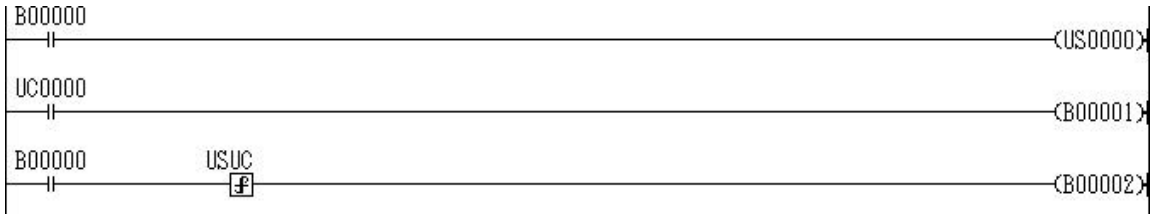
DSDC: If the input bit is turned OFF, 1 scan is turned ON without the 1 scan delay.



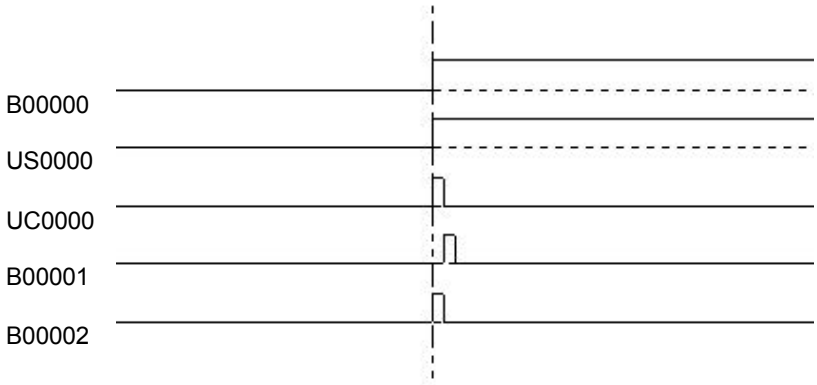
↓ With this, what was written in 2 lines can be written in 1 line.

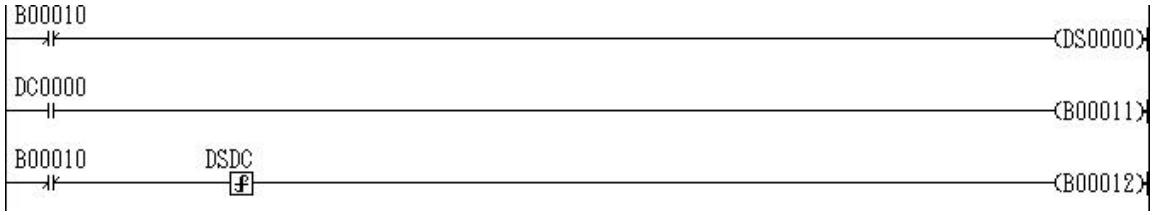


Example of use

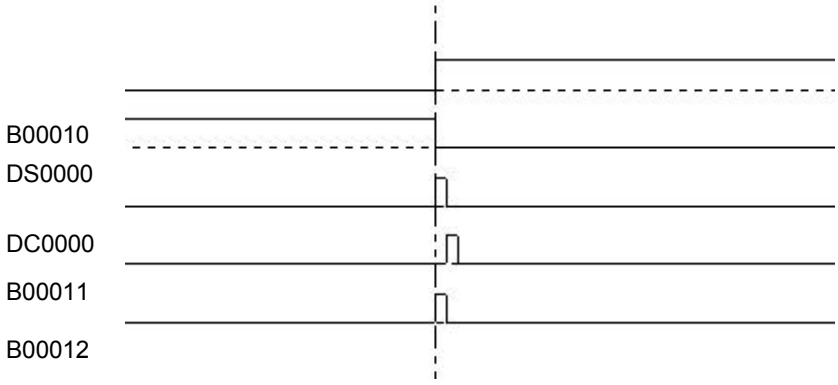


When B00000 is turned ON, after a delay for 1 scan, B00001 is turned ON for 1 scan, but B00002 is turned ON for 1 scan immediately after B00000 has been turned ON without the 1 scan delay.





When B00010 is turned ON, after a delay for 1 scan, B00011 is turned ON for 1 scan, but B00012 is turned ON for 1 scan immediately after B00010 has been turned ON without the 1 scan delay.



Kind	Name	Symbol	Execution time
Data flow language (Function 4)	SET RESET	SET F RESET F	--
Function	SET: When the input bit is turned ON, the designated output bit is kept to ON. RESET: When the input bit is turned OFF, the designated output bit is kept to OFF.		

SET: Note) While SET is ON, the contact set by the argument is turned OFF, when RESET is turned ON.

The setting contents of the function argument

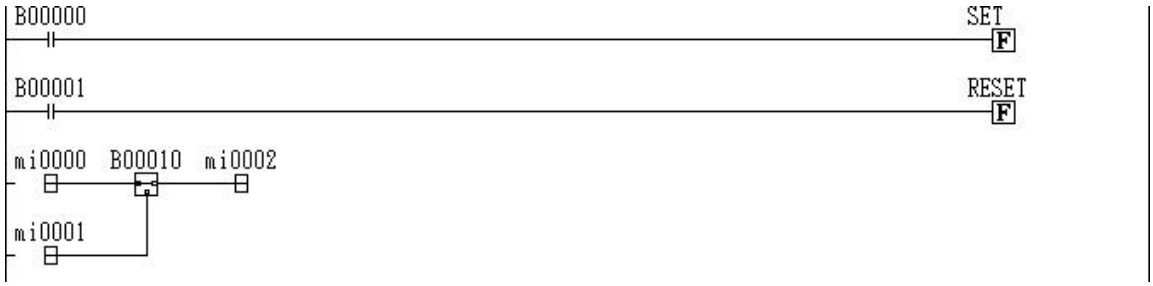
[1] SET coil: It designates the relay to be kept to ON.

RESET: Note) While RESET is ON, the contact set by the argument is not turned ON, even when SET is turned ON.

The setting contents of the function argument

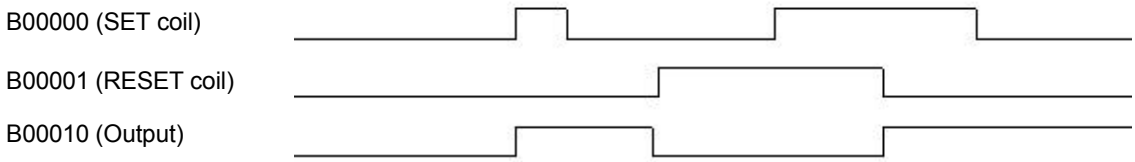
[1] RESET coil: It designates the relay to be kept to OFF.

Example of use



If B00000=ON, then B00010=ON, and the value in mi0001 is stored in mi0002.

If B00001=ON, then B00010=OFF, and the value in mi0000 is stored in mi0002.



If B00000=ON, then B00010=ON. (even when B00000=OFF, not that B00010=OFF)

If B00001=ON, then B00010=OFF. (even when B00000=ON, not that B00010=ON)

If B00001=OFF, now that B00000=ON, and so B00010=ON.

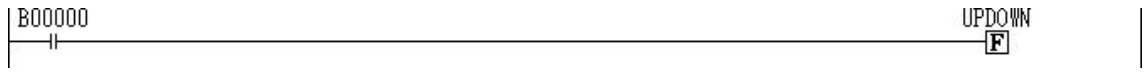
Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Counter (UPDOWN)	UPDOWN F	--
Function	This has gathered the counters (NR, NP, NU, ND, NZ and n0) in 1 line, and the operation is the same.		

The setting contents of the function argument

[1]	Reset coil:	It sets the relay that makes the present value of count 0.
[2]	Preset coil:	It sets the relay that makes the present value of count become the value set by the count preset value.
[3]	Upcoil:	It sets the present value of count to be incremental.
[4]	Downcoil:	It sets the present value of count to be decremental.
[5]	Zero detection contact:	It sets the relay that notifies that the present value of count has become zero.
[6]	Present value of count:	It sets the register to store the present value.
[7]	Count preset value:	It sets the value to be set to the present value of count when the preset coil has been turned ON.

Example of use

↓ With this, what was written in 5 lines can be written in 1 line.



Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Data transfer (MOVW/MOVWD)	MOVW F MOVWD F	--
Function	It transfers the designated data to the designated label in units of words.		

The setting contents of the function argument

[1] Label of transferrer: It designates the foremost address from which the data is transmitted.

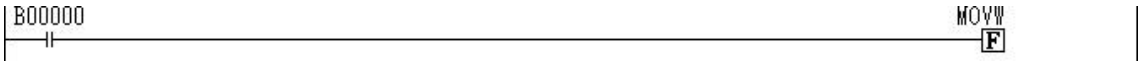
[2] Label of transferee: It designates the foremost address where the data is received.

[3] Offset of transferrer: It designates the number of interval between the label of transferrer and the address from which the data is transmitted. (for MOVW only)

[4] Offset of transferee: It designates the number of interval between the label of transferee and the address where the data is received. (for MOVW only)

[5] Number to be transferred: It designates the number of data to be transferred.

Example of use



When the setting is made as shown on the right, the data of 5 words is transferred from mi000A to b00004.

mi000A ⟶ b00004
mi000B ⟶ b00005
mi000C ⟶ b00006
mi000D ⟶ b00007
mi000E ⟶ b00008

MOVW

Argument	Label	Value
Label of transferrer	mi0000	
Label of transferee	b00000	
Offset of transferrer	ki0000	10
Offset of transferee	ki0001	4
Number to be transferred	ki0002	5

Kind	Name	Symbol	Execution time
Data flow language (Function 3)	Integer conversion	TODINT	--
	Real number conversion	TOREAL	
Function	The designated data is converted to the designated type and the result is output.		

TODINT (the real number input is converted to a 32-bit integer)

The setting contents of the function argument

[1] Transferrer (2 points used: even address) It designates the address where the input real number data is converted to a 32-bit integer and output.

[2] Transferee (2 points used: even address + 1) It designates the address where the sign is output when the input real number data is converted to a 32-bit integer.

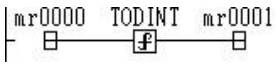
TOREAL (the 32-bit integer input is converted to a real number)

The setting contents of the function argument

[1] Transferrer (2 points used:even address) It designates the address where the input 32-bit integer data is converted to a real number and output.

[2] Transferee (2 points used:even address + 1) It designates the address where the sign is output when the input 32-bit integer data is converted to a real number.

Example of use



In the case of TODINT, if the setting is made as shown on the right and the data in the input real number register mr0000 is (-12.5600), then:

mi0010 = -13, mi0011 = -1

TODINT

Argument	Label	Value
Transferrer (even address)	mi0010	
Transferee (even address + 1)	mi0011	

In the case of TOREAL, if the setting is made as shown on the right, then:

mr0011 = 131082

mr0011 = ki0000 + ki0001 * 65536

= 10 + 2 * 65536

= 10 + 131072

= 131082

TOREAL

Argument	Label	Value
Transferrer (even address)	ki0000	10
Transferee (even address + 1)	ki0001	2

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Bank switching (F_BANK)	F_BANK	--
Function	It is used to synchronize the data in the broadcast communications area to be used in the FL-net module.		

The setting contents of the function argument

[1] Post number of the SX bus to be switched (integer):
Post number of the SX bus of the module (FL-net) for which bank switching is to be made

[2] Status (integer): If the operation is normal, 0 is input, and if not, the following error code is input.
- 64: A post number of the SX bus has been designated that is not the destination module.
- 65: Multiple bank switching requests of 1 CPU have been made.
- 66: While processing bank switching, access errors have occurred in the processor bus.

[3] In process flag (bit): It is turned ON while the bank switching is in process.

[4] Error flag (bit): It is turned ON for 1 scan when an error occurs.

Note) When using the bank switching, the correct setting of parameters of the FL-net module should be made in the system configuration definition. Without the correct setting, normal operation cannot be guaranteed.

Internal operation of the F_BANK function

At the 1st scan, the in process flag is turned ON.

At the 2nd scan, the completion flag is turned ON, and immediately thereafter the in process flag is turned OFF.

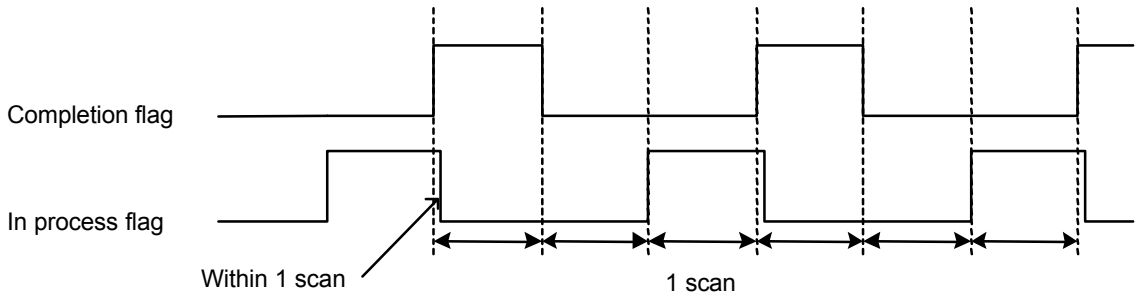
Transmittal and receiving of data should be done while the completion flag is ON.

At the 3rd scan, the completion flag is turned OFF.

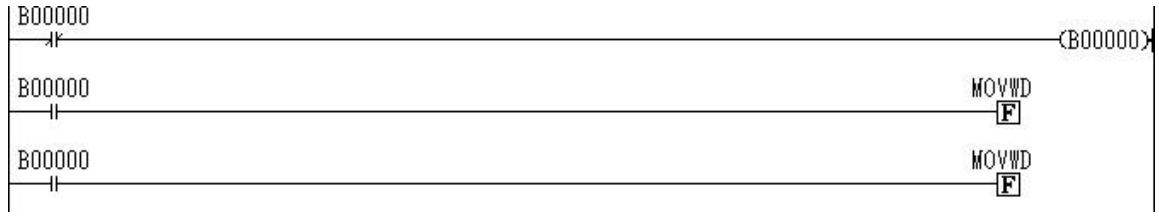
At the 4th scan, the in process flag is turned ON.

The rest is the repetition of the above.

In the transmittal and receiving of continuous data, the data that is actually passed over is the data when the completion flag has been turned ON, which occurs once every 3 scans.



Example of use



Parameters of each function should be set as shown on the right.

Since B00020 is a B-contact, at first the F_BANK function is executed and the in process flag is turned ON.

At the next scan the completion flag (B00020) is turned ON, and the transfer of data (MOVWD) should be made at this timing.

When B00020 is turned ON, since the first one is a B-contact, B00020 is turned OFF, returning to the initial state.

By repeating the above, the data transfer (MOVWD) is carried out.

F_BANK

Argument	Label	Value
Post number of the SX bus to be switched	ki0000	7
Status	mi0000	
In process flag	B00001	
Error flag	B00002	

MOVWD

Label of transferrer	g00000	
Label of transferee	fi0000	
Number to be transferred	ki0001	10

MOVWD

Label of transferrer	fi0100	
Label of transferee	g00100	
Number to be transferred	ki0002	10

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Remote data read	RREAD	--
Function	The data of the equipment that is connected to the network is read out by designating the address directly, via a communications module.		

The setting contents of the function argument

[1] Post number of the SX bus:
Post number of the SX bus of the communications module by way of which the reading is made

[2] Channel number: Channel number of the communications module

[3] Node number: Node number of the destination of communications

[4] Variable designation method:
It should be designated for each object of access of the destination of communications (see < About the variable designation method >)

[5] Foremost address of variable designation:
It designates the foremost address by which the type of data to be read is designated.
(see < Support message list>)

[6] Read data size: It designates the word size of the read data.

[7] Foremost address of the read data:
It designates the foremost address of the read data.

[8] Error flag: When the reading has not been done normally, it is turned ON for 1 scan.

[9] Status: It displays the contents of the error flag. They are given below.

More detailed contents will be explained in the examples of use.

The following are the values that are input into the status when an error flag has been turned ON.

Code	Name	Cause
68	Abnormal memory address designation	When there is an error in the address designated by [5].
69	Memory size exceeded	When the address designated by [5] + [6] exceed the effective range of the address. In this case the value of the read data is not guaranteed.
160	Abnormal designation of the destination of communications	When [4] =0 and there is no CPU number of the destination of communications
171	Internal resources used up	When the internal resources to execute R_READ, R_WRIT have been used up. Or when multiple numbers are started simultaneously, the internal resources may be used up. In this case, restart the controller after a while.
193	Abnormal channel open	When an abnormal value is set in [2].
195	Abnormal message transmission	When an abnormal value is set in [2]. When an abnormal value is set in [3]. When a value other than the type codes is set as the memory type.
201	No vacant port	When trying to open more ports than the specified number in 1 communications module.
206	Transfer size exceeded	When a value other than “0” has been set as the variable designation method, and the limitation value of the message data size of the communications module by way of which the reading is made has been exceeded.

< About the variable designation method >

The contents to be set at the variable designation method of R_READ and R_WRIT are indicated herein. The variable designation method is specified for each object of access of the destination of communications.

[1] When the variable designation method = 0

It is designated when the memory on CPU of the μGPCsx system is used via a network (not dependent on its type).

F	0
CPU number	
Memory type	
Lower address	
Higher address	

Name	Memory type code
Standard memory	1
Retain memory	3
User FB memory	5
System FB memory	9
System memory	10

Note) Do not designate other values than 1, 3, 5, 9 and 10 as the memory type code.

[2] When the variable designation method = 2

It is designated when using the equipment that is connected to a network of OPEN specifications such as JPCN1.

F	0
Effective size	
-	Address 1
-	.
-	.
-	Address n

Note) In this case, effective data should be input in the lower 8 bits of an array of which width is 16 bits.

This is because 8-bit data cannot be handled in the μGPCsx system.

< Support message list >

A support message list for the message transmission to be set in the variable designation address is indicated below. The value that is actually used in a function is the request part of the processing code. The number of parameters is set at the foremost address, lower 8 bits of the request command are set at the second, and higher 8 bits are set at the third.

No.	Type of message		Processing code (TCD code Note 1)		Message function used	Message data size	Number of parameters (Note 5)
			Request	Response			
[1]	Byte block readout Note 2)		65003 (FDEB)	65203 (FEB3)	R_READ (variable designation method = 2)	476 bytes	6
[2]	Byte block write Note 2)		65004 (FDEC)	65204 (FEB4)	R_WRIT (variable designation method = 2)	476 bytes	6
[3]	Word block readout		65005 (FDED)	65205 (FEB5)	R_READ (variable designation method = 2)	476 bytes	6
[4]	Word block write		65006 (FDEE)	65206 (FEB6)	R_WRIT (variable designation method = 2)	476 bytes	6
[5]	Network parameter readout		65007 (FDEF)	65207 (FEB7)	R_READ (variable designation method = 2)	56 bytes	2
[6]	Network parameter write		65008 (FDF0)	65208 (FEB8)	R_WRIT (variable designation method = 2)	20 bytes	2
[7]	Stop		65009 (FDF1)	65209 (FEB9)	R_WRIT (variable designation method = 2)	-	2
	Start		65010 (FDF2)	65210 (FEBA)	R_WRIT (variable designation method = 2)	-	2
[8]	Profile readout		65011 (FDF3)	65211 (FEBB)	R_READ (variable designation method = 2)	480 bytes	2
[9]	Communications log readout		65013 (FDF5)	65213 (FEBD)	R_READ (variable designation method = 2)	480 bytes	4
[10]	Communications log clear		65014 (FDF6)	65214 (FEBE)	R_WRIT (variable designation method = 2)	-	2
[11]	For use for message return test		65015 (FDF7)	65215 (FEBF)	R_WRIT (variable designation method = 2)	1024 bytes	2
[12]	Permeable type message		00000 - 59999 (0000 - EA5F)		M_SEND/M_RECEIVE	1026 bytes (Note 3)	-
	SX reserved	Address readout	100 (64)	150 (96)	R_READ (variable designation method = 0)	- (Note 4)	-
		Address write	101 (65)	151 (97)	R_WRIT (variable designation method = 0)	- (Note 4)	-
		Loader command	200 (C8)	250 (FA)	-	492 bytes	-

Note 1) ( ) is a hexadecimal representation.

Note 2) Since the μGPCsx does not support the data type of byte, it cannot accept the “byte block readout”, or “byte block write” request given by the destination node.

Note 3) It is a value containing TCD codes.

Note 4) The maximum size is the maximum value of the memory area designated by each CPU module.

Note 5) The number of parameters is the number of parameters set by the variable designation.

Example) For instance, when the network parameter read is used, at the foremost address of the variable designation, the number of parameters (2 in this case) is set at the first, lower 8 bits (EF) of the value of the request part (FDEF) of the processing code are set at the second, and higher 8 bits (FD) are set at the third.

< Virtual address space >

Memory of the μGPCsx	Virtual address space
Input and output memory	00 □ □ □ □ □ □ h -
Standard memory	02 □ □ □ □ □ □ h -
Retain memory	04 □ □ □ □ □ □ h -
System memory	08 □ □ □ □ □ □ h -

In the case of the memory map (default value) of the high-performance CPU module NP1PS-32, access to each memory is carried out as in the figure below.

Memory map

15

0

Input and output memory 512 words (fixed)	00000000 h . 000001FF h
Standard memory (high-speed 2 k words)	02000000 h . 020007FF h
(8 k words)	02000800 h . 02001FFF h
Retain memory 4 k words	04000000 h . 04000FFF h
Instance memory for user FB 4 k words	
Instance memory for system FB 4 k words	
System memory 512 words (fixed)	10000000 h . 100001FF h

Note 1) The virtual address of input and output varies depending on the system configuration, and is complicated. It is recommended that for the sake of simplification, you should transfer the desired access area first to the internal memory such as the standard memory, and gain access to such internal memory.

Note 2) The size of each memory varies depending on the model of CPU used.

Note 3) If the data is written into the system memory by mistake, it may cause malfunctioning or stop due to a serious failure. (The system operation cannot be guaranteed.)

< Details of the support message >

[1] Byte block readout

It is a function to read out data in units of bytes (in units of 8 bits for 1 address) via the FL-net from the virtual address space (32-bit address space) of the destination node. For the address map of the virtual address space, refer to the specifications of each node. (Variable designation method=2, readout request code=FDEB)

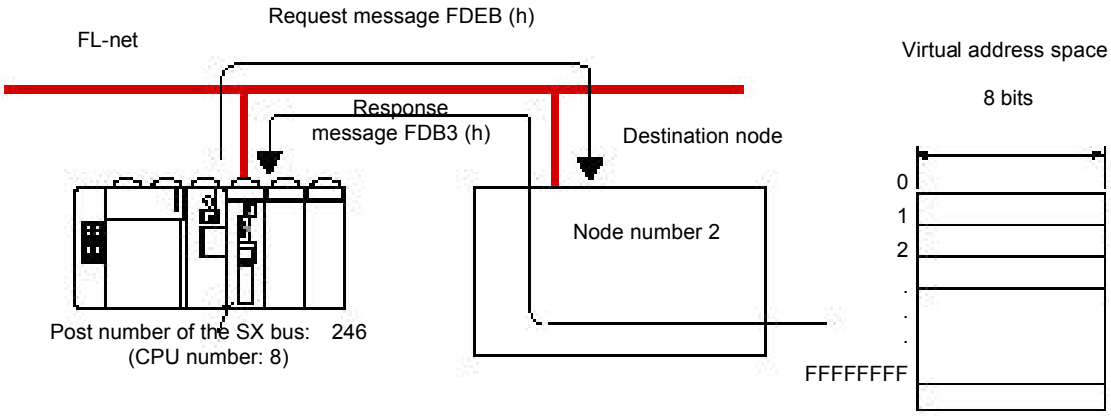


Fig.1 Image of byte block readout

< Example of a byte block readout program >

This is an example of reading out data of 12 words from the virtual address: 00000000(h) of CPU connected to the FL-net unit of node number "2". The value of variable designation format as given below is set one by one starting at the foremost address of variable designation: mi0000.

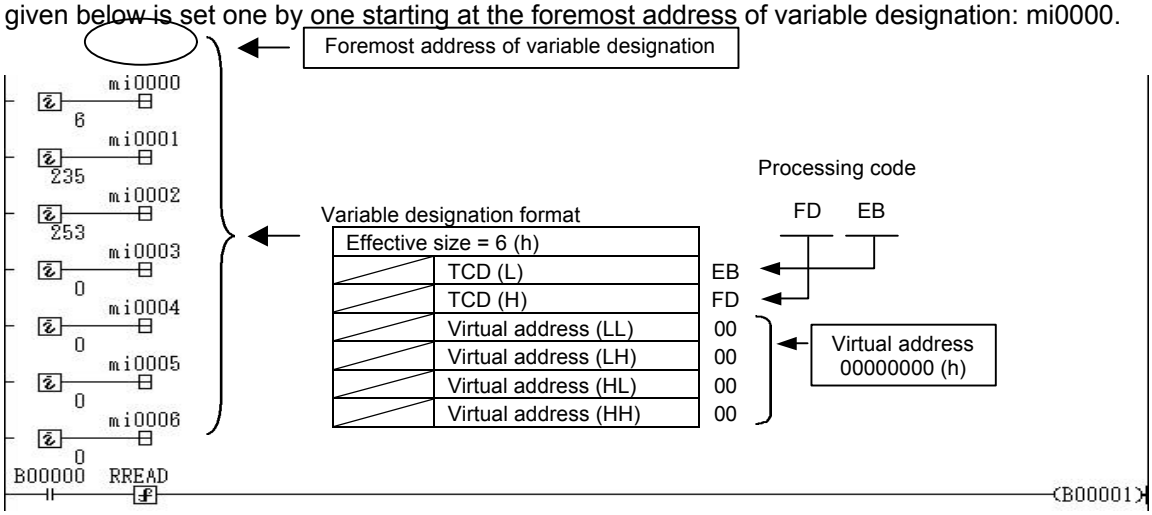


Fig. 2 Relation between the byte block readout circuit diagram and the variable designation format

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	12
Foremost address of readout data size	b00001	

Note 1) The channel number of the NP1L-FL1 is fixed at "0".

Note 2) The size of the readout data should satisfy the following:

(Amount of the readout data (number of words)) ≤ (Size of the received data)

[2] Word block readout

It is a message function to read out data in units of words (in units of 16 bits for 1 address) via a network from the virtual address space (32-bit address space) of the destination node. For the address map of the virtual address space, refer to the specifications of each node. (Variable designation method = 2, readout request code=FDED)

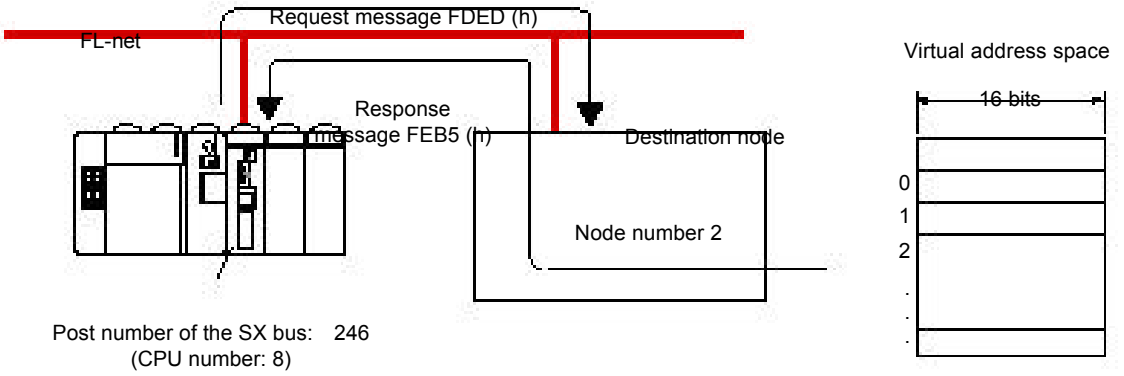


Fig.3 Image of word block readout

< Example of a word block readout program >

This is an example of reading out data of 10 words from the virtual address: 00000000(h) of CPU connected to the FL-net unit of node number “2”. The value of variable designation format as given below is set one by one starting at the foremost address of variable designation: mi0000.

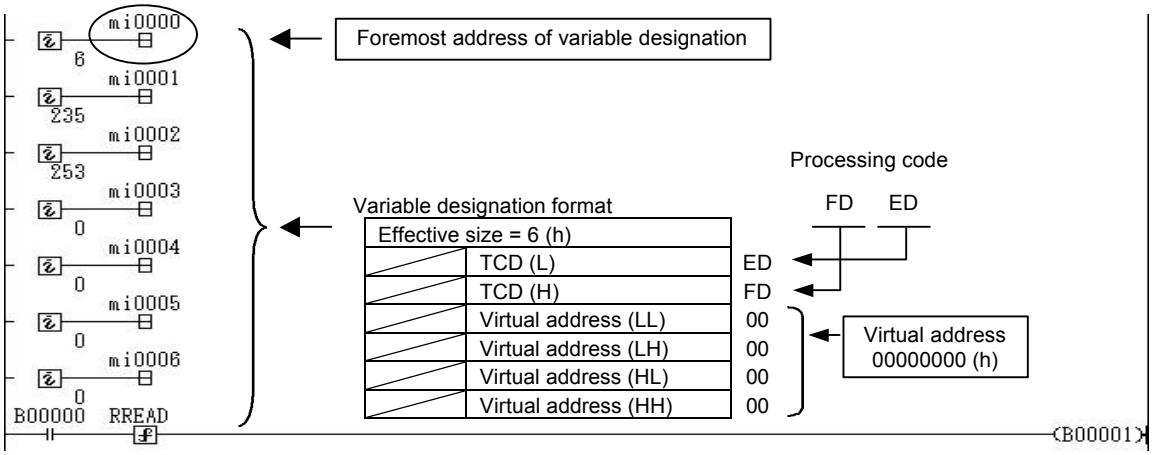


Fig. 4 Relation between the word block readout circuit diagram and the variable designation format

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	10
Foremost address of readout data size	b00001	

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Note 2) The size of the readout data should satisfy the following:

(Amount of the readout data (number of words)) ≤ (Size of the received data)

[3] Network parameter readout

It is a message function to read out network parameters of the destination node from Network.

(Variable designation method=2, readout request code=FDEF)

In the network parameter readout, the following information is read out.

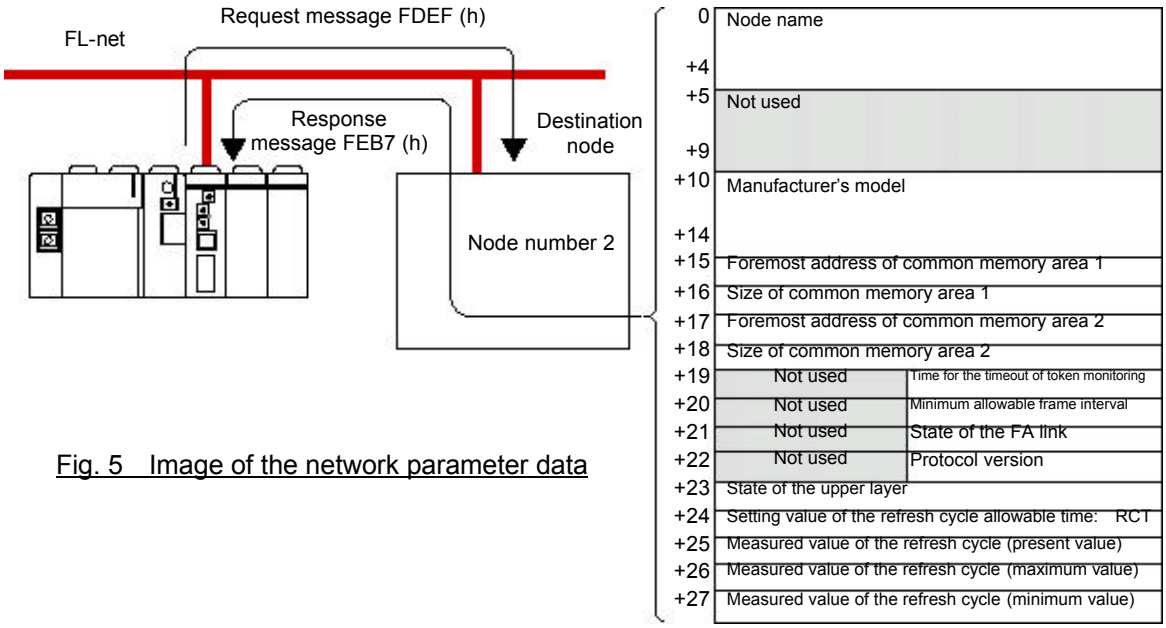


Fig. 5 Image of the network parameter data

< Example of a network parameter readout program >

The network parameters of the FL-net unit of node number "2" are read out.

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

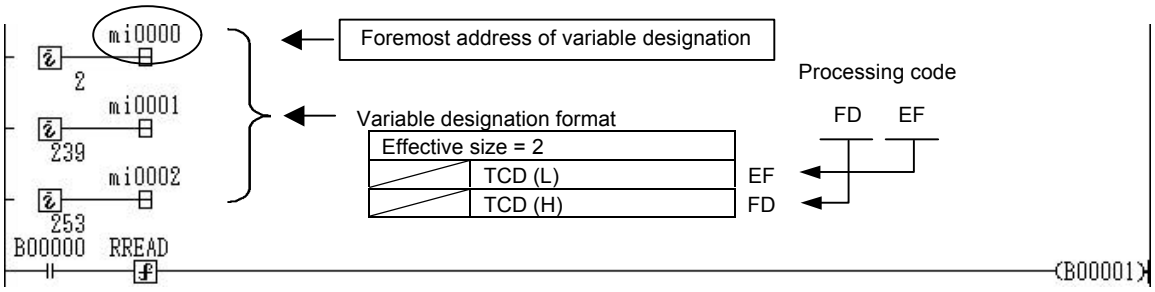


Fig. 6 Relation between the network parameter readout circuit diagram and the variable designation format

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	28
Foremost address of readout data size	b00001	

Note 1) The channel number of the NP1L-FL1 is fixed at "0".

Note 2) Since there are 28 words in the network parameters, the readout data size should be set at 28 or more.

Fig. 6 Relation between the network parameter readout circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.
Note 2) Since there are 28 words in the network parameters, the readout data size should be set at 28 or more.
Note 3) Note that the address is different from the common memory that is referred to by the FLRAS function.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	28
Foremost address of readout data size	b00001	

[4] Profile readout

It reads out from the network the system parameters (inherent information) of the destination node.

There are 2 parameters as the system parameter.

- Common parameter (indispensable) → Only common parameters are available for the NP1L-FL1.
- Parameter inherent to the device (arbitrary)

(Variable designation method = 2, readout request code = FDF3)

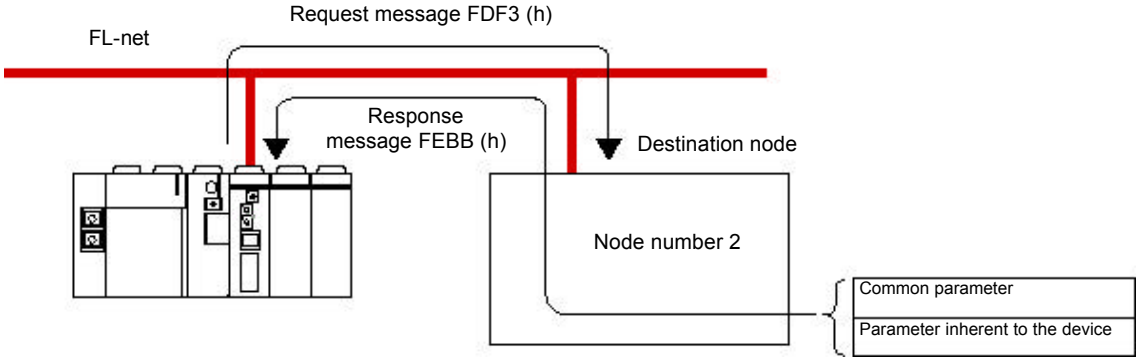


Fig. 7 Image of the Profile readout

< Example of a network parameter readout program >

The network parameters of the FL-net unit of node number “2” are read out.

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

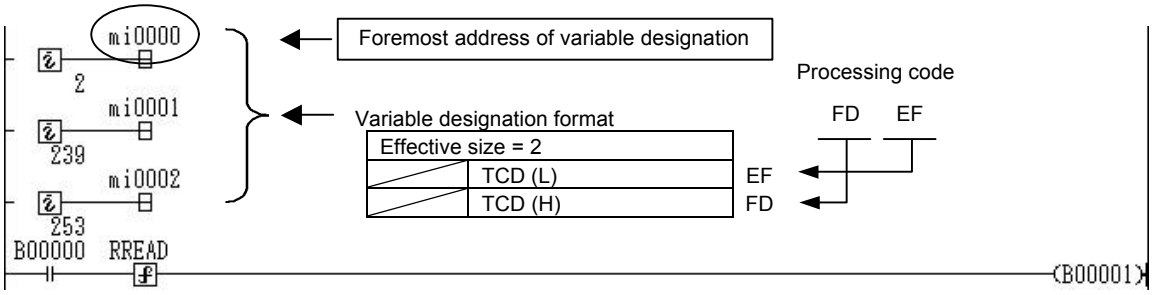


Fig. 8 Relation between the profile readout circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Note 2) The size of readout data should satisfy the following.
(Amount of the data to be read out (number of words)) ≤ (Size of the received data)

Note 3) For the readout data size, refer to the profile use of the destination node.
In the case of the NP1L-FL1, the size of profile is 113 bytes.
Therefore, the word size to be read out should be designated as 57 words.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	28
Foremost address of readout data size	b00001	

[5] Communications log data readout

It is a function to read out from the network the log information of the destination node.
(Variable designation method = 2, readout request code = FDF5)

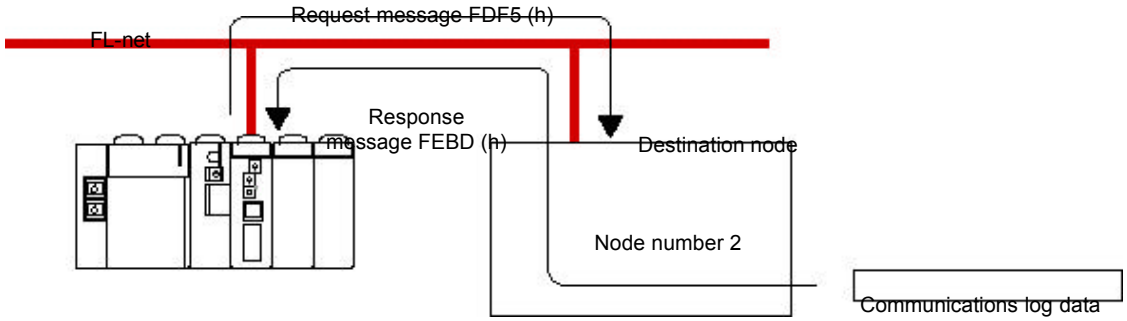


Fig. 9 Image of the communications log data readout

< Example of a setting of communications log data readout argument >

It reads out the communications log data (512 bytes) of the FL-net unit of node number “2”.

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

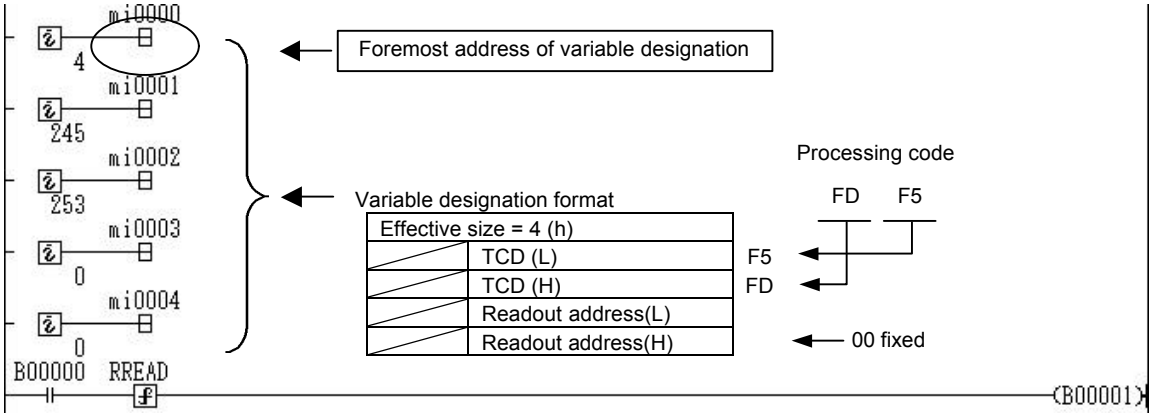


Fig. 10 Relation between the communications log data readout circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Note 2) The communications log data is 512 bytes (fixed) for every node of the FL-net. However, there are indispensable items and arbitrary items in the supplied items. For details, check the specifications of each node.
Also, the amount of data that can be read out at 1 time is 239 words (480 bytes). Hence, the read out needs to be made 2 times.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	17
Foremost address of readout data size	b00001	

Example of use

The figure blow is an example of the readout of network parameters.

In this configuration, 1 unit each of CPU and FL-net module are mounted on 1 base, and communications are carried out between 2 bases by means of the FL-net.

For the post number of the SX bus, the post number of the SX bus of the destination of communications should be set. (In this case, since the equipment is the FL-net module, ki0000 = 246.)

Channel number is fixed at “0” in the case of the FL-net module.

Node number is the 2nd FL-net module, and hence it is “2”.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	17
Foremost address of readout data size	b00001	
Error Flag	G00000	
Status	mi0010	

For the variable designation method, since the FL-net module is used in this case, it is “2”.

For the foremost address of variable designation, the foremost label should be designated from which the parameters to be set will be read. (In this case, it is mi0000.) Next, the number of parameters should be set to the designated label, and in this case since it is 2, mi0000=2, and then referring to the support message list, lower 8 bits: 239 (EF) of the applicable request command 65007 (FDEF) should be set to mi0001, and upper 8 bits: 253 (FD) should be set to mi0002.

As for the readout data size, since there are 28 words in the case of the network parameters, a value not smaller than this figure should be set.

As for the foremost address of the readout data, the foremost address of the label from which the readout data should be read.

Error flag should be turned ON for 1 scan when there has been a readout failure.

Status should indicate the contents of error when the error flag has been turned ON.

With the foregoing setting, information on the module that is mounted on other base board can be obtained.

Note 1) Note that the value of the network parameter is similar to that of the FLRAS function, but the address is different.

Note 2) Note that the contents of data at the time of reading are different from those at the time of writing.

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Remote data write (RWRITE)		--
Function	It writes data onto the equipment that is connected to the network by designating the address directly, via a communications module.		

The setting contents of the function argument

[1] Post number of the SX bus:
Post number of the SX bus of the module by way of which the communications are made

[2] Channel number: Channel number of the communications module

[3] Node number: Node number of the destination of communications

[4] Variable designation method:
It should be designated for each object of access of the destination of communications (see the next page)

[5] Foremost address of variable designation:
It designates the foremost address by which the type of data to be written is designated.

[6] Written data size: It designates the word size of the written data.

[7] Foremost address of the written data:
It designates the foremost address of the written data.

[8] Error flag: When the writing has not been done normally, it is turned ON for 1 scan.

[9] Status: It displays the contents of the error flag. They are given below.

More detailed contents will be explained in the examples of use.

Code	Name	Cause
35	Abnormal transmission interlock	When the module with which communications are made is interlocked. The transmission interlock is performed when an instance screen is opened and there is operations such as downloading, etc. Retry if this error has occurred.
68	Abnormal memory address designation	When there is an error in the address designated by [5].
69	Memory size exceeded	When the address designated by [5] + [6] exceed the effective range of the address. In this case the value of the read data is not guaranteed.
160	Abnormal designation of the destination of communications	When [4] =0 and there is no CPU number of the destination of communications
171	Internal resources used up	When the internal resources to execute R_READ, R_WRIT have been used up. Or when multiple numbers are started simultaneously, the internal resources may be used up. In this case, restart the controller after a while.
177	Abnormal parameters	When 0 is input in [6]. When a value other than those designated in the variable designation method has been input. When a value has been input that exceeds the range of values that can be used as the post number of the SX bus.
193	Abnormal channel open	When an abnormal value is set in [2].
201	No vacant port	When trying to open more ports than the specified number in 1 communications module.

206	Transfer size exceeded	When a value other than “0” has been set as the variable designation method, and the limitation value of the message data size of the communications module by way of which the reading is made has been exceeded.

[1] Byte block write

It is a function to write data in units of bytes (in units of 8 bits for 1 address) via the FL-net onto the virtual address space (32-bit address space) of the destination node. For the address map of the virtual address space, refer to the specifications of each node. (Variable designation method = 2, write request code = FDEC)

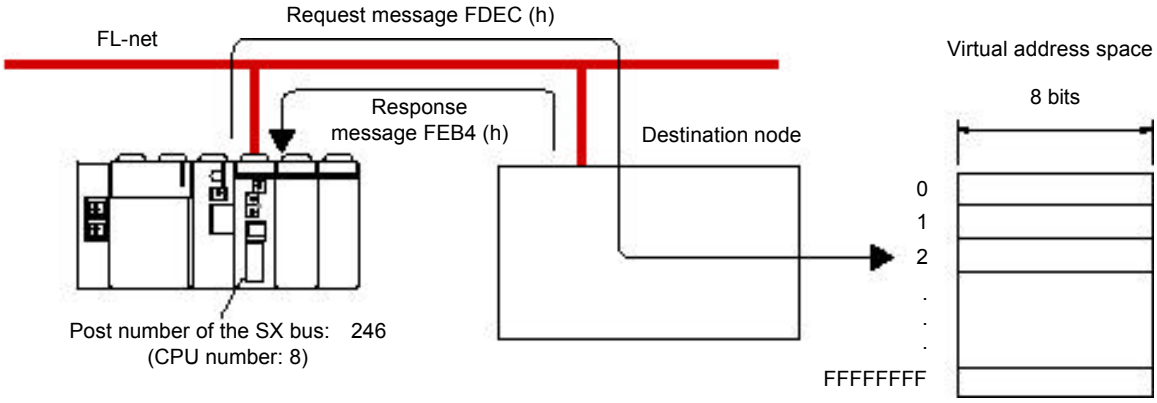


Fig. 1 Image of the byte block write

< Example of a byte block write program >

This is an example of writing data of 5 words onto the virtual address: 64(h) and thereafter of CPU connected to the FL-net unit of node number “2”. The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

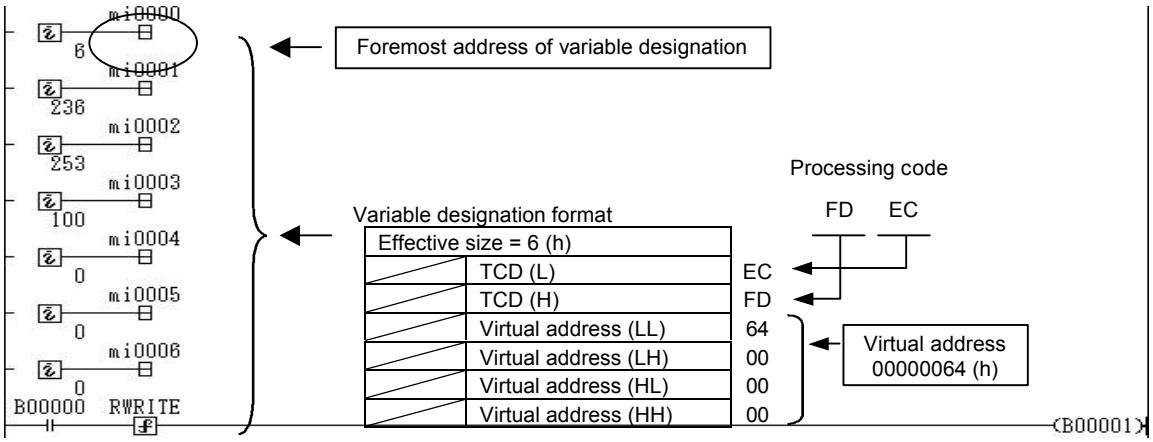


Fig. 2 Relation between the byte block write circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Note 2) The data is input, which is to be written from b00001 as has been designated as the foremost address of the readout data, up to the 5 words that has been designated by the readout data size (b00005).

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	5
Foremost address of readout data size	b00001	

[2] Word block write

It is a message function to write data in units of words (in units of 16 bits for 1 address) via a network onto the virtual address space (32-bit address space) of the destination node. For the address map of the virtual address space, refer to the specifications of each node. (Variable designation method = 2, write request code = FDEE)

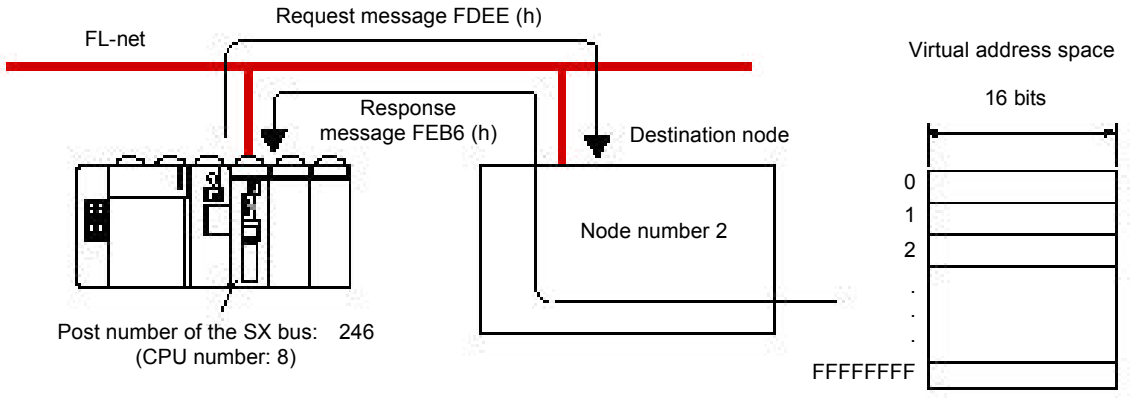


Fig. 3 Image of the word block write

< Example of a word block write program >

This is an example of reading out data of 5 words from the virtual address: 00000200 (h) of CPU connected to the FL-net unit of node number “2”. The value of variable designation format as given below is set one by one starting at the foremost address of variable designation: mi0000.

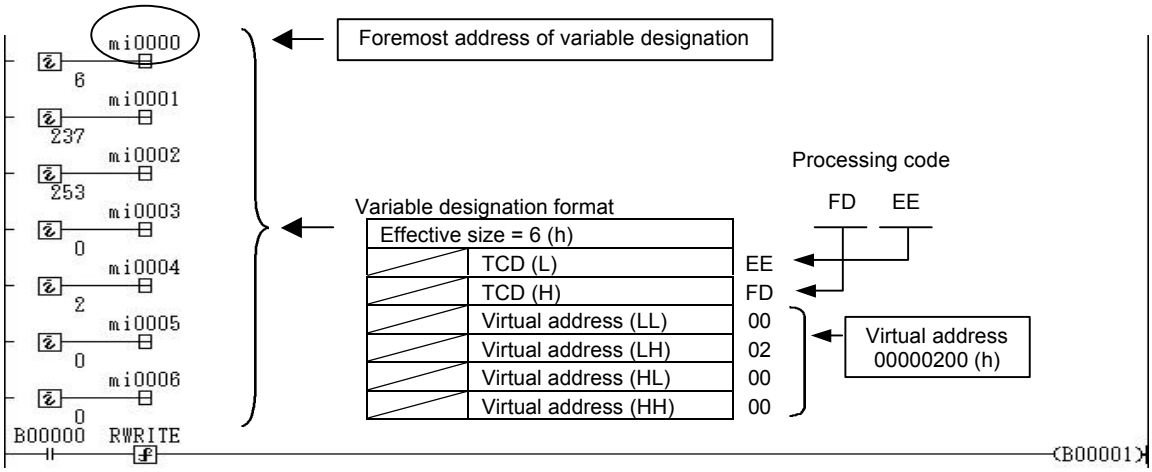


Fig. 4 Relation between the word block write circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	5
Foremost address of readout data size	b00001	

[3] Network parameter write

It is a function to change the network parameter information of the destination node.

The following information can be changed.

· Node name · Address and size of the common memory

When the address and size of the common memory have been changed, the destination node is separated from the network once, and then joins it again. If only the node name has been changed, the destination node will not be separated.

(Variable designation method = 2, readout request code = FDF0)

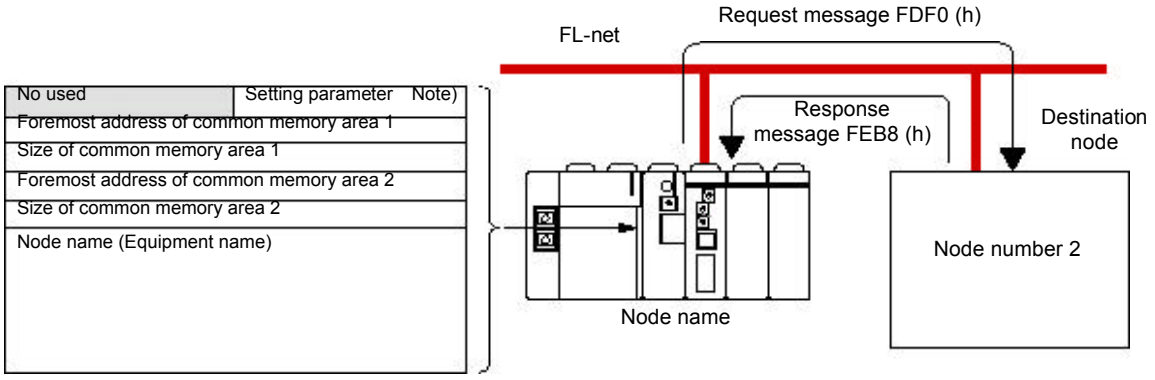


Fig. 5 Image of the network parameter write

Note) Setting parameter

01 (h): Only the address and size of common memory are written.

02 (h): Only the node name is written.

03 (h): Both the address & size of common memory and the node name are written.

< Example of a network parameter write program >

This is an example to write the network parameters of the FL-net unit of node number “2”.

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

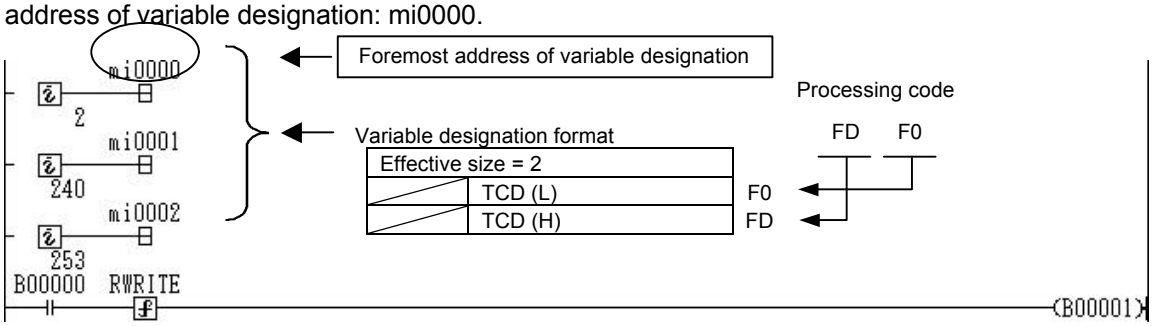


Fig. 6 Relation between the network parameter write circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Note 2) Note that the address is different from the common memory that is referred to by the FLRAS function.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	10

	Foremost address of readout data size	b00001	

[4] Start/stop command

It is a function to perform the remote start/stop of the destination node from the network. (Variable designation method = 2, stop request code = FDF1, start request code = FDF2)

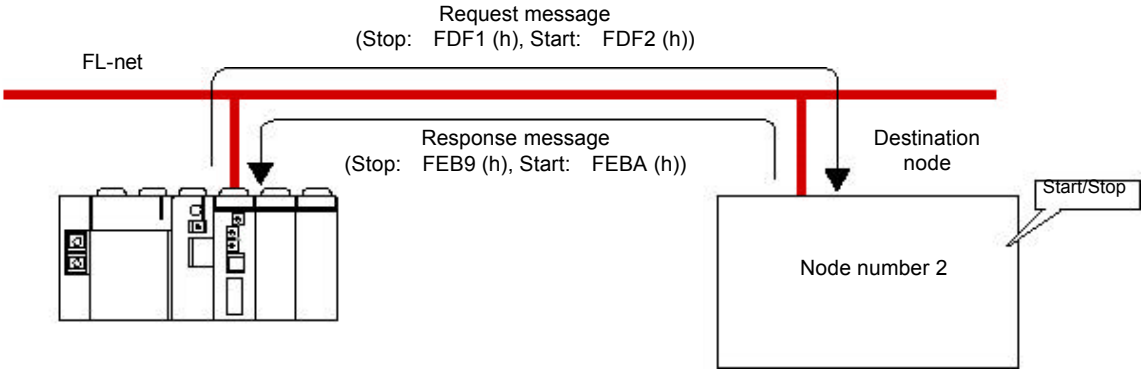


Fig. 7 Image of the start/stop command

< Example of a stop command program >

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

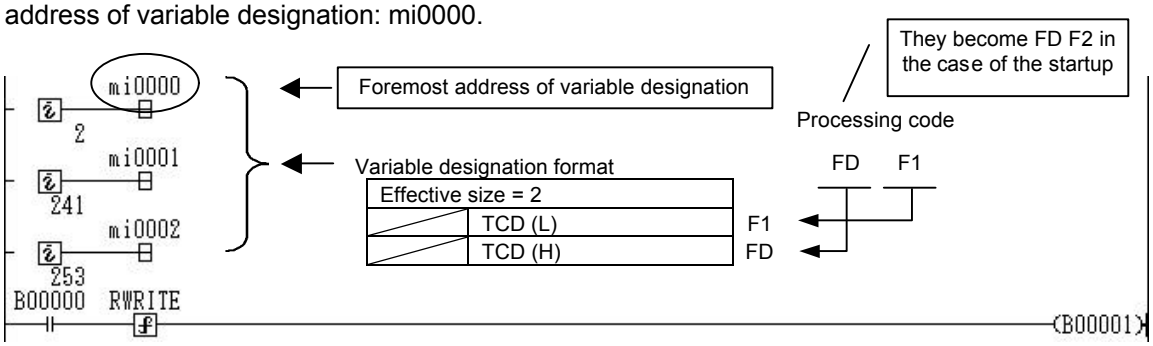


Fig. 8 Relation between the stop command circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at "0".

Note 2) Although there is no actual data to be written, a setting is required for the foremost address of readout data.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	10
Foremost address of readout data size	b00001	

[5] Communications log data clear

It is a function to clear the log information of the destination node from the network.

(Variable designation method = 2, clear request code = FDF6)

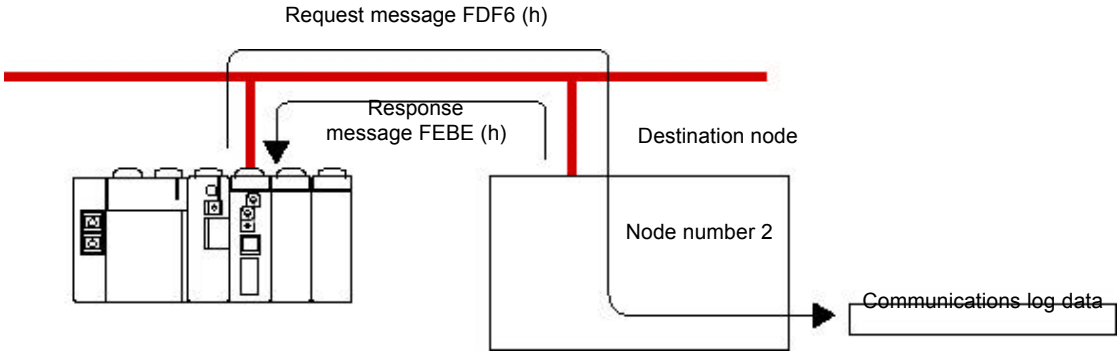


Fig. 9 Image of the communications log data clear

< Example of a communications log data clear program >

It clears the communications log data of the FL-net unit of node number “2”.

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

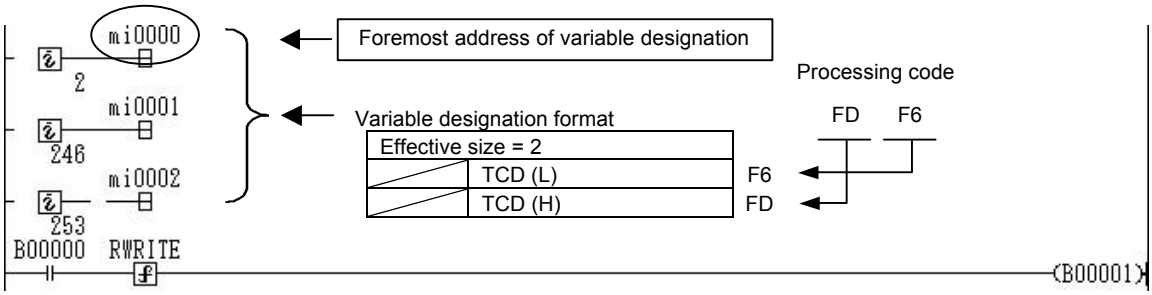


Fig. 10 Relation between the communications log data clear circuit diagram and the variable designation format

Note 1) The channel number of the NP1L-FL1 is fixed at “0”.

Note 2) The readout data size is fixed at “10”.

Note 3) Although there is no actual data to be written, a setting is required for the foremost address of readout data.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	10
Foremost address of readout data size	b00001	

[6] Message return

It is a function to make the received message return. The return is automatically carried out within the FL-net module/unit.

(Variable designation method = 2, return request code = FDF7)

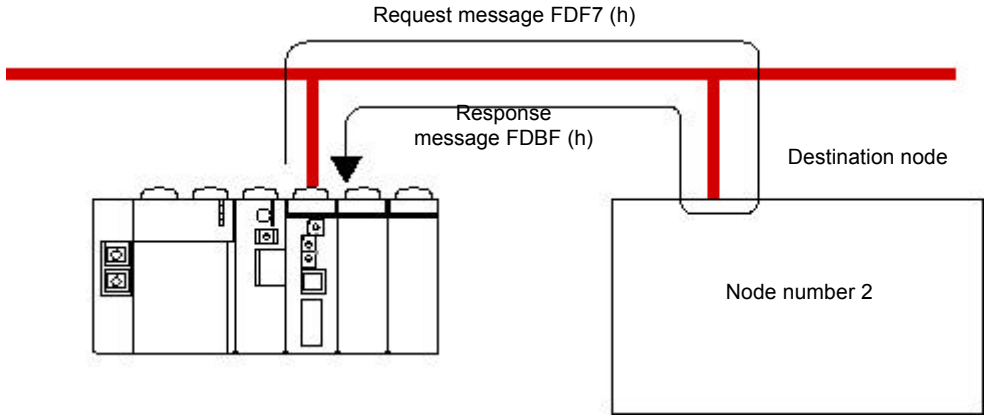


Fig. 9 Image of the message return

< Example of a message return program >

It sends out a message return request to the FL-net unit of node number “2”.

The parameters of variable designation format are input one by one starting at the foremost address of variable designation: mi0000.

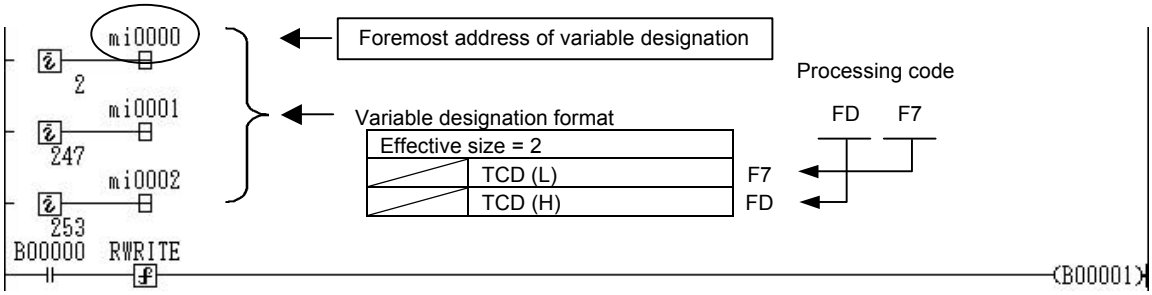


Fig. 12 Relation between the message return circuit diagram and the variable designation format

Note 1) The readout data size is fixed at “10”.

Note 2) Transmittal, receiving and verification of 512 words are automatically performed. When a verification error is detected, error status of 05 (h) is sent out.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	10
Foremost address of readout data size	b00001	

Example of use

The figure blow is an example of the readout of network parameters.

In this configuration, 1 unit each of CPU and FL-net module are mounted on 1 base, and communications are carried out between 2 bases by means of the FL-net.

For the post number of the SX bus, the post number of the SX bus of the destination of communications should be set. (In this case, since the equipment is the FL-net module, ki0000 = 246.)

Channel number is fixed at “0” in the case of the FL-net module.

Node number is the 2nd FL-net module, and hence it is “2”.

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Node number	ki0002	2
Variable designation method	ki0003	2
Foremost address of variable designation	mi0000	
Readout data size	ki0004	17
Foremost address of readout data size	b00001	
Error Flag	G00000	
Status	mi0010	

For the variable designation method, since the FL-net module is used in this case, it is “2”.

For the foremost address of variable designation, the foremost label should be designated from which the parameters to be set will be read. (In this case, it is mi0000.) Next, the number of parameters should be set to the designated label, and in this case since it is 2, mi0000 = 2, and then referring to the support message list, lower 8 bits: 240 (F0) of the applicable request command 65008 (FDF0) should be set to mi0001, and upper 8 bits: 253 (FD) should be set to mi0002.

As for the readout data size, since there are 10 words in the case of the network parameters, a value not smaller than this figure should be set.

Concerning the foremost address of the readout data, the foremost address of the label, from which the data to be written, should be designated.

Error flag should be turned ON for 1 scan when there has been a readout failure.

Status should indicate the contents of error when the error flag has been turned ON.

With the foregoing setting, information on the module that is mounted on other base board can be obtained.

Note 1) Note that the value of the network parameter is similar to that of the FLRAS function, but the address is different.

Note 2) Note that the contents of data at the time of reading are different from those at the time of writing.

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Channel open		--
Function	It is a function to set the destination of message communications. This setting is used in M_SEND (transmitting messages) and M_RECV (receiving messages) that are explained on the next page and thereafter. Verification of connection with the destination of communications shall not be made.		

The setting contents of the function argument

[1] Post number of the SX bus:

Communications outside the configuration
→ Post number of the SX bus of the module by way of which the communications are made

Communications inside the configuration
→ Post number of the SX bus of the CPU which is the destination of communications

[2] Channel number: Channel number inside the communications module
(When there are multiple channels, the object channel should be set, and when there are none, “0” should be set.)

[3] Station number (L): Station number on the network, of the destination of communications (lower 16 bits)

[4] Station number (H): Station number on the network, of the destination of communications (upper 16 bits)
(These do not have any meaning at the time of communications inside the configuration.) < see details of the arguments >

[5] Module type number:
0 → Communicating messages with a module inside the configuration
1 → Communicating messages with a module outside the configuration

[6] Communications mode:
It sets the communications conditions of the connection.
< see details of the arguments >

[7] Communications submode:
< see details of the arguments >
0 → It sets without delivery confirmation at the destination node.
1 → It sets with delivery confirmation at the destination node.

[8] Transmitting port number:
It sets the port number of the destination of communications.
Notes 1, 2)

[9] Receiving port number:
It sets the receiving port number. Notes 1, 2)

[10] Error flag: When abnormal termination of the open processing occurs, it is turned ON for 1 scan.

[11] Error status: It displays the contents of the error. < see details of the arguments >

[12] Connection number:
A connection number is assigned when the channel open processing has been completed.

Note 1) The port numbers that can be set on the SX bus by this function are 1 - 127.
Note 2) If the communications module by way of which communications outside the configuration are made is a PC card interface module, then the value that has been designated by the self port standard number/the port standard number of the destination of communications, in the parameters of PC card module in the system configuration definition, shall be added to the port number as an offset value.

< Operations of instruction >

[1] As a result of the startup (OFF → ON) of the input relay (B00000), the open processing of a module that has been designated by the post number of communications SX bus is started. (The open processing is not completed within 1 scan.)

[2] When the open processing has been completed normally, the normal flag is turned ON, and the connection number is output to the connection number. With this state, M_SEND and M_RECV can now be used.

[3] When the open processing has not been completed normally, the error flag is turned ON for 1 scan, and the error code is output to the status.

[4] Upon turning the input relay OFF, the close processing is performed (The close processing is not completed within 1 scan, either.)

[5] When the close processing has been completed, the normal flag is turned OFF (There is no abnormal termination in the close processing.)

< Matters requiring attention in the instruction >

[1] There are “Passive method” for receiving and “Active method” for transmittal as the open methods. For communicating, there are open processing for receiving and open processing for transmittal.

In order to transmit, the equipment to which the transmittal is made needs to be ready for receiving, and so the open processing of the “Passive method” needs to be completed first.

[2] If the input relay is turned ON → OFF while in the open state, the close processing is performed.

[3] When reopen is made after the close processing is over, it is required that the destination of communications side should be closed first, followed by the processing of reopen.

< Details of the arguments >

1) Station number (L), (H) - (2 words)

It sets the IP address of the destination of communications. The IP address is set by a hexadecimal number or a decimal number. Lower 16 bits should be set to station number (L), and upper 16 bits should be set to station number (H).

Example) When the IP address is 172.16.0.1, the setting should be made as follows.

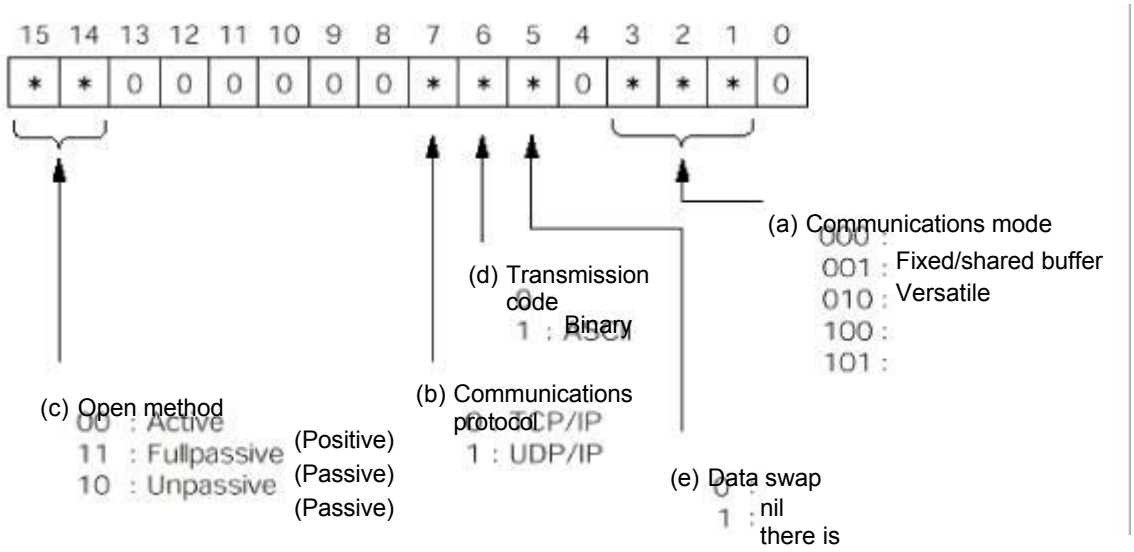
ACh	10h	00h	01h
172	16	0	1

Station number (L) = 0001 (h) or 1

Station number (H) = AC10 (h) or -21488

2) Communications mode

The communications mode of the connection, to which channel open is made, should be set to 1 word data as bit information. The contents of the 1 word shall be as follows.



(a) Communications mode

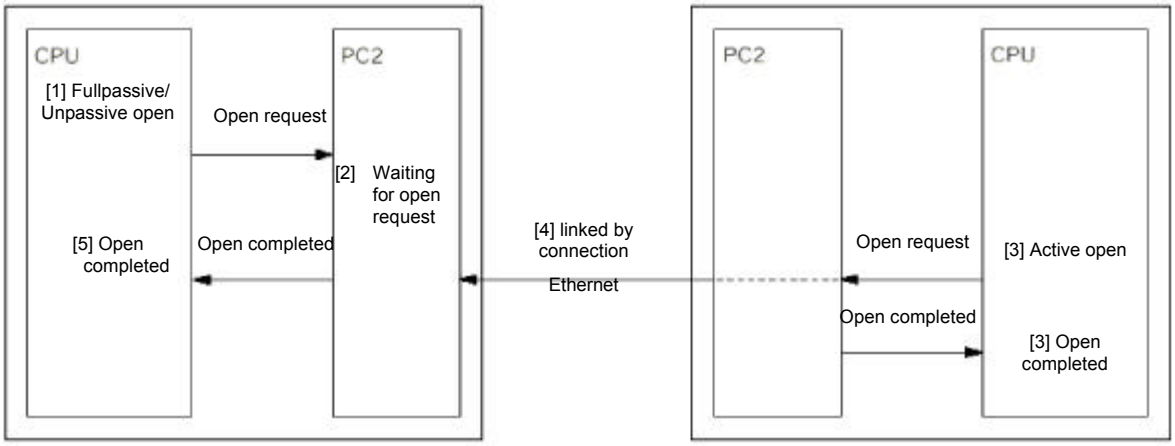
It sets the communications mode of the channel to be opened.

(b) Communications protocol

By means of the communications protocol of each connection, it should be set whether TCP/IP is used, or UDP/IP is used.

(c) Open method

When the open is made by TCP/IP, after the open processing of the node that performs the Fullpassive/Unpassive open (passive open) has been completed, the open of the node that performs the Active open (positive open) is carried out.



[1] Active open method

It carries out a positive open processing against other nodes that are in the state of open passive of TCP connection.

[2] Fullpassive open method

It carries out a passive open processing only against the specific nodes that have been set in the communications address setting area. It comes to the state of waiting for an Active open request by the other nodes that have been set in the communications address setting area.

[3] Unpassive open method

It carries out a passive open processing of TCP connection against all the other nodes that are connected to the network. It comes to the state of waiting for an Active open request by all the other nodes within the network.

(d) Transmission node

It selects the data code type (binary, ASCII) when carrying out data communications with other nodes.

(e) Data swap

When transmission codes are designated to be binary in all communications modes, it reverses the handling of upper bytes/lower bytes in the transmission data. If the transmission code is ASCII, this designation will have no meaning.

Example of the data setting of a communications mode
(an example in which the transmission code is made to be binary)

Communications method \ Communications mode		Versatile	Fixed/ shared buffer
TCP	Active	0002h	0000h
	Fullpasive	C002h	C000h
	Unpasive	8002h	8000h
UDP	Active	0082h	0080h
	Fullpasive	C082h	C080h
	Unpasive	8082h	8080h

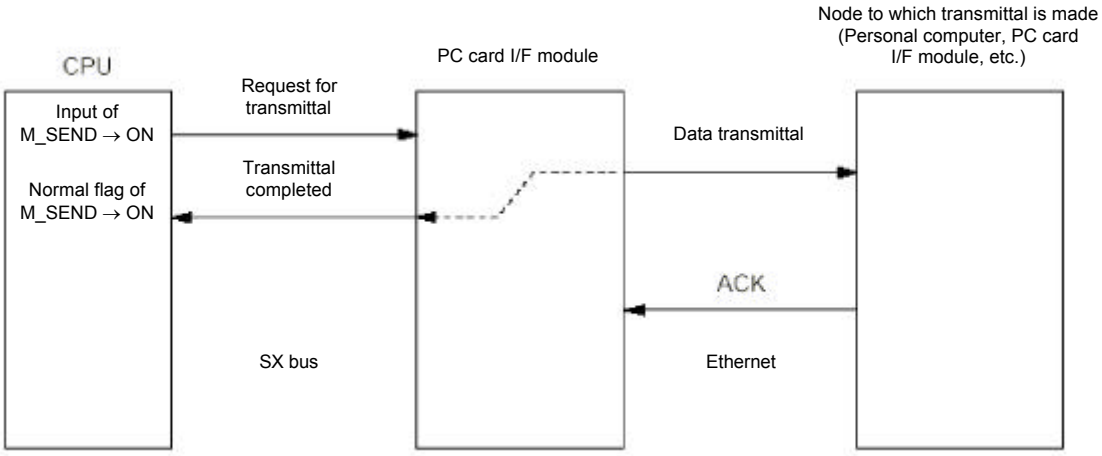
3) Communications submode

0: It sets without delivery confirmation in the destination node (destination module or destination node application).

1: It sets with delivery confirmation in the destination node (destination module or destination node application).

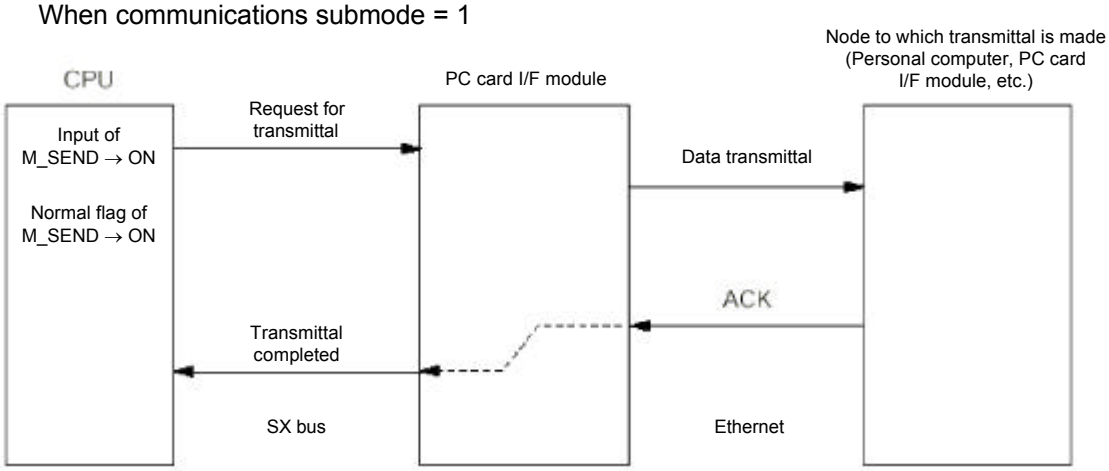
< About the operation of the communications submode>

[1] When communications submode = 0



* Without waiting for the ACK to be sent by the destination node, the transmittal is completed when the data has been transmitted onto the Ethernet.

[2] When communications submode = 1



* The transmittal is completed upon receipt of the ACK sent by the destination node

4) Error status

Name	Code	Contents
Abnormal parameter	177 (B1h)	When there is no module in the post number that has been designated by the communications bus post number, or the code designated by the module type number does not match the network type of the communications module.
Abnormal channel open	193 (C1h)	When an abnormal value has been set to the station number When an abnormal value has been set to the communications mode When the communications mode has been set to the active side (transmitting side), and the station number (IP address, transmittal port number) of the destination of communications does not exist on the network. Otherwise when no connection has been established.
Abnormal port designation	200 (C8h)	When the code designated by the receiving port number is not within the range of 1 - 127. When the same receiving port number has already been designated within the resource. When the same transmitting port number and receiving port number are registered as a combination of these on the same communications module.
Connection number, Client port number FULL	201 (C9h)	When it has been tried to open 57 ports or more simultaneously within the resource. When it has been tried to open the number of ports that exceeds the specified number within 1 communications module.

Note 1) For the common status of the message function, refer to (Appendix 4).

Note 2) Concrete examples of use are collectively indicated in the item of M_RECV.

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Message transmittal	M_SEND	--
Function	It performs the message transmittal to the destination of communications as set by M_OPEN.		

The setting contents of the function argument

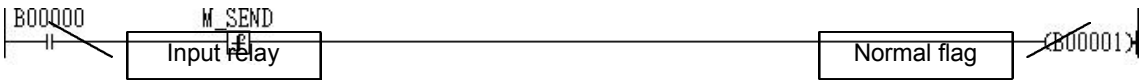
[1] Connection number:
It sets the connection number as opened by M_OPEN.

[2] Transmittal data storage variable:
It sets the foremost address where the transmittal data is stored.

[3] Transmittal data storage variable size:
It sets the data size in which the transmittal data is stored. (In units of words)

[4] Error flag: When the message transmittal has not been made normally, it is turned ON for 1 scan.

[5] Status: When the message transmittal has not been made normally, its contents are output.



< Operations of instruction >

[1] Transmittal of messages is carried out to the station having the connection number as has been set to the connection number at the startup of the input relay (OFF → ON) (The transmittal processing is not completed within 1 scan.)

[2] When the transmittal processing has been completed normally, the normal flag is turned ON for 1 scan.

[3] When the transmittal processing has not been completed normally, the error flag is turned ON for 1 scan, and the error code is output to the status.

< Matters requiring attention in the instruction >

[1] The amount of data that can be transmitted in 1 message transmittal is 1017 words. (Versatile communications mode) As for others, check the amount of data at each mode.

[2] The input relay is invalid while messages are being transmitted (from the startup of the relay input to the startup of the normal flag or error flag.)

[3] Do not change the transmittal data storage variable while messages are being transmitted. If it has been changed, the transmittal data is not guaranteed.

[4] When the number of data as has been designated by the transmittal data storage variable size exceeds the variable size as has been designated by the transmittal data storage variable, the data in excess of the latter size may be indefinite. Input the variable size that has been designated without fail as the transmittal data storage variable size.

[5] The program should be created so that the ON flag is input to the input relay after the normal flag of M_OPEN has been turned ON.

< Matters requiring attention when using M_SEND >

[1] In the versatile communications mode of UDP/IP, no delivery confirmation or flow control is carried out. When the processing of receiving cannot keep pace, the receiving buffer becomes full and the subsequent data will be destroyed. Therefore, the number of completed transmittal at the transmitting side does not match with the number of completed receiving at the receiving side. Also, when the receiving buffer has become full, about 10 seconds are required for releasing the buffer, and hence the receiving operations may be stopped during the time.

[2] When in Full Passive open, an open request has been received from the destination of communications, of which IP address and port number do not match, after connection has been once established, the Full Passive side send a close request to the Active side. As a result of this, at the Active side, when the open has been normally completed and the data transmittal has been carried out, there occurs Error Status C7h (compulsory close).

[3] When the port number of the transmitting side does not match with that at the receiving side, a transmittal error occurs, and compulsory close is carried out by the transmitting side, with an occurrence of Error Status “C7h: (compulsory close)”.

[4] When communications between the μGPCsx and another μGPCsx are made, in some cases, after continuous transmittal of 1 word has been made, the receiving side may, depending on the timing of M_RECV, return to CPU a response combining the 1 word that has been received first and the 1 word that has been received next. Hence, when the number of transmitted words is 1 word, the buffer area at the receiving side should have the size of 2 words. When the number of transmitted words is 2 words or more, the buffer area at the receiving side should have the same number as the number of transmitted words.

[5] When data is transmitted after converting it to ASCII codes in the versatile communications mode of UDP/IP, if the number of data exceeds 1019 bytes, the transmitting side transmits it by dividing it into 2 times. Therefore, the receiving side needs to make a receiving request twice. Also, the buffer area at the receiving side needs to be larger than the transmitted data.

< Error status >

Name	Code	Contents
Abnormal parameter	177 (B1h)	When 0 has been input as the transmitting data storage variable size
Abnormal message transmittal	195 (C3h)	When no message can be transmitted to the communications module with which communications are made. When there is no response from the communications module with which communications are made. (When no ACK is returned after transmittal has been completed.)
Channel close	199 (C7h)	When the destination of communications has been closed. Note) When this code has been received, close the applicable channel once, and then make an open request again.
Abnormal port designation	200 (C8h)	When the destination of communications has not been opened.
Buffer overflow	206 (CEh)	When the number of transmitted data has exceeded 1017 words (versatile communications mode)
Abnormal connection number	207 (CFh)	When the connection number that has not been opened is used. When it has been tried to transmit using the connection number that is being sent (this occurs when 2 M_SENDs are used in parallel with the same connection number.)

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Message receiving	M_RECV	--
Function	It carries out message receiving with the destination of communications, which has been set in M_OPEN.		

The setting contents of the function argument

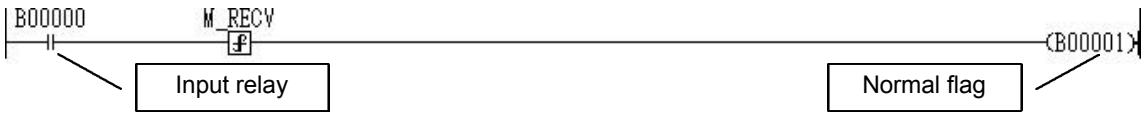
[1] Connection number:
It sets the connection number as established by M_OPEN.

[2] Receiving data storage variable:
It sets the foremost address where the receiving data is stored.

[3] Receiving data storage variable size:
It sets the data size in which the receiving data is stored. (In units of words)

[4] Error flag: When the message receiving has not been made normally, it is turned ON for 1 scan.

[5] Status: When the message receiving has not been made normally, its contents are output.



< Operations of instruction >

[1] Receiving of messages is carried out to the station having the connection number as has been set to the connection number at the startup of the input relay (OFF → ON) (The receiving processing is not completed within 1 scan.)

[2] When the receiving processing has been completed normally, the normal flag is turned ON for 1 scan.

[3] When the receiving processing has not been completed normally, the error is turned ON for 1 scan, and the error code is output to the status.

< Matters requiring attention in the instruction >

[1] The amount of data that can be transmitted in 1 message transmittal is 1017 words. (Versatile communications mode) As for others, check the amount of data at each mode.

[2] The input relay should be kept ON while receiving messages (from the startup of the input relay to the startup of the normal flag or error flag.) Turning the input relay OFF means the temporary suspension of receiving.

[3] After the temporary suspension of receiving has been made, when the input relay is started (OFF → ON), the receiving is restarted. At this time, even if the connection number, receiving data storage variable and receiving data storage variable size are changed, it is restarted with the input values before the suspension. The changes will not be reflected on the processing of message receiving.

[4] After the processing of message receiving is over, if the input relay is kept ON in the next scan as well, then a new processing of message receiving will be started.

[5] Keep the receiving data storage variable while processing the message receiving. If it has been changed, the receiving message data will not be guaranteed.

[6] When the number of data as has been designated by the receiving data storage variable size exceeds the variable size as has been designated by the receiving data storage variable, the other variable area may be changed. Input the variable size that has been designated without fail as the receiving data storage variable size.

[7] The program should be created so that any input to the input relay will be made after the normal flag of M_OPEN has been turned ON.

< Matters requiring attention when using M_RECV >

The same as M_SEND. See < Matters requiring attention when using M_SEND >.

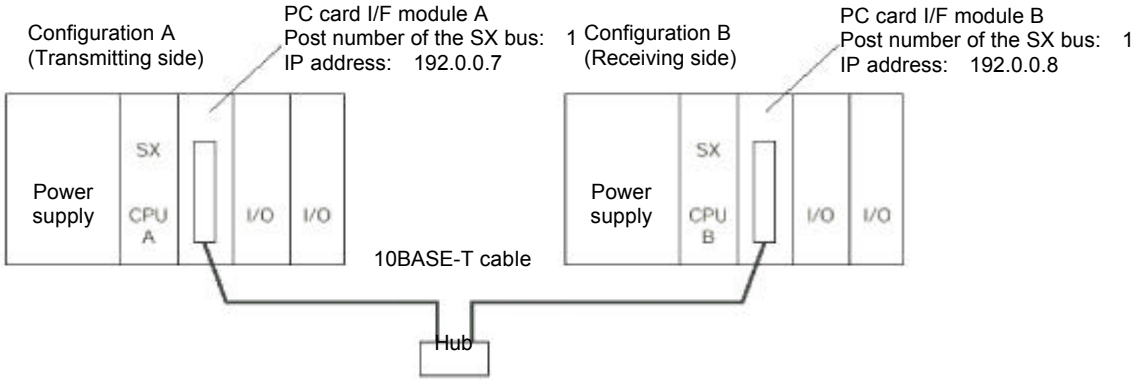
< Error status >

Name	Code	Contents
Abnormal parameter	177 (B1h)	When 0 has been input as the receiving data storage variable size
Channel close	199 (C7h)	When the destination of communications has been closed. Note) If this code has been received, then the applicable channel should be closed first, and a request for opening should be made once again.
Abnormal port designation	200 (C8h)	When the destination of communications has not been opened.
Buffer overflow	206 (CEh)	If data exceeding the designated receiving data size have been received, then at this time effective receiving data are stored in the receiving data storage variable.
Abnormal connection number	207 (CFh)	When the connection number that has not been opened is used. When it has been tried to receive using the connection number that is being received (this occurs when 2 M_RECVs are used in parallel with the same connection number.)

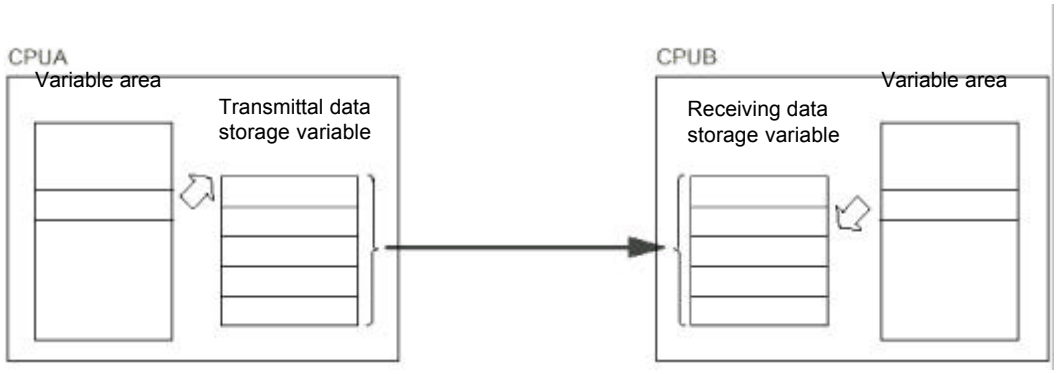
< Example of use of a program - 1>

An example of a program is presented herein to send data from A → B in a system as given below by means of the channel open “M_OPEN”, message transmittal “M_SEND”, message receiving “M_RECV” instructions.

< Illustration on configuration >



< Program Image >



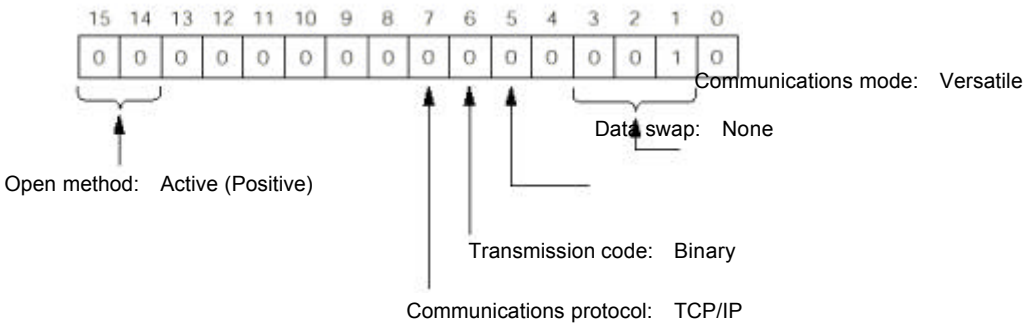
Contents of the program

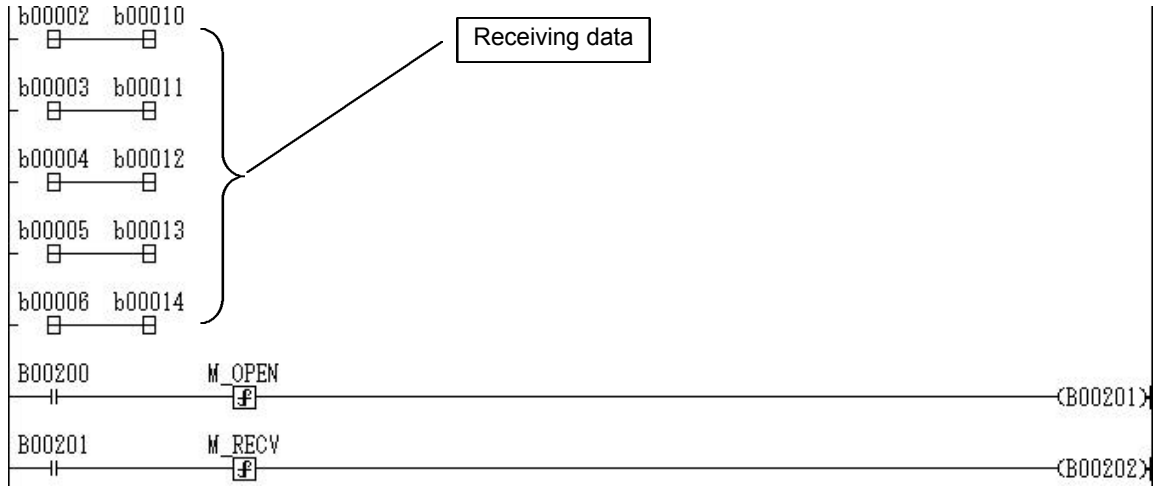
[1] “M_OPEN” at the receiving side CPU B is executed to open the channel.

[2] “M_RECEIVE” at the receiving side CPU B is executed to set the standby state for receiving.

[3] “M_OPEN” at the transmitting side CPU A is executed to open the channel.

[4] “M_SEND” at the transmitting side CPU A is executed to transmit the data to CPU B.





(1) Arguments of M_OPEN

Post number of the communications SX bus should be set at "1" of the destination of communications.

Channel number is fixed at "0".

For the station number, the IP address "192.0.0.9" of the destination of communications should be converted to hexadecimal numbers, setting "C000" to (H), and setting "0009" to (L).

Module type number should be set at "0", for it is communication outside of the configuration.

Communication mode should be set by referring the preceding page.

Communications submode should be set as with delivery confirmation at the destination node.

Transmitting port number should be set so that it may not overlap with the receiving port number.

Error flag B00000 will be turned ON if an error occurs when the M_OPEN function has been executed. Its result is output to the status.

A connection number is assigned when the channel open processing has been successfully completed.

M_OPEN

Argument	Label	Value
Post number of the SX bus	ki0000	1
Channel number	ki0001	0
Station number (L)	ki0002	0009 (H)
Station number (H)	ki0003	C000 (H)
Module type number	ki0004	1
Communication mode	ki0005	2
Sub mode	ki0006	1
Transmitting port number	ki0007	1
Receiving port number	ki0008	2
Error Flag	B00000	
Status	mi0000	
Connection number	mi0001	

M_RECV

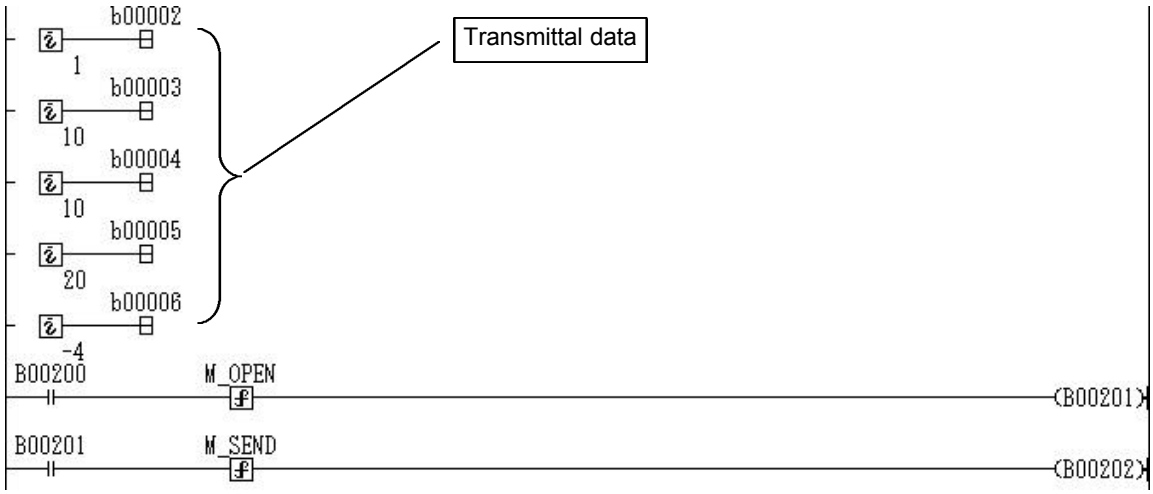
Connection number	mi0001	
Receiving data storage variable	b00002	
Receiving data storage variable size	ki0010	5
Error Flag	B00010	
Status	mi0010	

(2) Arguments of M_RECV

As for the connection number, the connection number that has been obtained in M_OPEN is used as it is.

In the receiving data storage variable, the foremost address of the label in which receiving is made should be set, and in the receiving data storage variable size, the number of words of the data to be received should be set.

Error flag B00010 will be turned ON if an error occurs when the M_RECV has been executed. Its result is output to the status.



(3) Arguments of M_OPEN

Post number of the communications SX bus should be set at “1” of the destination of communications.

Channel number is fixed at “0”.

For the station number, the IP address “192.0.0.8” of the destination of communications should be converted to hexadecimal numbers, setting “C000” to (H), and setting “0008” to (L).

Module type number should be set at “0”, for it is communication outside of the configuration.

Communication mode should be set by referring the preceding page.

Communications submode should be set as with delivery confirmation at the destination node.

Transmitting port number should be set so that it may not overlap with the receiving port number.

Error flag B00000 will be turned ON if an error occurs when the M_OPEN function has been executed. Its result is output to the status.

A connection number is assigned when the channel open processing has been successfully completed.

M_OPEN

Argument	Label	Value
Post number of the SX bus	ki0000	1
Channel number	ki0001	0
Station number (L)	ki0002	0008 (H)
Station number (H)	ki0003	C000 (H)
Module type number	ki0004	1
Communication mode	ki0005	2
Sub mode	ki0006	1
Transmitting port number	ki0007	2
Receiving port number	ki0008	1
Error Flag	B00000	
Status	mi0000	
Connection number	mi0001	

M_SEND

Connection number	mi0001	
Receiving data storage variable	b00002	
Receiving data storage variable size	ki0010	5
Error Flag	B00010	
Status	mi0010	

(4) Arguments of M_SEND

As for the connection number, the connection number that has been obtained in M_OPEN is used as it is.

In the transmittal data storage variable, the foremost address of the label in which transmitting is made should be set, and in the transmittal data storage variable size, the number of words of the data to be transmitted should be set.

Error flag B00010 will be turned ON if an error occurs when the M_SEND has been executed. Its result is output to the status.

(5)

If errors are indicated without any problem as in (1) through (4) above, then the data is passed from CPU A to CPU B.

If no data arrives, it should be considered that there is a mistake in the values of parameters that have been set by the function argument. Check them once again.

< Example of use of a program - 2 >

· Permeable type message transmission

If a permeable type message is received by the FL-net module/unit, it notifies the upper layer of the FL-net of the received message, and the upper layer of the FL-net that received the notice then notifies the user interface level of the said message as it is. When it has been notified to the user interface level, a corresponding response may be returned depending on the application program, etc. In the μGPCsx, the M_SEND/M_RECV functions are used.

Also, services inherent in the permeable type message may be provided by the equipment used.

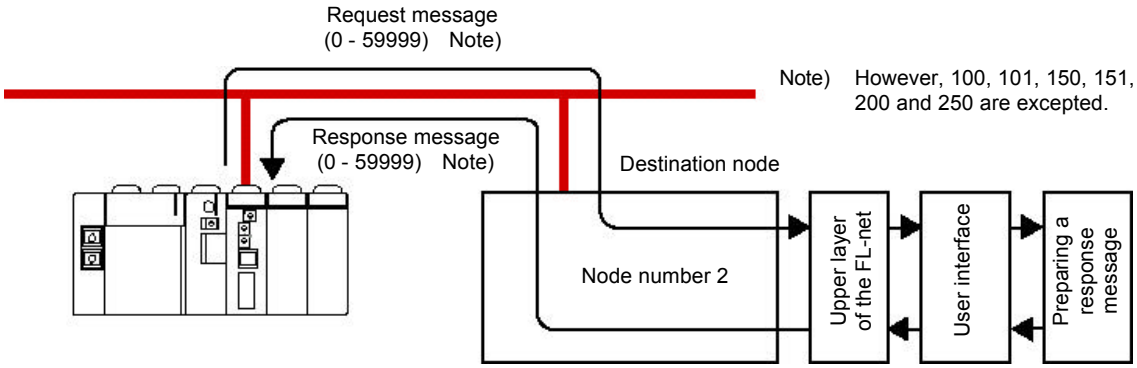


Fig. 1 Image of the return of a permeable type message

< Example of a program of transmitting a permeable type message >

It sends a message return request to the FL-net unit of node number “2”.

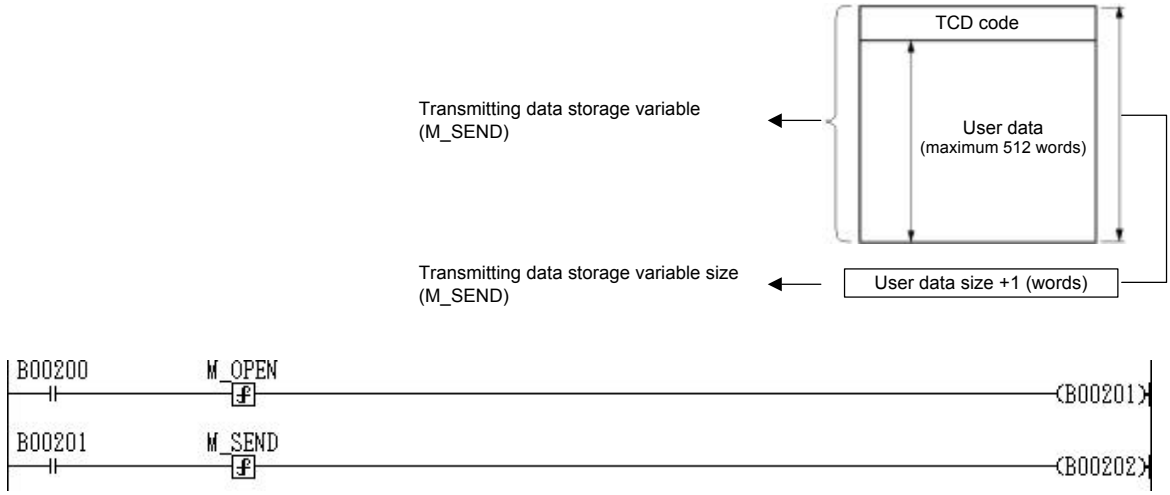


Fig. 2 Relation between the program of transmitting a permeable type message and the variable designation format

Note 1) Usually “3” (open for co-use for transmittal and receiving) should be designated. Multiple open requests cannot be made to the same node. (Operations cannot be guaranteed.) However, it is possible to open with 1: open dedicated to transmittal, and 2: open dedicated to receiving.

1: open dedicated to transmittal

2: open dedicated to receiving

3: open for co-use for transmittal and receiving

The others cannot be used.

Note 2) 1 - 127 can be used as the transmittal port number and receiving port number. These should not overlap with the port numbers that are used by the other M_OPEN functions.

M_OPEN

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Station number (L)	ki0002	0002 (H)
Station number (H)	ki0003	0000 (H)
Module type number	ki0004	1
Communication mode Note 1)	ki0005	3
Sub mode	ki0006	0
Transmitting port number Note 2)	ki0007	2
Receiving port number Note 2)	ki0008	1
Error Flag	B00000	
Status	mi0000	
Connection number	mi0001	

M_SEND

Connection number	mi0001	
Receiving data storage variable	b00002	
Receiving data storage variable size	ki0010	5
Error Flag	B00010	
Status	mi0010	

< Example of a program of receiving a permeable type message >

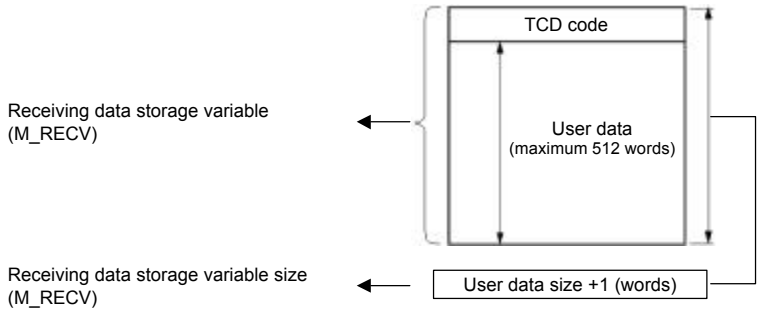


Fig. 3 Relation between the program of receiving a permeable type message and the variable designation format

Note 1) Usually “3” (open for co-use for transmittal and receiving) should be designated. Multiple open requests cannot be made to the same node. (Operations cannot be guaranteed.) However, it is possible to open with 1: open dedicated to transmittal, and 2: open dedicated to receiving.

1: open dedicated to transmittal

2: open dedicated to receiving

3: open for co-use for transmittal and receiving

The others cannot be used.

M_OPEN

Argument	Label	Value
Post number of the SX bus	ki0000	246
Channel number	ki0001	0
Station number (L)	ki0002	0002 (H)
Station number (H)	ki0003	0000 (H)
Module type number	ki0004	1
Communication mode	ki0005	3
Sub mode	ki0006	0
Transmitting port number Note 2)	ki0007	2
Receiving port number Note 2)	ki0008	1
Error Flag	B00000	
Status	mi0000	
Connection number	mi0001	

Note 2) 1 - 127 can be used as the transmittal port number and receiving port number. These should not overlap with the port numbers that are used by the other M_OPEN functions.

M_RECV

Connection number	mi0001	
Receiving data storage variable	b00002	
Receiving data storage variable size	ki0010	5
Error Flag	B00010	
Status	mi0010	

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	MATRIX	MATRIX f	--
Function	It is a function to input a matrix.		

The setting contents of the function argument

[1] Input register: It connects external equipment of which output data is switched by a strobe.

[2] Output register: Strobe output
(to be connected to the strobe input of external equipment.)

[3] Name of the foremost matrix input register:
It designates the foremost register name in which the data that has been input by the strobe output is stored one by one.

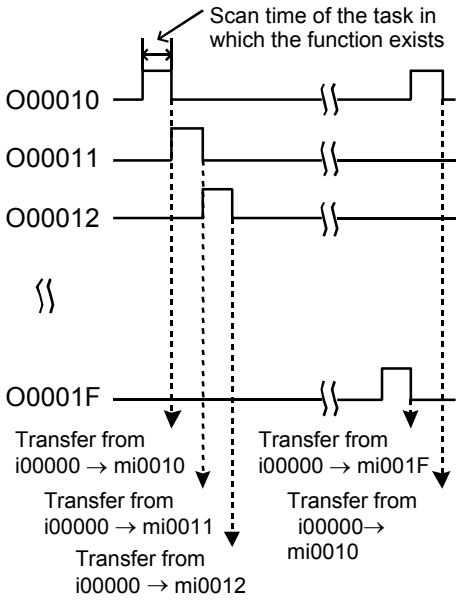
Example of use

Input register: i00000 (register name for data input of 1 word)

Output register: o00001 (output register name for generating strobe pulses)

Name of the foremost matrix input register: mi0010
i00000 data that has been input by the strobe output of o00001 (000010 - 00001F) is stored one by one from mi0010 to mi001F.

```
i00000 = 1   000010 = ON   mi0010 = 1
i00000 = 2   000011 = ON   mi0010 = 2
i00000 = 3   000012 = ON   mi0010 = 3
                  ↓
i00000 = 16  00001F = ON   mi001F = 16
i00000 = 17  000010 = ON   mi0010 = 17
i00000 = 18  000011 = ON   mi0011 = 18
```



Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Obtaining RAS information of the FL-net	FLRAS1 FLRAS8 FLRAS9	--
Function	It obtains the RAS information of the FL-net.		

FLRAS1 ⇒ It can obtain only 1 bit of information of the word designated by the argument.

The setting contents of the function argument

[1] Transferrer word offset:
It designates by the number of words the place where the desired information is.
The default is 0 (For details, see below.)

[2] Transferrer bit offset:
The default is 0 (For details, see below.)

[3] CPU flag (8 or 9):
8 → 1st unit of FL-net module
9 → 2nd unit of FL-net module

1) When 0 is designated as the bit offset, if the store is:
   a) a coil, then the information of the 0th bit (ON, OFF) is output.
   b) a register, then the information of all the bits of the designated word offset is output.
2) When other value than 0 is designated as the bit offset, if the store is:
   a) a coil, then the information of the designated bit (ON, OFF) is output.
   b) a register, then the bit value of the designated word offset is output as a numerical value.

FLRAS8, 9 ⇒ It can obtain information in the designated multiple words.

The setting contents of the function argument

[1] Transferrer offset: The default is 0 (For details, see below.)

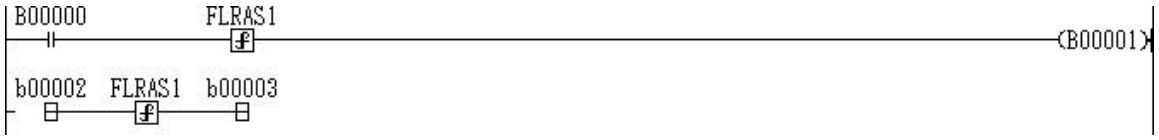
[2] Transferee address:
It designates the foremost address where the RAS information of the FL-net is obtained.

[3] Number to be transferred:
It designates the number of words to be transferred.

Note) When 2 units of FL-net modules are mounted on 1 base board, FLRAS8 obtains the FL-net module information of the 1st unit, and FLRAS9 obtains that of the 2nd unit.
Refer to the transferrer offset values as given below, to set the number to be transferred.
(For the detailed information of each bit, refer to the manual of the FL-net module.)

Word offset value	RAS information contents of the FL-net	Word offset value	RAS information contents of the FL-net
0 - 15	Participation flag	74 - 79	Network control table
16 - 31	Configuration flag	80 - 1103	Participation node control #C table
32 - 47	Abnormal flag	1104 - 2896	Participation node control #M table
48 - 73	Own node control table	2897 - 2962	FL-net error log

Example of use



If the 1st FLRAS function is set as shown on the right, the participation condition of node number 1 on CPU number 8 of the FL-net module is output to B00001.

When B00001=ON, node number 1 participates, and when B00001=OFF, it does not participate.

FLRAS1 1st

Argument	Label	Value
Transferrer word offset	ki0000	0
Transferrer bit offset	ki0001	1
CPU flag	ki0002	8

If the 2nd FLRAS function is set as shown on the right, the participation condition of node number 1 on CPU number 8 of the FL-net module is store to b00003 in a numerical value. If it participates, then since node number 1 is the 1st bit, 2 is stored, and if it does not participate, then 0 is stored. If the transferrer bit offset value is changed to ki0000=0, then the participation flags of node numbers 1 through 15 will be stored in b00003 as a numerical value.

FLRAS1 2nd

Transferrer word offset	ki0003	0
Transferrer bit offset	ki0004	1
CPU flag	ki0005	8

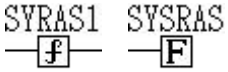
If the FLRAS8 function is set as shown on the right, then the information of the node number in which:

node numbers 1 - 15 participate is stored in mi0000.
node numbers 16 - 31 participate is stored in mi0001.
node numbers 32 - 47 participate is stored in mi0002.
node numbers 48 - 63 participate is stored in mi0003.

in a numerical value.

FLRAS8

Argument	Label	Value
Transferrer offset	ki0010	0
Transferrer offset	mi0000	
Number transferred	ki0011	4

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Obtaining RAS information of the system memory		--
Function	It obtains the RAS information of the system memory.		

SYRAS1 ⇒ It can obtain only 1 bit of information of the word designated by the argument.

The setting contents of the function argument

[1] Transferrer word offset:
It designates by the number of words the place where the desired information is.
The default is 0 (For details, see the next page.)

[2] Transferrer bit offset:
The default is 0 (For details, see next page.)

1) When 0 is designated as the bit offset, if the store is:
   a) a coil, then the information of the 0th bit (ON, OFF) is output.
   b) a register, then the information of all the bits of the designated word offset is output.

2) When other value than 0 is designated as the bit offset, if the store is:
   a) a coil, then the information of the designated bit (ON, OFF) is output.
   b) a register, then the bit value of the designated word offset is output.

SYSRAS ⇒ It can obtain information in the designated multiple words.

The setting contents of the function argument

[1] Transferrer offset:
The default is 0 (For details, see the next page.)

[2] Transferee address: It designates the address where the RAS information of the system memory is obtained.

[3] Number to be transferred: It designates the number of words to be transferred.

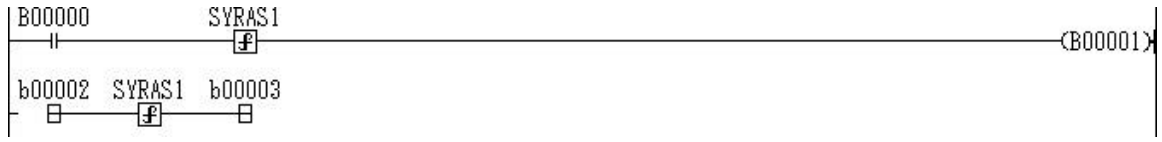
Refer to the transferrer offset values as given on the next page, to set the number to be transferred.

(For the detailed information of each bit, refer to Appendix 3.)

Word offset value	Contents of RAS information of the system memory	Word offset value	Contents of RAS information of the system memory
0	Resource operation start	22 - 29	System definition abnormality factor
1	Resource switch setting information	38 - 39	Application program abnormality factor
2	Resource serious failure factor	42 - 43	Announce relay
4	Resource light failure factor	49	Resource operation information
6	CPU abnormality factor	50	Resource configuration information
8	Memory abnormality factor	51	Resource abnormality information
10 - 11	SX bus abnormality factor	52 - 67	SX bus configuration information (configuration composition information)
12	Application abnormality factor (serious failure)	68 - 83	SX bus abnormality information (configuration abnormality information)
13	Application abnormality factor (light failure)	128 - 255	Remote IO master (0 - 7) (I/O module configuration/abnormality configuration)
14 - 16	User serious failure Factor 0 - Factor 47	508 - 511	SX bus transmission error rate information
18 - 20	User light failure Factor 0 - Factor 47		

Note) Word offset values of 3, 5, 7, 9, 17, 21, 30 - 37, 40, 41, 44 - 48, 84 - 127, 256 - 507 are not used.
However, when it is desired that the information on the 0th word to 8th word should be obtained at one time, if the number to be transferred is set at 9, then values are given to 3rd, 5th and 7th words as well, but the user needs not pay particular attention to it.

Example of use



If the 1st SYRAS1 function is set as shown on the right, the light failure information of the CPU module is output to B00001.

When B00001=ON, a light failure has occurred in the CPU module, and when B00001=OFF, it has not occurred.

SYRAS1 1st

Argument	Label	Value
Transferrer word offset	ki0000	0
Transferrer bit offset	ki0001	3

If the 2nd SYRAS1 function is set as shown on the right, the light failure information of the CPU module is store to b00003 in a numerical value. If a light failure has occurred, then since it is the 3rd bit, 8 is stored, and if it has not occurred, then 0 is stored. If the transferrer bit offset value is changed to ki0004=0, then the information of the operation flag of CPU to the master will be stored in b00003 as a numerical value.

SYRAS1 2nd

Transferrer word offset	ki0003	0
Transferrer bit offset	ki0004	3

If the SYSRAS function is set as shown on the right, then the information on:

Resource operation start is stored in mi0000.
Resource switch setting information is stored in mi0001.
Resource serious failure factor is stored in mi0002.
Resource light failure factor is stored in mi0004.
CPU abnormality factor is stored in mi0006.

in a numerical value.

SYSRAS

Argument	Label	Value
Transferrer offset	ki0010	0
Transferrer address	mi0000	
Number transferred	ki0011	6

Note) Values are given to mi0003 and mi0005, but the user needs not pay particular attention to it.

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	Versatile communications	C_FREE F	--
Function	It is a function for versatile communications.		

The setting contents of the function argument

[1] Transmittal request:
It starts the transmittal of data. When the transmittal is over, it needs to be turned OFF by the application.

[2] Transmittal data length:
It designates the transmittal data length by the number of bytes.

[3] Transmittal data address:
It designates the foremost address of the transmittal data.

[4] Receiving data address:
It designates the foremost address of the receiving data.

[5] Parameter address:
It designates the foremost address of parameters for port initialization.

[6] RAS information address:
It designates the foremost address of C_FREE operation information.

[7] Open status: It is a code to show the result of port initialization.

[8] Transmittal completed:
It is turned ON when transmittal has been completed. (1 scan)

[9] Transmittal abnormality:
It is turned ON when an error has occurred in transmittal.
(1 scan)

[10] Transmittal status:
It is a code to show the result of transmittal.

[11] Receiving completed:
It is turned ON when receiving has been completed. (1 scan)

[12] Receiving abnormality:
It is turned ON when an error has occurred in receiving. (1 scan)

[13] Receiving status: It is a code to show the result of receiving.

[14] Receiving data length:
It stores the received data length.

[15] RS-485 post number:
It stores the post number of the versatile communications module.

- Note) When using this function, secure the function instance memory of 3500 words.
- It can be set in the system configuration definition by choosing property - parameter of CPU module.
- For the details of this function, refer to the separate manual.

(1) Format of the RAS information address

Starting from the foremost address designated by the RAS information foremost address, parameter are input following the order given below.

RAS	RAS information
0	Port status
1	Communications module status
2	Number of times of transmittal request
3	Number of times of transmittal completion
4	Number of times of receiving
5	Number of times of frame detection
6	M_OPEN status
7	M_SEND status
8	M_RECV status
9	Number of times of M_SEND error
10	Number of times of M_RECV error

(2) Format of transmittal data and receiving data

15 8
0

Number of words	Transmittal data	
0	Data 2	Data 1
1	Data 4	Data 3
…	…	
511	Data n	Data n-1

n shall include the foremost code, end code BCC, etc.

15 8
0

Number of words	Receiving data	
0	Data 2	Data 1
1	Data 4	Data 3
…	…	
511	Data n	Data n-1

n shall include the foremost code, end code BCC, etc.

(3) Format of communications parameters

Number of words	Item	Contents		
0	Post number of versatile communications module number	It sets the post number on the SX bus of the versatile communications module.		
1	Port number	It designates the interface port of the versatile communications module. 0: RS-232C port 1: RS-485 port		
2	Message port number	It designates the message transmittal and receiving port number with the versatile communications module. (1 - 127) Note) It should not overlap with other message transmittal and receiving port number.		
3	Transmission rate	It designates the transmission rate. 0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57600 bps		
4	Data bit	It designates the data bit length. 7 stands for 1 data of 7 bits, and 8 represents 1 data of 8 bits. 0: 7 bits 1: 8 bits		
5	Parity bit	It is a bit for error detection, which is added to the data. It should be designated according to the setting of the destination equipment. 0: none 1: odd number 2: even number		
6	Stop bit	It is a bit for showing the end of data. It should be designated according to the setting of the destination equipment. 0: 1 bit 2: 2 bits		
7	DCE designation	When no control is made for signal lines, both modes of DCE/DTE operate in the same way. Although the RS-232C of the versatile communications module is of DTE specifications, it can be used as that of DCE specifications by reading the signal lines as given below. pin-4 (RS) → CS pin-5 (CS) → RS pin-6 (DR) → ER pin-20 (ER) → DR 0: DTE 1: DCE 2: modem DTE		
8	ER/DR signal control	0: none 1: exists		
9	Signal flow control	DTE mode	0: none →	RS: always ON Transmittal: unconditional
			1: exists →	RS: ON while transmittal Transmittal: when CS is ON
		DCE mode	0: none →	CS: always ON Transmittal: unconditional
			1: exists →	CS: when RS ON is ON Transmittal: when ER is ON
10	XON/XOFF control	Because the transmittal side and receiving side are connected asynchronously, flow control may be required in some cases. The receiving side sends XOFF to inform that it cannot receive data for a while, and releases it by sending XON. The “XON/XOFF control” requires that the destination equipment should be equipped with this function. 0: none 1: exists		
11	RS-485 mode	When RS-485 is used, it selects 4-line type or 2-line type. 0: 4-line type 1: 2-line type		
12	Code conversion	It converts binary data into character string variables. 0: none 1: ASCII conversion 2: EBCDIC conversion		

Number of words	Item	Contents
13	Frame detection	It designates the receiving method of data. 0: none When the data has been received, the receiving is completed. 1: variable length When the data enclosed by the foremost code and the end code has been detected, the receiving is completed. 2: fixed length When the received data reaches the number of receiving bytes, the receiving is completed.
14	Number of receiving bytes	At the time of fixed length, it designates the number of receiving bytes. At the time of variable length, it designates the number as “0”.
15	Number of bytes of the foremost code	At the time of variable length, it designates the number of bytes of the foremost code.
16	Foremost code 1	At the time of variable length, it designates the foremost code.
…	…	
20	Foremost code 5	
21	Number of bytes of the end code	At the time of variable length, it designates the number of bytes of the end code.
22	End code 1	At the time of variable length, it designates the end code.
…	…	
26	End code 5	
27	BCC designation	It is a setting as to whether a horizontal parity is added or not, which is used to check the transmission error of text data. 0: none 1: setting to be made in the order of upper/lower [Upper byte of BCC] [Lower byte of BCC] 2: setting to be made in the order of lower/upper [Lower byte of BCC] [Upper byte of BCC]
28	Range of calculation and position	It sets the position and range of calculation of BCC. ◄► : Range of calculation 0: The text part is calculated and is then put before the end code. [Foremost code] [TEXT] [BCC] [End code] Note) 1: The text part and end code are calculated and are then put after the end code. [Foremost code] [TEXT] [End code] [BCC] 2: The foremost code and text part are calculated and are then put before the end code. [Foremost code] [TEXT] [BCC] [End code] Note) 3: The foremost code, text part and end code are calculated and are then put after the end code. [Foremost code] [TEXT] [End code] [BCC] Note) In this case, the BCC code mode cannot be designated as binary.
29	Calculation formula of BCC	It is a calculation method of how the transmission error is checked. [D1] [D2] [-] [-] [Dn] 0: Addition D1 + D2 + .+Dn 1: Addition and reversal Reversal of (D1+D2+ … +Dn) 2: EOR D1 EOR D2 EOR … EOR Dn 3: CRC CRC-16: $X^{16} + X^{15} + X^2 + 1$
30	Code mode of BCC	It designates the code mode of BCC data 0: binary 1: ASCII 2: EBCDIC
31	Transmittal timer value	It is a transmittal monitoring timer from the time when the CPU module has sent a data transmittal request to the RS-232C line up to the completion of transmittal. Usually it is set at 100 (1 second). (in units of 0.01 seconds)

Example of use

If a setting is made as shown on the right, when B00000 is turned ON, data of the length set in mi0010 is transmitted from g00000 to external equipment.

Also, the data received from external equipment is stored in g00200 and the data length is stored in mi0011.

C_FREE

Argument	Label	Value
Transmittal request	B00000	
Transmittal data length	mi0010	
Transmittal data address	g00000	
Receiving data address	g00200	
Parameter address	ki0000	
RAS information address	g00400	
Open status	mi0000	
Transmittal completed	B00001	
Transmittal abnormality	B00002	
Transmittal status	mi0001	
Receiving completed	B00003	
Receiving abnormality	B00004	
Receiving status	mi0002	
Receiving data length	mi0011	
RS-485 post number	mi0012	

Kind	Name	Symbol	Execution time
Data flow language (Function 4)	AIP interface		--
Function	It uses the versatile communications module, to perform interfacing with the AIP manufactured by Komatsu.		

The setting contents of the function argument

[1] Communications parameter address:
It designates the foremost address of parameters for port initialization.

[2] RAS information address:
It designates the foremost address of the K_AIP operation information.

[3] Communications enabled:
It is turned ON when port initialization has been completed normally, showing that communications with AIP are enabled.

[4] Open status: It is a code to show the result of port initialization.

[5] Transmittal abnormality:
It is turned ON when an error has occurred in transmittal. (1 scan)

[6] Transmittal status: It is a code to show the result of transmittal.

[7] Receiving abnormality:
It is turned ON when an error has occurred in receiving. (1 scan)

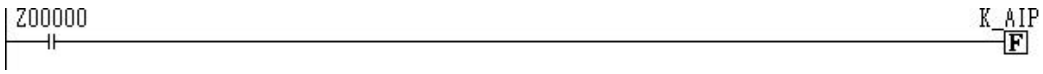
[8] Receiving status: It is a code to show the result of receiving.

Details of the communications parameters

Number of words	Item	Contents
0	Post number of the versatile communications module	It sets the post number on the SX bus of the versatile communications module.
1	Port number	It designates the interface port of the versatile communications module. 0: RS-232C port 1: RS-422 port
2	Message port number	It designates the message transmittal and receiving port number with the versatile communications module. (1 - 127) Note) It should not overlap with other message transmittal and receiving port number.
3	Transmission rate	It designates the transmission rate bps. 0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57600 bps

Note) When using this function, secure the function instance memory of 3500 words.
It can be set in the system configuration definition by choosing property - parameter of CPU module.
For the details of this function, refer to the separate manual.

Example of use



K_AIP

Argument	Label	Value
Communications parameter address	ki0000	
RAS information address	mi001	
Communications enabled	B00000	
Open status	mi0000	
Transmittal abnormality	B00001	
Transmittal status	mi0001	
Receiving abnormality	B00002	
Receiving status	mi0002	

Contents of communications parameter

ki0000	1
ki0001	0
ki0002	1
ki0003	4

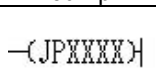
The above setting is to insert the versatile communications module to SX post number 1, thereby connecting with AIP by means of the RS-232C at 19200 bps.

Appendix

(Appendix 1) Symbols and each name

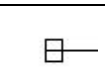
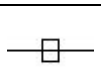
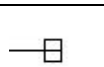
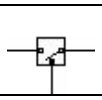
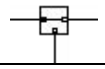
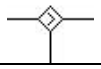
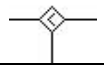
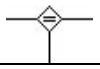
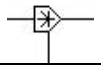
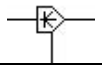
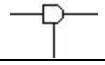
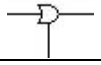
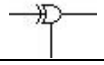
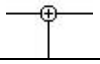
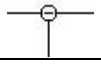
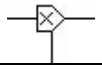
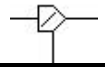
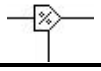
(1) LD language

Table 5.1

A-contact	B-contact	Logic reversal	Coil	Coupling element load	Coupling element store
					
Label	Jump	Return			
					

(2) Data flow language (basics)

Table 5.2

Load	Store & load	Store	a-contact	b-contact	c-contact
					
c-contact	Compare high	Compare low	Compare equal	Priority given to a upper-level	Priority given to a lower-level
					
Logical multiplication	Logical sum	Exclusive OR	Addition	Subtraction	Multiplication
					
Division	Remainder	Local constant: integer	Local constant: real number		
					

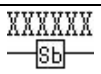
(3) Data flow language (function 1)

Table 5.3

Sign conversion	1 'complement	Absolute value conversion	Increment	Decrement	One half
					
Times 2	Second power	Exponent	Square root	Bit count	Gray code binary
					

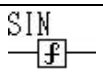
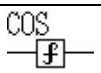
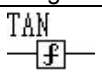
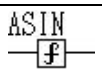
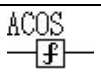
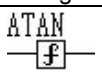
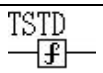
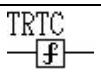
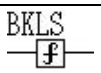
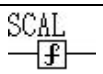
(4) Data flow language (function 2)

Table 5.4

Insensitive band	Pattern	Differential compensation	Phase compensation	PI compensation	ARC
					
S-ARC	Arithmetic average	Filter	PID compensation	Temporary delay	Delay
					
Constant cycle pulse	Variable setting pattern	Upper and lower limiter	Hysteresis	Unconditional subroutine	Conditional subroutine
					

(5) Data flow language (function 3)

Table 5.5

Sine	Cosine	Tangent	Cosecant	Secant	Cotangent
					
ON timer	OFF timer	ON differential	OFF differential	Backlash	Backlash correction
					
Scaling	Binary Gray conversion	Division and remainder	Integer conversion	Real number conversion	
					

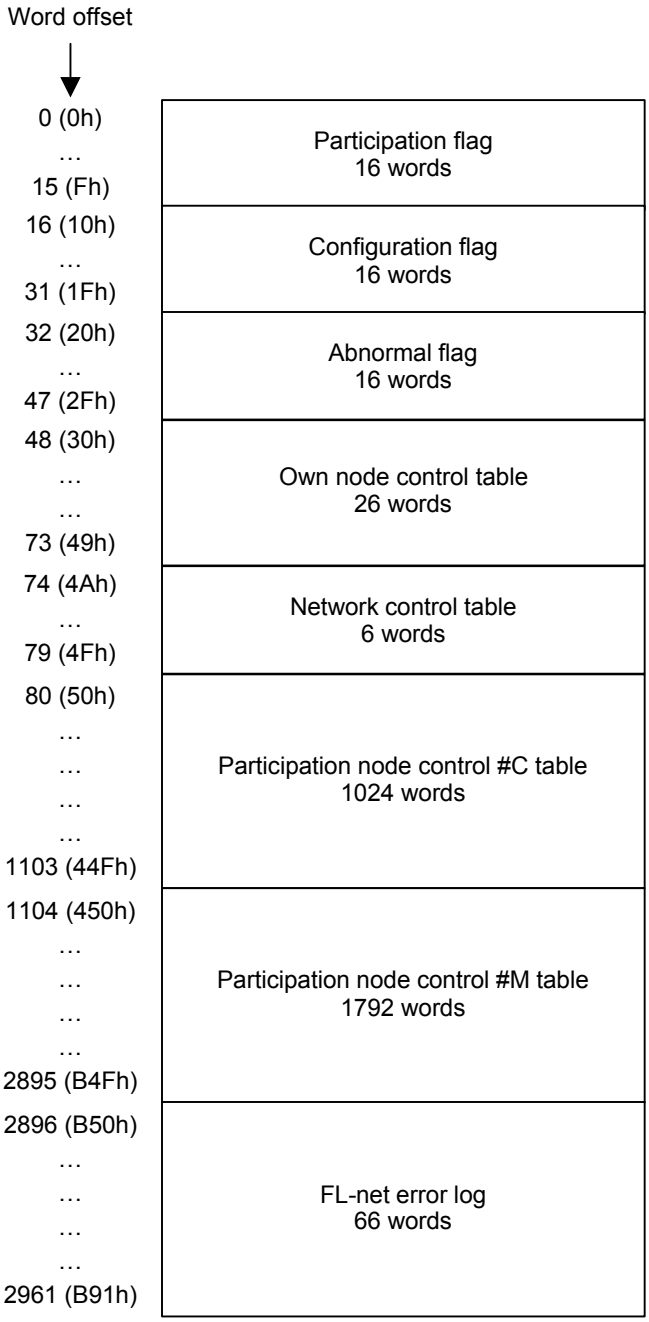
(6) Data flow language (function 4)

Table 5.6

Bank switch	Remote data read	Remote data write	Channel open	Message transmittal	Message receiving
F_BANK	RREAD	RWRITE	M_OPEN	M_SEND	M_RECV
Matrix	Obtaining RAS information of the FL-net	Obtaining RAS information of the system memory	Set	Reset	Data transfer
MATRIX	FLRAS1	SYRAS1	SET	RESET	MOVW
Data transfer	Counter	Obtaining RAS information of the FL-net	Obtaining RAS information of the FL-net	Obtaining RAS information of the system memory	Versatile communications
MOVWD	UPDOWN	FLRAS8	FLRAS9	SYSRAS	C_FREE
AIP interface					
K_AIP					

(Appendix 2) Link data area inside the FL-net module

The participation flag, configuration flag, etc. of the FL-net module are assigned to the memory inside the FL-net module. These data can be referred to by using the functions FLRAS1, 8 and 9. The word offset values are of decimal representation. Inside brackets ( ) are of hexadecimal representation.



(1) Participation flag/configuration flag/abnormal flag (word offset value: 0 (0h) - 47 (2F))

It shows the state of each node connected to the FL-net. The state of each node is judged by the combination of the participation flag/configuration flag/abnormal flag and the state of node configuration registration inside the system configuration definition.

< Change in the flag depending on the state of the node >

Configuration registration	Participation	Configuration	Abnormal	State of the node
None	OFF	OFF	OFF	No registration, no node being connected.
	ON	OFF	OFF	No registration, node being connected (participation).
	OFF	OFF	ON	No registration, node dropped.
Exists	OFF	OFF	ON	Applicable node not being connected, or dropped.
	ON	ON	OFF	Applicable node normally connected (participation).

[1] Participation flag (word offset value: 0 (0h) - 15 (Fh)) (readout only)

It is turned ON when the applicable node participates on the FL-net. The figures in the table represents the node number.

<Participation flag of each node>

Word offset ↓	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	Bit offset ↓ (0h) 0
0 (0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
1 (1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
2 (2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
3 (3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
4 (4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
5 (5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
6 (6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
7 (7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
8 (8h)	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
9 (9h)	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
10 (Ah)	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
11 (Bh)	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
12 (Ch)	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
13 (Dh)	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
14 (Eh)	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
15 (Fh)		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

The part indicated with ▭ is not used.

[2] Configuration flag (word offset value: 16 (10h) - 31 (1Fh)) (readout only)

It is turned ON when the node on the FL-net is registered in the system configuration and actually participates in the FL-net.

< Configuration flag of each node >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
16 (10h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
17 (11h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
18 (12h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
19 (13h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
20 (14h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
21 (15h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
22 (16h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
23 (17h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
24 (18h)	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
25 (19h)	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
26 (1Ah)	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
27 (1Bh)	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
28 (1Ch)	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
29 (1Dh)	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
30 (1Eh)	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
31 (1Fh)		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

[3] Abnormal flag (word offset value: 32 (20h) - 47 (2Fh)) (readout only)

It is turned ON when the node on the FL-net has dropped or does not participate in the FL-net.

< Abnormal flag of each node >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
32 (20h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
33 (21h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
34 (22h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
35 (23h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
36 (24h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
37 (25h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
38 (26h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
39 (27h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
40 (28h)	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
41 (29h)	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
42 (2Ah)	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
43 (2Bh)	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
44 (2Ch)	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
45 (2Dh)	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
46 (2Eh)	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
47 (2Fh)		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

(2) Own node control table (word offset value: 48 (30h) - 73 (49h))

It controls the data concerning the setting of the own node. Each setting data is assigned as shown in the figure below.

48 (30h)	Node number (1 byte)	**Not used**
49 (31h) 50 (32h) 51 (33h) 52 (34h) 53 (35h)	Node name (10 bytes)	
54 (36h) 55 (37h) 56 (38h) 57 (39h) 58 (3Ah)	**Not used**	
59 (3Bh) 60 (3Ch) 61 (3Dh) 62 (3Eh) 63 (3Fh)	Manufacturer's model (10 bytes)	
64 (40h)	State of the own node (1 byte)	**Not used**
65 (41h)	State of the FL-net (1 byte)	**Not used**
66 (42h)	State of the upper layer (2 bytes)	
67 (43h)	Common memory area 1 Foremost address of transmittal area (2 bytes)	
68 (44h)	Common memory area 1 Transmittal area size (2 bytes)	
69 (45h)	Common memory area 2 Foremost address of transmittal area (2 bytes)	
70 (46h)	Common memory area 2 Transmittal area size (2 bytes)	
71 (47h)	Minimum allowable frame interval (1 byte)	**Not used**
72 (48h)	Token monitoring time (1 byte)	**Not used**
73 (49h)	Protocol version (1 byte)	**Not used**

- Node number

  The number set at the node number setting switch on the front of the NP1L-FL1 is indicated in a hexadecimal number.

- Node name

  The node name set in the FL-net parameters in the system configuration definition is indicated.

  For instance, if the node name is “TOYO DENKI”, the indication shall be as follows.

49 (31h)	54 (h) “T”	4F(h) “O”
50 (32h)	59 (h) “Y”	4F(h) “O”
51 (33h)	20 (h) “ “	44 (h) “D”
52 (34h)	45 (h) “E”	4E(h) “N”
53 (35h)	4B(h) “K”	49 (h) “I”

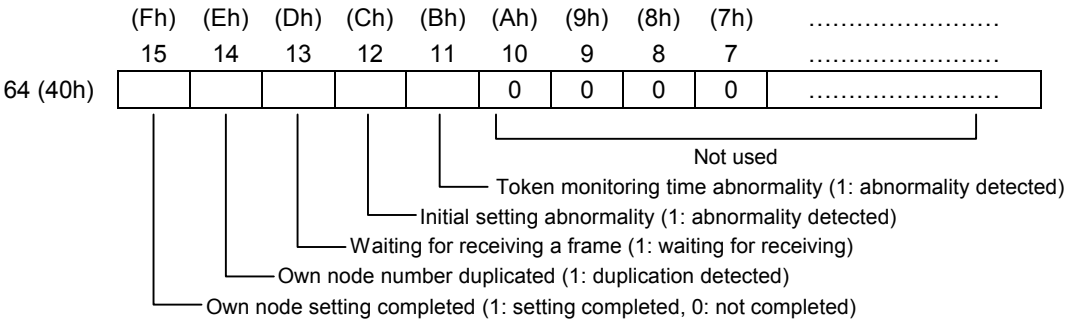
- Manufacturer’s model

  In the case of NP1L-FL1, it is specified as “NP1L-FL1”, and indicated as shown in the figure below.

59 (3Bh)	4E(h) “N”	50 (h) “P”
60 (3Ch)	31 (h) “1”	4C(h) “L”
61 (3Dh)	2D(h) “-“	46 (h) “F”
62 (3Eh)	4C(h) “L”	31 (h) “1”
63 (3Fh)	20 (h) “ ”	20 (h) “ ”

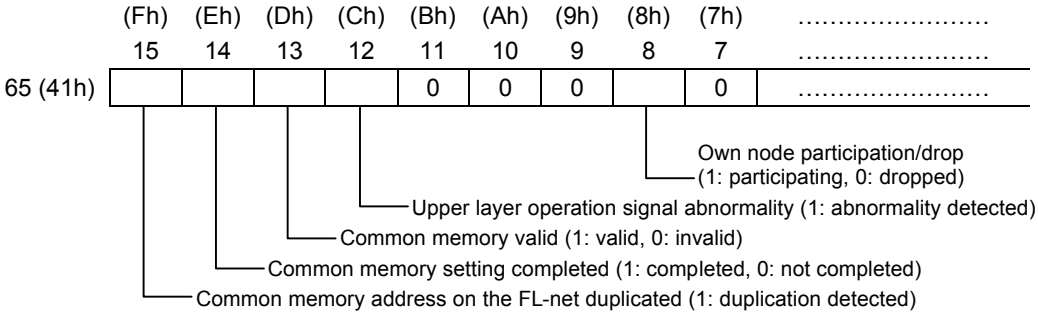
- State of the own node

  It shows the state of the own node (NP1L-FL1).

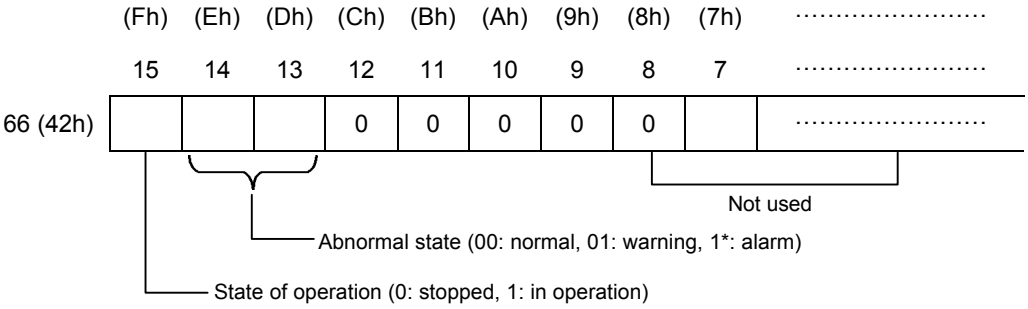


- State of the FL-net

  The information on the state of the FL-net can be divided into the information shared on the network and the information controlled by each node independently.



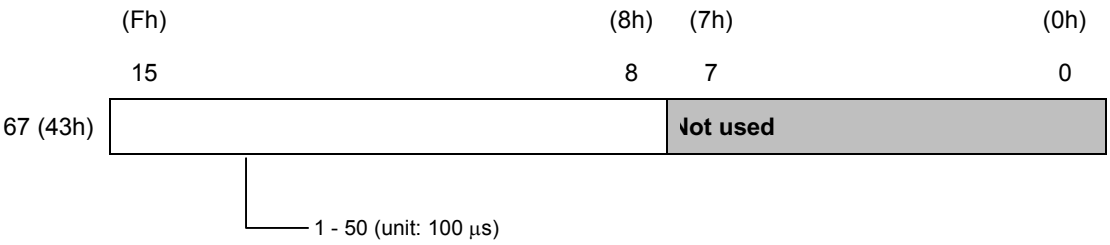
- State of the upper layer



- Minimum allowable frame interval

  The time from the receiving of a token from other node to the sending of a frame by the own node is called a frame interval.

  At this time, the minimum time that each node must wait until it sends out a frame is called a minimum allowable frame interval.



- Token monitoring time

  The time from the receiving of a token by the own node (NP1L-FL1) from the token retaining node to the passing of the token to the next retaining node.

- Protocol version

  The protocol version is fixed at 80 hex.

(3) Network control table (word offset value: 74(4Ah) - 79 (4Fh))

74 (4Ah)	Token retaining node number (1 byte)	**Not used**
75 (4Bh)	Minimum allowable frame interval (1 byte)	**Not used**
76 (4Ch)	Refresh cycle allowable time (2 bytes)	
77 (4Dh)	Refresh cycle measuring time present value (2 bytes)	
78 (4Eh)	Refresh cycle measuring time maximum value (2 bytes)	
79 (4Fh)	Refresh cycle measuring time minimum value (2 bytes)	

(4) Participation node control #C table (word offset value: 80(50h) - 1103 (44Fh))

The transmittal area of each node participating in the FL-net is indicated. The information of 1 node is indicated in 4 words.

80 (50h)	
…	…
+4 × (	Common memory area 1 Foremost address of transmittal area (2 bytes)
+4 × (Node number) +1	Common memory area 1 Transmittal area size (2 bytes)
+4 × (Node number) +2	Common memory area 2 Foremost address of transmittal area (2 bytes)
+4 × (Node number) +3	Common memory area 2 Transmittal area size (2 bytes)
…	…
• 1103 (44Fh)	•

(5) Participation node control #M table (word offset value: 1104 (450h) - 2895 (B4Fh))

The contents of setting of the FL-net parameters of each node participating in the FL-net are indicated. The information of 1 node is indicated in 7 words.

1104 (450h)		
…	…	
+7 × (Node number)	State of the FL-net (1 byte)	**Not used**
+7 × (Node number)+1	State of the upper layer (2 bytes)	
+7 × (Node number)+2	Token monitoring time (1 byte)	**Not used**
+7 × (Node number)+3	Minimum allowable frame interval (1 byte)	**Not used**
+7 × (Node number)+4	Refresh cycle allowable time (2 bytes)	
+7 × (Node number)+5	**Not used**	
+7 × (Node number)+6	**Not used**	
…	…	
2895 (B4Fh)		

(6) FL-net log (word offset value: 2896 (B50h) - 2961 (B91h)

History on the communications of the FL-net is stored.

2896 (B50h)	Number of times of arrival (2 words)	2930 (B72h)	Number of times of ACK error (2 words)
2898 (B52h)	Number of times of transmittal error of the socket part (2 words)	2932 (B74h)	**Not used (8 words)**
2900 (B54h)	**Not used (2 words)**	2940 (B7Ch)	Number of times of token multi-recognition (2 words)
2902 (B56h)	Number of times of receiving (2 words)	2942 (B7Eh)	Number of times of token destruction (2 words)
2904 (B58h)	Number of times of receiving error (2 words)	2944 (B80h)	Number of times of token reissue (2 words)
2906 (B5Ah)	**Not used (8 words)**	2946 (B82h)	**Not used (2 words)**
2914 (B62h)	Number of times of cyclic transmission error (2 words)	2948 (B84h)	Number of times of token monitoring timeout (2 words)
2916 (B64h)	**Not used (2 words)**	2950 (B86h)	**Not used (2 words)**
2918 (B66h)	Number of times of message transmission re-transmittal (2 words)	2952 (B88h)	Number of times of frame waiting state (2 words)
2920 (B68h)	Number of times of message transmission re-transmittal over (2 words)	2954 (B8Ah)	Number of times of subscription (2 words)
2922 (B6Ah)	**Not used (2 words)**	2956 (B8Ch)	Number of times of self-drop (2 words)
2924 (B6Ch)	Number of times of message receiving error (2 words)	2958 (B8Eh)	Number of times of drop by skipping (2 words)
2926 (B6Eh)	**Not used (4 words)**	2960 (B90h)	Number of times of recognition of the drop of other node (2 words)

(Appendix 3) System memory area (512 words)

The system memory is an area of which use is determined, in which flags, etc. to inform the operating state or abnormal state of the system of the μGPCsx series are assigned. These data can be referred to by means of the SYRAS1, SYSRAS functions. The word offset value is of decimal representation. Inside brackets ( ) are of hexadecimal representation.

• Word offset	
0 (0h)	Resource operation status
1 (1h)	Resource switch/user ROM state
2 (2h)	Resource serious failure factor
3 (3h)	**Not used**
4 (4h)	Resource light failure factor
5 (5h)	**Not used**
6 (6h)	CPU abnormality factor
7 (7h)	**Not used**
8 (8h), 9 (9h)	Memory abnormality factor
10 (Ah), 11 (Bh)	SX bus abnormality factor
12 (Ch)	Application abnormality factor (serious failure)
13 (Dh)	Application abnormality factor (light failure)
14 (Eh) - 16 (10h)	User serious failure Factor 0 - Factor 47
17 (11h)	**Not used**
18 (12h) - 20 (14h)	User light failure Factor 0 - Factor 47
21 (15h)	**Not used**
22 (16h) - 29 (1Dh)	System definition abnormality factor
30 (1Eh) - 37 (25h)	**Not used**
38 (26h), 39 (27h)	Application program abnormality factor
40 (28h), 41 (29h)	**Not used**
42 (2Ah), 43 (2Bh)	Announce relay
44 (2Ch), 45 (2Dh)	**Not used**
46 (2Eh)	Redundancy Announce relay
47 (2Fh)	Redundancy operation mode
48 (30h), 49 (31h)	Resource running/operation information
50 (32h), 51 (33h)	Resource configuration/abnormality information
52 (34h) - 67 (43h)	SX bus configuration information (configuration composition information)
68 (44h) - 83 (53h)	SX bus abnormality information (configuration composition information)
84 (54h) - 99 (63h)	SX bus directly connected module degeneration mode information
100 (64h) - 127 (7Fh)	**Not used**

• Word offset	
128 - 135 (80h) - (87h)	Remote I/O master 0 I/O module configuration information
136 - 143 (88h) - (8Fh)	Remote I/O master 0 I/O module abnormality information
144 - 151 (90h) - (97h)	Remote I/O master 1 I/O module configuration information
152 - 159 (98h) - (9Fh)	Remote I/O master 1 I/O module abnormality information
160 - 167 (A0h) - (A7h)	Remote I/O master 2 I/O module configuration information
168 - 175 (A8h) - (AFh)	Remote I/O master 2 I/O module abnormality information
176 - 183 (B0h) - (B7h)	Remote I/O master 3 I/O module configuration information
184 - 191 (B8h) - (BFh)	Remote I/O master 3 I/O module abnormality information
192 - 199 (C0h) - (C7h)	Remote I/O master 4 I/O module configuration information
200 - 207 (C8h) - (CFh)	Remote I/O master 4 I/O module configuration information
208 - 215 (D0h) - (D7h)	Remote I/O master 5 I/O module configuration information
216 - 223 (D8h) - (DFh)	Remote I/O master 5 I/O module abnormality information
224 - 231 (E0h) - (E7h)	Remote I/O master 6 I/O module configuration information
232 - 239 (E8h) - (EFh)	Remote I/O master 6 I/O module abnormality information
240 - 247 (F0h) - (F7h)	Remote I/O master 7 I/O module configuration information
248 - 255 (F8h) - (FFh)	Remote I/O master 7 I/O module abnormality information
256 - 507 (100h) - (1FBh)	**Not used**
508 - 511 (1FCh) - (1FFh)	SX bus transmission error rate information

(1) Resource operation status (word offset value: 0 (0h)) (readout only)

It shows the operating status and operation mode of the resource (CPU module).

Word offset Bit offset

W	B	Name	Explanation
0 (0h)	0 (0h)	In operation	It is turned ON when CPU is in operation.
	1 (1h)	Being stopped	It is turned ON when CPU is stopped.
	2 (2h)	Serious failure	It is turned ON when a serious failure has occurred in the resource.
	3 (3h)	Light failure	It is turned ON when a light failure has occurred in the resource.
	4 (4h)	Redundancy running	It is turned ON when in redundancy operation and running CPU.
	5 (5h)	Redundancy standby	It is turned ON when in redundancy operation and stand by CPU.
	6 (6h)	1:1 redundancy	It is turned ON when the system is in 1:1 redundancy mode.
	7 (7h)	N:1 redundancy	It is turned ON when the system is in N:1 redundancy mode.
	8 (8h)	Non-automatic operation mode	It is turned ON when in non-automatic operation mode.
	9 (9h)	Automatic operation mode	It is turned ON when in automatic operation mode.
	10 (Ah)	Former state mode	It is turned ON when in former state mode.
	11 (Bh)	Without batteries operation mode	It is turned ON when in operation without batteries.
	12 (Ch)	**Not used**	
	13 (Dh)	SX bus directly connected module degeneration mode Note)	It is turned ON when in the degeneration of all the modules that are directly connected to the SX bus, and in the module that can handle the individual reset.
	14 (Eh)	Processor bus master	It is turned ON when being the CPU module that controls the processor bus.
	15 (Fh)	SX bus master	It is turned ON when being the CPU module that controls the SX bus.

- Non-automatic operation mode

  It is a mode in which CPU will not start operation if the power supply of the system is turned ON with the key switch at the front of the CPU module being in the position of “RUN” or “TERM”. The setting is made by means of the operation designation at the time of powering on inside the “setting” of the resource.

- Automatic operation mode

  It is a mode in which CPU will start operation if the power supply of the system is turned ON with the key switch at the front of the CPU module being in the position of “RUN” or “TERM”. The setting is made by means of the operation designation at the time of powering on inside the “setting” of the resource. (The default is the automatic operation mode.)

- Former state mode

  If the power supply of the system is turned ON with the key switch at the front of the CPU module being in the position of “RUN”, CPU will start operation, and if the power supply of the system is turned ON in the position of “TERM”, then the state becomes the former state immediately before the power supply was turned OFF (in operation or being stopped).

- Without batteries operation mode

  All the memory is initialized when the system is powered on (substitution of the initial value or 0 clear). Also, the checking of the connection of batteries and checking of voltage are not be carried out. The setting is made by means of the operation designation at the time of powering on inside the "setting" of the resource. Also, when being in this mode and in the former state mode, the automatic operation mode is activated.

  Note) In the TDsxEditor, the setting of degeneration cannot be made and hence, the module on the SX bus is set to be with degeneration beforehand. Therefore, the user cannot change the setting of degeneration.

(2) Resource switch/user ROM state (word offset value: 1 (1h)) (readout only)

It shows the state of the switch of the CPU module that controls the resource.

W	B	Name	Explanation
1 (1h)	0 (0h)	CPU number	It indicates the number that is set at the CPU number setting switch at the front of the CPU module by using 4 bits (0 - F). However, the setting range of the CPU module is 0 - 7.
	1 (1h)		
	2 (2h)		
	3 (3h)		
	4 (4h)	**Not used**	
	5 (5h)		
	6 (6h)	State of the user ROM card being mounted Note 1)	1: mounted, 0: not mounted
	7 (7h)	User ROM card write protect Note 1)	1: write prohibited 0: write enabled (effective when 1.6 is ON)
	8 (8h)	STOP position	It is turned ON when the key switch is in the STOP position.
	9 (9h)	TERM position (lower)	It is turned ON when the key switch is in the TERM position (lower).
	10 (Ah)	TERM position (upper) Note 2) Note 3)	It is turned ON when the key switch is in the TERM position (upper).
	11 (Bh)	RUN position	It is turned ON when the key switch is in the RUN position.
	12 (Ch)	**Not used**	
	'		
	15 (Fh)		

Note 1) Only the product that can handle the user ROM card (compact flash card) is applicable.

Note 2) The TERM position flag is turned ON when the key switch is in an unstable state as well.

Note 3) In the case of the high-performance CPU module that can handle the user ROM card, it is turned ON when in the UR8M_TERM position.

(3) Resource serious failure factor (word offset value: 2 (2h)) (readout only)

It is a failure factor that causes the stop of operation of the resource (1 CPU system).

W	B	Name	Explanation
2 (2h)	0 (0h)	CPU abnormality	It is turned ON when a serious failure has occurred in the own CPU module.
	1 (1h)	Power supply abnormality	It is turned ON when disconnecting of power supply has occurred.
	2 (2h)	Memory abnormality	It is turned ON when abnormality has occurred in the own CPU module.
	3 (3h)	SX bus abnormality	It is turned ON when abnormality has occurred, such as disengagement of cable, return plug detachment, etc.
	4 (4h)	Application abnormality	It is turned ON when there is abnormality in the application program or system definition.
	5 (5h)	**Not used**	
	6 (6h)	Common module abnormality	It is turned ON when there is abnormality in the common module on the SX bus other than the own CPU module.
	7 (7h)	Redundancy interlock switching execution abnormality	It is turned ON when in the redundancy operation mode, the interlock switching operation cannot be executed.
	8 (8h)	**Not used**	
	'		
	12 (Ch)		
	13 (Dh)	Other hardware abnormality	It is turned ON when abnormality has occurred in the CPU number setting switch.
	14 (Eh)	**Not used**	
	15 (Fh)	User serious failure	It is turned ON when in the application program, either of the bits of the user serious failure flags (word offset: 14 - 16) has been turned ON.

(4) Resource light failure factor (word offset value: 4 (4h)) (readout only)

It is a failure factor that the resource continues operation.

W	B	Name	Explanation
4 (4h)	0 (0h)	**Not used**	
	1 (1h)		
	2 (2h)	Memory abnormality	It is turned ON when abnormality has occurred in the own CPU module.
	3 (3h)	SX bus abnormality	It is turned ON when abnormality has occurred in SX bus.
	4 (4h)	Application abnormality	It is turned ON when there is abnormality in the application program or system definition.
	5 (5h)	I/O module abnormal	It is turned ON when there is abnormality in the I/O module under the control of the own CPU module. Note 1)
	6 (6h)	Common module abnormality Note 1)	It is turned ON when there is abnormality in the common module on the SX bus other than the own CPU module.
	7 (7h)	**Not used**	
	'		
	11 (Bh)		
	12 (Ch)	User ROM card CPU verification inconsistent Note 2)	It is turned ON when the contents of the user ROM card are different from those in the memory inside the CPU. The contents to be verified are system definition, project and password.
	13 (Dh)	Other hardware abnormality	It is turned ON when abnormality has occurred in the key switch, loader/switch for versatile communications switching. The CPU module operates as "TERM" when there is abnormality in the key switch. Also, it operates as the loader side when there is abnormality in the loader/switch for versatile communications switching.
	14 (Eh)	Battery abnormality	It is turned ON when the voltage of the batteries for data backup has decreased, or there are no batteries.
	15 (Fh)	User light failure	It is turned ON when in the application program, either of the bits of the user light failure flags (word offset: 18 - 20) has been turned ON.

Note 1) The common module is the SX bus directly connected module that does not occupy the input and output area. (CPU module, communications module, etc.)

Note 2) Only the product that can handle the user ROM card (compact flash card) is applicable.

(5) CPU abnormality factor (word offset value: 6 (6h)) (readout only)

W	B	Name	Explanation
6 (6h)	0 (0h)	Operation processor abnormality	Hardware abnormality of the LSI for operation inside the CPU module
	1 (1h)	OS processor abnormality	Hardware abnormality of the LSI for OS control inside the CPU module
	2 (2h)	**Not used**	
	'		
	15 (Fh)		

(6) Memory abnormality factor (word offset value: 8 (8h), 9 (9h)) (readout only)

W	B	Name	Explanation	Failure level
8 (8h)	0 (0h)	System ROM abnormality	It is turned ON when abnormality has occurred in the system ROM inside the CPU module.	Serious failure
	1 (1h)	System RAM abnormality	It is turned ON when abnormality has occurred in the system RAM inside the CPU module.	Serious failure
	2 (2h)	Application ROM abnormality	It is turned ON when abnormality has occurred in the ROM for storing applications inside the CPU module.	Serious failure Note 1)
	3 (3h)	Application RAM abnormality	It is turned ON when abnormality has occurred in the RAM for storing applications inside the CPU module.	Serious failure
	4 (4h)	**Not used**		
	'			
	14 (Eh)			
	15 (Fh)	Memory backup abnormality	It is turned ON when the power failure retention data is not retained.	Serious failure Note 2)
9 (9h)	0 (0h)	**Not used**		
	'			
	14 (Eh)			
	15 (Fh)	Memory backup abnormality	It is turned ON when the power failure retention data is not retained.	Light failure Note 2)

Note 1) It also is turned ON when abnormality has occurred in the user ROM card.

Note 2) The bits to be turned ON of the high-performance CPU at the time of memory backup being abnormal, vary depending on the version of the module.
V**.25 or older: .8.15 will be ON, V10.30 or newer: .9.15 will be ON.

About the operation after the memory abnormality has occurred

When the memory abnormality has occurred, all the area of user memory undergoes 0 clear. However, up to 8.0 - 8.3, there is a high possibility of hardware failure, and so even if the power supply is turned OFF → ON, there is a high possibility that memory abnormality will occur again, resulting in a serious failure.

(7) SX bus abnormality factor (word offset value: 10 (Ah), 11 (Bh))

W	B	Name	Explanation	Failure level
10 (Ah)	0 (0h)	SX bus LSI abnormality	It is turned ON when abnormality has occurred in the LSI that controls the SX bus.	Serious failure
	1 (1h)	Post number duplication	It is turned ON when modules having the same SX bus post number exist in 1 configuration.	Serious failure
	2 (2h)	Excessive number of units connected	It is turned ON when the number of modules connected to the SX bus has exceeded 254.	Serious failure
	3 (3h) to 12 (Ch)	**Not used**		
	13 (Dh)	SX bus transmission abnormality	It is turned ON when there is abnormality in the SX bus transmission.	Serious failure
	14 (Eh)	Processor bus access abnormality	It is turned ON when there is abnormality in the processor bus access. (when there is an access abnormality factor in the own module)	Serious failure
	15 (Fh)	I/O refresh jam	It is turned ON when the refreshing of input and output data by the SX bus has not been made for more than 128 ms.	Serious failure
11 (Bh)	0 (0h) to 13 (Dh)	**Not used**		
	14 (Eh)	Processor bus access abnormality	It is turned ON when there is abnormality in the processor bus access. (when there is an access abnormality factor in the destination module) It can be turned OFF by the application program.	Serious failure
	15 (Fh)	**Not used**		

(8) Application abnormality factor (word offset value: 12 (Ch), 13 (Dh)) (readout only)

W	B	Name	Explanation	Failure level
12 (Ch)	0 (0h)	System definition abnormality	It is turned ON when there is abnormality in the system definition.	Serious failure
	1 (1h)	Application program abnormality	It is turned ON when there is abnormality in the application program.	Serious failure
	2 (2h) to 15 (Fh)	**Not used**		
13 (Dh)	0 (0h)	**Not used**		
	1 (1h)	Application program abnormality	It is turned ON when there is abnormality in the application program.	Light failure
	2 (2h) to 15 (Fh)	**Not used**		

(9) User serious failure (word offset value: 14 (Eh)-16 (10h))

W	B	Name	Explanation
14 (Eh)	0 (0h)	User serious failure factor 0	When either of the bits is turned ON by the application program, CPU stops due to the serious failure.
	'		
	15 (Fh)	User serious failure factor 15	
15 (Fh)	0 (0h)	User serious failure factor 16	
	'		
	15 (Fh)	User serious failure factor 31	
16 (10h)	0 (0h)	User serious failure factor 32	
	'		
	15 (Fh)	User serious failure factor 47	

(10) User light failure (word offset value: 18 (12h)-20 (14h))

W	B	Name	Explanation
18 (12h)	0 (0h)	User light failure factor 0	When either of the bits is turned ON by the application program, CPU generates the light failure. Operation continues. When the bit being ON is turned OFF by the application program, recovery from the light failure state is effected.
	'		
	15 (Fh)	User light failure factor 15	
19 (13h)	0 (0h)	User light failure factor 16	
	'		
	15 (Fh)	User light failure factor 31	
20 (14h)	0 (0h)	User light failure factor 32	
	'		
	15 (Fh)	User light failure factor 47	

(11) System definition abnormality factor (word offset value: 22 (16h)-29 (1Dh)) (readout only)

W	B	Name	Explanation	Failure level
22 (16h)	0 (0h)	**Not used**		
	1 (1h)	System configuration definition abnormality	It is turned ON when the contents of the system configuration definition do not match the actual system configuration.	Serious failure
	2 (2h)	System operation definition abnormality	It is turned ON if the tact cycle is set at 0.5 ms in a system in which multiple common modules are connected in 1 configuration, or in a system where a standard CPU is used.	Serious failure
	3 (3h)	System D0 setting abnormality	It is turned ON when the SX bus directly connected module to which the system D0 (output) has been set is not a digital output module.	Serious failure
	4 (4h)	Redundancy setting abnormality	It is turned ON when there is an error in the designation of the range of equivalence in the system redundancy definition.	Serious failure
	5 (5h)	Degeneration startup setting abnormality	It is turned ON when there exists a module that cannot handle the degeneration function in the system, and the degeneration startup setting has been made.	Serious failure
	6 (6h) to 9 (9h)	**Not used**		
	10 (Ah)	CPU operation definition abnormality	It is turned ON when the CPU number that has been set in the system configuration definition does not match the setting of switches in the CPU module.	Serious failure
	11 (Bh)	CPU memory boundary definition abnormality	It is turned ON when the memory used in the application program exceeds the total capacity of memory.	Serious failure
	12 (Ch) to 15 (Eh)	**Not used**		
23 (17h)	0 (0h)	CPU I/O group definition abnormality for default task	It is turned on when the input module is set as the output selection.	Serious failure
	1 (1h)	CPU I/O group definition abnormality for 0 level task		
	2 (2h)	CPU I/O group definition abnormality for 1 level task		
	3 (3h)	CPU I/O group definition abnormality for 2 level task		
	4 (4h)	CPU I/O group definition abnormality for 3 level task		
	5 (5h)	Directly connected I/O degeneration definition abnormality	It is turned on when there is abnormality in the directly connected I/O degeneration definition.	Serious failure

23 (17h)	6 (6h)	Remote I/O master 0 degeneration definition abnormality	It is turned ON when there is abnormality in the degeneration definition.	Serious failure
	7 (7h)	Remote I/O master 1 degeneration definition abnormality		
	8 (8h)	Remote I/O master 2 degeneration definition abnormality		
	9 (9h)	Remote I/O master 3 degeneration definition abnormality		
	10 (Ah)	Remote I/O master 4 degeneration definition abnormality		
	11 (Bh)	Remote I/O master 5 degeneration definition abnormality		
	12 (Ch)	Remote I/O master 6 degeneration definition abnormality		
	13 (Dh)	Remote I/O master 7 degeneration definition abnormality		
	14 (Eh)	**Not used**		
	15 (Fh)			
24 (18h)	0 (0h)	Directly connected I/O hold definition abnormality	It is turned ON when having given a hold definition to a module other than the output module, or given a hold definition to an output module that has been set to the system D0.	Serious failure
	1 (1h)	Directly connected I/O operation definition abnormality	It is turned ON when the SX bus directly connected module to which the system D0 (output) has been set is not a digital output module.	Serious failure
	2 (2h)	**Not used**		
	'			
	15 (Fh)			
25 (19h)	0 (0h)	Remote I/O master 0 Redundancy setting abnormality	It is turned ON when there is abnormality in the operation definition of the remote I/O master.	Serious failure
	1 (1h)	Remote I/O master 1 Redundancy setting abnormality		
	2 (2h)	Remote I/O master 2 Redundancy setting abnormality		
	3 (3h)	Remote I/O master 3 Redundancy setting abnormality		
	4 (4h)	Remote I/O master 4 Redundancy setting abnormality		
	5 (5h)	Remote I/O master 5 Redundancy setting abnormality		
	6 (6h)	Remote I/O master 6 Redundancy setting abnormality		
	7 (7h)	Remote I/O master 7 Redundancy setting abnormality		
	8 (8h)	**Not used**		
	'			
	15 (Fh)			
26 (1Ah)	0 (0h)	Processor link 0 operation definition abnormality	It is turned ON when there is abnormality in the operation definition of the P-link/PE-link/FL-net. Processor link 0 can handle line number “8”, and processor link 1 can handle line number “9”.	Serious failure
	1 (1h)	Processor link 1 operation definition abnormality		
	2 (2h)	**Not used**		
	'			
	15 (Fh)			

(12) Application program abnormality factor (word offset value: 38 (26h), 39 (27h))

W	B	Name	Explanation	Failure level
38 (26h)	0 (0h)	Application WDT abnormality	It is turned ON when the execution time of the default task exceeds the set value of the watchdog timer.	Serious failure
	1 (1h)	Application execution abnormality	It is turned ON when abnormality such as temporary size over, etc. has occurred while executing the user program.	Serious failure
	2 (2h)	**Not used**		
	'			
	10 (Ah)			
	11 (Bh)	FB instance setting abnormality	It is turned ON when the designated storage address does not exist, etc.	Serious failure
	12 (Ch)	Initial value setting abnormality	It is turned ON when the set initial value exceeds the range of storage area, etc.	Serious failure
	13 (Dh)	SFM boundary definition setting abnormality	It is turned ON when the capacity has been set that exceeds the maximum capacity of instance memory for the system FB, etc.	Serious failure
	14 (Eh)	POU instruction abnormality	It is turned ON when there is abnormality in POU.	Serious failure
	15 (Fh)	Task registration abnormality	It is turned ON when there is abnormality in task registration.	Serious failure
39 (27h)	0 (0h)	0 level task drop	It is turned ON when the execution of a task has been dropped. It can be turned OFF by the application program.	Light failure
	1 (1h)	1 level task drop		
	2 (2h)	2 level task drop		
	3 (3h)	3 level task drop		
	4 (4h)	0 level task jam	It is turned ON when the execution of a program has jammed and the set constant cycle time cannot be observed. It can be turned OFF by the application program.	Light failure
	5 (5h)	1 level task jam		
	6 (6h)	2 level task jam		
	7 (7h)	3 level task jam		
	8 (8h)	**Not used**		
	'			
	14 (Eh)			
	15 (Fh)	Tact cycle monitoring abnormality	It is turned ON when the value is different from the value set by the system definition. It can be turned OFF by the application program.	Light failure

(13) Announce relay (word offset value: 42 (2Ah), 43 (2Bh))

W	B	Name	Explanation
42 (2Ah)	0 (0h)	Initial flag	It is turned ON when the first operation is started after downloading a program, and at the time of initial startup (called operation start). It will not be turned OFF while in operation.
	1 (1h)	Power supply disconnecting flag	It is turned ON when power supply disconnecting occurred while in the former operation.
	2 (2h)	**Not used**	
	'		
	13 (Dh)		
	14 (Eh)	Dummy module flag	It is turned ON when 1 unit or more dummy modules are mounted in the configuration.
	15 (Fh)	Processor bus access prohibited flag	It is turned ON when the processor bus access cannot be used.
43 (2Bh)	0 (0h)	0 level start flag	It is turned ON when the first 0 level task is being executed.
	1 (1h)	1 level start flag	It is turned ON when the first 1 level task is being executed.
	2 (2h)	2 level start flag	It is turned ON when the first 2 level task is being executed.
	3 (3h)	3 level start flag	It is turned ON when the first 3 level task is being executed.
	4 (4h)	**Not used**	
	'		
	14 (Eh)		
	15 (Fh)	Default task start flag	It is turned ON when the default task is being executed for the first time.

(14) Redundancy announce relay (word offset value: 46 (2Eh))

Redundancy operation mode (word offset value: 47 (2Fh)) (readout only)

W	B	Name	Explanation
46 (2Eh)	0 (0h)	Redundancy continuation startup flag	It is turned ON when being operated in the redundancy mode, the state has been changed from standby to running. (CPU that has been switched from the standby side to the running)
	1 (1h)	**Not used**	
	'		
	15 (Fh)		
47 (2Fh)	0 (0h)	Redundancy logic CPU number	It indicates in 4 bits the logic CPU number when in the redundancy mode. (0 - 7) When the default standby CPU has started running, in particular, it can be recognized which default running CPU is substituted by the said CPU. It is indefinite in other mode than redundancy.
	'		
	3 (3h)		
	4 (4h)	**Not used**	
	'		
	7 (7h)		
	8 (8h)	Redundancy interlock switching mode 0	It is turned ON when being operated in 1:1 redundancy mode, the pair of CPU 0/1 is set to with interlock switching setting.
	9 (9h)	Redundancy interlock switching mode 1	It is turned ON when being operated in 1:1 redundancy mode, the pair of CPU 2/3 is set to with interlock switching setting.
	10 (Ah)	Redundancy interlock switching mode 2	It is turned ON when being operated in 1:1 redundancy mode, the pair of CPU 4/5 is set to with interlock switching setting.
	11 (Bh)	Redundancy interlock switching mode 3	It is turned ON when being operated in 1:1 redundancy mode, the pair of CPU 6/7 is set to with interlock switching setting.
	12 (Ch)	**Not used**	
	'		
	15 (Fh)		

(15) Resource running/operation information (word offset value: 48 (30h), 49 (31h)) (readout only)

It is used to recognize in the application program the sate of the system (CPU module) when in redundancy mode or in single mode. The resource running information is valid only when in redundancy mode.

The state given in the table below is valid when the applicable bit of resource configuration/abnormality information (word offset value: 50, 51) is ON.

< When in redundancy mode >

Resource running information	Resource operation information	Resource state
OFF	OFF	Standby CPU being stopped
ON	OFF	Running CPU being stopped
ON	ON	Running CPU being stopped
OFF	ON	Standby CPU being stopped

< Resource running information >

W	B	Name	Explanation
48 (30h)	0 (0h)	CPU0 running	It is turned ON when in redundancy mode, the CPU is the running CPU. It is indefinite when not in redundancy mode.
	1 (1h)	CPU1 running	
	2 (2h)	CPU2 running	
	3 (3h)	CPU3 running	
	4 (4h)	CPU4 running	
	5 (5h)	CPU5 running	
	6 (6h)	CPU6 running	
	7 (7h)	CPU7 running	
	8 (8h)	**Not used**	
	'		
	15 (Fh)		

< Resource operation information >

W	B	Name	Explanation
49 (31h)	0 (0h)	CPU0 in operation	It is turned ON when a CPU module of the applicable number exists on the SX bus, and the CPU is in operation.
	1 (1h)	CPU1 in operation	
	2 (2h)	CPU2 in operation	
	3 (3h)	CPU3 in operation	
	4 (4h)	CPU4 in operation	
	5 (5h)	CPU5 in operation	
	6 (6h)	CPU6 in operation	
	7 (7h)	CPU7 in operation	
	8 (8h)	**Not used**	
	'		
	15 (Fh)		

(16) Resource configuration/abnormality information (word offset value: 50 (32h), 51 (33h)) (readout only)

It is used to recognize in the application program the sate of the resource (CPU module).

< When in redundancy mode >

Resource running information	Resource operation information	Resource state
OFF	OFF	Nonexistent
ON	OFF	Normal (in operation or being stopped)
ON	ON	Light failure (in operation or being stopped)
OFF	ON	Serious failure (being stopped or dropped)

< Resource running information >

W	B	Name	Explanation
50 (32h)	0 (0h)	CPU0 configuration	It is turned ON when a CPU module of the applicable number exists on the SX bus, and the resource running status is normal or in a light failure.
	1 (1h)	CPU1 configuration	
	2 (2h)	CPU2 configuration	
	3 (3h)	CPU3 configuration	
	4 (4h)	CPU4 configuration	
	5 (5h)	CPU5 configuration	
	6 (6h)	CPU6 configuration	
	7 (7h)	CPU7 configuration	
	8 (8h)	**Not used**	
	'		
	15 (Fh)		

< Resource operation information >

W	B	Name	Explanation
51 (33h)	0 (0h)	CPU0 abnormality	It is turned ON when a CPU module of the applicable number exists on the SX bus, and the resource running status is in a serious failure or in a light failure.
	1 (1h)	CPU1 abnormality	
	2 (2h)	CPU2 abnormality	
	3 (3h)	CPU3 abnormality	
	4 (4h)	CPU4 abnormality	
	5 (5h)	CPU5 abnormality	
	6 (6h)	CPU6 abnormality	
	7 (7h)	CPU7 abnormality	
	8 (8h)	**Not used**	
	'		
	15 (Fh)		

(17) Configuration composition information (word offset value: 52 (34h)-67(43h)) (readout only)

When a module exists on the SX bus, and it is operating normally or in a light failure, the bit of the SX bus post number of the applicable module is turned ON.

It is distinguished by the combination with the following configuration abnormality information, as to whether the operation is normal or in a light failure.

Resource running information	Resource operation information	Resource state
OFF	OFF	Nonexistent
ON	OFF	Normal
ON	ON	Light failure
OFF	ON	Serious failure

• Word offset ↓ • Bit offset ↓

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
52 (34h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
53 (35h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
54 (36h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
55 (37h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
56 (38h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
57 (39h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
58 (3Ah)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
59 (3Bh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
60 (3Ch)	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
61 (3Dh)	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
62 (3Eh)	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
63 (3Fh)	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
64 (40h)	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
65 (41h)	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
66 (42h)	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
67 (43h)		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

(18) Configuration abnormality information (word offset value: 68 (44h)-83(53h)) (readout only)

When a module exists on the SX bus, and it is in a serious failure or in a light failure, the bit corresponding to the SX bus post number of the module is turned ON.

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
68 (44h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
69 (45h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
70 (46h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
71 (47h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
72 (48h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
73 (49h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
74 (4Ah)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
75 (4Bh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
76 (4Ch)	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
77 (4Dh)	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
78 (4Eh)	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
79 (4Fh)	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
80 (50h)	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
81 (51h)	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
82 (52h)	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
83 (53h)		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

(19) SX bus directly connected module degeneration mode information

(word offset value: 84 (54h)-99 (63h)) (readout only)

When a module exists on the SX bus, which cannot be degenerated or to which individual reset cannot be made, the bit of the SX bus post number of the module is turned ON.

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
84 (54h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
85 (55h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
86 (56h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
87 (57h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
88 (58h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
89 (59h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
90 (5Ah)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
91 (5Bh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
92 (5Ch)	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
93 (5Dh)	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
94 (5Eh)	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
95 (5Fh)	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
96 (60h)	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
97 (61h)	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
98 (62h)	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
99 (63h)		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

(20) Remote I/O master 0 - I/O module configuration/abnormality information

(word offset value: 128 (80h)-143 (8Fh)) (readout only)

When a remote I/O module exists under the control of the remote I/O master 0, and it is normal or in a light failure, the bit of the remote post number of the applicable module is turned ON.

Resource running information	Resource operatior information	Resource state
OFF	OFF	Nonexistent
ON	OFF	Normal
ON	ON	Light failure
OFF	ON	Serious failure

< Configuration information >

	(Fh)	(Eh)	(Dh)	(Ch)	(Bh)	(Ah)	(9h)	(8h)	(7h)	(6h)	(5h)	(4h)	(3h)	(2h)	(1h)	(0h)
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
128 (80h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
129 (81h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
130 (82h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
131 (83h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
132 (84h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
133 (85h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
134 (86h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
135 (87h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

When a remote I/O module exists under the control of the remote I/O master 0, and it is in a serious failure or in a light failure, the bit corresponding to the remote post number of the module is turned ON.

< Abnormality information >

	(Fh)	(Eh)	(Dh)	(Ch)	(Bh)	(Ah)	(9h)	(8h)	(7h)	(6h)	(5h)	(4h)	(3h)	(2h)	(1h)	(0h)
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
136 (88h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
137 (89h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
138 (8Ah)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
139 (8Bh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
140 (8Ch)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
141 (8Dh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
142 (8Eh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
143 (8Fh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

Hereafter, how to read the information in (21) - (27) is the same as that in (20).

(21) Remote I/O master 1 - I/O module configuration/abnormality information (word offset value: 144 (90h)-159 (9Fh)) (readout only)

< Configuration information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
144 (90h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
145 (91h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
146 (92h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
147 (93h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
148 (94h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
149 (95h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
150 (96h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
151 (97h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
152 (98h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
153 (99h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
154 (9Ah)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
155 (9Bh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
156 (9Ch)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
157 (9Dh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
158 (9Eh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
159 (9Fh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(22) Remote I/O master 2 - I/O module configuration/abnormality information (word offset value: 160 (A0h)-175 (AFh)) (readout only)

< Configuration information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
160 (A0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
161 (A1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
162 (A2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
163 (A3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
164 (A4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
165 (A5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
166 (A6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
167 (A7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
168 (A8h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
169 (A9h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
170 (AAh)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
171 (ABh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
172 (ACh)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
173 (ADh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
174 (AEh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
175 (AFh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(23) Remote I/O master 3 - I/O module configuration/abnormality information (word offset value: 176 (B0h)-191 (BFh)) (readout only)

< Configuration information >

	(Fh)	(Eh)	(Dh)	(Ch)	(Bh)	(Ah)	(9h)	(8h)	(7h)	(6h)	(5h)	(4h)	(3h)	(2h)	(1h)	(0h)
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
176 (B0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
177 (B1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
178 (B2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
179 (B3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
180 (B4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
181 (B5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
182 (B6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
183 (B7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh)	(Eh)	(Dh)	(Ch)	(Bh)	(Ah)	(9h)	(8h)	(7h)	(6h)	(5h)	(4h)	(3h)	(2h)	(1h)	(0h)
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
184 (B8h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
185 (B9h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
186 (BAh)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
187 (BBh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
188 (BCh)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
189 (BDh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
190 (BEh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
191 (BFh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(24) Remote I/O master 4 - I/O module configuration/abnormality information (word offset value: 192 (C0h)-207 (CFh)) (readout only)

< Configuration information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
192 (C0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
193 (C1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
194 (C2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
195 (C3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
196 (C4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
197 (C5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
198 (C6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
199 (C7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
200 (C8h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
201 (C9h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
202 (CAh)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
203 (CBh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
204 (CCh)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
205 (CDh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
206 (CEh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
207 (CFh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(25) Remote I/O master 5 - I/O module configuration/abnormality information (word offset value: 208 (D0h)- 223 (DFh)) (readout only)

< Configuration information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
208 (D0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
209 (D1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
210 (D2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
211 (D3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
212 (D4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
213 (D5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
214 (D6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
215 (D7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
216 (D8h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
217 (D9h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
218 (DAh)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
219 (DBh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
220 (DCh)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
221 (DDh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
222 (DEh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
223 (DFh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(26) Remote I/O master 6 - I/O module configuration/abnormality information (word offset value: 224 (E0h)-239 (EFh)) (readout only)

< Configuration information >

	(Fh)	(Eh)	(Dh)	(Ch)	(Bh)	(Ah)	(9h)	(8h)	(7h)	(6h)	(5h)	(4h)	(3h)	(2h)	(1h)	(0h)
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
224 (E0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
225 (E1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
226 (E2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
227 (E3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
228 (E4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
229 (E5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
230 (E6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
231 (E7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh)	(Eh)	(Dh)	(Ch)	(Bh)	(Ah)	(9h)	(8h)	(7h)	(6h)	(5h)	(4h)	(3h)	(2h)	(1h)	(0h)
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
232 (E8h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
233 (E9h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
234 (EAh)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
235 (EBh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
236 (ECh)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
237 (EDh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
238 (EEh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
239 (EFh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(27) Remote I/O master 7 - I/O module configuration/abnormality information

(word offset value: 240 (F0h)-255 (FFh)) (readout only)

< Configuration information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
240 (F0h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
241 (F1h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
242 (F2h)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
243 (F3h)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
244 (F4h)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
245 (F5h)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
246 (F6h)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
247 (F7h)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

< Abnormality information >

	(Fh) 15	(Eh) 14	(Dh) 13	(Ch) 12	(Bh) 11	(Ah) 10	(9h) 9	(8h) 8	(7h) 7	(6h) 6	(5h) 5	(4h) 4	(3h) 3	(2h) 2	(1h) 1	(0h) 0
248 (F8h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
249 (F9h)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
250 (FAh)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
251 (FBh)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
252 (FCh)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
253 (FDh)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
254 (FEh)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
255 (FFh)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

(28) SX bus transmission error rate information

(word offset value: 508 (1FCh) - 511 (1FF)) (readout only)

The number of times of tact in which the SX bus error has occurred, out of the 100,000 times of tact that have been executed, is indicated by the parts per million (ppm).

If there is 1 time of error out of the 100,000 times, the value will become “10”. The refresh of the value is made every 100,000 times of execution.

Address	Name	Explanation
508 (1FCh)	Maximum value (lower word)	The maximum value, of the transmission error rate of the SX bus that has been detected by the own CPU module, is set.
509 (1FDh)	Maximum value (higher word)	
510 (1FEh)	The present value (lower word)	The present value, of the transmission error rate of the SX bus that has been detected by the own CPU module, is set.
511 (1FFh)	The present value (higher word)	

Note 1) Each type of system flag information of the system memory area can be referred to from the application program, but it should not be used for the “event variable” that starts up the event task of the application program. (There are some variables whereby the task is not started up.)

(Appendix 4) Error status related to the message function

Status code	Name	Factor	Countermeasures					
164 (A4h)	Destination of message transmittal designation abnormality	No module exists in the designated SX post number.	Recheck the input terminal that sets the destination of communications.	○	○	○	○	○
165 (A5h)	Message receiving BUSY	On the SX bus, the destination of communications is BUSY.	Start the function after a while. Reduce the message load.	○	○	○	○	○
170 (AAh)	Message transmittal BUSY	The message transmittal resource is BUSY in the CPU module.	Start the function after a while. Reduce the load of the own CPU module.	○	○	○	○	○
197 (C5h)	Network transmittal BUSY	The destination of communications is BUSY between the communications modules.	Start the function after a while. Reduce the load of the own CPU module.	-	○	-	○	○
177 (B1h)	Parameter abnormality	The input exceeded the specified range of input.		○	○	○	○	○
193 (C1h)	Channel open abnormality	The station number is incorrect. The communications mode is incorrect. The channel number is incorrect.		○	-	-	-	-
195 (C3h)	Message transmittal abnormality	The message transmittal cannot be effected. No response sent by the destination of communications has been received. The station number is incorrect. A response with abnormality code has been received. The destination of communications has not supported it.		-	○	-	○	○
199 (C7h)	Channel close	The communications are outside the configuration, and the destination of communications is closed.		-	○	○	-	-
200 (C8h)	Port designation abnormality	The receiving port number is out of the range of 1 - 127. The port has already been designated within the resource. The destination of communications has not been opened yet.		○	○	○	○	○

Status code	Name	Factor	Countermeasures					
201 (C9h)	Connection number, client port number FULL	The client port numbers are FULL. Within the resource, 57 or more numbers are opened simultaneously. The number of ports opened has exceeded the specified number.		○	-	-	○	○
206 (CEh)	Buffer overflow	The number of data transmitted exceeds 4096 bytes. The receiving data exceeds the storage variable size. When a value other than 0 has been designated as the module type number, the limitation on the communications module has been exceeded. In the RWRITE function, the destination of transmittal has detected abnormality.		-	○	○	○	○
207 (CFh)	Connection number abnormality	A connection number that has not been opened is used.		-	○	○	-	-
05 (05h)	Verification error	A verification error has been detected in the return of the message.		-	-	-	-	○
68 (44h)	Memory address designation abnormality	The designated address has exceeded the effective range.		-	-	-	○	○
69 (45h)	Memory size exceeded	The number of words for the reading out and writing of addresses has exceeded the effective range.		-	-	-	○	○