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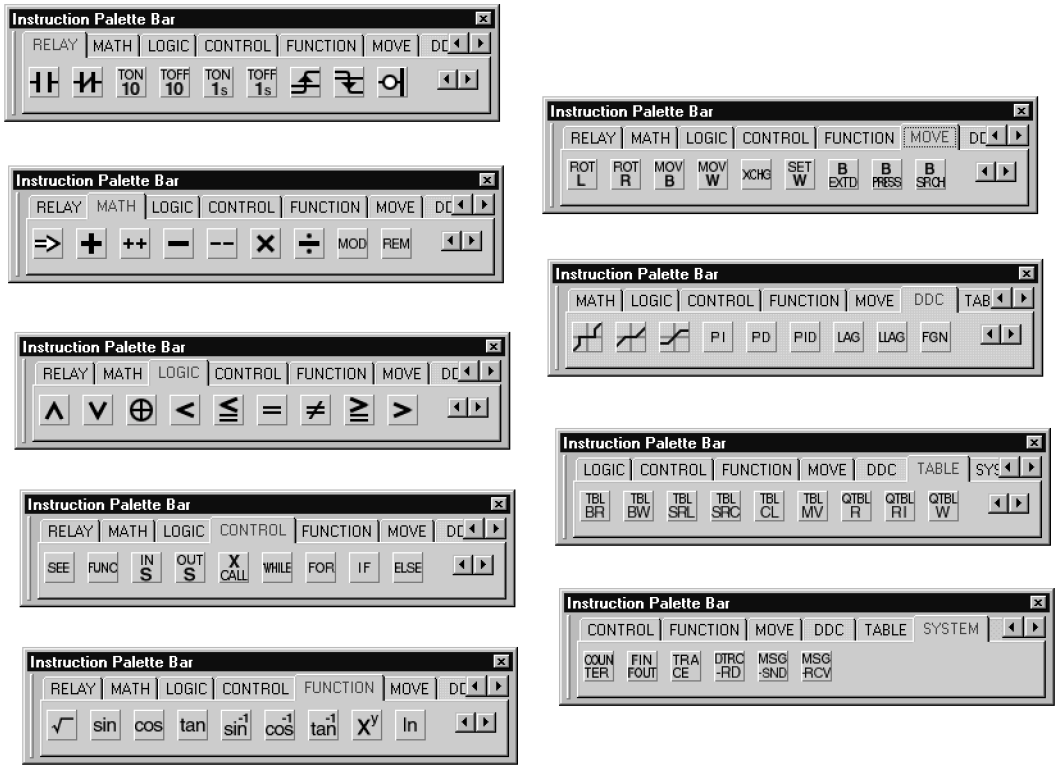

Ladder Works
Ladder Editor Programming Manual

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Appendix

1 Relay Circuit Instructions

1.1 N.O. Contact Instruction (NOC)

[Outline]

The NOC sets the value of the bit output to ON if the value of the referenced register is 1(ON) and to OFF is the value of the referenced register is 0 (OFF).

[Format]

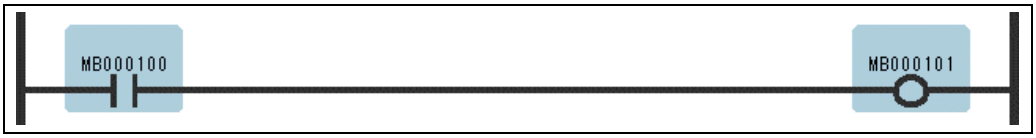
Symbol : NOC
Full Name : NO Contact
Category : RELAY
Icon : 

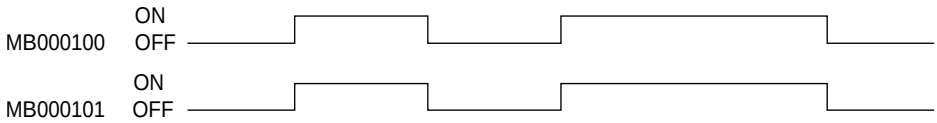
[Parameter]

Parameter Name	Setting
Relay No.	· Any bit type register · Any bit type register with subscript

[Program Example]

When MW000100 becomes ON, MB000101 becomes ON.



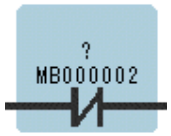


1.2 N.C. Contact instruction (NCC)

[Outline]

The NCC sets the value of the bit output to OFF when the value of the referenced register is 1 (ON), and to ON when the value of the referenced register is 0 (OFF).

[Format]



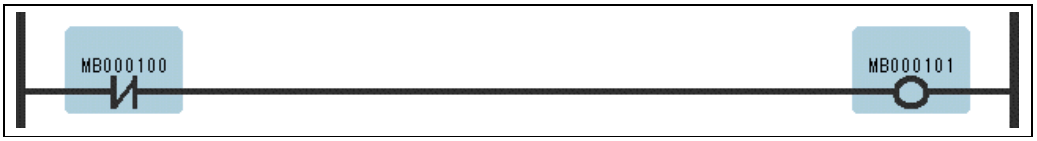
Symbol : NCC
Full Name : NC Contact
Category : RELAY
Icon : 

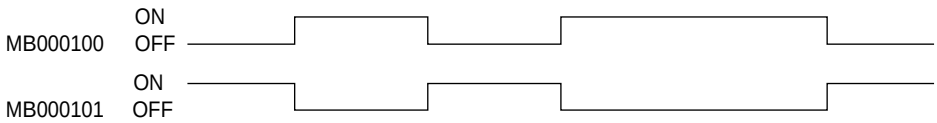
[Parameter]

Parameter Name	Setting
Relay No.	· Any bit type register · Any bit type register with subscript

[Program Example]

When MB000100 becomes ON, MB000101 becomes OFF.



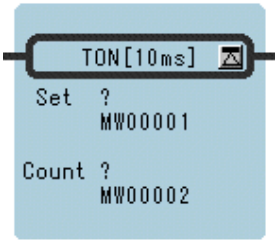


1.3 10-MS ON-DELAY TIMER Instruction (TON[10ms])

[Outline]

The TON[10ms] is executed while the immediately-preceding value of the bit input is ON. The value of the bit output is set to ON when the timer value reaches the set value. The timer stops when the immediately-preceding value of the bit input is set to OFF during timing. When the bit input is set to ON again, timing restarts from the beginning (0). A value equal to the actual timed time (10ms Unit) is stored in the timer value register.

[Format]

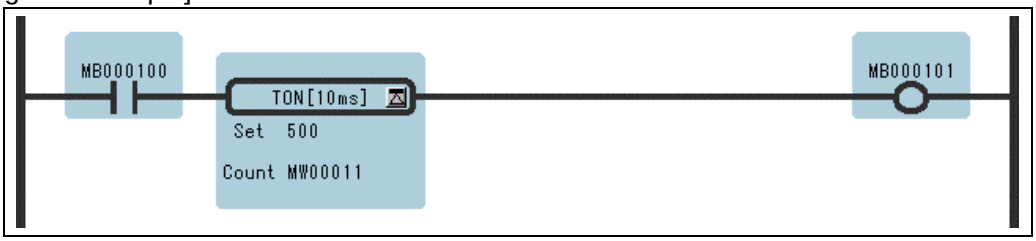


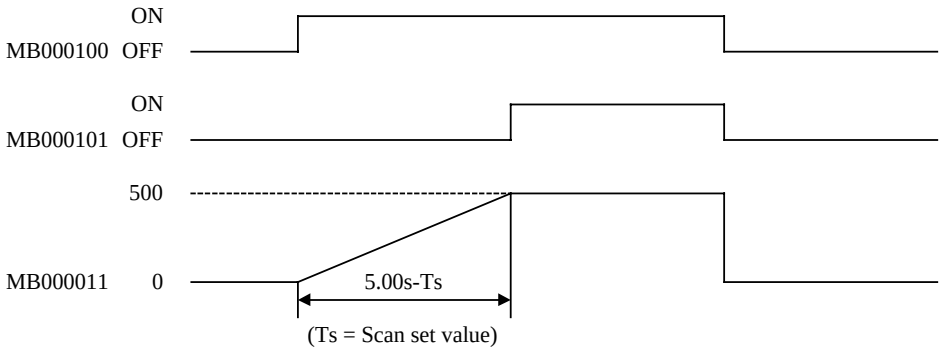
Symbol : TON[10ms]
Full Name : On-Delay Timer[10ms]
Category : RELAY
Icon : TON 10

[Parameter]

Parameter Name	Setting
Set (set value)	· Any integer type register · Any integer type register with subscript (0 to 65535 : in 0.01sec unit) · Constant
Count (timer value)	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)

[Program Example]





Notes: MW00011 works as timer count register. Thus, it is essential that there is no overlap. Set an unused register.

1.4 10-MS OFF-DELAY TIMER Instruction (TOFF[10ms])

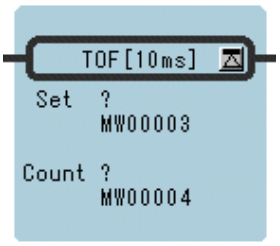
[Outline]

The TOFF[10ms] is executed while the immediately-preceding value of the bit input is OFF. The value of the bit output is set to OFF when the timer value reaches the set value.

The timer stops when the immediately-preceding value of the bit input is set to ON during timing.

When the bit input is set to OFF again, timing restarts from the beginning (0). A value equal to the actual timed time (10ms Unit) is stored in the timer value register.

[Format]

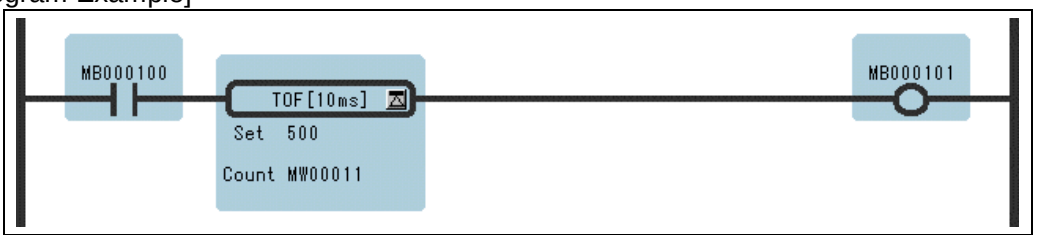


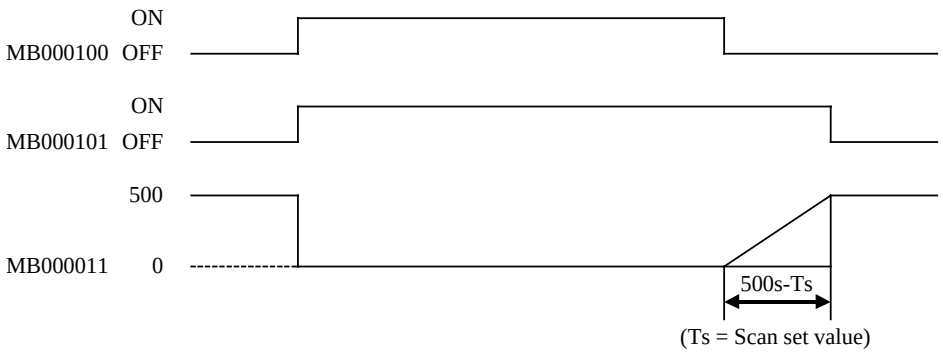
Symbol : TOFF[10ms]
Full Name : Off-Delay Timer[10ms]
Category : RELAY
Icon : 

[Parameter]

Parameter Name	Setting
Set (set value)	· Any integer type register · Any integer type register with subscript (0 to 65535 : 0.01sec unit) · Constant
Count (timer value)	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)

[Program Example]





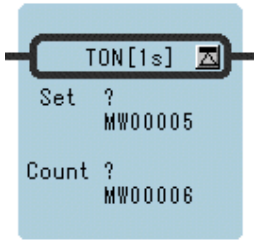
Notes: MW00011 works as timer count register. Thus, it is essential that there is no overlap. Set an unused register.

1.5 1-S ON-DELAY TIMER Instruction (TON[1s])

[Outline]

The TON[1s] times while the immediately-preceding value of the bit input is ON. The value of the bit output is set to ON when the timer value reaches the set value. The timer stops when the immediately-preceding value of the bit input is set to ON during timing. When the bit input is set to OFF again, timing restarts from the beginning (0). A value equal to the actual timed time (1s Unit) is stored in the timer value register.

[Format]

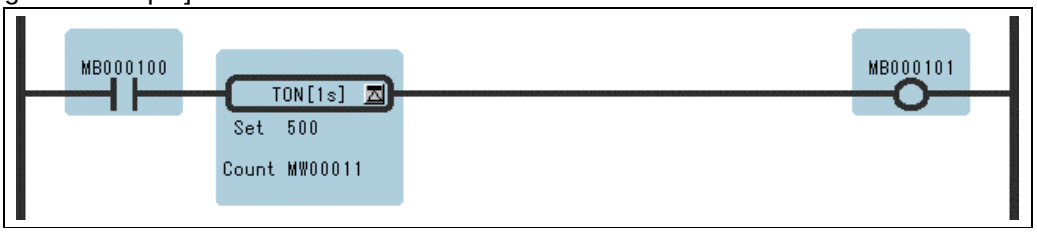


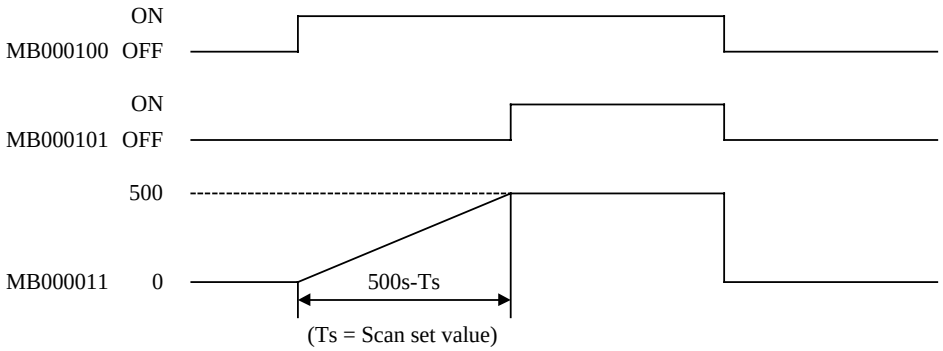
Symbol : TON[1s]
Full Name : On-Delay Timer[1s]
Category : RELAY
Icon : 

[Parameter]

Parameter Name	Setting
Set (set value)	· Any integer type register · Any integer type register with subscript (0 to 65535 : 1sec unit) · Constant
Count (timer value)	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)

[Program Example]





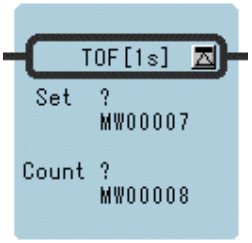
Notes: MW00011 works as timer count register. Thus, it is essential that there is no overlap. Set an unused register.

1.6 1-S OFF-DELAY TIMER Instruction (TOFF[1s])

[Outline]

The TOFF[1s] times while the immediately-preceding value of the bit input is OFF. The value of the bit output is set to OFF when the timer value reaches the set value. The timer stops when the immediately-preceding value of the bit input is set to ON during timing. When the bit input is set to OFF again, timing restarts from the beginning (0). A value equal to the actual timed time (1s Unit) is stored in the timer value register.

[Format]

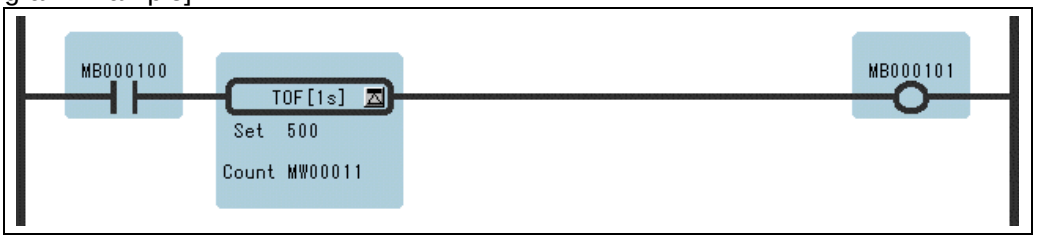


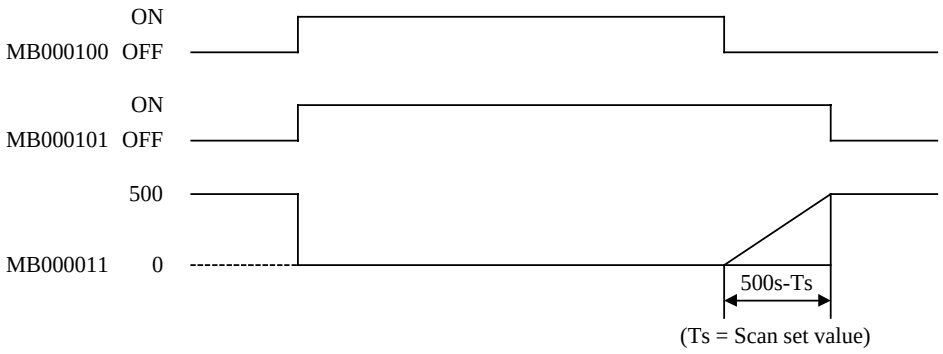
Symbol : TOFF[1s]
Full Name : Off-Delay Timer[1s]
Category : RELAY
Icon : 

[Parameter]

Parameter Name	Setting
Set (set value)	· Any integer type register · Any integer type register with subscript (0 to 65535 : 1sec unit) · Constant
Count (timer value)	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)

[Program Example]





Notes: MW00011 works as timer count register. Thus, it is essential that there is no overlap. Set an unused register.

1.7 RISING PULSE Instruction (ON – PLS)

[Outline]

The ON-PLS sets the value of the bit input to ON during one scan when the immediately-preceding value of the bit output changes from OFF to ON. The designated register is used to store the previous value of the bit output.

[Format]

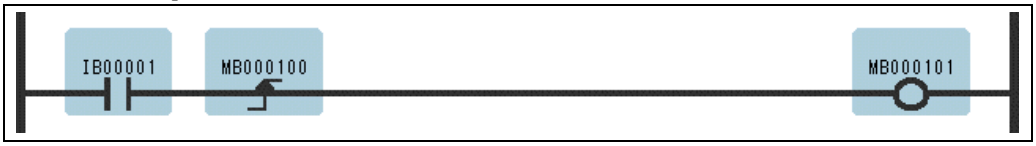
Symbol : ON-PLS
Full Name : Rise Pulse
Category : RELAY
Icon : 

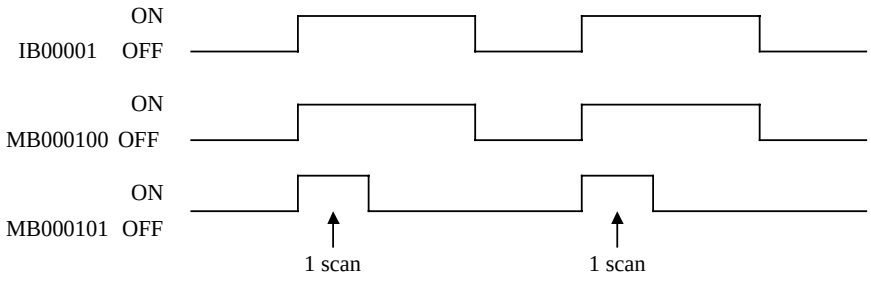
[Parameter]

Parameter Name	Setting
Register No.	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C registers)

[Program Example]

When IB00001 turns ON from OFF, MB000101 turns ON and stays ON during 1 scan. MB000100 is used to store the previous value of IB00001.





Register status of Rising pulse instruction is shown in Table 1.1.

Table 1.1 Register Status with Rising Pulse Instruction

Input		Result	
IB00001	MB000100 (Previous value of IB00001)	MB000100 (IB00001 stored)	MB000101
OFF	OFF	OFF	OFF
OFF	ON	OFF	OFF
ON	OFF	ON	ON
ON	ON	ON	OFF

Notes: Case of Program Example, the instruction is used not for rise detection of MB000100 but is used for rise detection of IB00001. MB000100 is used only for storing the previous value of IB00001.

1.8 FALLING PULSE Instruction (OFF – PLS)

[Outline]

The OFF-PLS sets the value of the bit input to ON for one scan when the immediately-preceding value of the bit output changes from ON to OFF. The designated register is used to store the previous value of the bit output.

[Format]

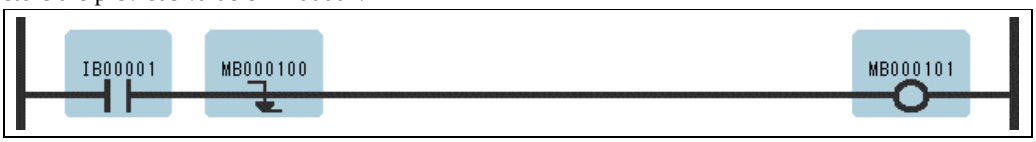
Symbol : OFF-PLS
Full Name : Fall Pulse
Category : RELAY
Icon : 

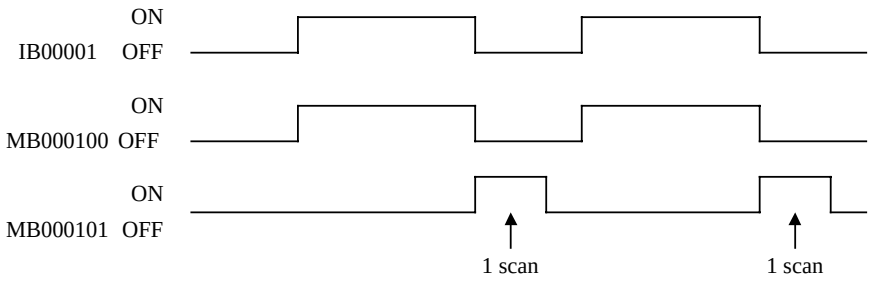
[Parameter]

Parameter Name	Setting
Register No.	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C registers)

[Program Example]

When IB00001 turns OFF, MB000101 turns ON and stays ON during 1 scan. MB000100 is used to store the previous value of IB00001.





Register status of Falling pulse instruction is shown in Table 1.2.

Table 1.2 Register Status with Falling Pulse Instruction

Input		Result	
IB00001	MB000100 (Previous value of IB00001)	MB000100 (IB00001 stored)	MB000101
OFF	OFF	OFF	OFF
OFF	ON	OFF	ON
ON	OFF	ON	OFF
ON	ON	ON	OFF

Notes: Case of Program Example, the instruction is used not for fall detection of MB000100 but is used for fall detection of IB00001. MB000100 is used only for storing the previous value of IB00001.

1.9 COIL Instruction (COIL)

[Outline]

The COIL sets the value of the referenced register to 1 (ON) when the immediately-preceding value of the bit input is ON, and to 0 (OFF) when the immediately-preceding value of the bit input is OFF.

[Format]

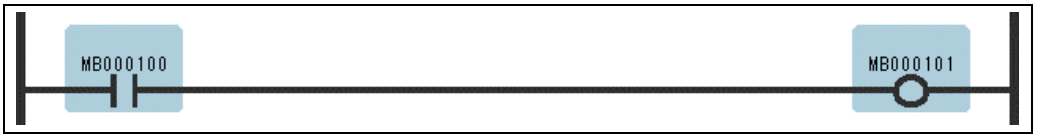
Symbol : COIL
Full Name : Coil
Category : RELAY
Icon : 

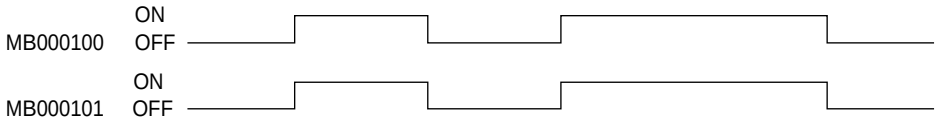
[Parameter]

Parameter Name	Setting
Coil No.	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C registers)

[Program Example]

When MB000100 becomes ON, MB000101 becomes ON.





1.10 SET COIL Instruction (S-COIL)

[Outline]

The S-COIL turns ON the output when the execution condition is satisfied, and maintains the ON state.

[Format]

Symbol : S-Coil
Full Name : Set Coil
Category : RELAY
Icon : 

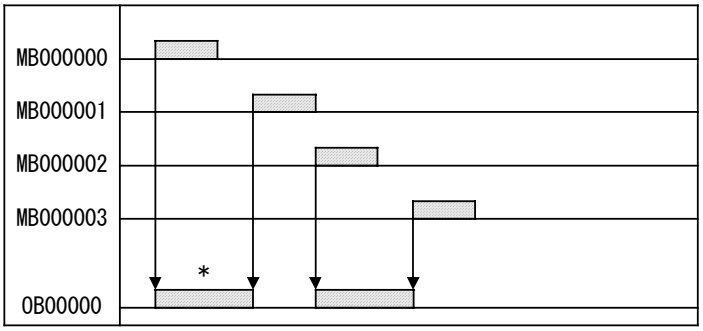
[Parameter]

Parameter Name	Setting
Coil No.	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C registers)

[Program Example]

Case where the same output destination is designated multiple times.

The above example acts as in the graph below.



* When OB00000 is OFF, with the "set coil" instruction, OB00000 turns ON.

1.11 RESET COIL Instruction (R-COIL)

[Outline]

The R-COIL turns OFF the output when the execution condition is satisfied, and maintains the OFF state.

[Format]

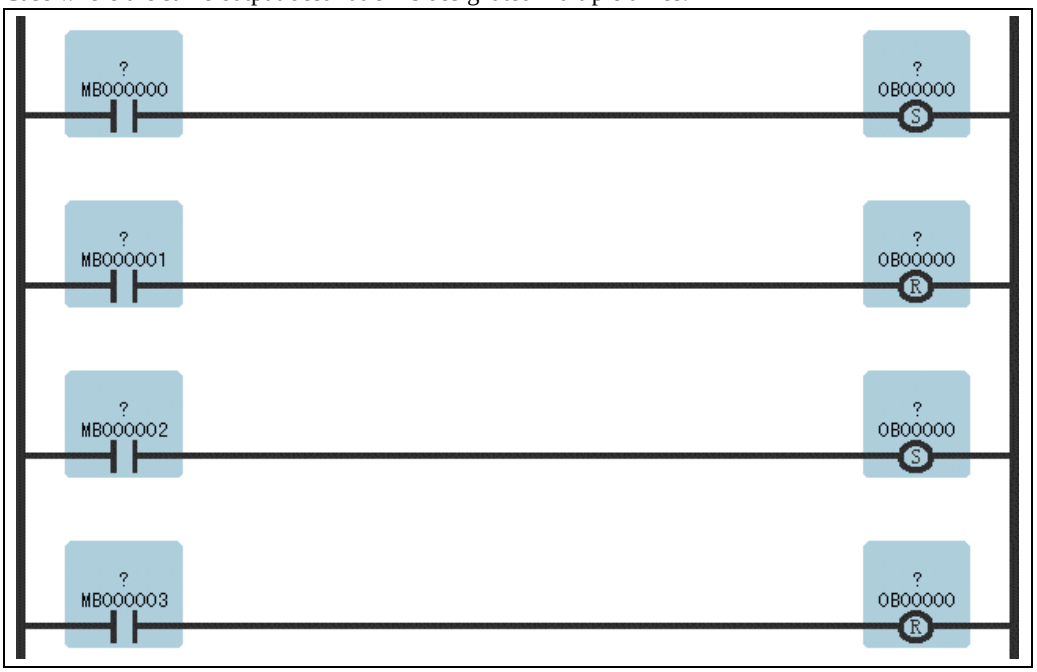
Symbol : R-Coil
Full Name : Reset Coil
Category : RELAY
Icon : 

[Parameter]

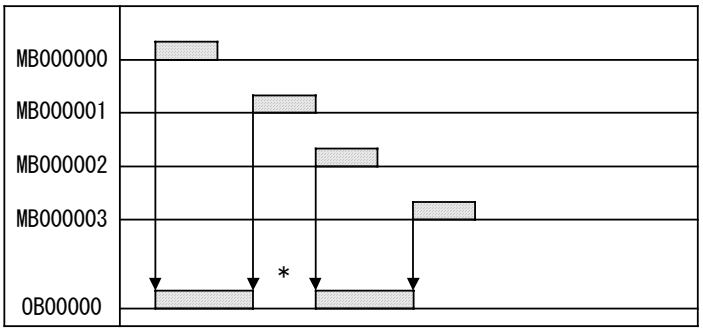
Parameter Name	Setting
Coil No.	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C registers)

[Program Example]

Case where the same output destination is designated multiple times.



The above example acts as in the graph below.



* When OB00000 is ON, with the "reset coil" instruction, OB00000 turns OFF.

2 Numeric Operation Instructions

2.1 STORE Instruction (STORE)

[Outline]

The STORE instruction stores the contents of *Source* in the *Dest*.

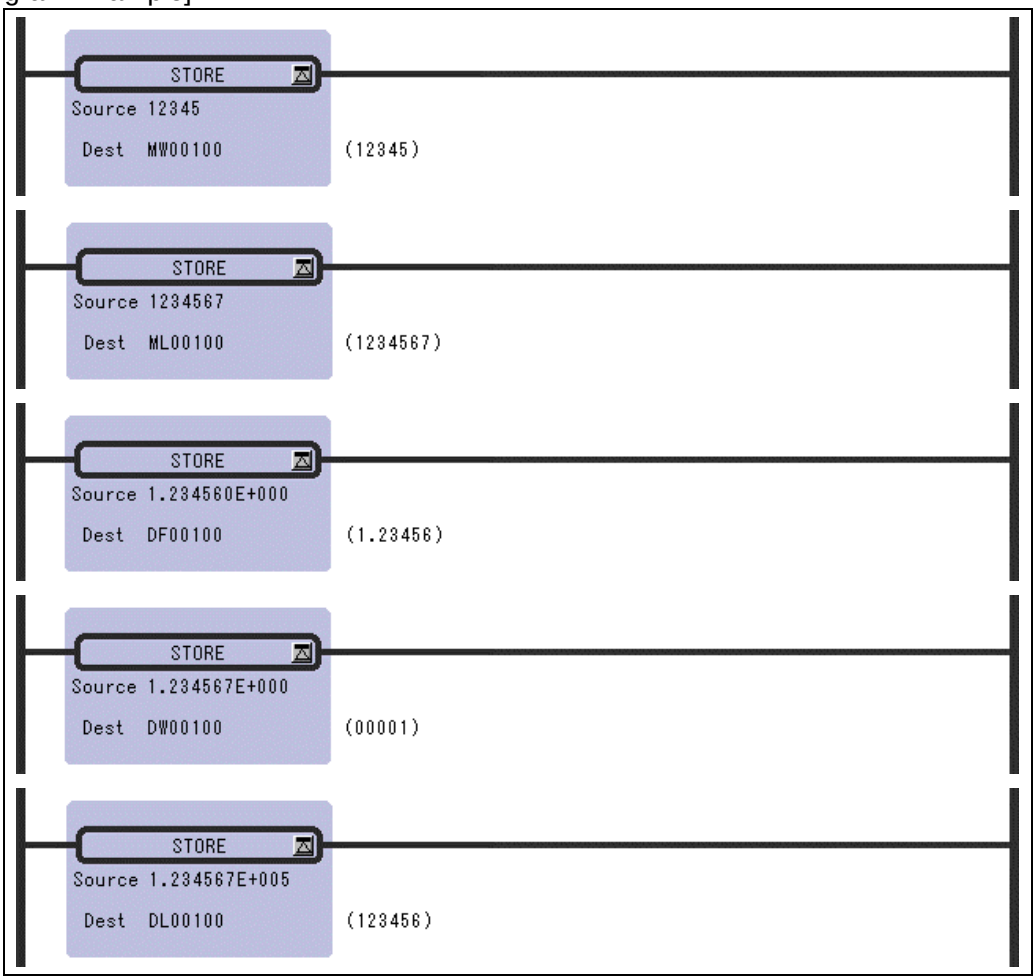
[Format]

Symbol : STORE
Full Name : Store
Category : MATH
Icon : 

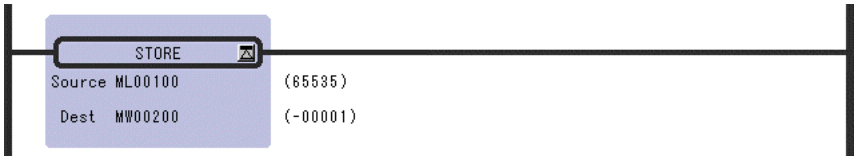
[Parameter]

Parameter Name	Setting
Source	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]



Notes: When a double-length integer type data is stored in an integer type register, the lower 16 bits are stored as they are. Be careful since an operation error will not occur even if the data to be stored exceeds the integer range (-32768 to 32767).

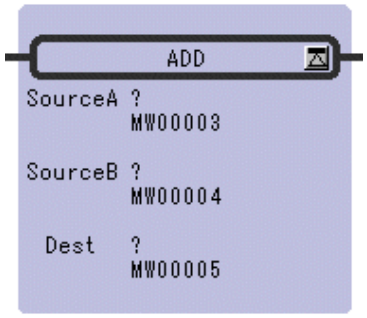


2.2 ADDITION Instruction (ADD)

[Outline]

The ADD instruction adds integer, double-length integer, and real number values. *Source B* is added to *Source A* and stored in the *Dest*. If the result of adding integer values is greater than 32767, an overflow error occurs. If the result of adding double-length integer values is greater than 2147483647, an overflow error occurs.

[Format]



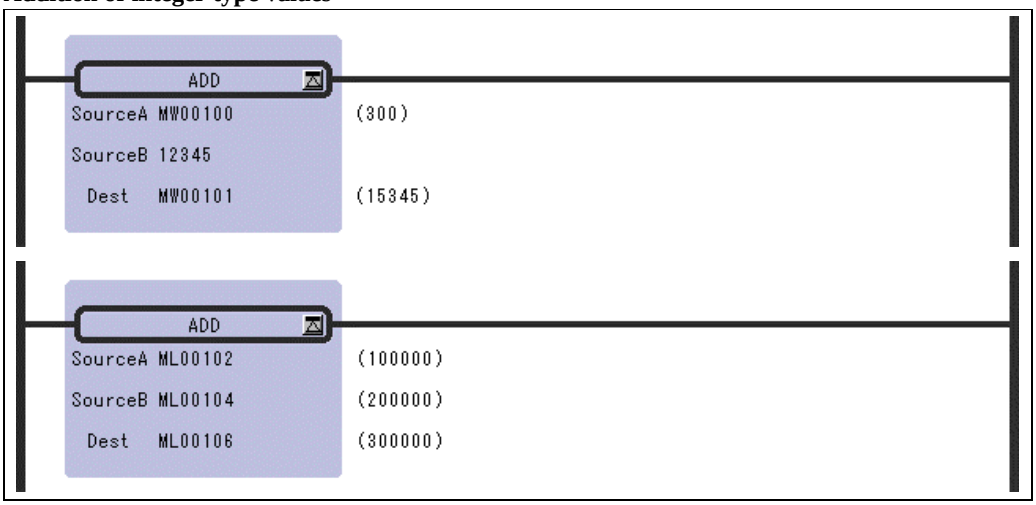
Symbol : ADD
Full Name : Add
Category : MATH
Icon : 

[Parameter]

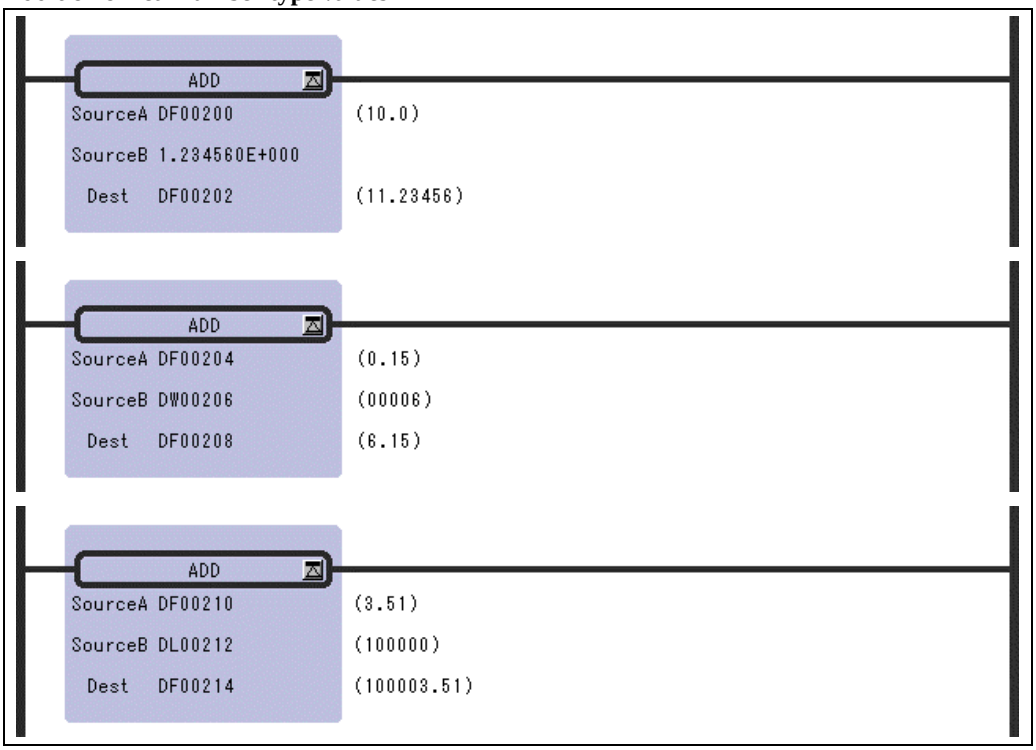
Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Addition of integer type values



Addition of real number type values



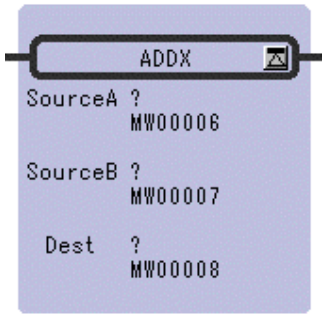
Notes: In the case of double-length integer type values, an operation using addition and subtraction instructions (+, –, ++, --) will be a 32-bit operation. However, when an addition or subtraction instruction is used in a remainder correction operation (where a multiplication instruction (×) is the immediately preceding instruction and a division instruction (÷) is the immediately subsequent instruction), the operation will be a 64-bit operation.

2.3 EXTENDED ADDITION Instruction (ADDX)

[Outline]

The ADDX instruction adds integer values. *Source B* is added to *Source A* and stored in the *Dest.* No operation error occurs, even if the operation results in an overflow. Otherwise, the ADDX is much the same as the ADD.

[Format]



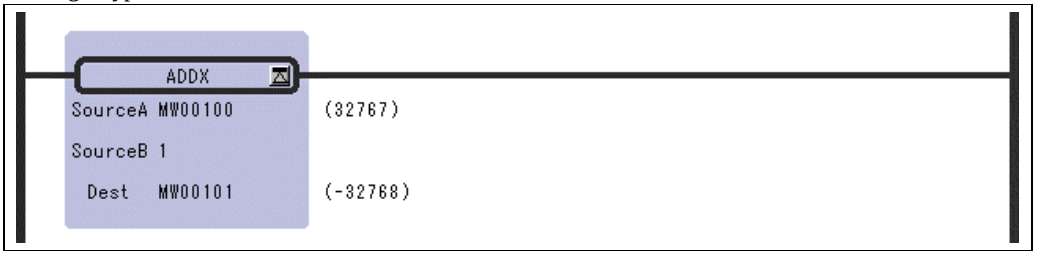
Symbol : ADDX
Full Name : Expanded Add
Category : MATH
Icon : ++

[Parameter]

Parameter Name	Setting
Source A	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Source B	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

This instruction is used in cases where it is desirable that operation errors do not occur in the addition of integer type values.



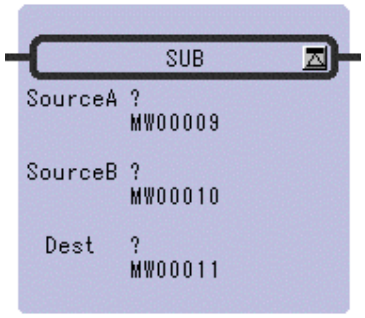
Notes: In the case of double-length integer type values, an operation using addition and subtraction instructions (+, –, ++, --) will be a 32-bit operation. However, when an addition or subtraction instruction is used in a remainder correction operation (where a multiplication instruction (×) is the immediately preceding instruction and a division instruction (÷) is the immediately subsequent instruction), the operation will be a 64-bit operation.

2.4 SUBTRACTION Instruction (SUB)

[Outline]

The SUB instruction subtracts integer, double-length integer, and real number values. *Source B* is subtracted to *Source A* and stored in the *Dest*. If the result of subtracting integer values is smaller than – 32768, an underflow error occurs. If the result of subtracting double-length integer values is smaller than – 2147483648, an underflow error occurs.

[Format]



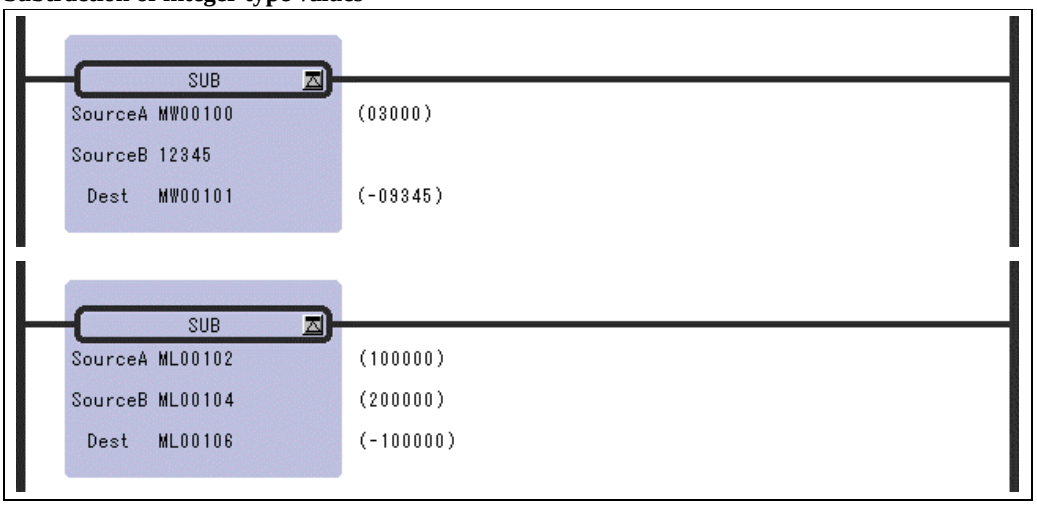
Symbol : SUB
Full Name : Subtract
Category : MATH
Icon :

[Parameter]

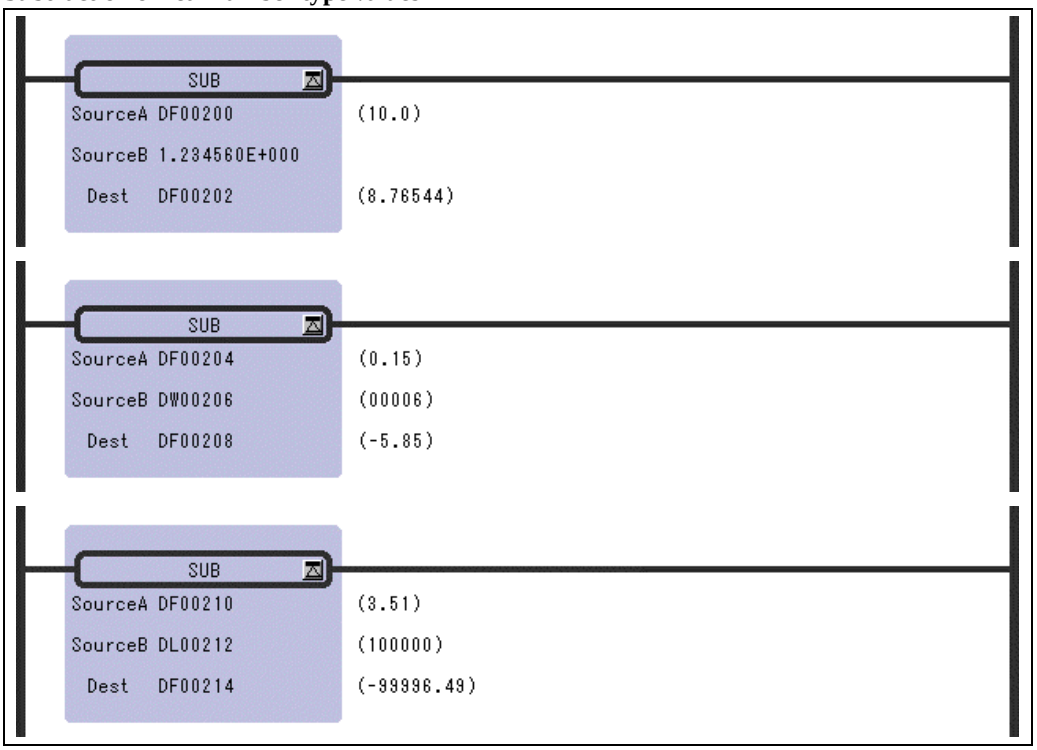
Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Subtraction of integer type values



Subtraction of real number type values



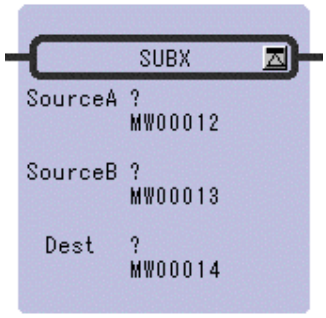
Notes: In the case of double-length integer type values, an operation using addition and subtraction instructions (+, –, ++, --) will be a 32-bit operation. However, when an addition or subtraction instruction is used in a remainder correction operation (where a multiplication instruction (×) is the immediately preceding instruction and a division instruction (÷) is the immediately subsequent instruction), the operation will be a 64-bit operation.

2.5 EXTENDED SUBTRACTION Instruction (SUBX)

[Outline]

The SUBX instruction subtracts integer values. No operation error occurs, even if the operation results in an underflow.

[Format]



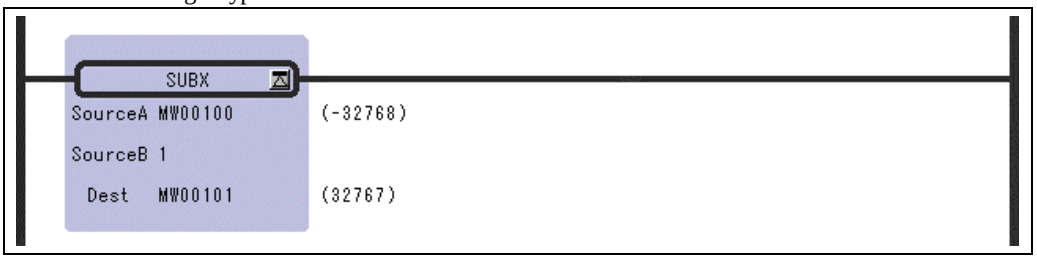
Symbol : SUBX
Full Name : Expanded Subtract
Category : MATH
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Source B	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

This instruction is used in cases where it is desirable that operation errors do not occur in the subtraction of integer type values.



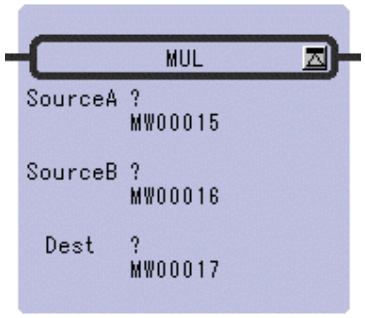
Notes: In the case of double-length integer type values, an operation using addition and subtraction instructions (+, –, ++, --) will be a 32-bit operation. However, when an addition or subtraction instruction is used in a remainder correction operation (where a multiplication instruction (×) is the immediately preceding instruction and a division instruction (÷) is the immediately subsequent instruction), the operation will be a 64-bit operation.

2.6 MULTIPLICATION Instruction (MUL)

[Outline]

The MUL instruction multiplies integer, double-length integer, and real number values. *Source B* is multiplied to *Source A* and stored in the *Dest*.

[Format]



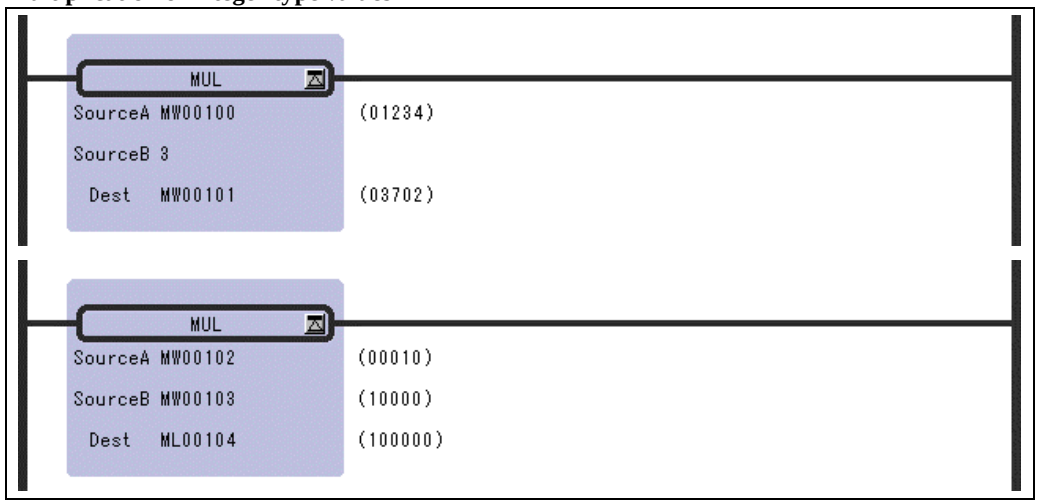
Symbol : MUL
Full Name : Multiply
Category : MATH
Icon :

[Parameter]

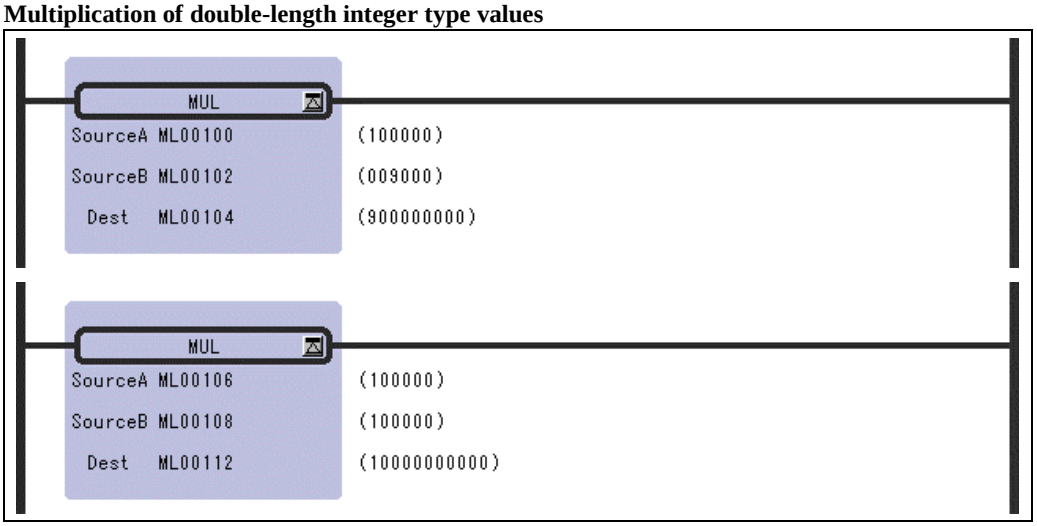
Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

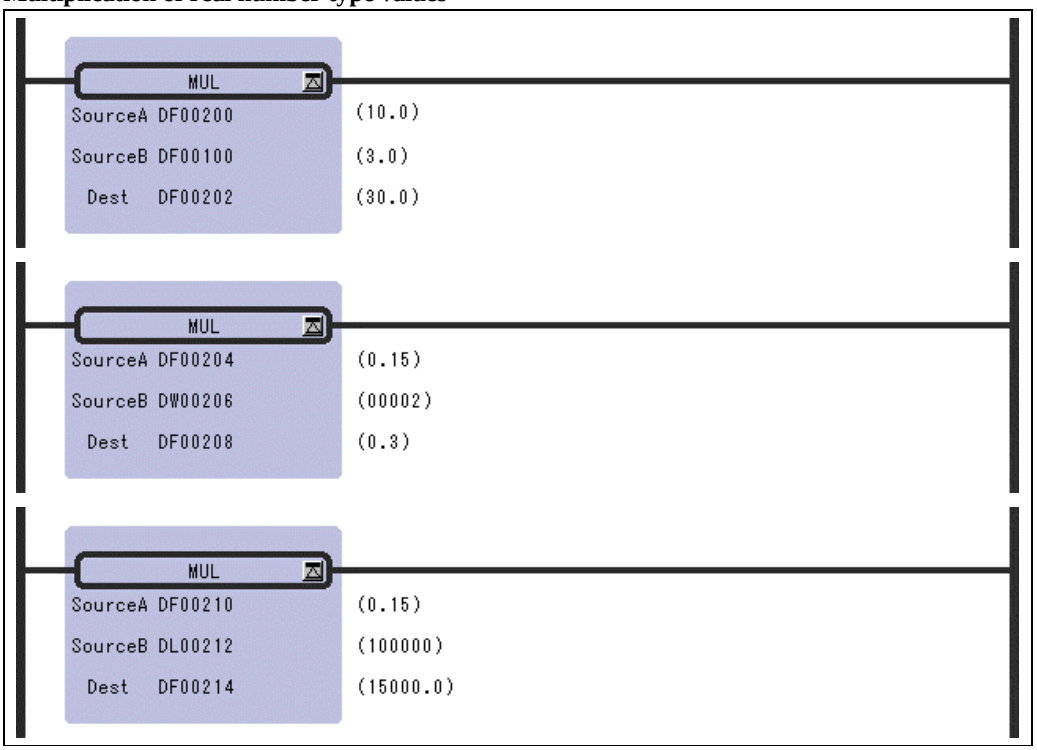
Multiplication of integer type values



Multiplication of double-length integer type values



Multiplication of real number type values



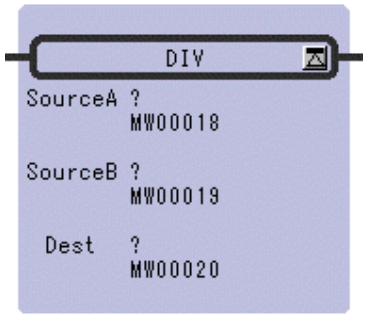
Notes: In the case of double-length integer type values, an operation using addition and subtraction instructions (+, –, ++, --) will be a 32-bit operation. However, when an addition or subtraction instruction is used in a remainder correction operation (where a multiplication instruction (×) is the immediately preceding instruction and a division instruction (÷) is the immediately subsequent instruction), the operation will be a 64-bit operation.

2.7 DIVISION Instruction (DIV)

[Outline]

The DIV instruction divides integer, double-length integer, and real number values. *Source A* is divided by *Source B* and stored in the *Dest*.

[Format]



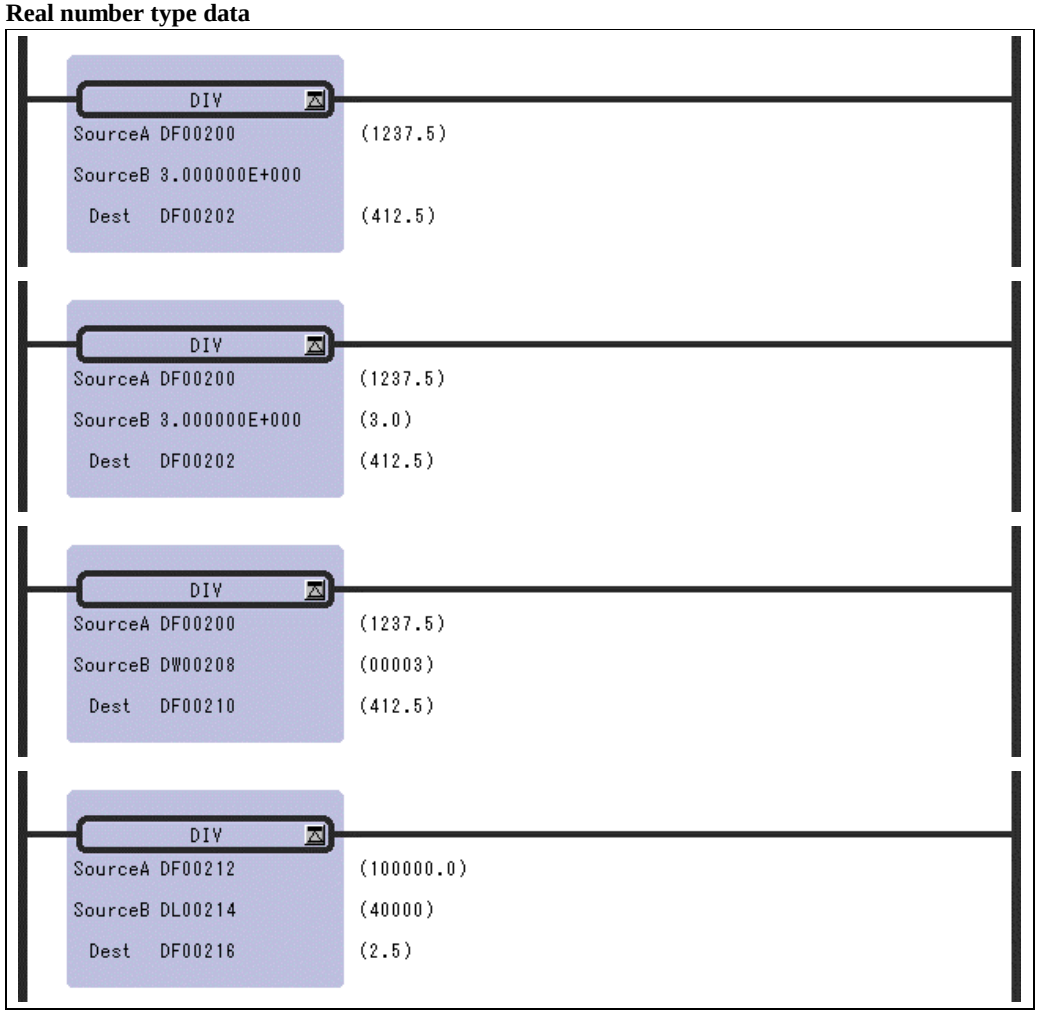
Symbol : DIV
Full Name : Divide
Category : MATH
Icon :

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Real number type data

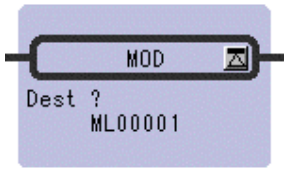


2.8 MOD Instruction (MOD)

[Outline]

The MOD instruction outputs the remainder of integer or double-length integer division to the *Dest*. Always execute the MOD immediately after the division instruction. If the MOD is executed somewhere else, the operation results obtained before the next entry instruction cannot be guaranteed.

[Format]



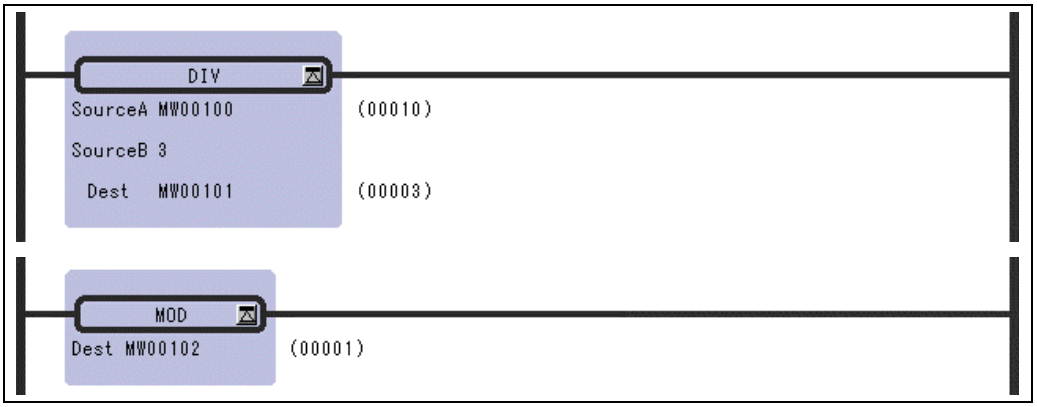
Symbol : MOD
Full Name : Integer Remainder
Category : MATH
Icon : MOD

[Parameter]

Parameter Name	Setting
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

The quotient of an integer type division is stoned in MW00101 and the remainder is stored in MW00102.



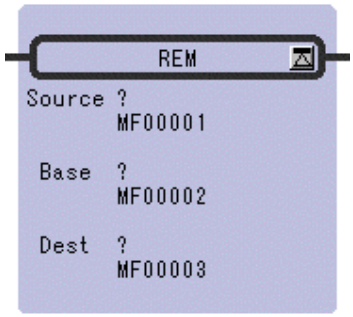
2.9 REM Instruction (REM)

[Outline]

The REM instruction outputs the remainder of real number division to the *Dest*. Here, the remainder refers to the remainder obtained by repeatedly subtracting the *Base* designated by the *Source*. Thus, the n is the number of times subtraction is repeated.

$$Dest = Source - (Base \times n) \quad (0 \leqq Dest < Base)$$

[Format]



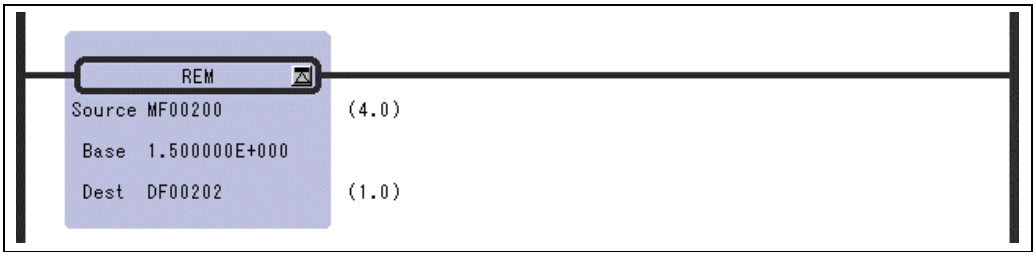
Symbol : REM
Full Name : Real Remainder
Category : MATH
Icon : 

[Parameter]

Parameter Name	Setting
Source	· Any real number type register · Any real number type register with subscript · Constant
Base	· Any real number type register · Any real number type register with subscript · Constant
Dest	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

The remainder of the division of the real number variable MF00200 by the constant value, 1.5, is determined and stored in DF00202.

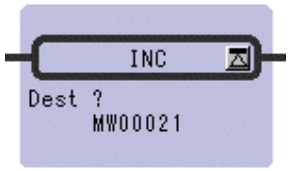


2.10 INC Instruction (INC)

[Outline]

The INC instruction adds 1 to the designated integer or double-length integer register. For integer registers, no overflow error occurs even if the result of addition exceeds 32767. Likewise, no overflow error occurs for double-length integer registers.

[Format]



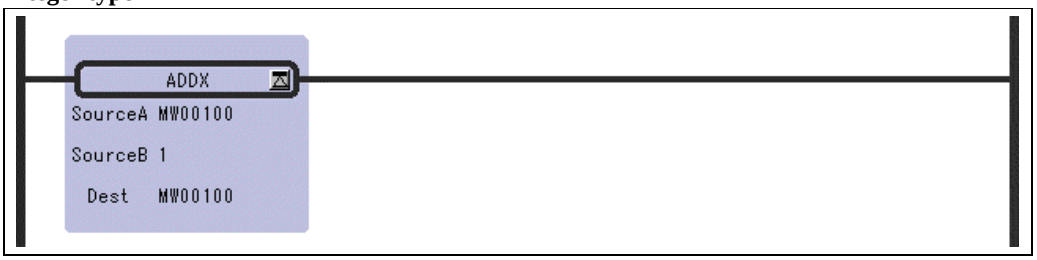
Symbol : INC
Full Name : Increment
Category : MATH
Icon : 

[Parameter]

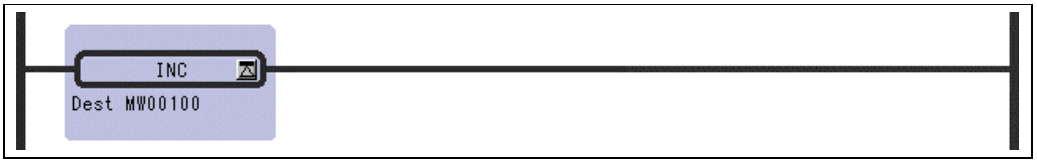
Parameter Name	Setting
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

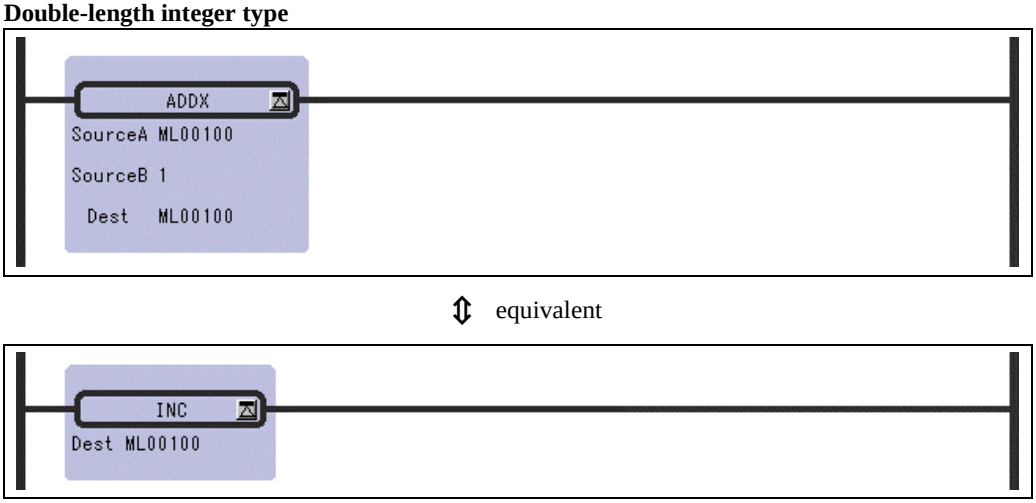
Integer type



⇕ equivalent



Double-length integer type

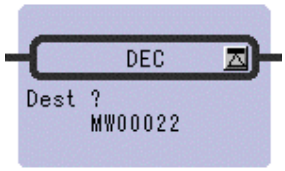


2.11 DEC Instruction (DEC)

[Outline]

The DEC instruction subtracts 1 from the designated integer or double-length integer register. For integer registers, no underflow error occurs even if the result of subtraction is less than – 32768. Likewise, no underflow error occurs for double-length integer registers.

[Format]



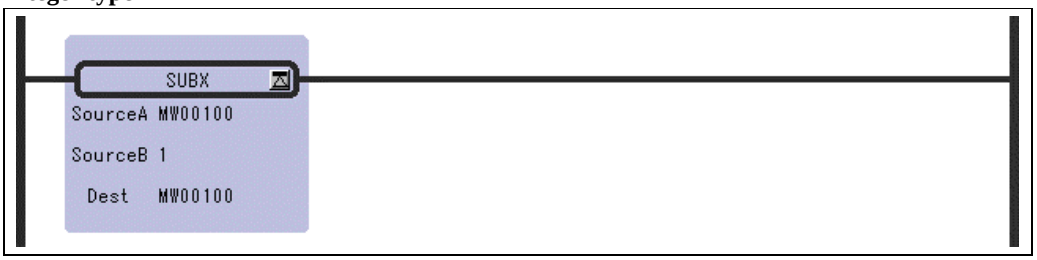
Symbol : DEC
Full Name : Decrement
Category : MATH
Icon : 

[Parameter]

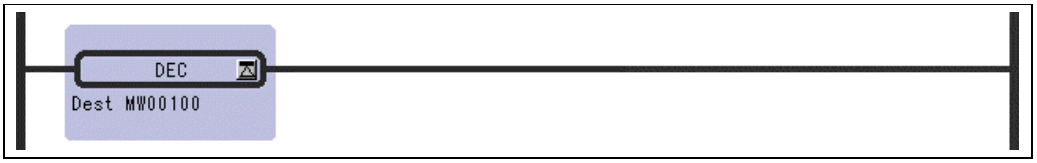
Parameter Name	Setting
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

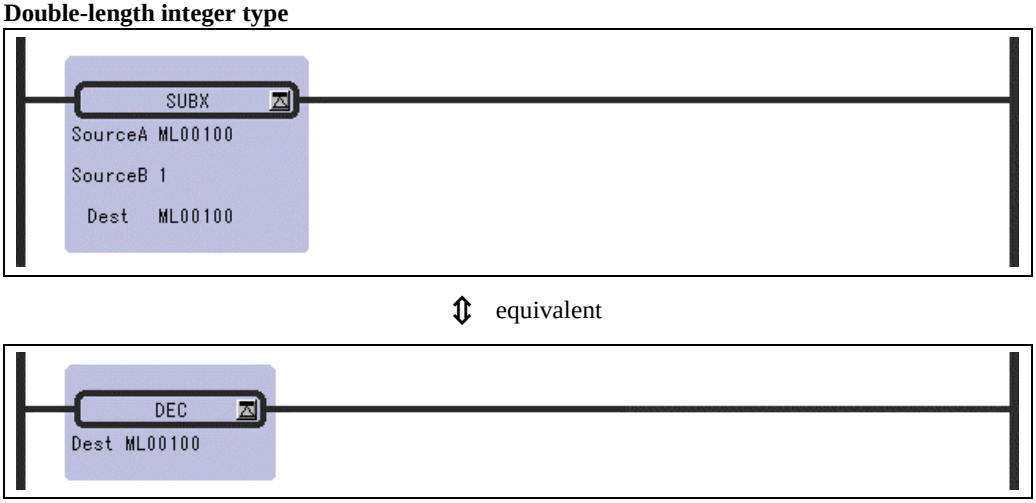
Integer type



⇕ equivalent



Double-length integer type



2.12 ADD TIME Instruction (TMADD)

[Outline]

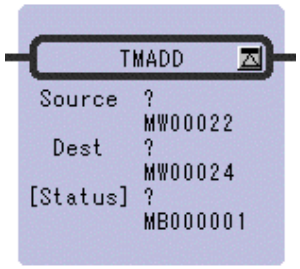
The TMADD instruction adds one time (hours/minutes/seconds) to another time. The *Source* is added to the *Dest* and the result is stored in the *Dest*. The formats of *Source* and *Dest* are as follows.

Data Format

Register Offset	Data Contents	Data Range (BCD)
0	Hours/minutes	Upper byte (hours) : 0 to 23 Lower byte (minutes) : 0 to 59
1	Seconds	0000～0059

If the contents of the *Dest* and *Source* and the operation result are with the appropriate ranges, the operation will be performed normally. After the operation is completed, the *[Status]* is turned OFF. If the contents of the *Dest* and *Source* are outside the data ranges, the operation is not performed. In this case, 9999H is stored in the column "second" of the *Dest*, and the *[Status]* is turned ON.

[Format]



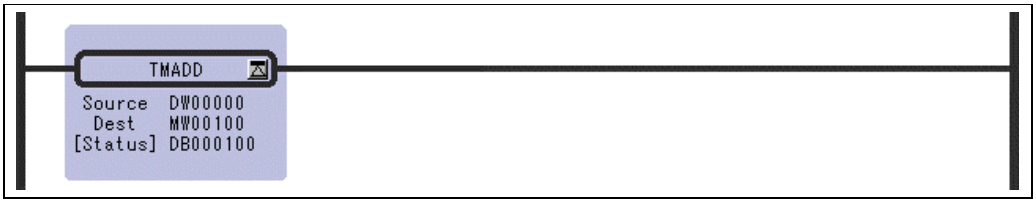
Symbol : TMADD
Full Name : Time Add
Category : MATH
Icon : 

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C register) · Any integer type register with subscript (except for # and C register)
[Status]	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C register) * possible to omit

[Program Example]

The time data in DW0000 to DW00101 is added to the time data in MW00100 to MW00101.



8 hrs 40 min 32 sec + 1 hrs 22 min 16 sec = 10 hrs 2 min 48sec
(MW00100) (MW00101) (DW00000) (DW00001) (MW00100) (MW00101)

Time data	Before execution	After execution
MW00100	0840H	1002H
MW00101	0032H	0048H
DW00000	0122H	0122H
DW00001	0016H	0016H

2.13 SUBTRACT TIME Instruction (TMSUB)

[Outline]

The TMSUB instruction subtracts one time (hours/minutes/seconds) from another time. The *Source* is subtracted from the *Dest* and the result is stored in the *Dest*. The formats of *Source* and *Dest* are as follows.

Data Format

Register Offset	Data Contents	Data Range (BCD)
0	Hours/minutes	Upper byte (hours) : 0 to 23 Lower byte (minutes) : 0 to 59
1	Seconds	0000～0059

If the contents of the *Dest* and *Source* are with the appropriate ranges, the operation will be performed normally. After the operation is completed, the *[Status]* is turned OFF. If the contents of the *Dest* and *Source* are outside the data ranges, the operation is not performed. In this case, 9999H is stored in the column "second" of the *Dest*, and the *[Status]* is turned ON.

[Format]

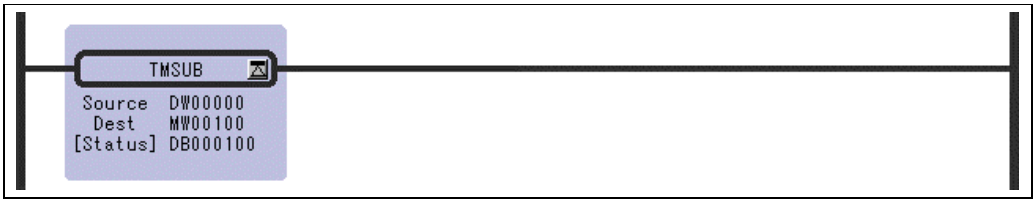
Symbol : TMSUB
Full Name : Time Sub
Category : MATH
Icon : 

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C register) · Any integer type register with subscript (except for # and C register)
[Status]	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C register) * possible to omit

[Program Example]

The time data in DW0000 to DW0001 is subtracted to the time data in MW00100 to MW00101.



8 hrs 40 min 32sec + 1 hrs 22 min 16 sec = 7 hrs 18 min 16 sec
(MW00100) (MW00101) (DW00000) (DW00001) (MW00100) (MW00101)

Time data	Before execution	After execution
MW00100	0840H	0718H
MW00101	0032H	0016H
DW00000	0122H	0122H
DW00001	0016H	0016H

2.14 SPEND TIME Instruction (SPEND)

[Outline]

The SPEND instruction subtracts one time (year/month/day/hours/minutes/seconds) from another time data and calculates the elapsed time. *Source* is subtracted from the *Dest* and the result is stored in the *Dest*. The formats of *Source* and *Dest* are as follows.

Source Format

Register Offset	Data Contents	Data Range (BCD)	I/O
0	Year (BCD)	0000～0099	IN
1	Month/Day (BCD)	Upper byte (month) : 1 to 12 Lower byte (day) : 1 to 31	IN
2	Hours/minutes (BCD)	Upper byte (hours) : 0 to 23 Lower byte (minutes) : 0 to 59	IN
3	Seconds (BCD)	0000～0059	IN

Dest Format

Register Offset	Data Contents	Data Range (BCD)	I/O
0	Year (BCD)	0000～0099	IN/OUT
1	Month/Day (BCD)	Upper byte (month) : 1 to 12 Lower byte (day) : 1 to 31	IN/OUT
2	Hours/minutes (BCD)	Upper byte (hours) : 0 to 23 Lower byte (minutes) : 0 to 59	IN/OUT
3	Seconds (BCD)	0000～0059	IN/OUT
4	Total number of seconds	This is the number of records which is obtained by converting Year/Month/Day/ Hour/Minutes/Seconds, which is the results of operations, to seconds. (Double-length integer)	IN/OUT
5			

If the contents of the *Dest*, *Source* and the operation result are with the appropriate ranges, the operation will be performed normally. After the operation is completed, *[Status]* is turned OFF. If the contents of the *Dest* and *Source* are outside the data ranges, the operation is not performed. In this case, 9999H is stored in the column "second" of the *Dest*, and the *[Status]* is turned ON.

[Format]

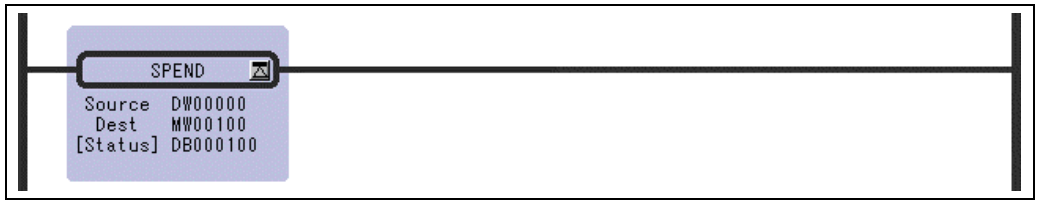
Symbol : SPEND
Full Name : Time Spend
Category : MATH
Icon : 

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C register) · Any integer type register with subscript (except for # and C register)
[Status]	· Any bit type register (except for # and C register) · Any bit type register with subscript (except for # and C register) * possible to omit

[Program Example]

The time elapsed from the time data in MW00100 to MW00103 to the time data in DW00000 to DW00003 is stored to MW00100 - MW00105.



98 yrs 5 mos 11 days 15 hrs 4 min 47 sec – 98 yrs 4 mos 2 days 8 hrs 13 min 8 sec
(MW00100) (MW00101) (MW00102) (MW00103) (DW00000) (DW00101) (DW00102) (DW00103)
= 0 yrs 39 days 6 hrs 51 min 39 sec
(MW00100) (MW00101) (MW00102) (MW00103)

Time data	Before execution	After execution
MW00100	H0098	H0000
MW00101	H0511	H0039
MW00102	H1504	H0651
MW00103	H0047	H0039
MW00104	—	3394299 (Decimal)
MW00105	—	
DW00000	H0098	H0098
DW00001	H0402	H0402
DW00002	H0813	H0813
DW00003	H0008	H0008

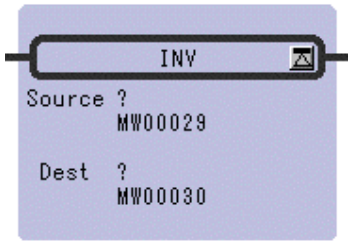
Notes: In the operation results, the year is counted as 365 days and a leap year is not taken into consideration. Also, the number of months is not counted. It is counted in days.

2.15 SIGN INVERSION Instruction (INV)

[Outline]

The INV instruction inverts the sign of the contents of the *Source*, and the result is stored in the *Dest*.

[Format]



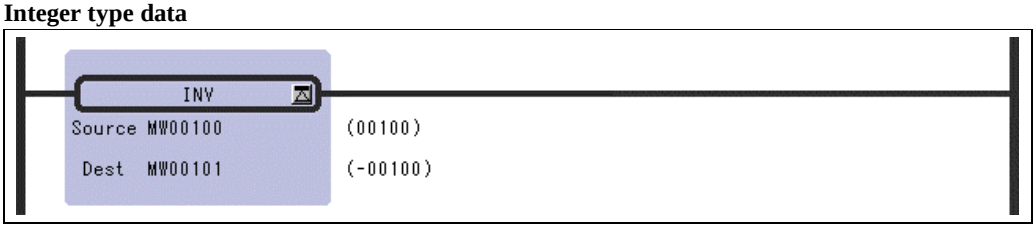
Symbol : INV
Full Name : Inverse
Category : MATH
Icon : 

[Parameter]

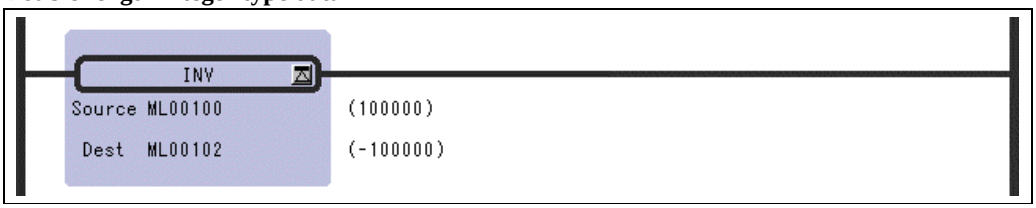
Parameter Name	Setting
Source	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

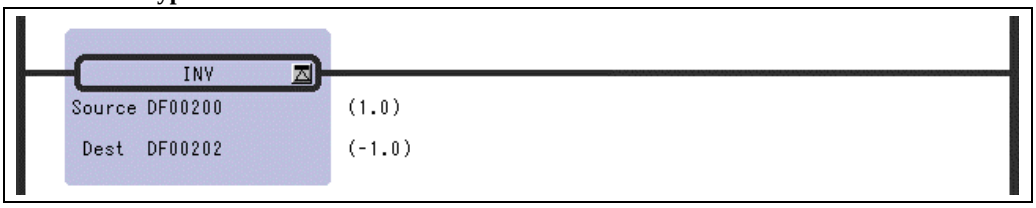
Integer type data



Double-length integer type data



Real number type data

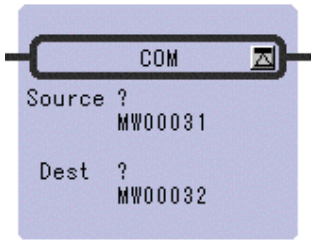


2.16 1'S COMPLEMENT Instruction (COM)

[Outline]

The COM instruction determines the 1's complement of the contents of the *Source* and the result is stored in the *Dest*.

[Format]



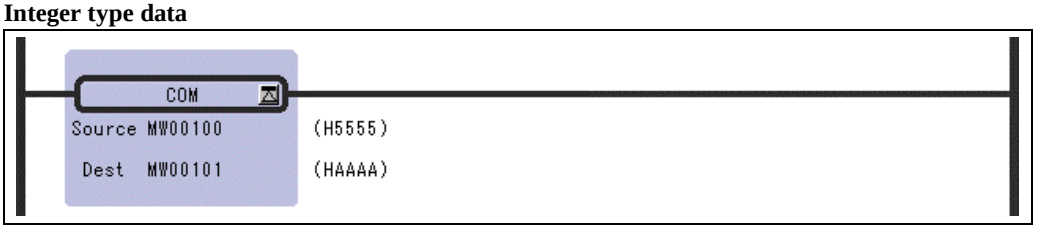
Symbol : COM
Full Name : Complement
Category : MATH
Icon : 

[Parameter]

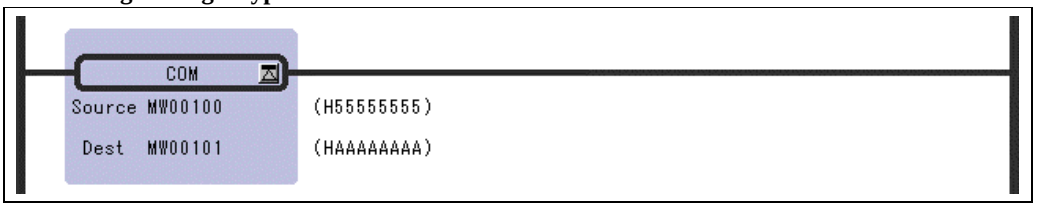
Parameter Name	Setting
Source	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Integer type data



Double-length integer type data

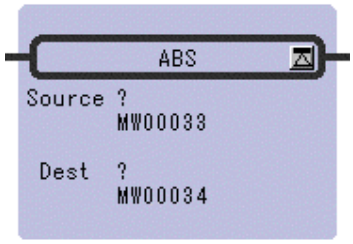


2.17 ABSOLUTE VALUE CONVERSION Instruction (ABS)

[Outline]

The ABS instruction determines the absolute value of the contents of the *Source* and the result is stored in the *Dest*.

[Format]



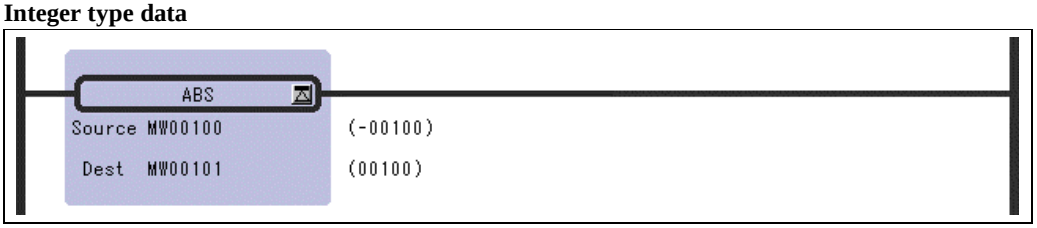
Symbol : ABS
Full Name : Absolute
Category : MATH
Icon : |n|

[Parameter]

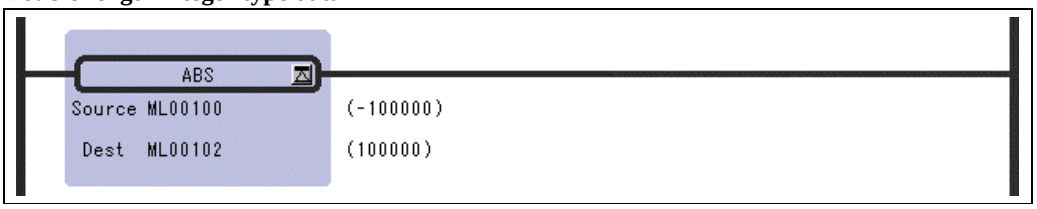
Parameter Name	Setting
Source	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register
Dest	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

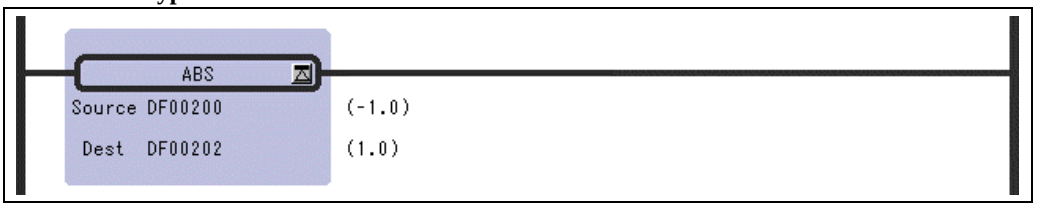
Integer type data



Double-length integer type data



Real number type data



2.18 BINARY CONVERSION Instruction (BIN)

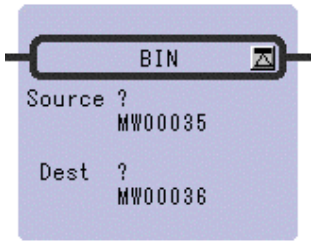
[Outline]

The BIN instruction converts a binary coded decimal (BCD) value in the *Source* and into a binary value (binary conversion) and the result is stored in the *Dest.* If the 4 - digit BCD value in the integer is abcd, the output value (*Dest*) of the BIN instruction can be determined by the following formula:

Dest = (a x 1,000) + (b x 100) + (c x 10) + d

Although the above formula is applicable even if the value in the *Source* is not in BCD notation (e.g. 123FH), correct results are obtained in such cases.

[Format]



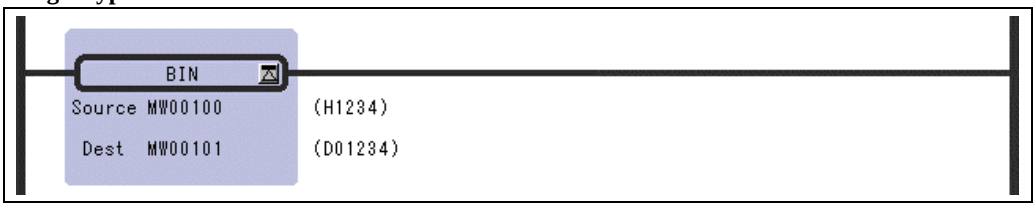
Symbol : BIN
Full Name : Convert to Binary
Category : MATH
Icon : BIN BCD

[Parameter]

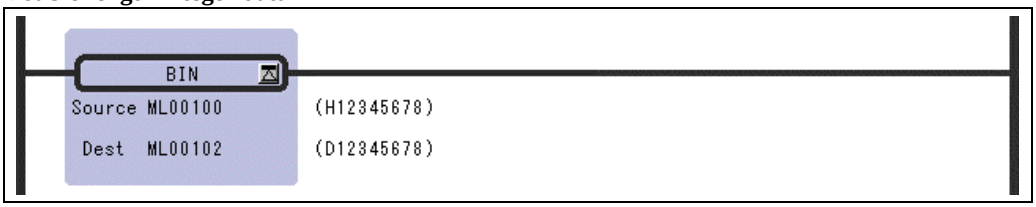
Parameter Name	Setting
Source	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Integer type data



Double-length integer data



2.19 BCD CONVERSION Instruction (BCD)

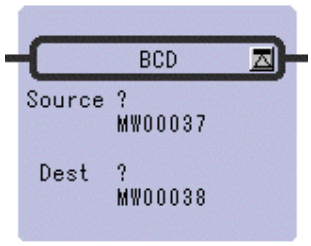
[Outline]

The BCD instruction converts a binary value in the *Source* into a BCD value (BCD conversion) and the result is stored in the *Dest*. If the 4 - digit decimal value in the *Source* is abcd, the output value (*Dest*) of the BCD instruction can be determined by the following formula:

Dest = (a × 4096) + (b × 256) + (c × 16) + d

Although the above formula is applicable even if the value in the *Source* cannot be expressed in BCD notation (e.g. numbers greater than 9999 or negative numbers), correct results are obtained in such cases.

[Format]



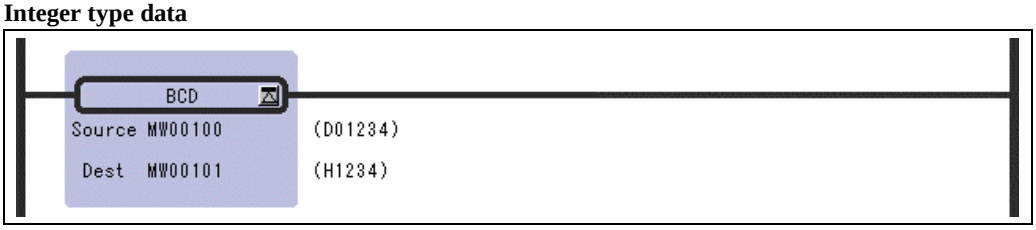
Symbol : BCD
Full Name : Convert to BCD
Category : MATH
Icon : BCD BIN

[Parameter]

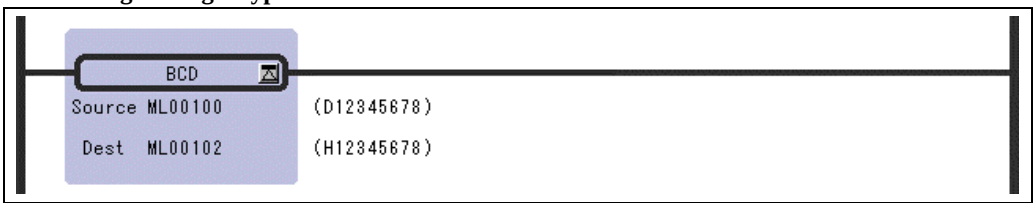
Parameter Name	Setting
Source	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Integer type data



Double-length integer type data

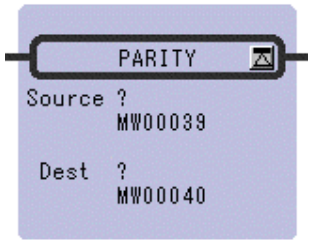


2.20 PARITY CONVERSION Instruction (PARITY)

[Outline]

The PARITY instruction counts the number of bits in the *Source* that are set to ON (or 1) and the result is stored in the *Dest.*

[Format]



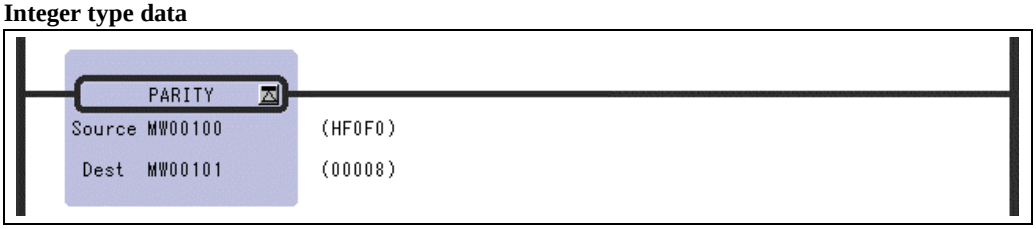
Symbol : PARITY
Full Name : Count ON Bit
Category : MATH
Icon : 0101 #?

[Parameter]

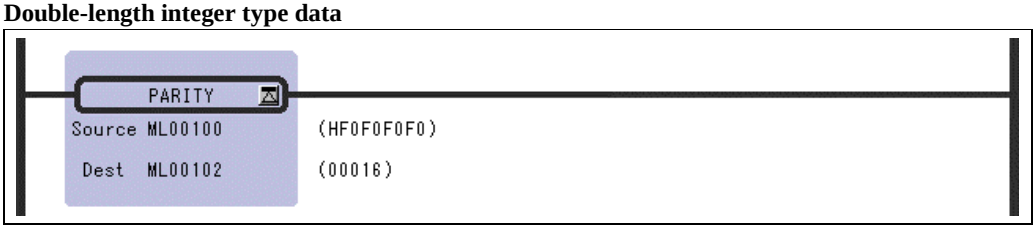
Parameter Name	Setting
Source	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register
Dest	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers) · Subscript register

[Program Example]

Integer type data



Double-length integer type data



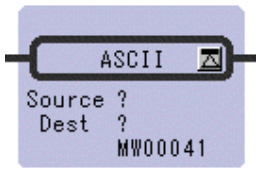
2.21 ASCII CONVERSION Instruction (ASCII)

[Outline]

The ASCII instruction converts the specified characters (character string in *Source*) to the corresponding ASCII character codes and stores them in the designated *Dest*. It recognizes uppercase and lowercase characters separately.

The first character is stored in the lower-place byte of the first word and the second character is stored in the higher-place byte of the first word. Other characters are stored in the same way. If the number of characters is odd, the higher-place byte of the last word in the storage register is set to 0. Up to 32 characters can be entered.

[Format]



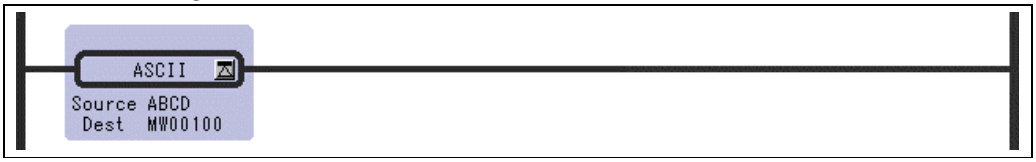
Symbol : ASCII
Full Name : Convert Character to ASCII
Category : MATH
Icon : 

[Parameter]

Parameter Name	Setting
Source	· ASCII characters
Dest	· Any integer type register (except for # and C register) · Any integer type register with subscript (except for # and C register)

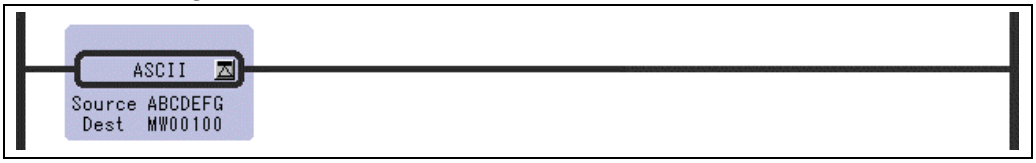
[Program Example]

The character string "ABCD" is stored in MW00100 to MW00101.



	Upper	Lower	
MW00100	42H ('B')	41H ('A')	MW00100 = 4241H
MW00101	44H ('D')	43H ('C')	MW00101 = 4443H

The character string "ABCDEFG" is stored in MW00100 to MW00103.



	Upper	Lower	
MW00100	42H ('B')	41H ('A')	MW00100 = 4241H
MW00101	44H ('D')	43H ('C')	MW00101 = 4443H
MW00102	46H ('F')	45H ('E')	MW00100 = 4645H
MW00103	00H	47H ('G')	MW00101 = 0047H

↑
"0" is entered in the extra byte.

2.22 ASCII CONVERSION 2 Instruction (BINASC)

[Outline]

The BINASC instruction converts the 16-bit binary data stored in the *Source* into four-digit hexadecimal ASCII character codes and stores them in the designated *Dest* (two words).

[Format]

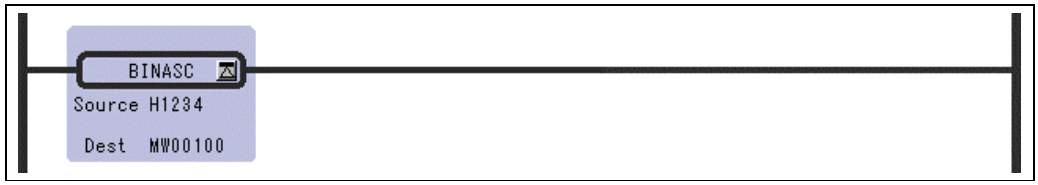
Symbol : BINASC
Full Name : Convert Binary to ASCII
Category : MATH
Icon : BIN ASC

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript · Constant
Dest	· Any integer type register (except for # and C register) · Any integer type register with subscript (except for # and C register)

[Program Example]

The "1234H" binary is converted to a for digit hexadecimal ASICII code and stored in MW00100 to MW00101.



	Upper	Lower	
MW00100	32H ('2')	31H ('1')	MW00100 = 3231H
MW00101	34H ('4')	33H ('3')	MW00101 = 3433H

2.23 ASCII CONVERSION 3 Instruction (ASCBIN)

[Outline]

The ASCBIN instruction converts four-digit hexadecimal ASCII character codes in the *Source* into 16-bit binary data and stores it in the *Dest*.

[Format]

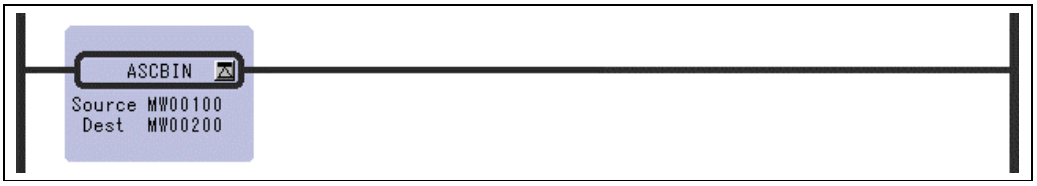
Symbol : ASCBIN
Full Name : Convert ASCII to Binary
Category : MATH
Icon : ASC BIN

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C register) · Any integer type register with subscript (except for # and C register)

[Program Example]

The for-byte ASCII code stored in MW00100 to MW00101 is converted to two-byte binary data, and the result is stored in MW00200.



Source

	Upper	Lower
MW00100	32H ('2')	31H ('1')
MW00101	34H ('4')	33H ('3')

→

	Upper	Lower
MW00200	12H	34H

3 Logical Operation/ Comparison Instructions

3.1 AND Instruction (AND)

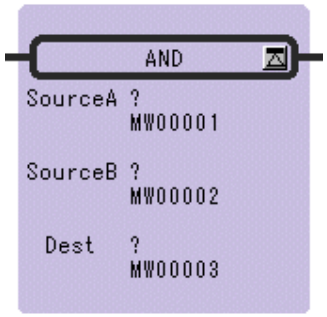
[Outline]

The AND instruction outputs the logical product (AND) of *Source A* and *Source B* to the *Dest*.

1 bit Truth Table for the Logical Product

Source A	Source B	Dest
0	0	0
0	1	0
1	0	0
1	1	1

[Format]



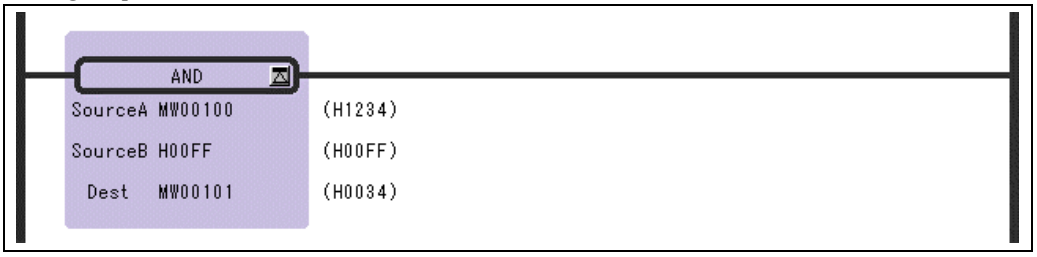
Symbol : AND
Full Name : AND
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Source B	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Dest	· Any integer type and double-length integer type register (except for # and C register) · Any integer type and double-length integer type register with subscript (except for # and C register) · Subscript register

[Program Example]

The logical product of MW000100 and a constant is stored in MW00101.



3.2 OR Instruction (OR)

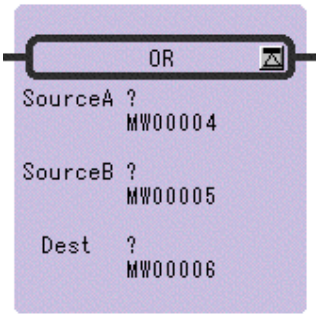
[Outline]

The OR instruction outputs the logical sum (OR) of *Source A* and *Source B* to the *Dest*.

1 bit Truth Table for the Logical Sum

Source A	Source B	Dest
0	0	0
0	1	1
1	0	1
1	1	1

[Format]



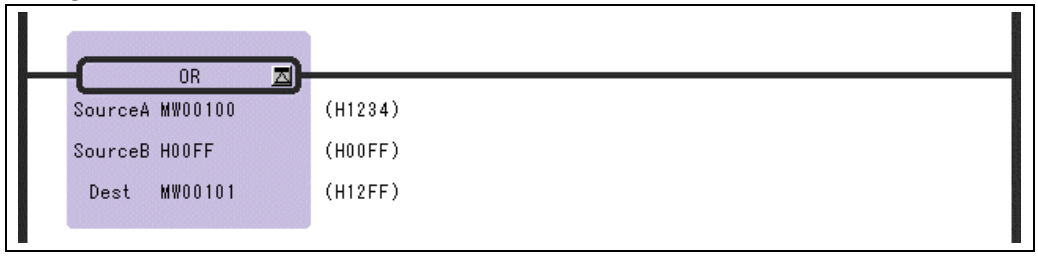
Symbol : OR
Full Name : Inclusive OR
Category : LOGIC
Icon :

[Parameter]

Parameter Name	Setting
Source A	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Source B	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Dest	· Any integer type and double-length integer type register (except for # and C register) · Any integer type and double-length integer type register with subscript (except for # and C register) · Subscript register

[Program Example]

The logical sum of MW00100 and a constant is stored in MW00101.



3.3 XOR Instruction (XOR)

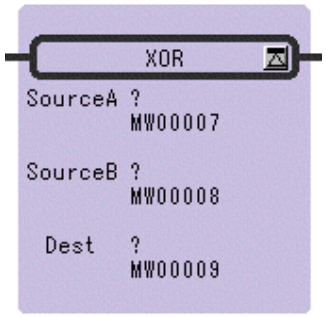
[Outline]

The XOR instruction outputs the exclusive logical sum (XOR) of *Source A* and *Source B* to the *Dest*.

1 bit Truth Table for the Exclusive Logical Sum

Source A	Source B	Dest
0	0	0
0	1	1
1	0	1
1	1	0

[Format]



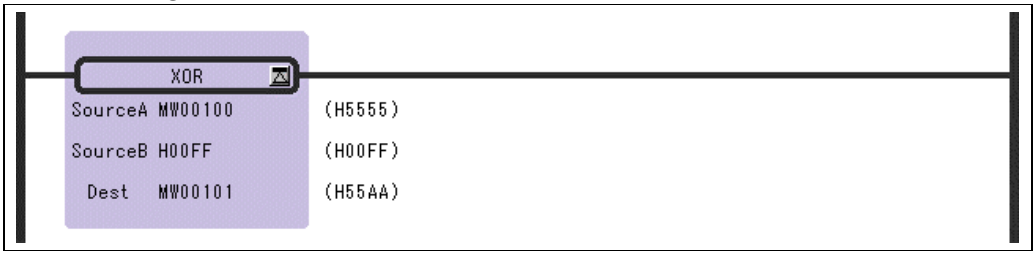
Symbol : XOR
Full Name : Exclusive OR
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Source B	· Any integer type and double-length integer type register · Any integer type and double-length integer type register with subscript · Subscript register · Constant
Dest	· Any integer type and double-length integer type register (except for # and C register) · Any integer type and double-length integer type register with subscript (except for # and C register) · Subscript register

[Program Example]

The exclusive logical sum of MW00100 and a constant is stored in MW00101.

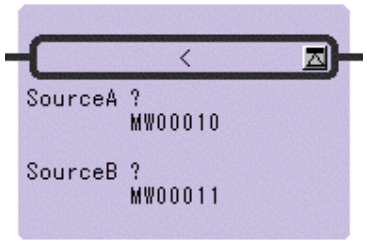


3.4 Comparison Instruction (<)

[Outline]

This instruction compare *Source A* with *Source B* and stores the comparison result in the bit output (the result is ON when true).

[Format]



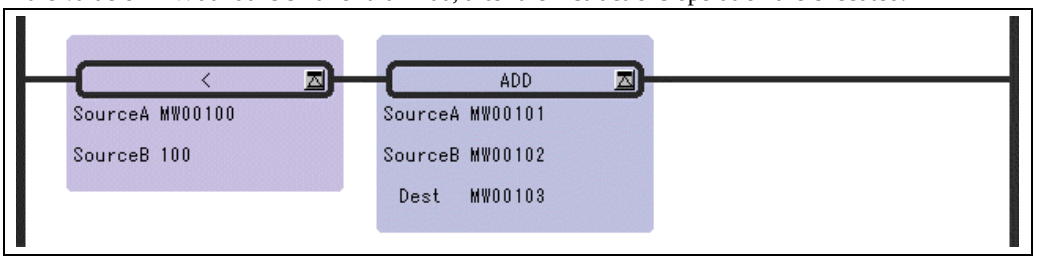
Symbol : <
Full Name : Less Than (A < B)
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

[Program Example]

If the value of MW00100 is smaller than 100, after the instructions operation are executed.

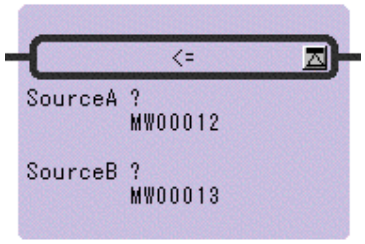


3.5 Comparison Instruction (<=)

[Outline]

This instruction compare *Source A* with *Source B* and stores the comparison result in the bit output (the result is ON when true).

[Format]



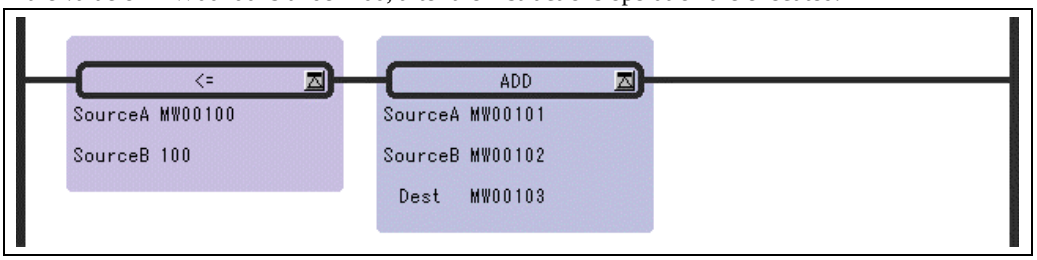
Symbol : <=
Full Name : Less Than or Equal (A<=B)
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

[Program Example]

If the value of MW00100 is under 100, after the instructions operation are executed.

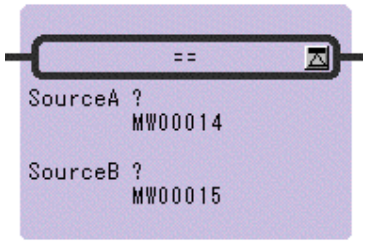


3.6 Comparison Instruction (=)

[Outline]

This instruction compare *Source A* with *Source B* and stores the comparison result in the bit output (the result is ON when true).

[Format]



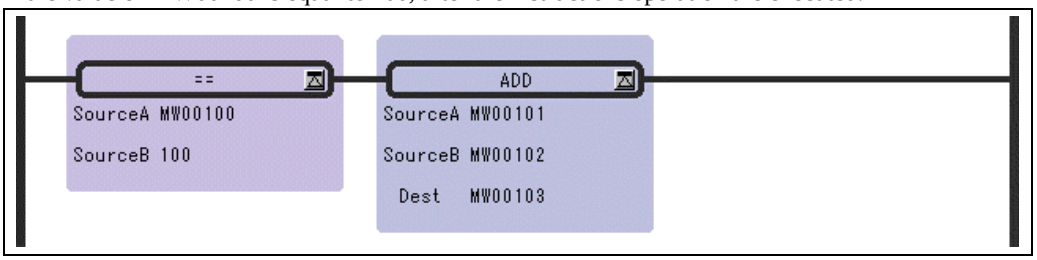
Symbol : =
Full Name : Equal (A = B)
Category : LOGIC
Icon :

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

[Program Example]

If the value of MW00100 is equal to 100, after the instructions operation are executed.



3.7 Comparison Instruction (!=)

[Outline]

This instruction compare *Source A* with *Source B* and stores the comparison result in the bit output (the result is ON when true).

[Format]

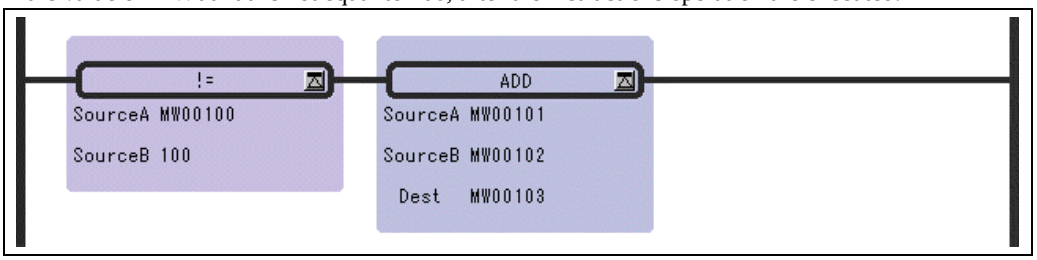
Symbol : !=
Full Name : Not Equal (A!=B)
Category : LOGIC
Icon : ≠

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

[Program Example]

If the value of MW00100 is not equal to 100, after the instructions operation are executed.

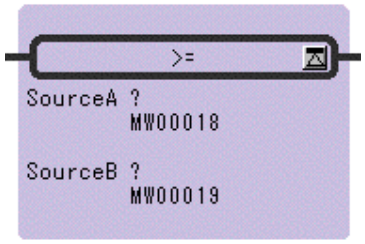


3.8 Comparison Instruction (>=)

[Outline]

This instruction compare *Source A* with *Source B* and stores the comparison result in the bit output (the result is ON when true).

[Format]



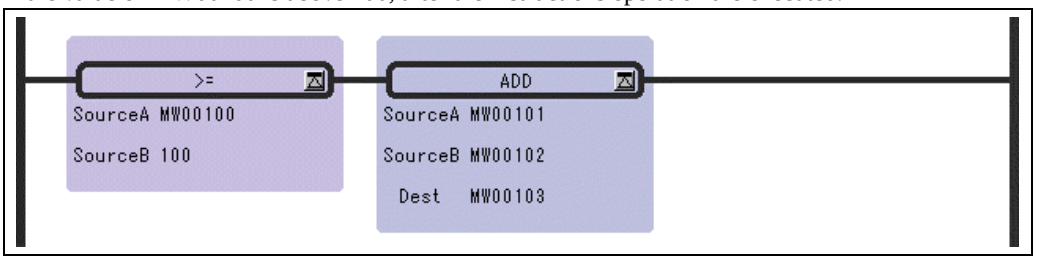
Symbol : >=
Full Name : Greater Than or Equal (A>=B)
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

[Program Example]

If the value of MW00100 is above 100, after the instructions operation are executed.

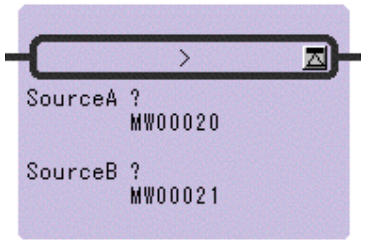


3.9 Comparison Instruction (>)

[Outline]

This instruction compare *Source A* with *Source B* and stores the comparison result in the bit output (the result is ON when true).

[Format]



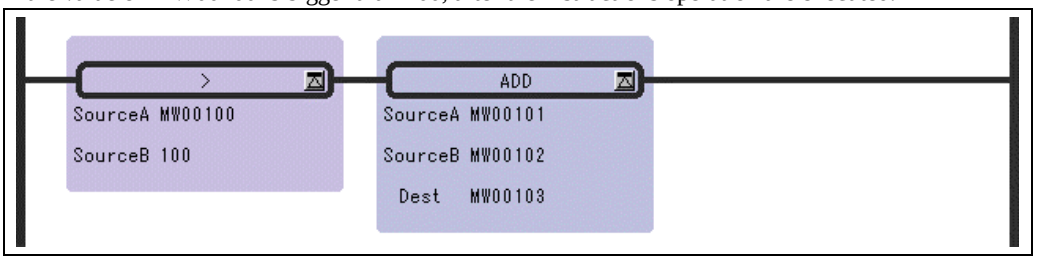
Symbol : >
Full Name : Greater Than (A > B)
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Source A	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Source B	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

[Program Example]

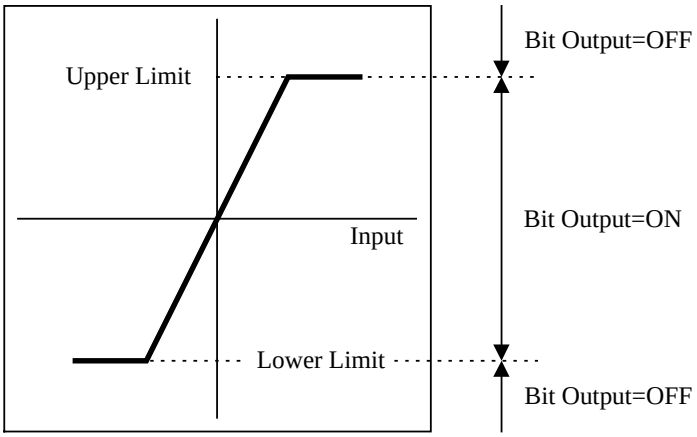
If the value of MW00100 is bigger than 100, after the instructions operation are executed.



3.10 RANGE CHECK Instruction (RCHK)

[Outline]

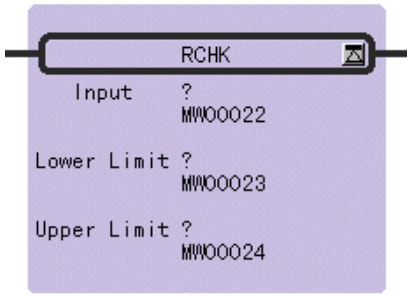
The RCHK instruction checks whether the input value in the *Input* is within the *Lower Limit* and *Upper Limit*, and then outputs the result to the bit output. The contents of the *Input* are retained.



If the Input value(*Input*) is greater than the *Lower Limit* and less than the *Upper Limit*, the result(Bit Output) = ON.

- In the cases other than the above, the result(Bit Output) = OFF.

[Format]



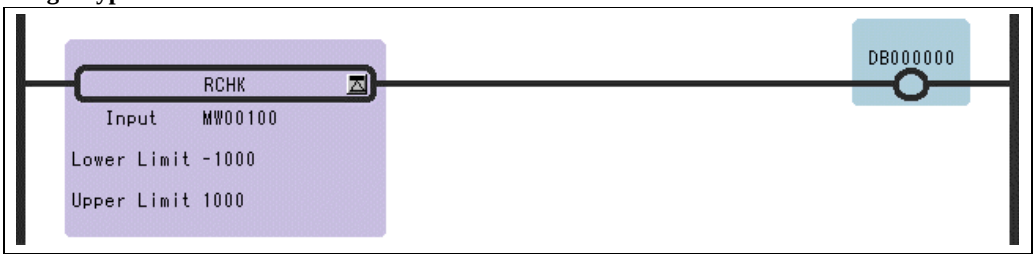
Symbol : RCHK
Full Name : Range Check
Category : LOGIC
Icon : 

[Parameter]

Parameter Name	Setting
Input	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Lower Limit	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Upper Limit	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant

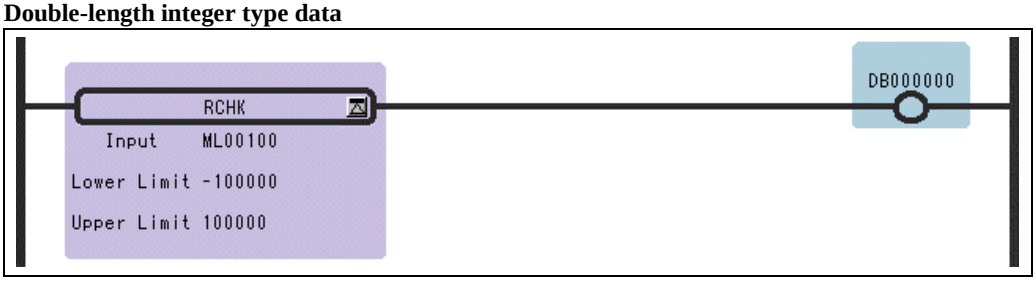
[Program Example]

Integer type data



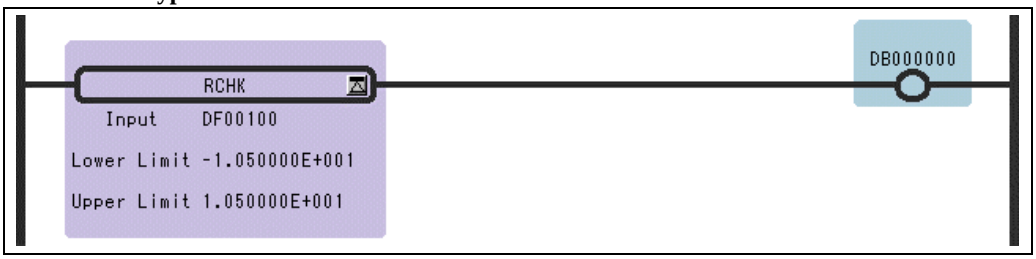
Input (MW00100)	Output (DB000000)
-1000>MW00100	OFF
-1000<=MW00100<=1000	ON
MW00100>1000	OFF

Double-length integer type data



Input (ML00100)	Output (DB000000)
-100000>ML00100	OFF
-100000<=ML00100<=100000	ON
ML00100>100000	OFF

Real number type data



Input (DF00100)	Output (DB000000)
-10.5>DF00100	OFF
-10.5<=DF00100<=10.5	ON
DF00100>10.5	OFF

4 Program Control Instructions

4.1 SUB-DRAWING CALL Instruction (SEE)

[Outline]

The SEE instruction is used to call a sub-drawing from a drawing or to call a sub-sub- drawing from a sub-drawing. Calling is not possible between drawings of different types. For example, SEE H01 cannot be specified in DWG.L.

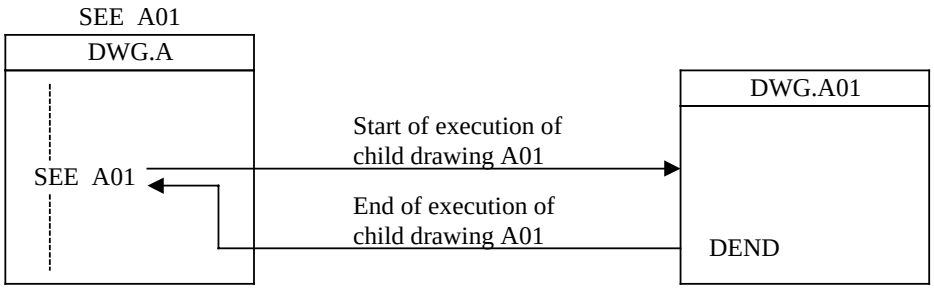
[Format]

Symbol : SEE
Full Name : Call Program
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Name	Program Name

[Program Example]

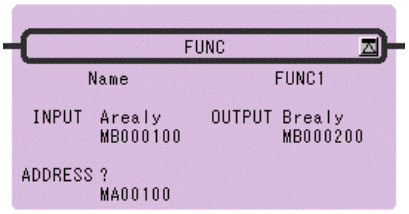


4.2 FUNCTION CALL Instruction (FUNC)

[Outline]

The FUNC instruction is used to call a user function or system function from a drawing, sub-drawing, or user function. The user function to be called must be defined in advance. (System functions do not have to be defined by the user because they are already defined by the system.)

[Format]



Symbol : FUNC
Full Name : User Function
Category : CONTROL
Icon : FUNC

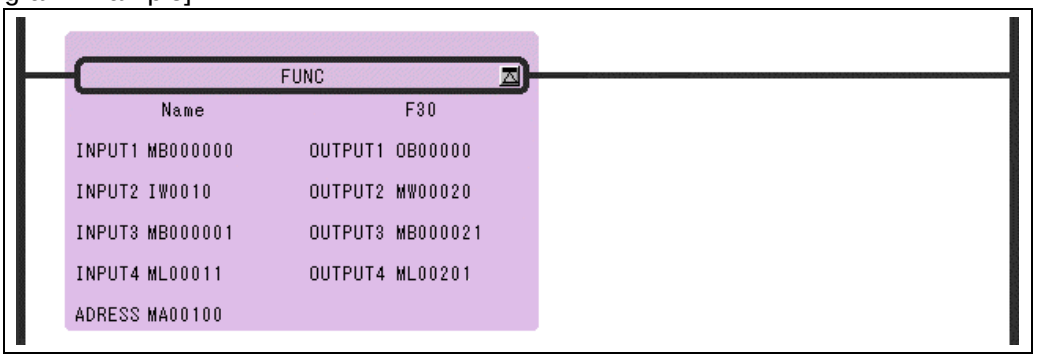
[Parameter]

Parameter Name	Setting
Name	Program name
INPUT	Input parameter (the data type depends on function definition)
ADRESS	Address parameter (Address type register)
OUTPUT	Output parameter (the data type depends on function definition)

The forms of parameter input and output are shown in below.

Input Data Form	Input Designation	Description
Bit input	B-VAL	Designates the output to be of a bit type. The bit type data become the input to the function.
Integer type input	I-VAL	Designates the input to be of an integer type. The contents (integer data) of the register with the designated number become the input to the function.
	I-REG	Designates the input to be the contents of an integer type register. The number of the integer type register is designated when referencing the function. The contents (integer data) of the register with the designated number become the input to the function.
Double-length integer type input	L-VAL	Designates the input to be of a double-length integer type register. When reference the function, the contents (double-length integer data) of the register with the designated number become the input to the function.
	L-REG	Designates the input to be the contents of a double-length integer type register. When reference the function, the contents (double-length integer data) of the register with the designated number become the input to the function.
Real number type input	F-VAL	Designates the input to be of a real number type. The contents (real number data) of the register with the designated number become the input to the function.
	F-REG	Designates the input to be the contents of a real number type register. The number of the real number type register is designated when referencing the function. The contents (real number data) of the register with the designated number become the input to the function.
Address input	—	Hands over the address of the designated register (an arbitrary integer register) to the function. Only 1 input is allowed in the case of a user function.

[Program Example]

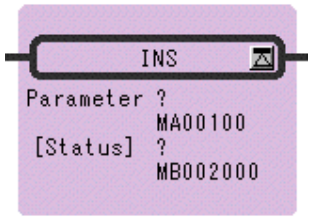


4.3 DIRECT INPUT STRING Instruction (INS)

[Outline]

The INS instruction continuously performs direct input to a single module according to the contents of a previously-set parameter table. INS can only be used for LIO modules.

[Format]



Symbol : INS
Full Name : Direct Input String
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Parameter	· Register address (except for # and C registers) · Register address with subscript
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

INS Instruction Parameter/Data

ADR	Type	Symbol	Name	Specifications	Input or Output
0	W	RSSEL	Module designation 1	Designation of module for performing input<For details refer to (1) and (2) below>	IN
1	W	MDSEL	Module designation 2		IN
2	W	STS	Status	Output of a bit equivalence of the status for each word input	OUT
3	W	N	Number of words	Designation of number of continuous input words	IN
4	W	ID1	Input data 1	If there is an error in the output of input data, 0 is stored	OUT
⋮	⋮	⋮	⋮		⋮
N+3	W	IDN	Input data N		OUT

Method of setting RSSEL

Designates the rack/slot where the target module is mounted.

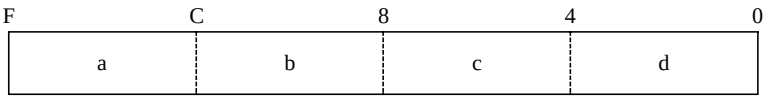
Hexadecimal expression: xxyyH

xx＝rack number（01H≦xx≦04H）

yy＝slot number（00H≦yy≦0DH）

（The rack number = 1, slot number = 3 with tixation in MP930）

Method of setting MDSEL



a:Input module type　　0:Discrete input module
　　1:Register input module

b:Rack number (1≦b≦4)

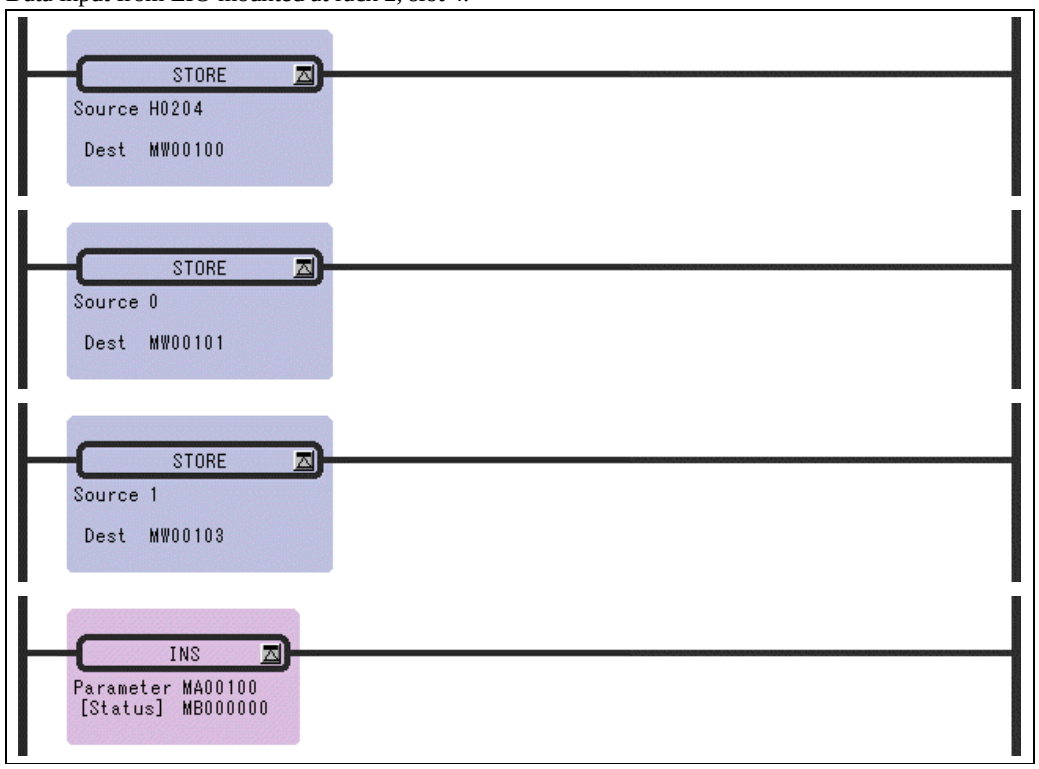
c:Slot number (1≦c≦9)

d:Data offset (0≦d≦7)

(The input module type = 0, rack number = 1, slot number = 3, data offset = 0 with fixation in MP930)

[Program Example]

Data input from LIO mounted at rack 2, slot 4.

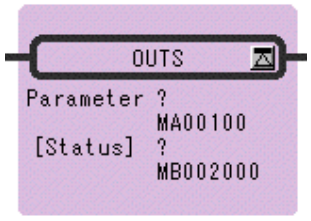


4.4 DIRECT OUTPUT STRING Instruction (OUTS)

[Outline]

The OUTS instruction continuously performs direct output to a single module according to the contents of a previously-set parameter table. OUTS can only be used for LIO modules.

[Format]



Symbol : OUTS
Full Name : Direct Output String
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Parameter	· Register address (except for # and C registers) · Register address with subscript
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

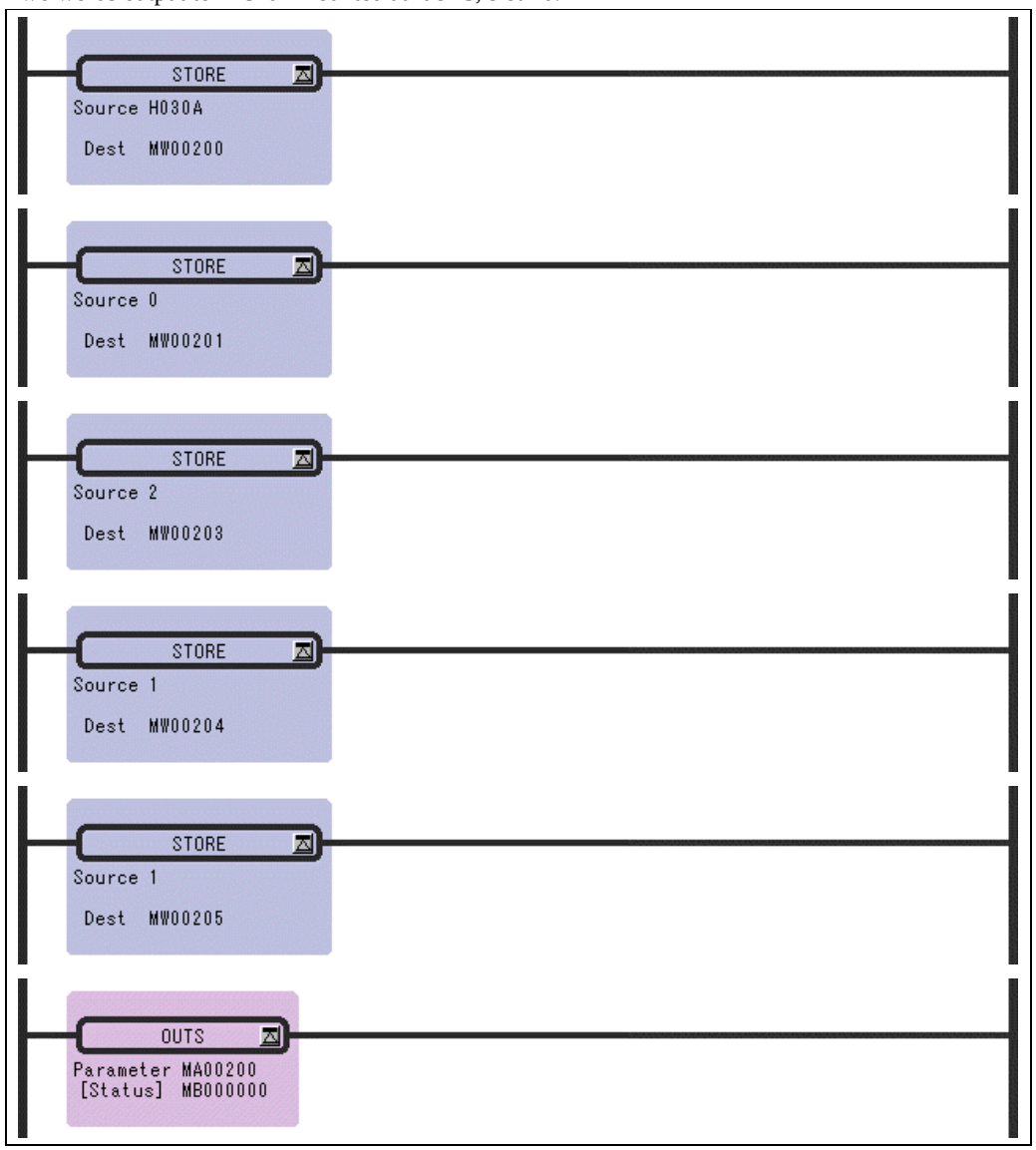
OUTS Instruction Parameter/Data

ADR	Type	Symbol	Name	Specifications	Input or Output
0	W	RSSEL	Module designation 1	Designation of module for performing output*	IN
1	W	MDSEL	Module designation 2		IN
2	W	STS	Status	Output of a bit equivalence of the status for each word output	OUT
3	W	N	Number of words	Designation of number of words output continuously	IN
4	W	OD1	output data 1	Setting output data	IN
⋮	⋮	⋮	⋮		⋮
N+3	W	ODN	output data N		IN

＊ Method of setting RSSEL and N (number of words) is the same as for INS.

[Program Example]

Two words output to LIO-01 mounted at rack 3, slot 10.



Notes: Two outputs will be done by using the OUTS instruction because local I/O is allocated by default for MP930.

4.5 EXTENSION PROGRAM CALL Instruction (XCALL)

[Outline]

The XCALL instruction is used to call an extension program. Extension programs are table format programs. Although a pulurality of XCALL instructions may be used in one drawing, the same extension program cannot be called more than once.

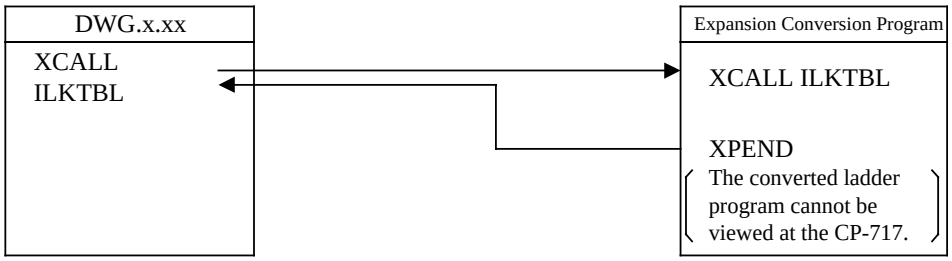
[Format]

Symbol : XCALL
Full Name : Call Extended Program
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Name	MCTBL : Constant table (M register) IOTBL : I/O conversion table ILKTBL : Interlock table ASMTBL : Parts composition table

[Program Example]

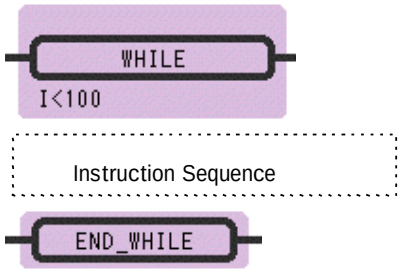


4.6 WHILE Instruction (WHILE, END_WHILE)

[Outline]

Instruction between WHILE and END_WHILE is repeatedly executed as long as the condition specified by WHILE instruction is satisfied. When the condition is no longer satisfied, instruction sequence is not executed and the program proceeds with the instruction immediately after END_WHILE.

[Format]



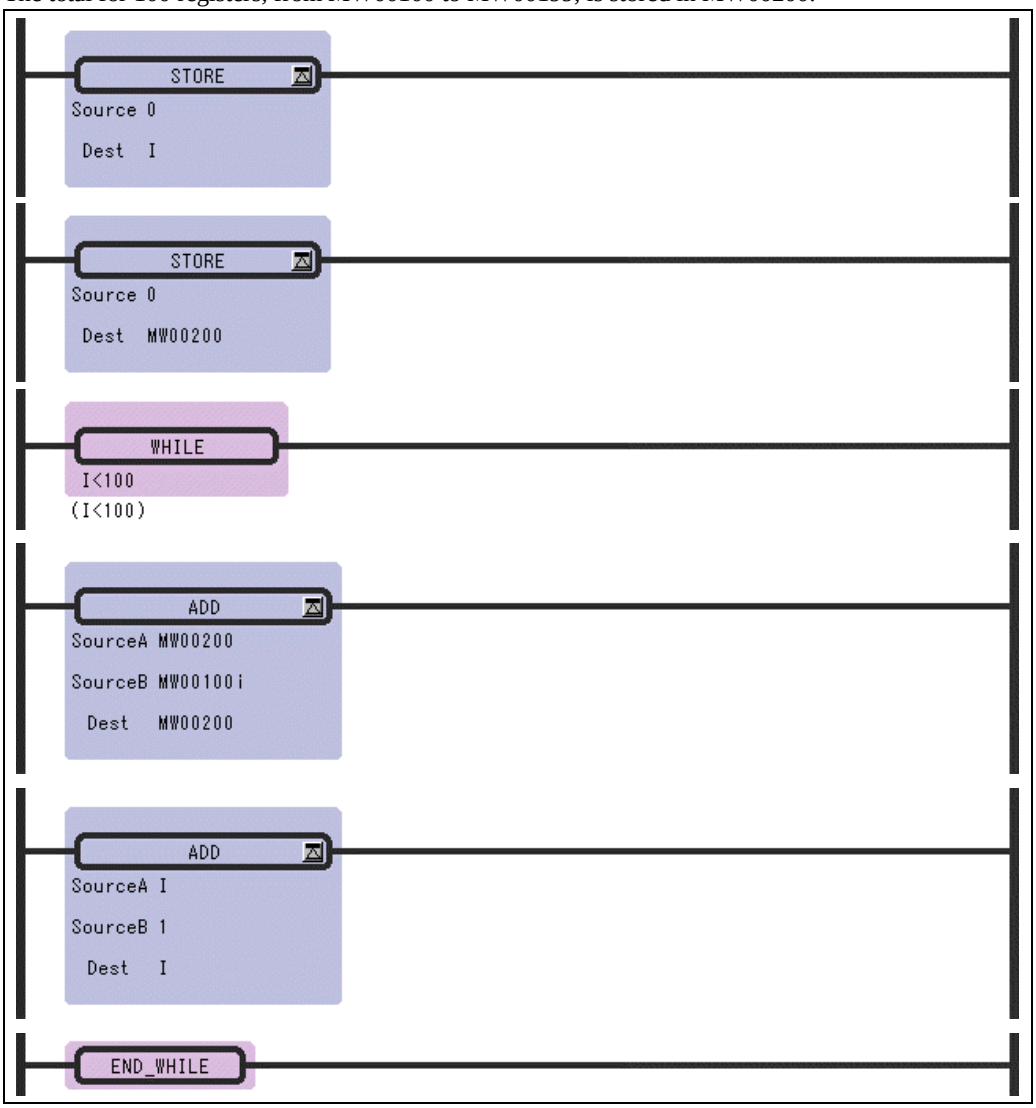
Symbol : WHILE
END_WHILE
Full Name : While Do
End of While
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Conditional Expression	Description by Expression

[Program Example]

The total for 100 registers, from MW00100 to MW00199, is stored in MW00200.

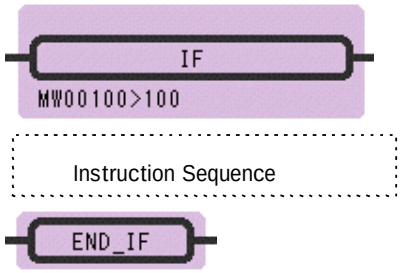


4.7 IF Instruction (IF, END_IF)

[Outline]

If the conditional expression in the IF instruction is approved, the instruction sequence between IF and END_IF is executed. If the conditional expression in the IF instruction is not approved, the instruction sequence between IF and END_IF is not executed.

[Format]



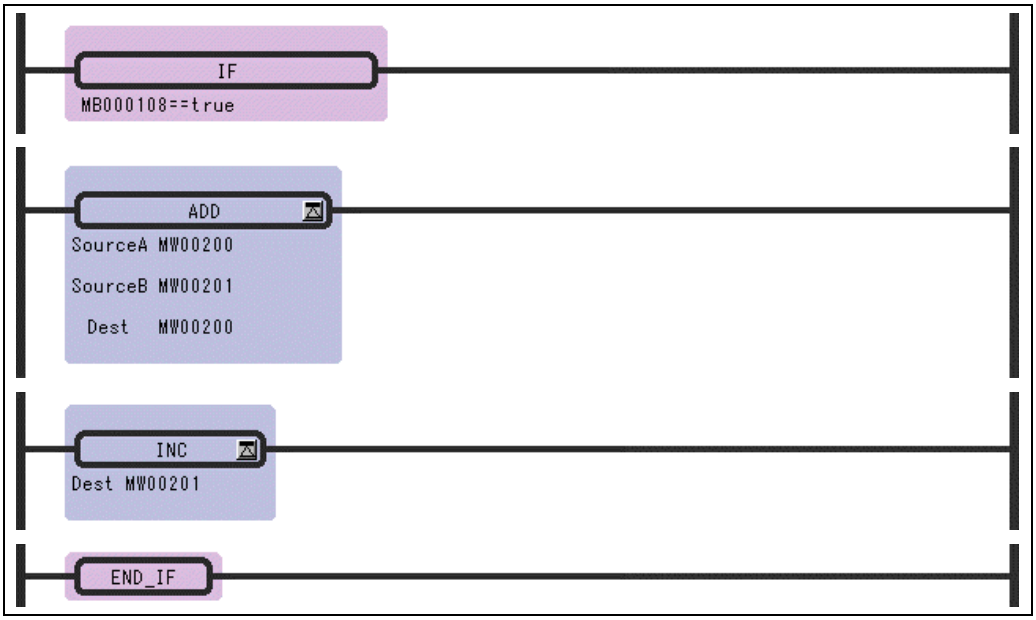
Symbol : IF
END_IF
Full Name : If Then
End of If
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Conditional Expression	Description by Expression

[Program Example]

If MB000108 is ON, MW00201 is added to MW00200, and MW00201 is incremented.

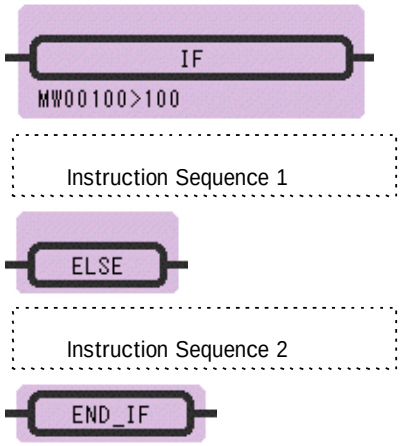


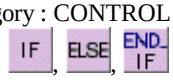
4.8 IF Instruction (IF, ELSE, END_IF)

[Outline]

If the conditional expression in the IF instruction is approved, the instruction sequence 1 between IF and ELSE is executed. If the conditional expression in the IF instruction is not approved, the instruction sequence 2 between ELSE and END_IF is executed.

[Format]



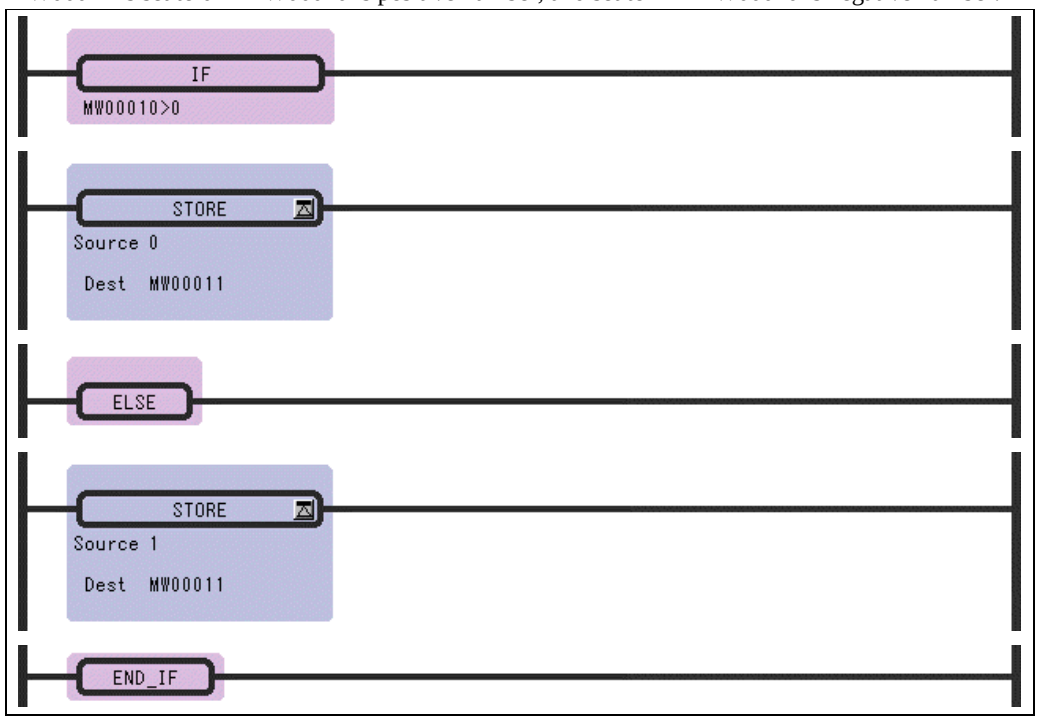
Symbol : IF
ELSE
END_IF
Full Name : If Then
Else
End of If
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Conditional Expression	Description by Expression

[Program Example]

MW00011 is set to 0 if MW00010 is positive number, and set to 1 if MW00010 is negative number.

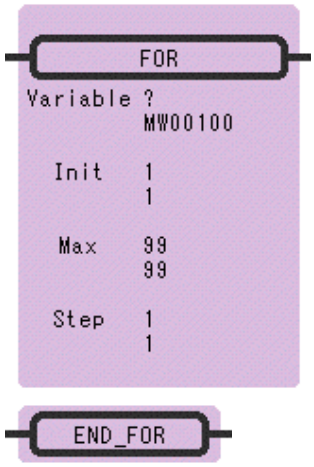


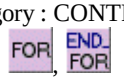
4.9 FOR Instruction (FOR, END_FOR)

[Outline]

The instruction sequence surrounded by the FOR instruction and the corresponding END_FOR instruction are executed by the number of times. *Variable* starts from initial value (*Init*) and is incremented by *Step* on each execution. The instruction sequence is ended when *Variable* > *Max*

[Format]



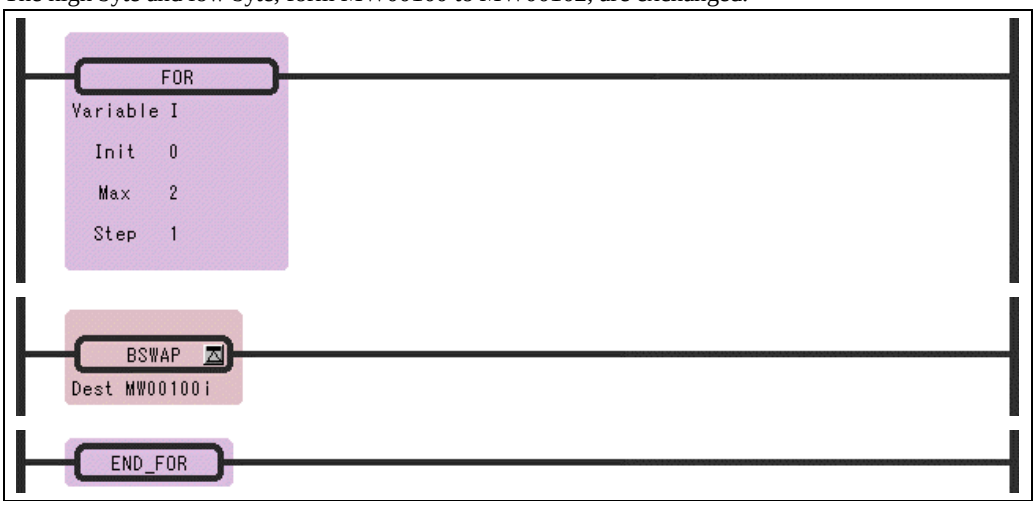
Symbol : FOR
END_FOR
Full Name : For
End of For
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Variable	・Any integer type register ・Any integer type register with subscript ・Subscript register (I and J registers)
Init	・Any integer type register ・Any integer type register with subscript ・Subscript register ・Constant
Max	・Any integer type register ・Any integer type register with subscript ・Subscript register ・Constant
Step	・Any integer type register ・Any integer type register with subscript ・Subscript register ・Constant

[Program Example]

The high byte and low byte, form MW00100 to MW00102, are exchanged.

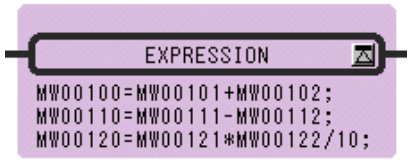


4.10 EXPRESSION Instruction (EXPRESSION)

[Outline]

EXPRESSION instruction is composed by one block. It considers on a par with a coil type component, and an input line has the Instruction of Enable/Disable command. In the block, Expression box for an operation formula description is prepared, and the description of the operation formula to 1000 lines is possible.

[Format]

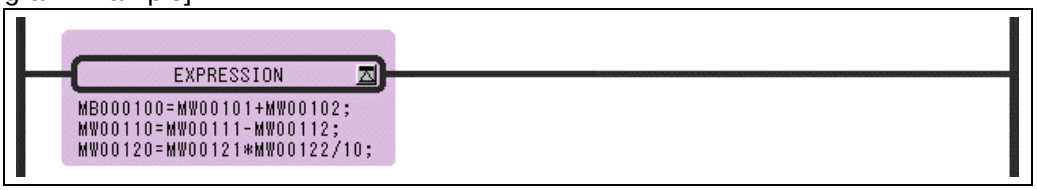


Symbol : EXPRESSION
Full Name : Expression
Category : CONTROL
Icon : 

[Parameter]

Parameter Name	Setting
Conditional Expression	Description by Expression

[Program Example]



5 Basic Function Instructions

5.1 SQUARE ROOT Instruction (SQRT)

[Outline]

The SQRT instruction calculates the square root of an integer or real number value as the operation result. The input units and output results for integer and real number values are different. This instruction cannot be used for double-length integer data.

Integer Type Data

The square root of *Source* is stored in *Dest*. The operation result of the SQRT instruction slightly differs from the square root in mathematical terms. To be more precise, the operation result is expressed by the following formula:

32768* sign (A)*SQRT (|A|/ 32768)

sign (A) : sign of the Source

|A| : absolute value of the Source

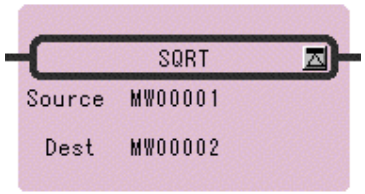
In other words, the operation result is equal to the mathematical square root multiplied by approximately 181.02. If the input is a negative value, the square root of the absolute value is calculated first and then the negative value of the square root is output as the operation result.

The maximum error of the output value is +/-2.

Real Number Type Data

The square root of *Source* is stored in *Dest*. If the input is a negative value, the square root of the absolute value is calculated first and then the negative value of the square root is output as the operation result. This instruction can be used in a real number operation.

[Format]



Symbol : SQRT
Full Name : Square Root
Category : FUNCTION
Icon : 

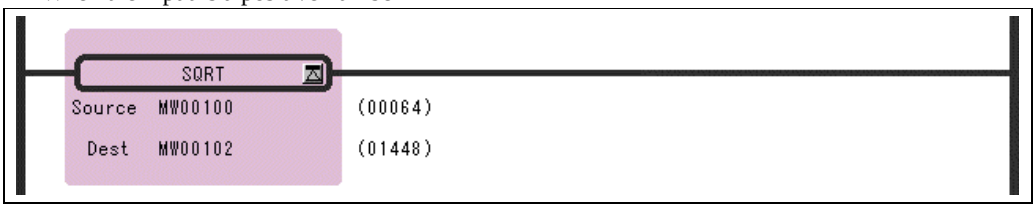
[Parameter]

Parameter Name	Setting
Source (Input)	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Dest (Output)	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

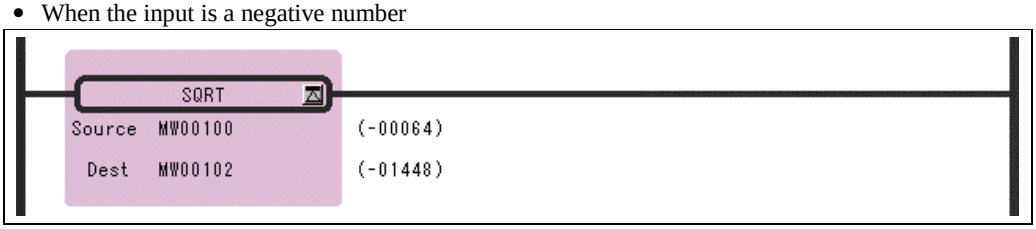
[Program Example]

Integer type data

- When the input is a positive number

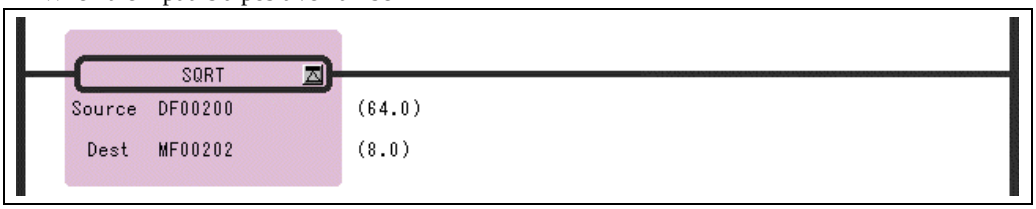


- When the input is a negative number

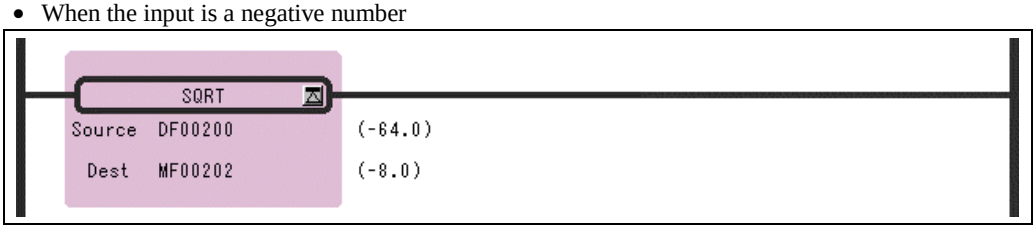


Real number type data

- When the input is a positive number



- When the input is a negative number



5.2 SINE Instruction (SIN)

[Outline]

The SIN instruction calculates the sine of an integer or real number value as the operation result. The input units and output results for integer and real number values are different. This instruction cannot be used for double-length integer data.

Integer Type Data

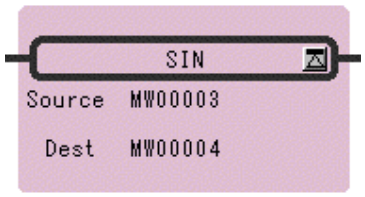
This instruction can be used between -327.68 and 327.67 degrees. The *Source* is used as the input (1 = 0.01 degree) and the operation result is stored in the *Dest*. Upon output, the operation result is multiplied by 10,000.

If a value outside the range of -327.68 to 327.67 is entered, the correct result cannot be obtained. For example, if 360.00 is entered, -295.36 degrees will be output as the result.

Real Number Type Data

The *Source* is used as the input (unit = degrees) and the sine of the input is stored in the *Dest*.

[Format]



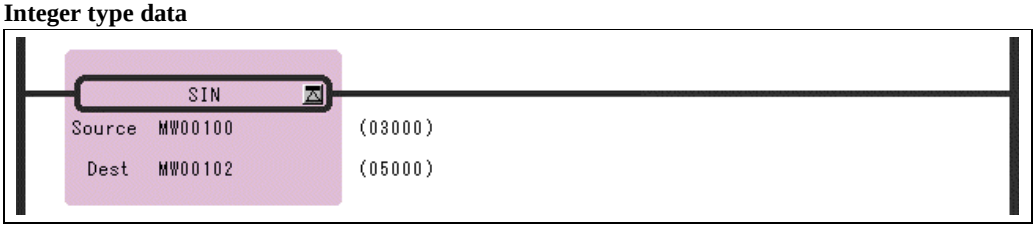
Symbol : SIN
Full Name : Sine
Category : FUNCTION
Icon : 

[Parameter]

Parameter Name	Setting
Source (Input)	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Dest (Output)	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

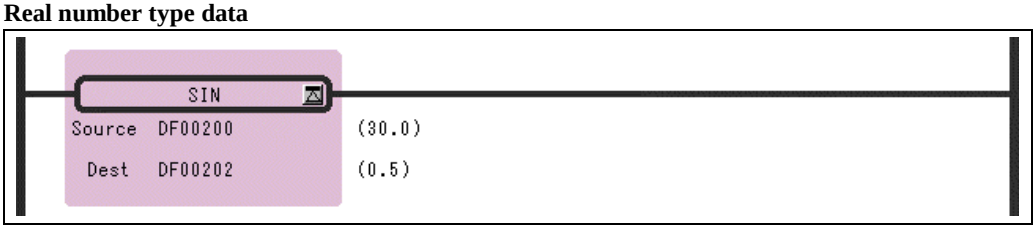
[Program Example]

Integer type data



Input X = 30 degrees (MW00100 = 30*100 = 3000)
Output SIN (X) = 0.50 (MW00102 = 0.50*10000 = 5000)

Real number type data



5.3 COSINE Instruction (COS)

[Outline]

The COS instruction calculates the cosine of integer or real number values as the operation result. The input units and output results for integer and real number values are different. This instruction cannot be used for double-length integer data.

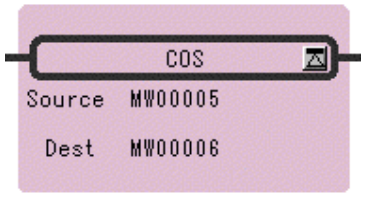
Integer Type Data

This instruction can be used between -327.68 and 327.67 degrees. The *Source* is used as the input (1 = 0.01 degrees) and the operation result is stored in the *Dest*. Upon output, the operation result is multiplied by 10,000. If a value outside the range of -327.68 to 327.67 is entered, the correct result is obtained. For example, if 360.00 is entered, -295.36 degrees is output as a result.

Real Number Type Data

The *Source* is used as the input (unit = degrees) and the cosine of the input is stored in the *Dest*.

[Format]



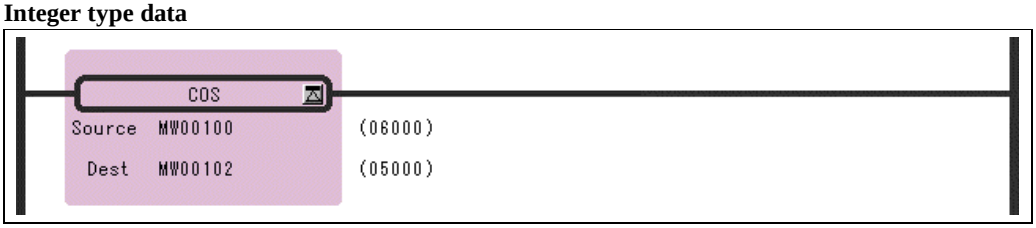
Symbol : COS
Full Name : Cosine
Category : FUNCTION
Icon : 

[Parameter]

Parameter Name	Setting
Source (Input)	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Dest (Output)	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

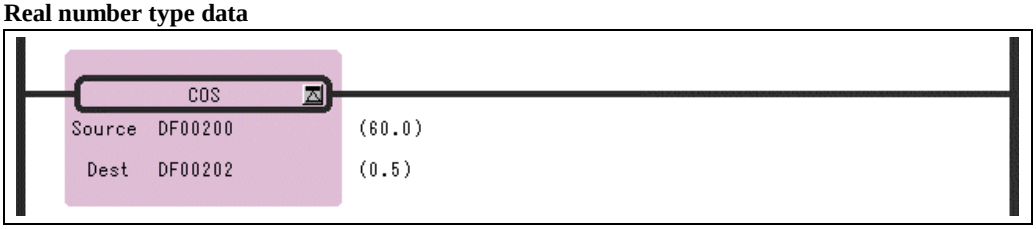
[Program Example]

Integer type data



Input X = 60 degrees (MW00100 = 60*100 = 6000)
Output COS (X) = 0.50 (MW00102 = 0.50*10000 = 500)

Real number type data

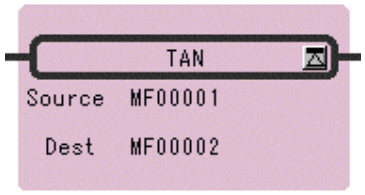


5.4 TANGENT Instruction (TAN)

[Outline]

The TAN instruction uses the *Source* as the input (unit = degrees) and stores the tangent of the input in the *Dest*. This instruction can be used in a real number operation.

[Format]



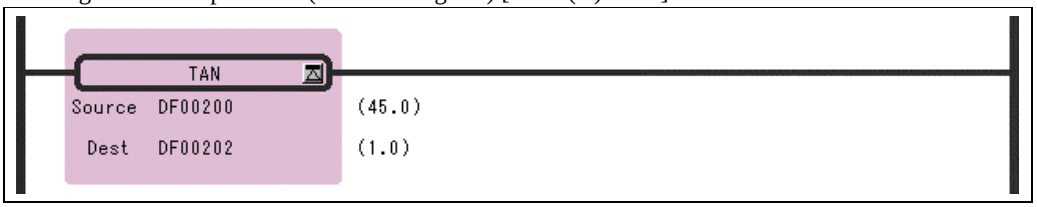
Symbol : TAN
Full Name : Tangent
Category : FUNCTION
Icon : tan

[Parameter]

Parameter Name	Setting
Source (Input)	· Any real number type register · Any real number type register with subscript · Constant
Dest (Output)	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

The tangent of the input value (X = 45.0 degrees) [TAN (X) = 1.0] is calculated.



Notes: TANGENT Instruction cannot be used for integer type and double-length integer type data.

5.5 ARC SINE Instruction (ASIN)

[Outline]

The ASIN instruction uses the *Source* as the input and stores the arc sine (unit = degrees) of the input in the *Dest*. This instruction can be used in a real number operation.

[Format]

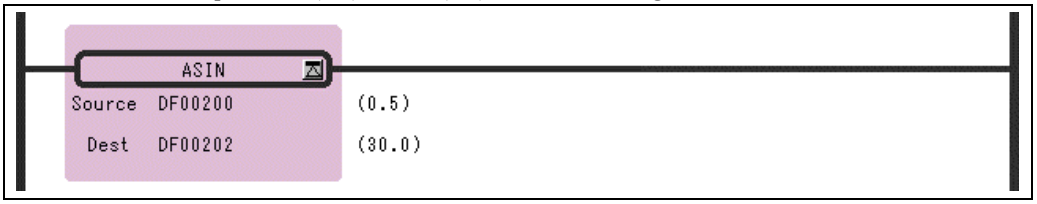
Symbol : ASIN
Full Name : Arc Sine
Category : FUNCTION
Icon : 

[Parameter]

Parameter Name	Setting
Source (Input)	· Any real number type register · Any real number type register with subscript · Constant
Dest (Output)	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

The arc sine of the input value (0.5) [ASIN (0.5) = θ = 30.0 degrees] is calculated.



Notes: ARC SINE Instruction cannot be used for integer type and double-length integer type data.

5.6 ARC COSINE Instruction (ACOS)

[Outline]

The ACOS instruction uses the *Source* as the input and stores the arc cosine (unit = degrees) of the input in the *Dest*. This instruction can be used in a real number operation.

[Format]

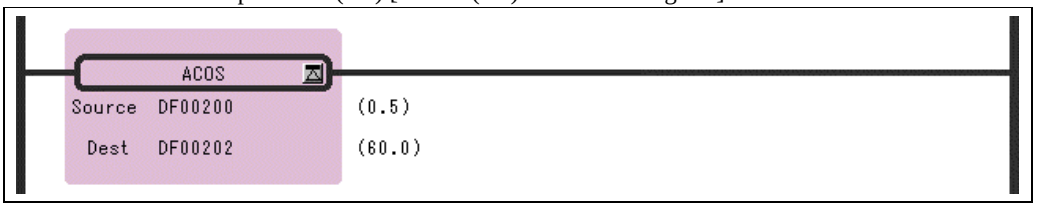
Symbol : ACOS
Full Name : Arc Cosine
Category : FUNCTION
Icon : 

[Parameter]

Parameter Name	Setting
Source (Input)	· Any real number type register · Any real number type register with subscript · Constant
Dest (Output)	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

The arc cosine of the input value (0.5) [ACOS (0.5) = X = 60.0 degrees] is calculated.



Notes: ARC COSINE Instruction cannot be used for integer type and double-length integer type data.

5.7 ARC TANGENT Instruction (ATAN)

[Outline]

The ATAN instruction calculates the arc tangent of integer or real number data as the operation result. The input units and output results for integer and real number data are different. This instruction cannot be used for double-length integer data.

Integer Type Data

This instruction can be used between -327.68 and 327.67 degrees. The *Source* is used as the input (1 = 0.01 degrees) and the operation result is stored in the *Dest*. Upon output, the operation result is multiplied by 100.

Real Number Type Data

The *Source* is used as the input (unit = degrees) and the arc tangent of the input is stored in the *Dest*. This instruction cannot be used for integer type and double-length integer data.

[Format]

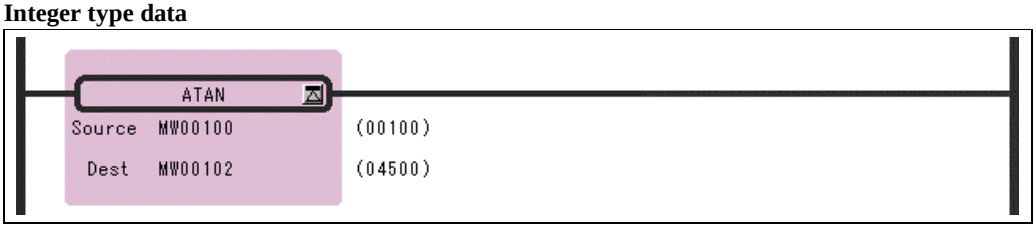
Symbol : ATAN
Full Name : Arc Tangent
Category : FUNCTION
Icon : 

[Parameter]

Parameter Name	Setting
Source (Input)	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Dest (Output)	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

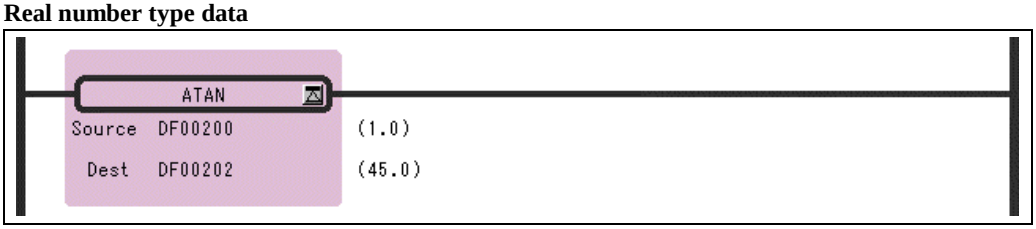
[Program Example]

Integer type data



Input X = 1.00 (MW00100 = 1.00*100 = 100)
Output X = 45 degrees (MW00102 = 45*100 = 4500)

Real number type data

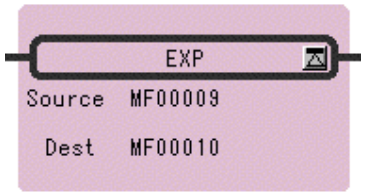


5.8 EXPONENT Instruction (EXP)

[Outline]

The EXP instruction uses the *Source* as the input (x) and stores the natural logarithmic base (e) to the power of the input (e^x) in the *Dest* as the operation result. This instruction can be used only in a real number operation.

[Format]



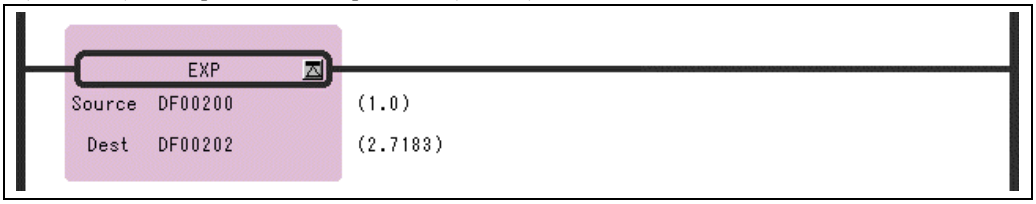
Symbol : EXP
Full Name : Exponential
Category : FUNCTION
Icon : X^y

[Parameter]

Parameter Name	Setting
Source (Input)	· Any real number type register · Any real number type register with subscript · Constant
Dest (Output)	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

e (= 2.7183) to the power of the input value (x = 1.0) is calculated.



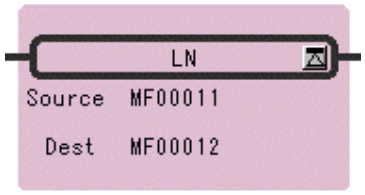
Notes: Maximum value(3.4･･･E + 38) is stored and an operation error will not occur even if the operation results of EXP instruction in an overflow.

5.9 NATURAL LOGARITHM Instruction (LN)

[Outline]

The LN instruction uses the *Source* as the input (x) and stores the natural logarithm (Log_e^x) of the input in the *Dest* as the operation result. This instruction can be used only in a real number operation.

[Format]



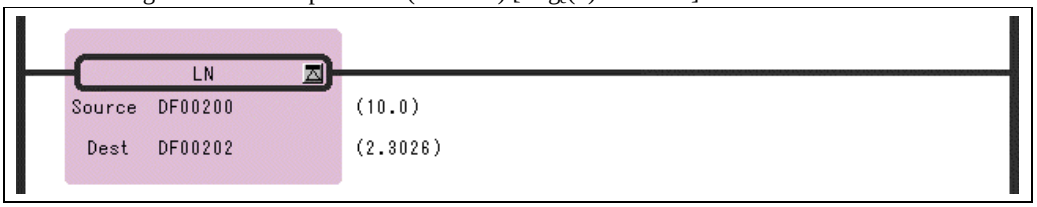
Symbol : LN
Full Name : Natural Logarithm
Category : FUNCTION
Icon : 

[Parameter]

Parameter Name	Setting
Source (Input)	· Any real number type register · Any real number type register with subscript · Constant
Dest (Output)	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

The natural logarithm of the input value (x = 10.0) [$Log_e(x)$ = 2.3026] is calculated.



Notes: LN instruction is input(x) value is checked, execute the following handling.

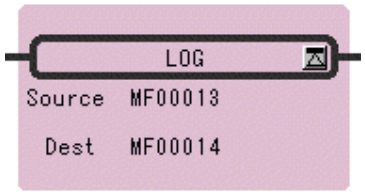
- When the input is minus LN (-1), calculate a absolute value
- When the input is zero LN (0), take $-\infty$ for solution.

5.10 COMMON LOGARITHM Instruction (LOG)

[Outline]

The LOG instruction uses the *Source* as the input (x) and stores the common logarithm (Log_{10}^{x}) of the input in the *Dest* as the operation result. This instruction can be used only in a real number operation.

[Format]



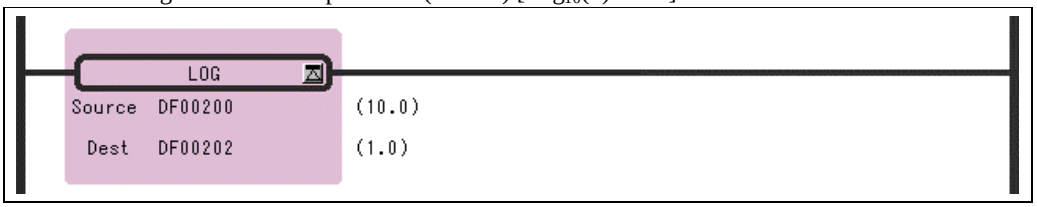
Symbol : LOG
Full Name : Logarithm Base 10
Category : FUNCTION
Icon : log

[Parameter]

Parameter Name	Setting
Source (Input)	· Any real number type register · Any real number type register with subscript · Constant
Dest (Output)	· Any real number type register (except for # and C register) · Any real number type register with subscript (except for # and C register)

[Program Example]

The common logarithm of the input value (x = 10.) [$Log_{10}(x) = 1.0$] is calculated.



Notes: LOG instruction is input(x) value is checked, execute the following handling.

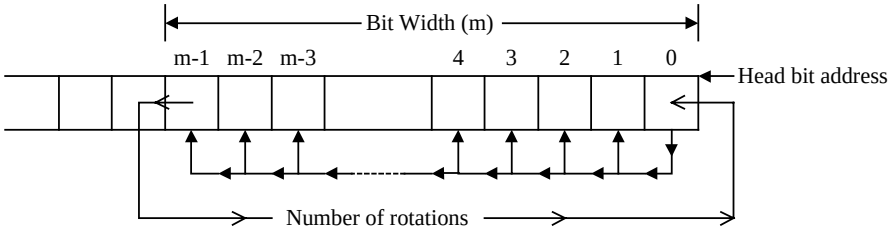
- When the input is minus LOG (-1), calculate a absolute value
- When the input is zero LOG (0), take $-\infty$ for solution.

6 Data Manipulation Instructions

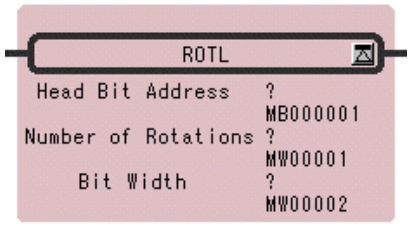
6.1 BIT ROTATION LEFT Instruction (ROTL)

[Outline]

The ROTL instruction is used to rotate bits to the left the number of times designated in the bit table designated by the leading bit address and bit width.



[Format]



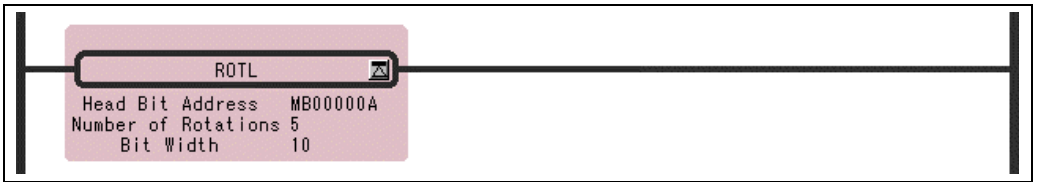
Symbol : ROTL
Full Name : Bit Rotate Left
Category : MOVE
Icon : 

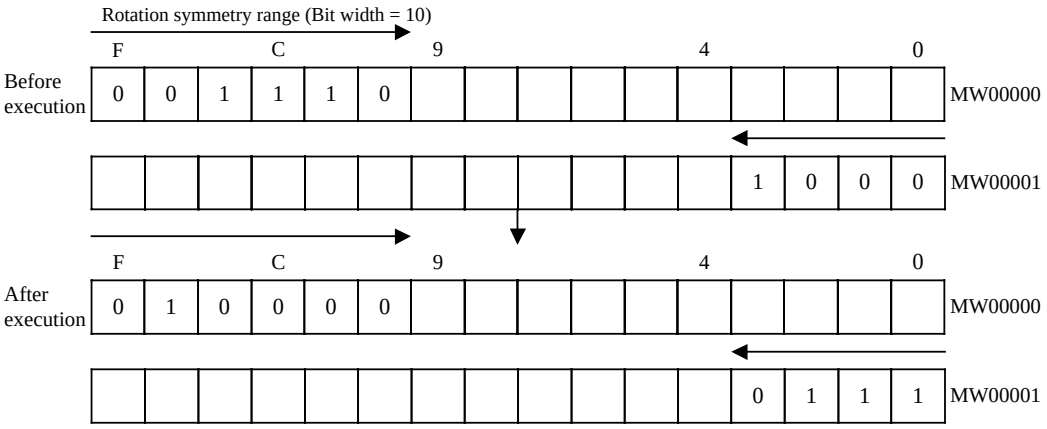
[Parameter]

Parameter Name	Setting
Head Bit Address	· Any bit type register (except for # and C registers) · Any bit type register with subscript (except for # and C registers)
Number of Rotations	· Any integer type register · Any integer type register with subscript · Constant
Bit Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The data having MB00000A (bit A of MW00000) as the head address and a bit width of 10 are rotated five times to the left.

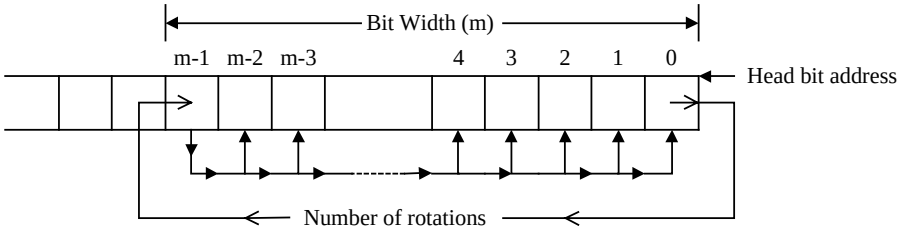




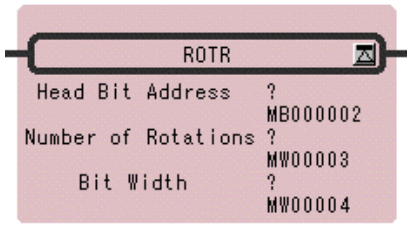
6.2 BIT ROTATION RIGHT Instruction (ROTR)

[Outline]

The ROTR instruction is used to rotate bits to the right the number of times designated in the bit table designated by the leading bit address and bit width.



[Format]



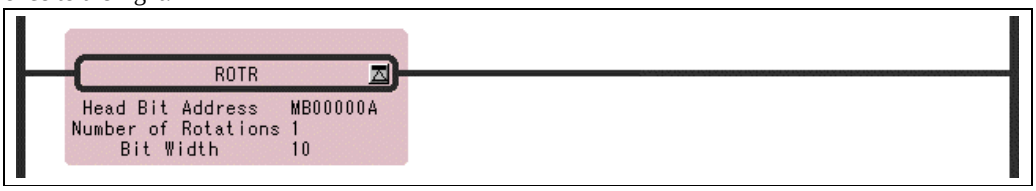
Symbol : ROTR
Full Name : Bit Rotate Right
Category : MOVE
Icon : 

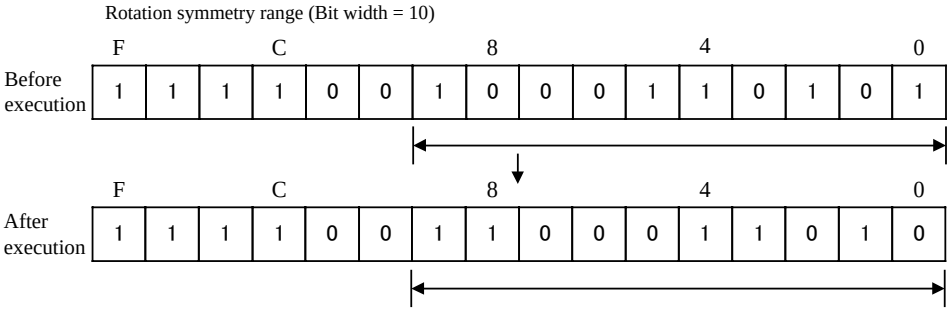
[Parameter]

Parameter Name	Setting
Head Bit Address	· Any bit type register (except for # and C registers) · Any bit type register with subscript (except for # and C registers)
Number of Rotations	· Any integer type register · Any integer type register with subscript · Constant
Bit Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The data having MB00000 (bit 0 of MW00000) as the head address and a bit width of 10 are rotated once to the right.



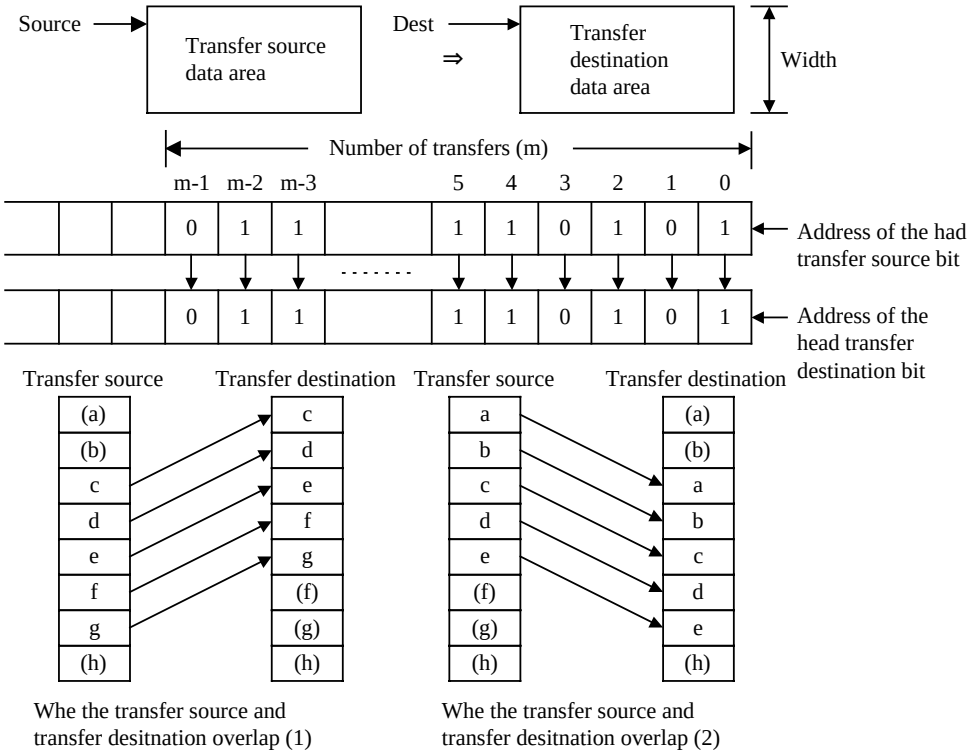


6.3 MOVE BITS Instruction (MOVB)

[Outline]

The MOVB instruction moves the designated number of bits (*Width*) from the beginning of the move source bits (*Source*) to the beginning of the move destination bits (*Dest*). The move process is performed one bit at a time in the direction in which the relay number increases.

Unless the move source bits overlap with the move destination bits, the move source bit table is stored. If there is overlap between them, the move source bit table may not be stored.



[Format]

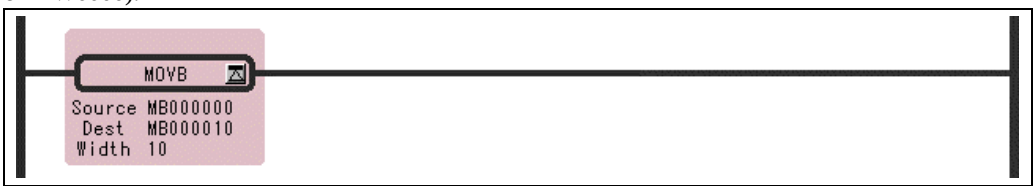
Symbol : MOVB
Full Name : Move Bit
Category : MOVE
Icon : 

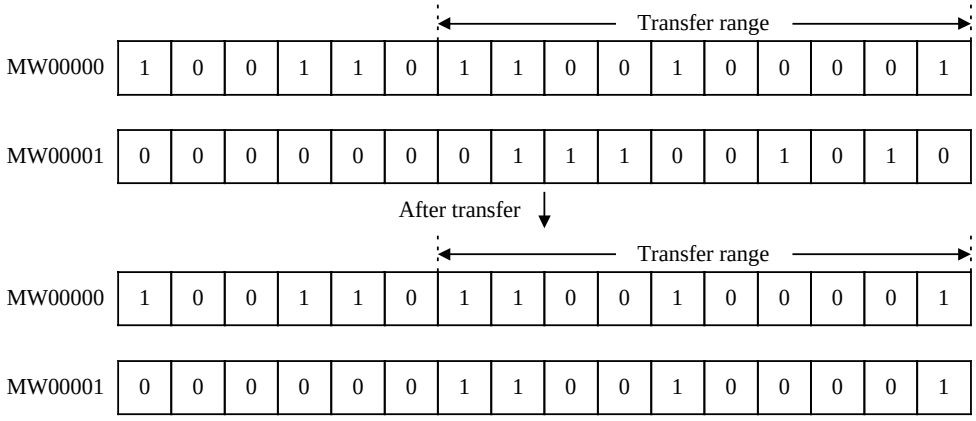
[Parameter]

Parameter Name	Setting
Source	· Any bit type register · Any bit type register with subscript
Dest	· Any bit type register (except for # and C registers) · Any bit type register with subscript (except for # and C registers)
Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The 10 bits of data starting from MB000000 (bit 0 of MW00000) are transferred to MB000010 (bit 0 of MW0000).



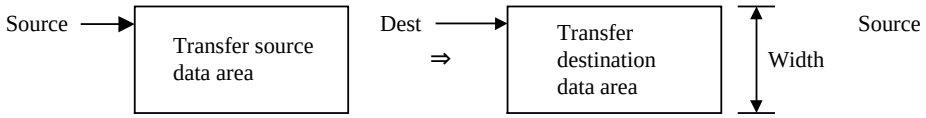


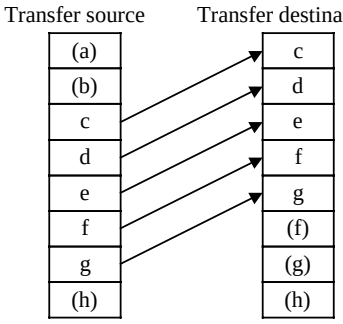
6.4 MOVE WORD Instruction (MOVW)

[Outline]

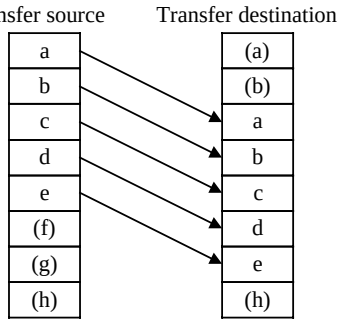
The MOVW instruction moves the designated number of words (*Width*) from the beginning of the move source registers (*Source*) to the beginning of the move destination registers (*Dest*). The move process is performed one word at a time in the direction in which the register number increases.

Unless the move source registers overlap with the move destination registers, the move source word table is stored. If there is overlap between them, the move source bit table may not be stored.





Whe the transfer source and transfer desitnation overlap (1)



Whe the transfer source and transfer desitnation overlap (2)

[Format]

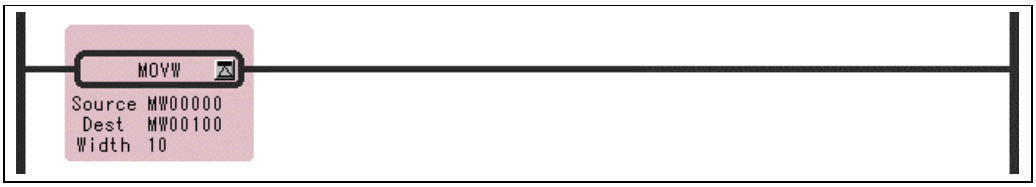
Symbol : MOVW
Full Name : Move Word
Category : MOVE
Icon : 

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The word data MW00000 to MW00009 are transferred to MW00100 to MW00109.

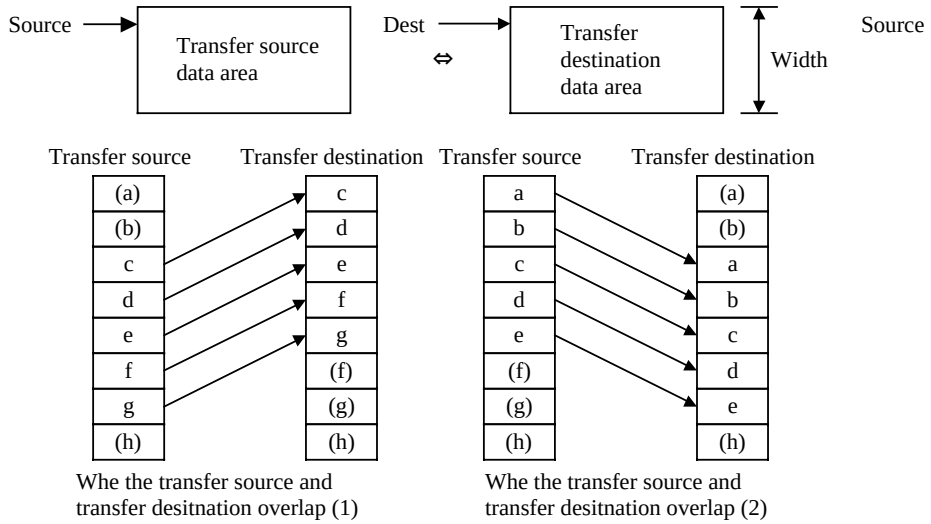


MW00000	1234H			MW00100	1234H
MW00001	2345H			MW00101	2345H
MW00002	3456H		After transfer →	MW00102	3456H
⋮	⋮			⋮	⋮
MW00009	9999H			MW00109	9999H

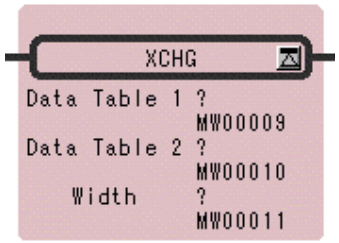
6.5 EXCHANGE Instruction (XCHG)

[Outline]

The XCHG instruction is used to exchange data between data tables 1 (*Data Table1*) and 2 (*Data Table2*).



[Format]



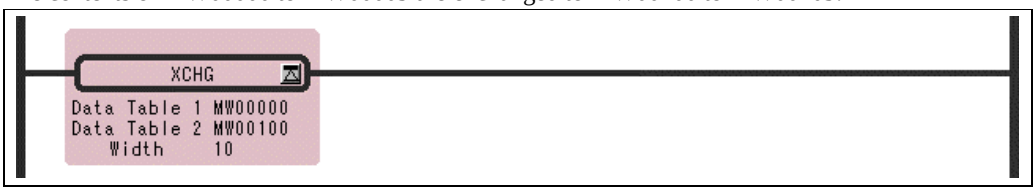
Symbol : XCHG
Full Name : Exchange
Category : MOVE
Icon : 

[Parameter]

Parameter Name	Setting
Data Table 1	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Data Table 2	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The contents of MW00000 to MW00009 are exchanged to MW00100 to MW00109.



MW00000	1031H	MW00100	2050H
MW00001	1032H	MW00101	2051H
MW00002	1033H	MW00102	2052H
MW00003	1034H	MW00103	2053H
MW00004	1035H	MW00104	2054H
MW00005	1036H	MW00105	2055H
MW00006	1037H	MW00106	2056H
MW00007	1038H	MW00107	2057H
MW00008	1039H	MW00108	2058H
MW00009	1030H	MW00109	2059H

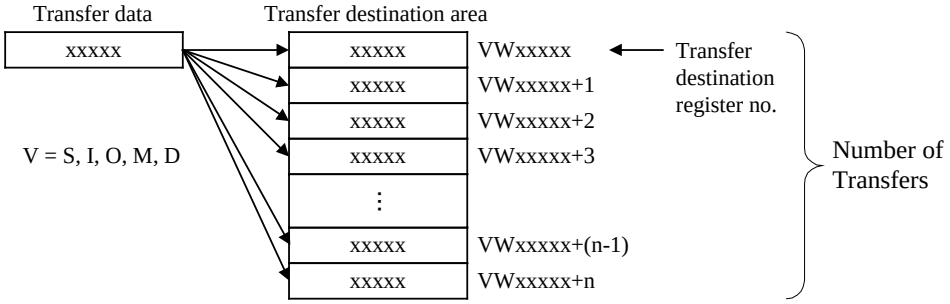
After transfer →

MW00000	2050H	MW00100	1031H
MW00001	2051H	MW00101	1032H
MW00002	2052H	MW00102	1033H
MW00003	2053H	MW00103	1034H
MW00004	2054H	MW00104	1035H
MW00005	2055H	MW00105	1036H
MW00006	2056H	MW00106	1037H
MW00007	2057H	MW00107	1038H
MW00008	2058H	MW00108	1039H
MW00009	2059H	MW00109	1030H

6.6 SET WORDS Instruction (SETW)

[Outline]

The SETW instruction stores the designated data (*Set Data*) in all registers designated by the transfer destination register number (*Dest*) and the number of destination registers (*Width*). The storage process is performed one word at a time in the direction in which the register number increases.



[Format]

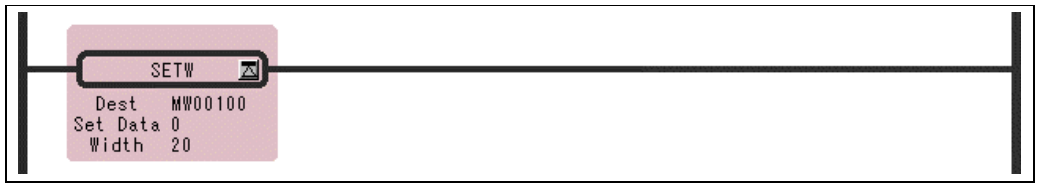
Symbol : SETW
Full Name : Set Word
Category : MOVE
Icon : 

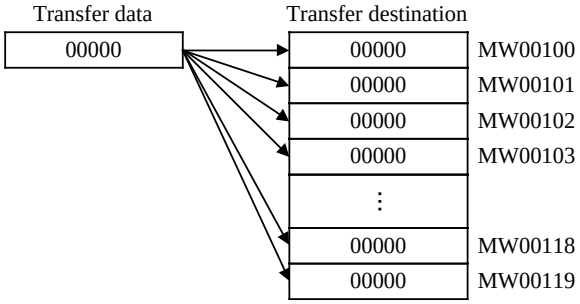
[Parameter]

Parameter Name	Setting
Dest	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Set Data	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers) · Constant
Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The contents of MW00100 to MW00119 are set to 0.

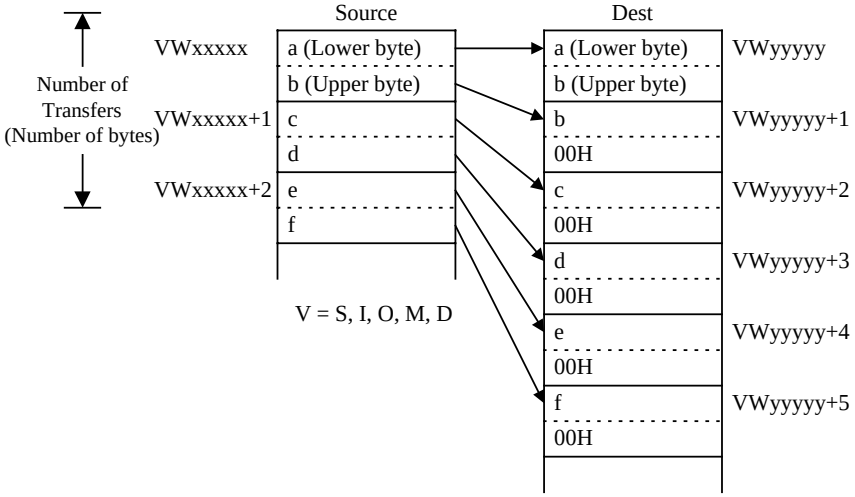




6.7 BYTE-TO-WORD EXPANSION Instruction (BEXTD)

[Outline]

The BEXTD instruction stores the byte sequence stored in the transfer source registers (*Source*) one byte at a time in the word sequence in the transfer destination registers (*Dest*). The higher-place bytes of the transfer destination registers are set to 0.



[Format]

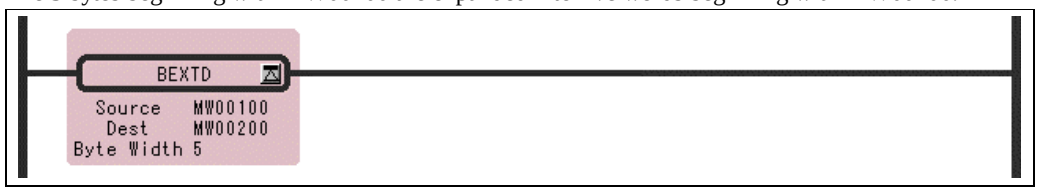
Symbol : BEXTD
Full Name : Extend Byte to Word
Category : MOVE
Icon : 

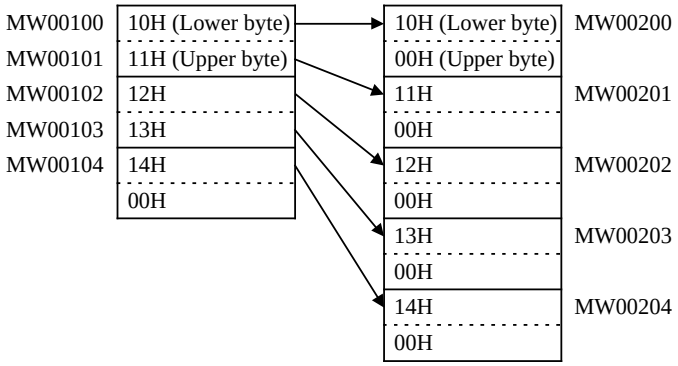
[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Byte Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The 5 bytes beginning with MW00100 are expanded into five words beginning with MW00200.



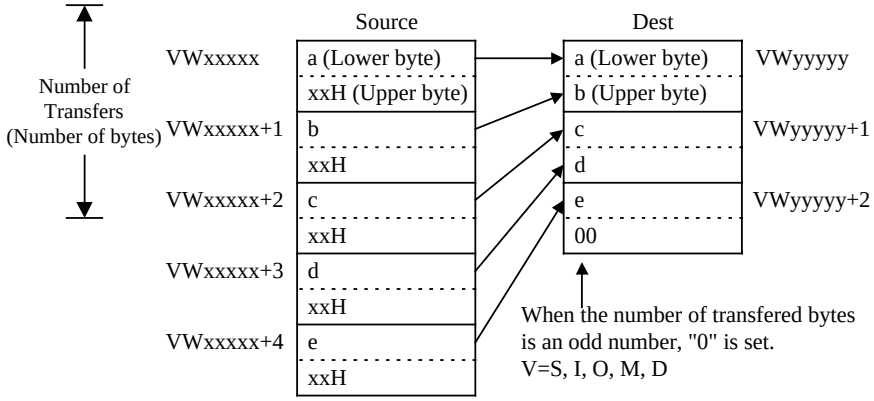


6.8 WORD-TO-WORD COMPRESSION Instruction (BPRESS)

[Outline]

The BPRESS instruction stores the lower-place bytes of the word sequence stored in the transfer source registers (*Source*) in the byte sequence of the transfer destination registers (*Dest*). The higher-place bytes of the transfer source registers are ignored. This function is the reverse of that of the BEXTD instruction.

In the case of BPRESS VWxxxxx to VWyyyyy B=N



[Format]

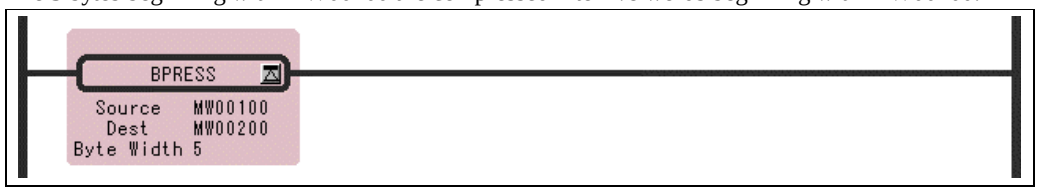
Symbol : BPRESS
Full Name : Compress Word to Byte
Category : MOVE
Icon : 

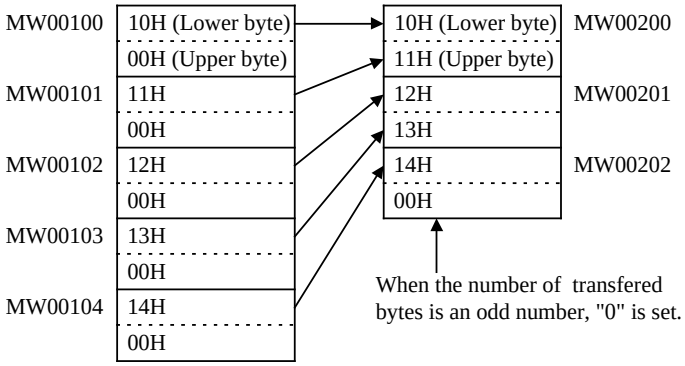
[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Byte Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The 5 bytes beginning with MW00100 are compressed into five words beginning with MW00200.



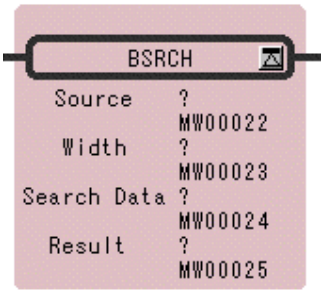


6.9 BINARY SEARCH Instruction (BSRCH)

[Outline]

The BSRCH instruction uses a binary search method to search the designated data (*Search Data*) within the designated search range (*Source*). The search result (offset from the leading register number of the search range for the matching data) is stored in the designated register (*Result*).

[Format]



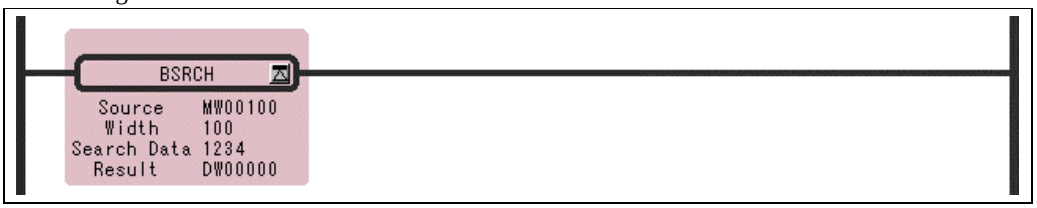
Symbol : BSRCH
Full Name : Binary Data Search
Category : MOVE
Icon : 

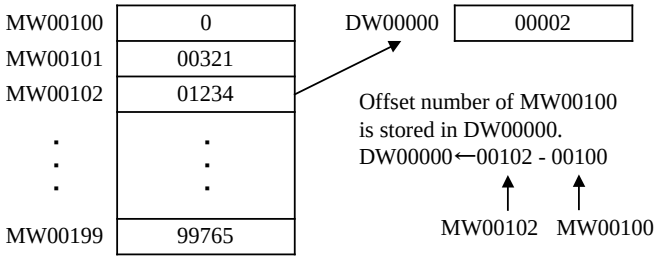
[Parameter]

Parameter Name	Setting
Source	· Any integer type and double-length integer type register · Any integer type and double-length type register with subscript
Width	· Any integer type and double-length integer type register · Any integer type and double-length type register with subscript
Search Data	· Any integer type and double-length integer type register · Any integer type and double-length type register with subscript · Constant
Result	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)

[Program Example]

Data matching with 01234 are searched for in registers MW00100 to MW00199, and the result is stored in register DW00000.



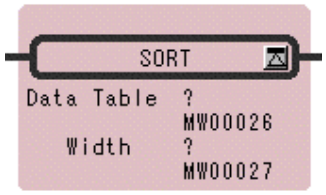


6.10 SORT Instruction (SORT)

[Outline]

The SORT instruction sorts data within the designated register range (*Data Table*, *Width*) in ascending order.

[Format]



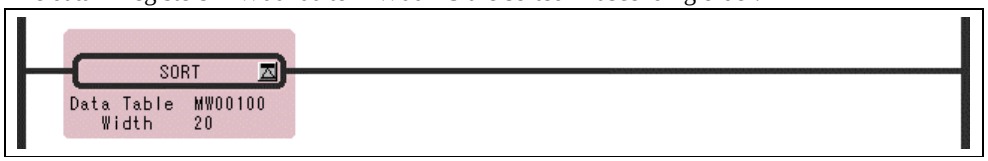
Symbol : SORT
Full Name : Sort
Category : MOVE
Icon : 

[Parameter]

Parameter Name	Setting
Data Table	· Any integer type and double-length integer type register (except for # and C registers) · Any integer type and double-length integer type register with subscript (except for # and C registers)
Width	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers) · Constant

[Program Example]

The data in registers MW00100 to MW00119 are sorted in ascending order.

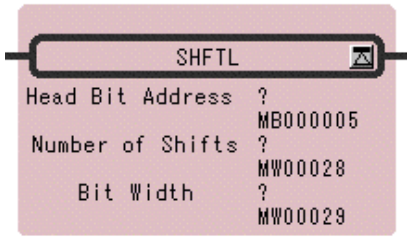


6.11 BIT SHIFT LEFT Instruction (SHFTL)

[Outline]

The SHFTL instruction shifts the bit sequence designated by the leading bit address (*Head Bit Address*) and bit width (*Bit Width*) to the left the designated number of bits (*Number of Shifts*).

[Format]



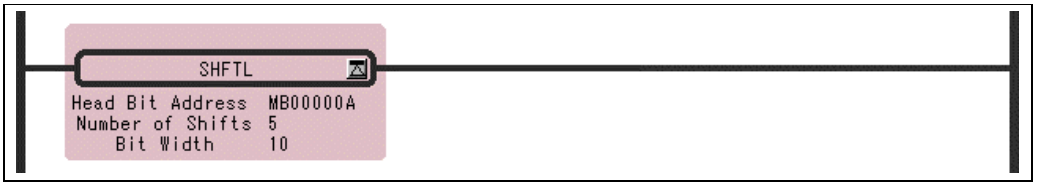
Symbol : SHFTL
Full Name : Bit Shift Left
Category : MOVE
Icon : 

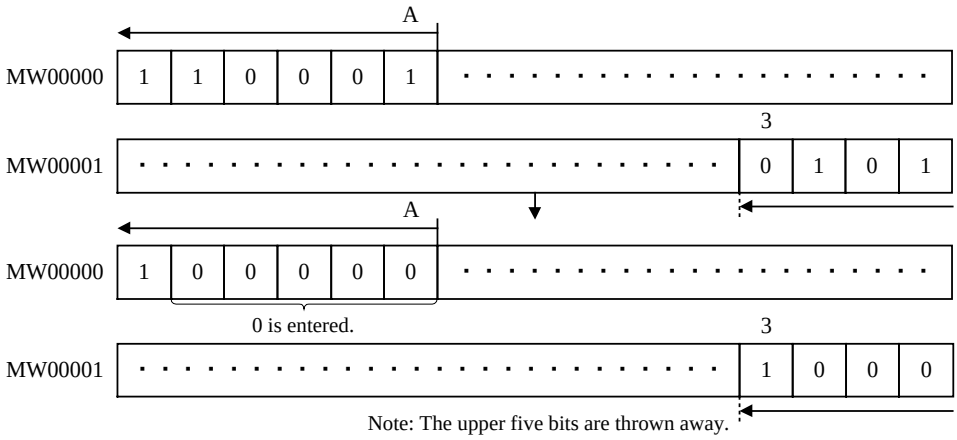
[Parameter]

Parameter Name	Setting
Head Bit Address	· Any bit type register (except for # and C registers) · Any bit type register with subscript (except for # and C registers)
Number of Shifts	· Any integer type register · Any integer type register with subscript · Constant
Bit Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

A ten-bit wide section of data with MB0000A (bit A of MW00000) as the head is shifted five bits to the left.





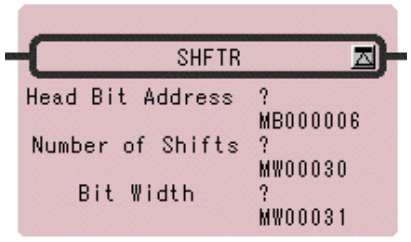
Note: The upper five bits are thrown away.

6.12 BIT SHIFT RIGHT Instruction (SHFTR)

[Outline]

The SHFTR instruction shifts the bit sequence designated by the leading bit address (*Head Bit Address*) and bit width to (*Bit Width*) the right the designated number of bits (*Number of Shifts*).

[Format]



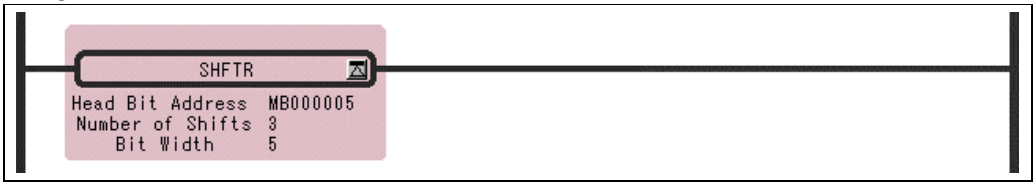
Symbol : SHFTR
Full Name : Bit Shift Right
Category : MOVE
Icon : SHFT R

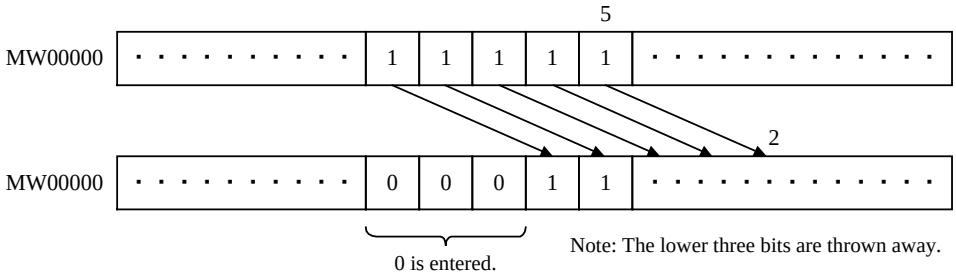
[Parameter]

Parameter Name	Setting
Head Bit Address	· Any bit type register (except for # and C registers) · Any bit type register with subscript (except for # and C registers)
Number of Shifts	· Any integer type register · Any integer type register with subscript · Constant
Bit Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

A five-bit wide section of data with MB0005 (bit A of MW00000) as the head is shifted three bits to the right.





6.13 COPY WORD Instruction (COPYW)

[Outline]

The COPYW instruction copies the designated number of words (*Width*) from the beginning of the copy source register (*Source*) to the beginning of the copy destination register (*Dest*). The copy process copies the entire block of data from the copy source to the copy destination. Even if there is overlap between the copy source and the copy destination, the full copy data block is copied to the copy destination.

[Format]

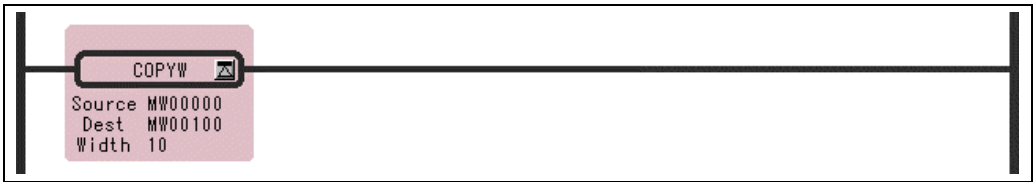
Symbol : COPYW
Full Name : Copy Word
Category : MOVE
Icon : 

[Parameter]

Parameter Name	Setting
Source	· Any integer type register · Any integer type register with subscript
Dest	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)
Width	· Any integer type register · Any integer type register with subscript · Constant

[Program Example]

The word data of MW00000 to MW00009 are transferred to MW00100 to MW00109.

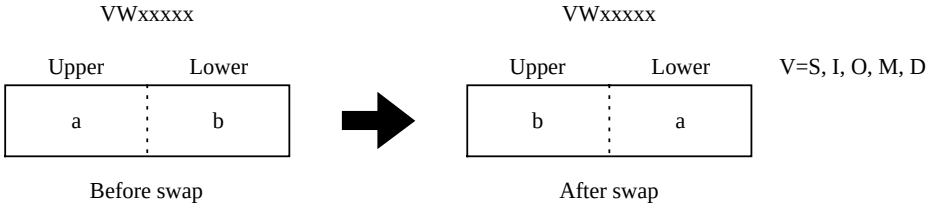


MW00000	1032H			MW00100	1032H
MW00001	1133H			MW00101	1133H
MW00002	1234H		After transfer →	MW00102	1234H
⋮	⋮			⋮	⋮
MW00008	1841H			MW00108	1841H
MW00009	1842H			MW00109	1842H

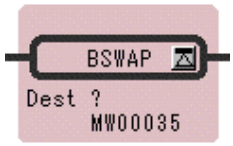
6.14 BYTE SWAP Instruction (BSWAP)

[Outline]

The BSWAP instruction swaps the higher-place and lower-place bytes of the designated register (*Dest*).



[Format]



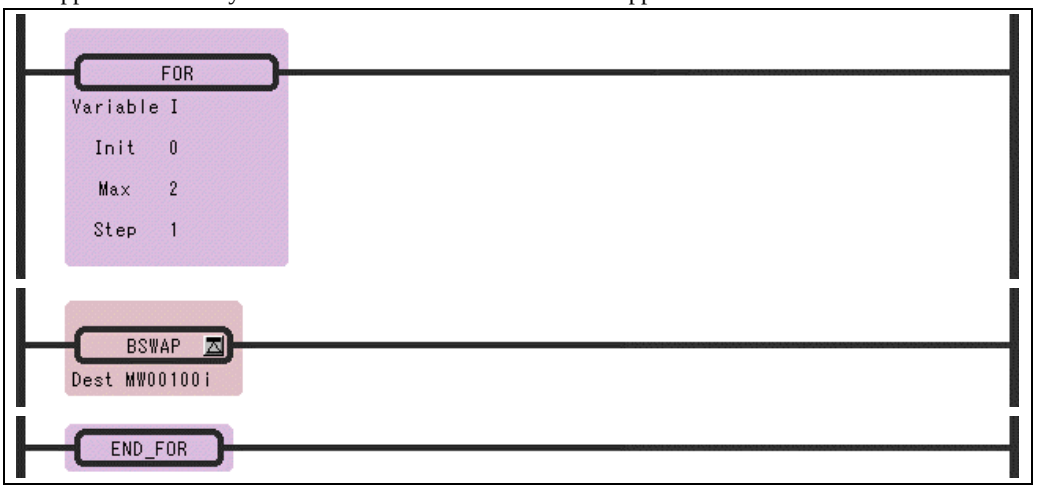
Symbol : BSWAP
Full Name : Byte Swap
Category : MOVE
Icon : 

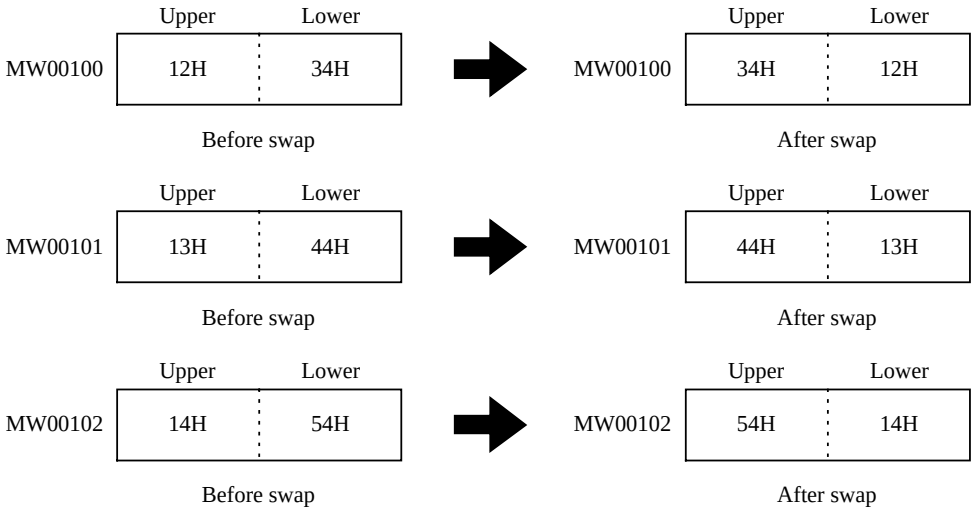
[Parameter]

Parameter Name	Setting
Dest	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers)

[Program Example]

The upper and lower bytes of MW00100 to MW00102 are swapped.




Upper
Lower
MW00100
12H
34H
Before swap
MW00100
34H
12H
After swap
Upper
Lower
MW00101
13H
44H
Before swap
MW00101
44H
13H
After swap
Upper
Lower
MW00102
14H
54H
Before swap
MW00102
54H
14H
After swap

7 DDC Instructions

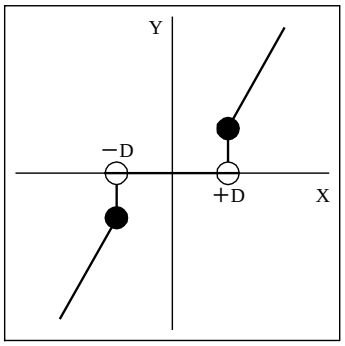
7.1 DEAD ZONE A Instruction (DZA)

[Outline]

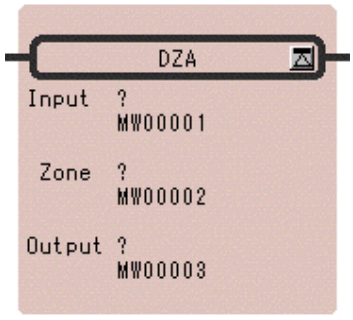
The DZA instruction executes a dead zone operation on integer, double-length integer or real number data.

The following operation is performed, where *Input* is the input value, *Zone* is the designated dead zone value, and *Output* is the output value:

- *Output* = *Input* (absolute value of *Input* is greater than or equal to the absolute value of *Zone*)
- *Output* = 0 (absolute value of *Input* is less than the absolute value of *Zone*)



[Format]



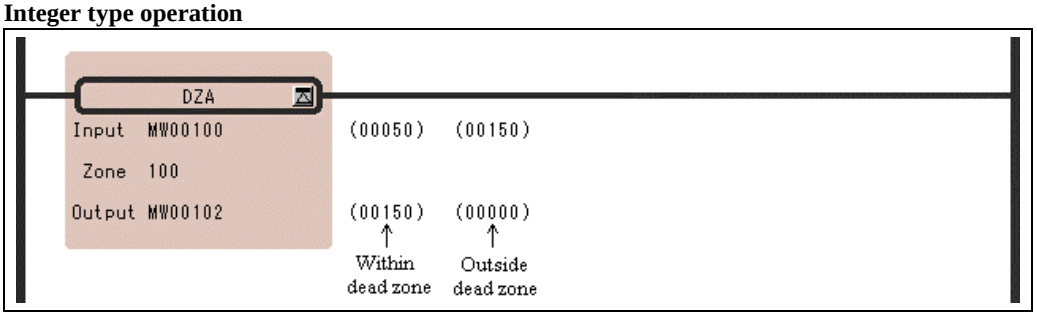
Symbol : DZA
Full Name : Dead Zone A
Category : DDC
Icon : 

[Parameter]

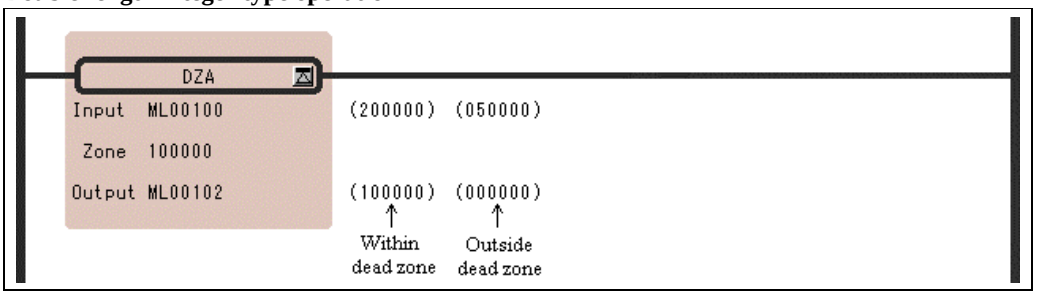
Parameter Name	Setting
Input	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Zone	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Output	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

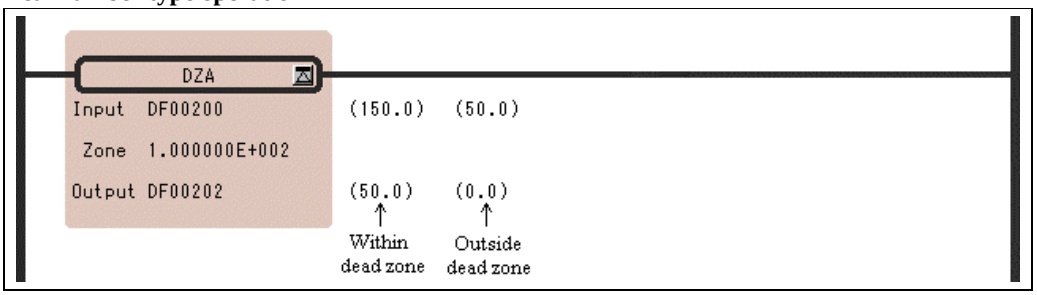
Integer type operation



Double-length integer type operation



Real number type operation



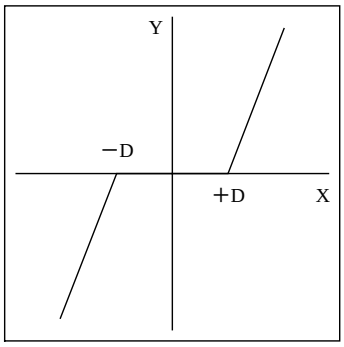
7.2 DEAD ZONE B Instruction (DZB)

[Outline]

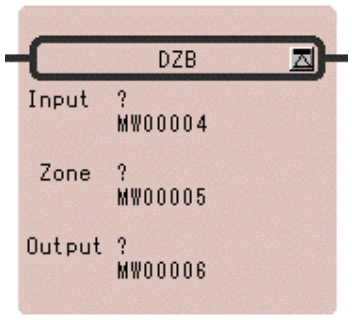
The DZB instruction executes a dead zone operation on integer, double-length integer or real number data.

The following operation is performed, where *Input* is the input value, *Zone* is the designated dead zone value, and *Output* is the output value:

- *Output* = *Input* – the absolute value of *Zone* (the absolute value of *Input* is greater than or equal to the absolute value of *Zone*; *Input* is greater than or equal to 0)
- *Output* = *Input* + the absolute value of *Zone* (the absolute value of *Input* is greater than or equal to the absolute value of *Zone*; *Input* is less than or equal to 0)
- *Output* = 0 (the absolute value of *Input* is less than the absolute value of *Zone*)



[Format]



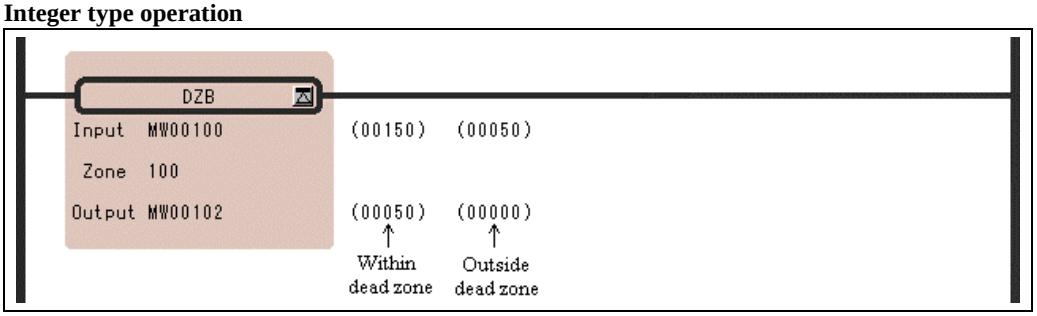
Symbol : DZB
Full Name : Dead Zone B
Category : DDC
Icon : 

[Parameter]

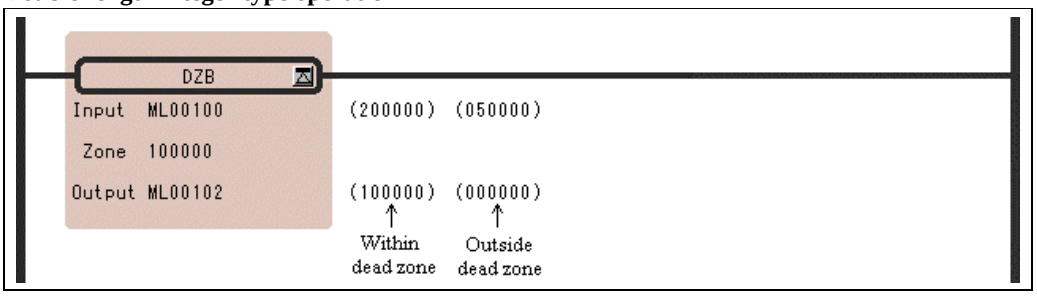
Parameter Name	Setting
Input	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Zone	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Output	· Any integer type, double-length integer type and real number type register (except for # and C registers) · Any integer type, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

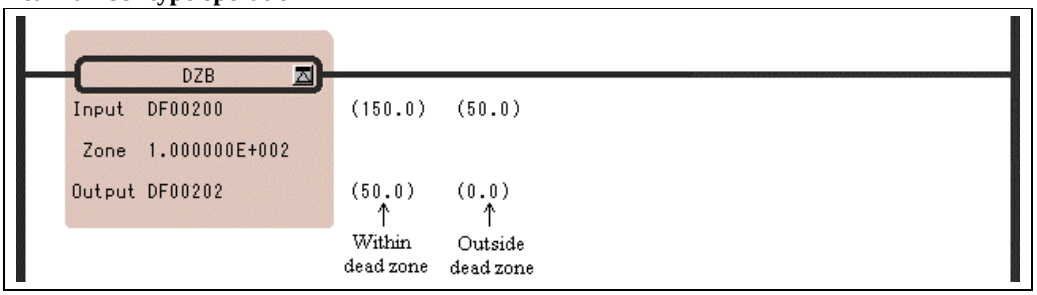
Integer type operation



Double-length integer type operation



Real number type operation

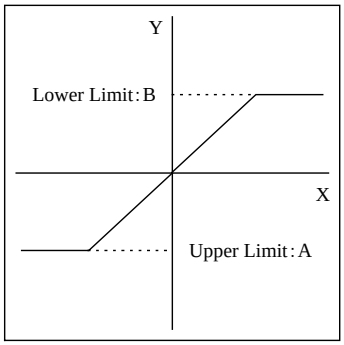


7.3 UPPER/LOWER LIMIT Instruction (LIMIT)

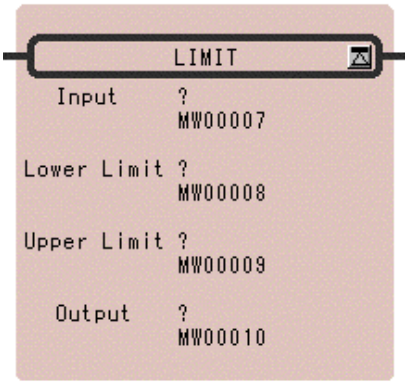
[Outline]

The LIMIT instruction executes an upper/lower limit operation on integer, double-length integer, or real number data. The following operation is performed, where *Input* is the input value, *Lower Limit* is the lower limit, *Upper Limit* is the upper limit, and *Output* is the output value:

- *Output* = *Lower Limit* (*Input* is less than *Lower Limit*)
- *Output* = *Input* (*Lower Limit* is less than or equal to *Input* which is less than or equal to *Upper Limit*)
- *Output* = *Upper Limit* (*Upper Limit* is less than *Input*)



[Format]



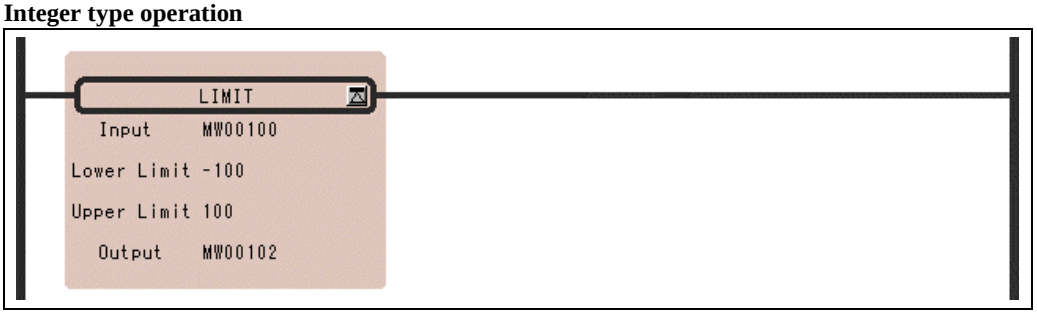
Symbol : LIMIT
Full Name : Limit
Category : DDC
Icon : 

[Parameter]

Parameter Name	Setting
Input	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Lower Limit	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Upper Limit	· Any integer type, double-length integer type and real number type register · Any integer type, double-length integer type and real number type register with subscript · Subscript register · Constant
Output	· Any integer type and double-length integer register (except for # and C registers) · Any integer type and double-length integer register with subscript (except for # and C registers) (except for # and C registers) · Subscript register

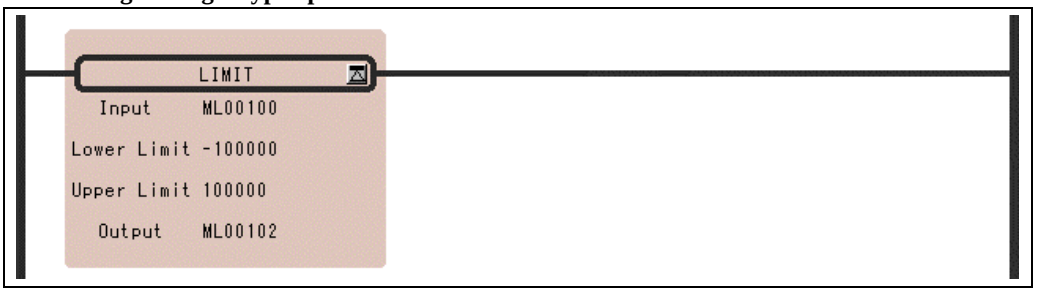
[Program Example]

Integer type operation



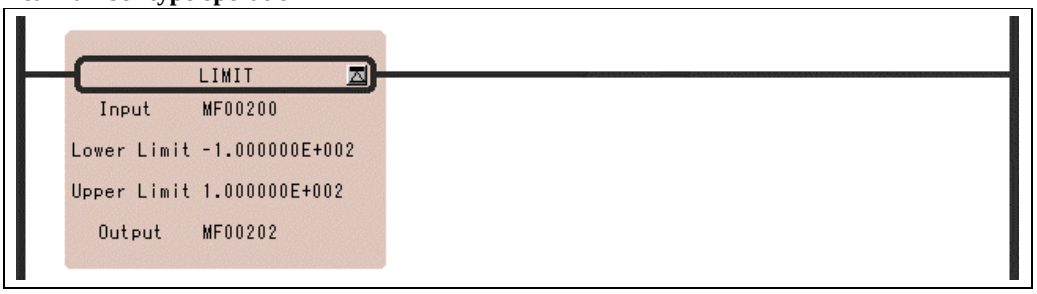
Input (MW00100)	Output (MW0010)
-100 > MW00100	-00100 (under the lower limit)
-100≦MW00100≦100	Value of MW00100 (with in the upper and lower limit)
MW00100 >100	00100 (above the upper limit)

Double-length integer type operation



Input (ML00100)	Output (ML00102)
-100000 > ML00100	-100000 (under the lower limit)
-100000≦ML00100≦100000	Value of ML00100 (with in the upper and lower limit)
ML00100 > 100000	100000 (above the upper limit)

Real number type operation



Input (DF00200)	Output (DF00202)
-100.0 > DF00200	-100.0 (under the lower limit)
-100.0≦DF00200≦100.0	Value of MF00200 (with in the upper and lower limit)
DF00200 > 100.0	100.0 (above the upper limit)

7.4 PI CONTROL Instruction (PI)

[Outline]

The PI instruction executes a PI control operation according to the contents of a previously set parameter table. The input (*Input*) to the PI operation must be integer or real number data. Double-length integer data cannot be used. The configurations of the parameter tables for integer and real number data are different. Operations are performed by processing each parameter as an integer consisting of the lower-place 16 bits.

Table of Integer Type PI Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	Kp	P gain	Gain of the P correction (a gain of 1 is set to 100)	IN
2	W	Ki	Integration adjustment gain	Gain of the integration circuit input (a gain of 1 is set to 100)	IN
3	W	Ti	Integration time	Integration time (ms)	IN
4	W	IUL	Upper integration limit	Upper limit for the I correction value	IN
5	W	ILL	Lower integration limit	Lower limit for the I correction value	IN
6	W	UL	Upper PI limit	Upper limit for the P+I correction value	IN
7	W	LL	Lower PI limit	Lower limit for the P+I correction value	IN
8	W	DB	PI output dead band	Width of the dead band for the P+I correction value	IN
9	W	Y	PI output	PI correction output (also output to the A register)	OUT
10	W	Yi	I correction value	Storage of the I correction value	OUT
11	W	IREM	I remainder	Storage of the I remainder	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	Integration reset	"ON" is input when integration is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Table of Real Type PI Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	F	Kp	P gain	Gain of the P correction	IN
4	F	Ki	Integration adjustment gain	Gain of the integration circuit input	IN
6	F	Ti	Integration time	Integration time (s)	IN
8	F	IUL	Upper integration limit	Upper limit for the I correction value	IN
10	F	ILL	Lower integration limit	Lower limit for the I correction value	IN
12	F	UL	Upper PI limit	Upper limit for the P+I correction value	IN
14	F	LL	Lower PI limit	Lower limit for the P+I correction value	IN
16	F	DB	PI output dead band	Width of the dead band for the P+I correction value	IN
18	F	Y	PI output	PI correction output (also output to the A register)	OUT
20	F	Yi	I correction value	Storage of the I correction value	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	Integration reset	"ON" is input when integration is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Here, the PI operation is expressed as follows:

$$\frac{Y}{X} = Kp + Ki \times \frac{1}{Ti \times S}$$

X : deviation input value

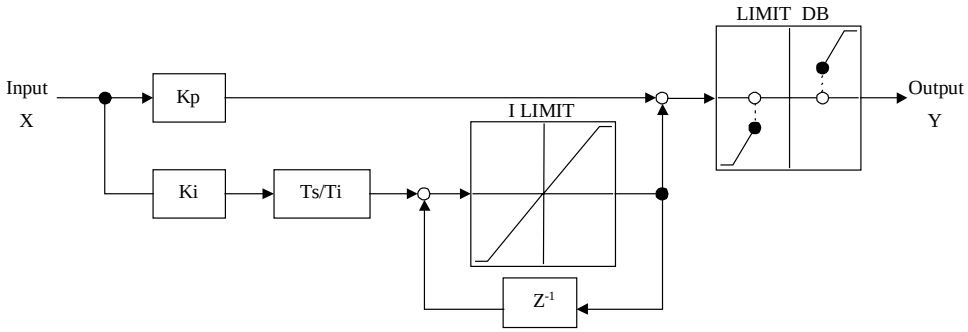
Y : output value

The following operation is performed within the PI instruction:

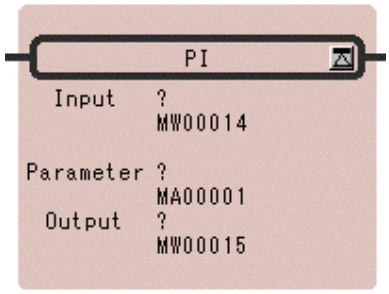
$$Y = Kp \times X + \{(Ki \times X + IREM) / \frac{Ti}{Ts} + Yi'\}$$

Yi' : previous I output value

Ts : scan time set value



[Format]



Symbol : PI
Full Name : PI Control
Category : DDC
Icon : 

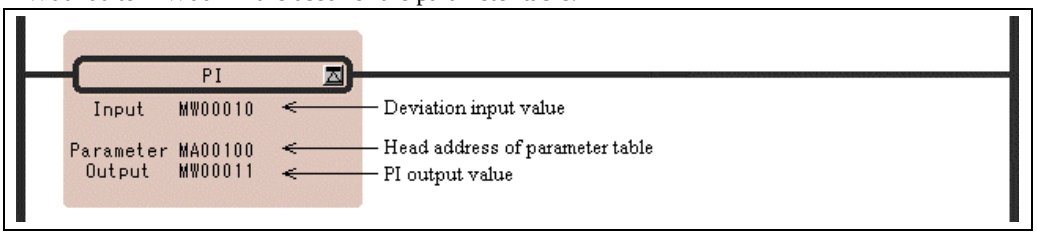
[Parameter]

Parameter Name	Setting
Input	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

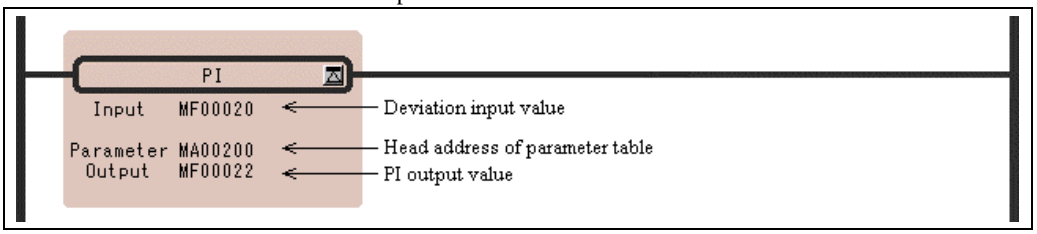
Integer type operation

MW00100 to MW00111 are used for the parameter table.



Real number type operation

MF00200 to MF00220 are used for the parameter table.



7.5 PD CONTROL Instruction (PD)

[Outline]

The PD instruction executes a PD control operation according to the contents of a previously set parameter table. The input (*Input*) to the PD operation must be integer or real number data. Double-length integer data cannot be used. The configurations of the parameter tables for integer and real number data are different. Operations are performed by processing each parameter as an integer consisting of the lower-place 16 bits.

Table of Integer Type PD Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	Kp	P gain	Gain of the P correction (a gain of 1 is set to 100)	IN
2	W	Kd	D gain	Gain of the differentiation circuit input (a gain of 1 is set to 100)	IN
3	W	Td1	Divergence differentiation time	The differentiation time (ms) used in the case of diverging input.	IN
4	W	Td2	Convergence differentiation time	The differentiation time (ms) used in the case of converging input.	IN
5	W	UL	Upper PD limit	Upper limit for the P+D correction value	IN
6	W	LL	Lower PD limit	Lower limit for the P+D correction value	IN
7	W	DB	PD output dead band	Width of the dead band for the P+D correction value	IN
8	W	Y	PD output	PD correction output (also output to the A register)	IN
9	W	X	Input value storage	Storage of the present deviation input value	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Table of Real Type PD Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	F	Kp	P gain	Gain of the P correction	IN
4	F	Kd	D gain	Gain of the differentiation circuit input	IN
6	F	Td1	Divergence differentiation time	The differentiation time (s) used in the case of diverging input.	IN
8	F	Td2	Convergence differentiation time	The differentiation time (s) used in the case of converging input.	IN
10	F	UL	Upper PD limit	Upper limit for the P+D correction value	IN
12	F	LL	Lower PD limit	Lower limit for the P+D correction value	IN
14	F	DB	PD output dead band	Width of the dead band for the P+D correction value	IN
16	F	Y	PD output	PD correction output (also output to the A register)	IN
18	F	X	Input value storage	Storage of the present deviation input value	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Here, the PD operation is expressed as follows:

$$\frac{Y}{X} = Kp + Kd \times Td \times S$$

X : deviation input value

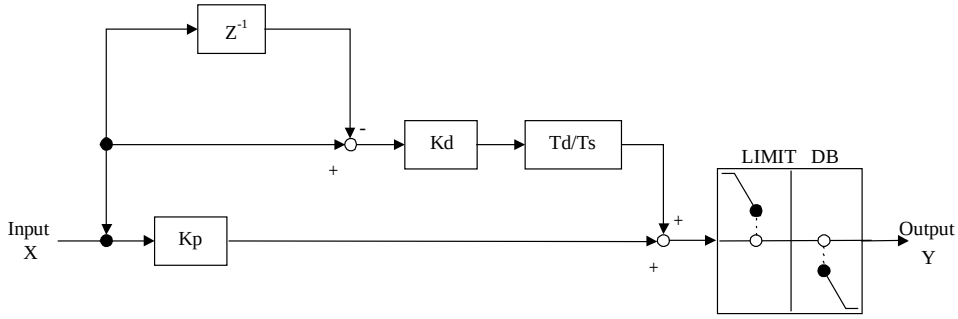
Y : output value

The following operation is performed within the PD instruction:

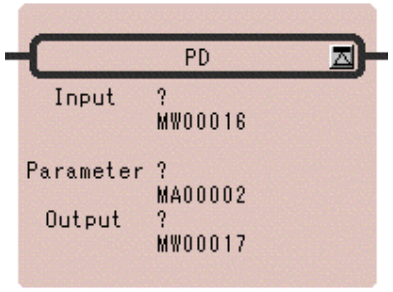
$$Y = Kp \times X + Kd \times (X - X') \times \frac{Td}{Ts}$$

X' : previous input value

Ts : scan time set value



[Format]



Symbol : PD
Full Name : PD Control
Category : DDC
Icon : 

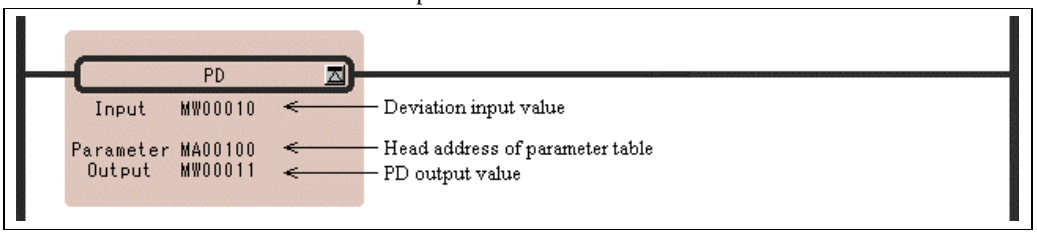
[Parameter]

Parameter Name	Setting
Input	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

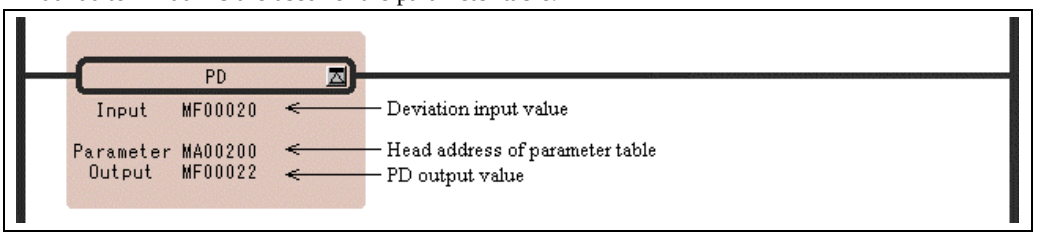
Integer type operation

MW00100 to MW00109 are used for the parameter table.



Real number integer type operation

MF00200 to MF00218 are used for the parameter table.



7.6 PID CONTROL Instruction (PID)

[Outline]

The PID instruction executes a PID control operation according to the contents of a previously set parameter table. The input (*Input*) to the PID operation must be integer or real number data. Double-length integer data cannot be used. The configurations of the parameter tables for integer and real number data are different. Operations are performed by processing each parameter as an integer consisting of the lower-place 16 bits.

Table of Integer Type PID Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *[1]	IN/OUT
1	W	Kp	P gain	Gain of the P correction (a gain of 1 is set to 100)	IN
2	W	Ki	I gain	Gain of the integration circuit input (a gain of 1 is set to 100)	IN
3	W	Kd	D gain	Gain of the differentiation circuit input (a gain of 1 is set to 100)	IN
4	W	Ti	Integration time	Integration time (ms)	IN
5	W	Td1	Divergence differentiation time	The differentiation time (ms) used in the case of diverging input.	IN
6	W	Td2	Convergence differentiation time	The differentiation time (ms) used in the case of converging input.	IN
7	W	IUL	Upper integration limit	Upper limit for the I correction value	IN
8	W	ILL	Lower integration limit	Lower limit for the I correction value	IN
9	W	UL	Upper PID limit	Upper limit for the P+I+D correction value	IN
10	W	LL	Lower PID limit	Lower limit for the P+I+D correction value	IN
11	W	DB	PID output dead band	Width of the dead band for the P+I+D correction value	IN
12	W	Y	PID output	PID correction output (also output to the A register)	OUT
13	W	Ti	I correction value	Storage of the I correction value	OUT
14	W	IREM	I remainder	Storage of the I remainder	OUT
15	W	X	Input value storage	Storage of the present deviation input value	OUT

*[1] : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	Integration reset	"ON" is input when integration is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Table of Real Type PID Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	F	Kp	P gain	Gain of the P correction	IN
4	F	Ki	I gain	Gain of the integration circuit	IN
6	F	Kd	D gain	Gain of the differentiation circuit input	IN
8	F	Ti	Integration time	Integration time (s)	IN
10	F	Td1	Divergence differentiation time	The differentiation time (s) used in the case of diverging input.	IN
12	F	Td2	Convergence differentiation time	The differentiation time (s) used in the case of converging input.	IN
14	F	IUL	Upper integration limit	Upper limit for the I correction value	IN
16	F	ILL	Lower integration limit	Lower limit for the I correction value	IN
18	F	UL	Upper PID limit	Upper limit for the P+I+D correction value	IN
20	F	LL	Lower PID limit	Lower limit for the P+I+D correction value	IN
22	F	DB	PID output dead band	Width of the dead band for the P+I+D correction value	IN
24	F	Y	PID output	PID correction output (also output to the A register)	OUT
26	F	Ti	I correction value	Storage of the I correction value	OUT
28	F	X	Input value storage	Storage of the present deviation input value	OUT

*1:Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	Integration reset	"ON" is input when integration is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Here, the PID operation is expressed as follows:

$$\frac{Y}{X} \; Kp + Ki \times \frac{1}{Ti \times S} = Kd \times Td \times S$$

$$\frac{Y}{X} = Kp + Kd \times Td \times S$$

X : deviation input value

Y : output value

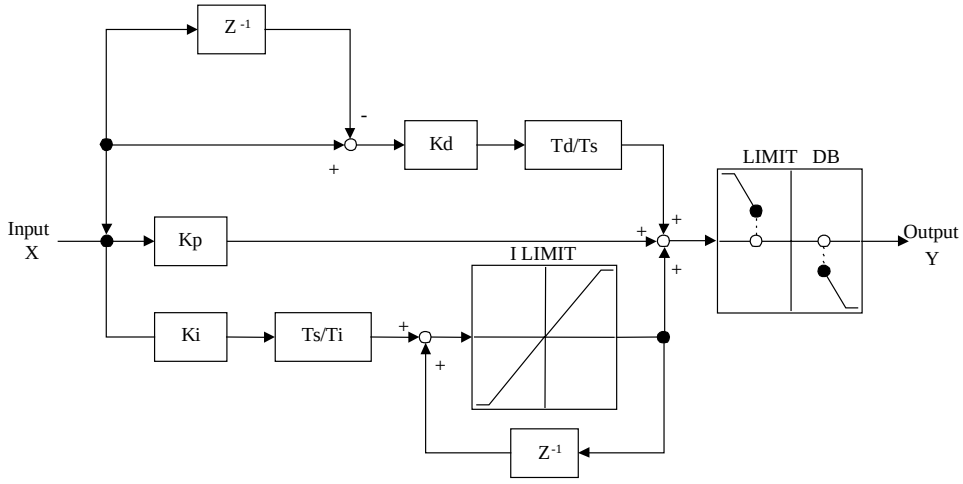
The following opertion is performed within the PID instruction:

$$Y = Kp \times X + \{ \; (Ki \times X + IREM) / \frac{Ti}{Ts} + Yi' \} + Kd \times \; (X - X') \times \frac{Td}{Ts}$$

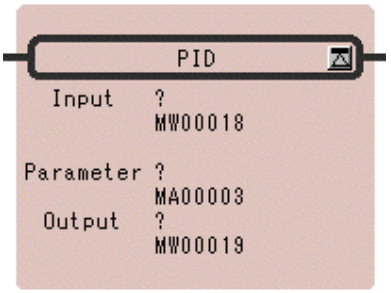
X' : previous input value

Yi' : previous I output value

Ts : scan time set value



[Format]



Symbol : PID
Full Name : PID Control
Category : DDC
Icon : PID

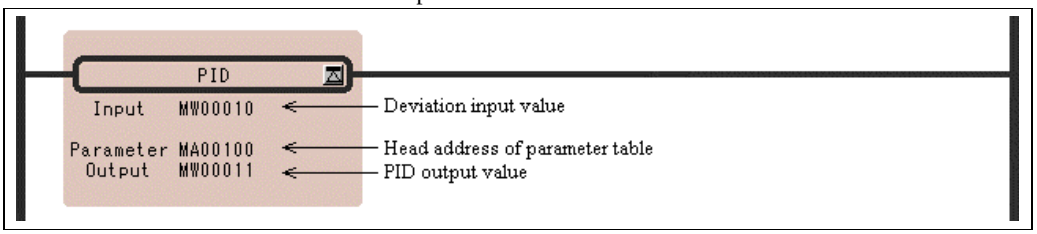
[Parameter]

Parameter Name	Setting
Input	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

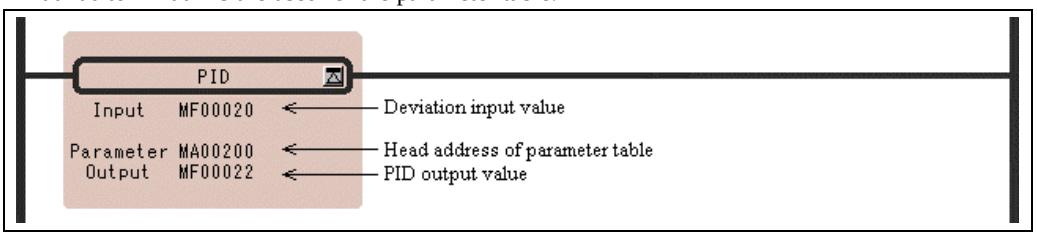
Integer type operation

MW00100 to MW00115 are used for the parameter table.



Real number type operation

MF00200 to MF00228 are used for the parameter table.



7.7 FIRST-ORDER LAG Instruction (LAG)

[Outline]

The LAG instruction calculates the first-order lag according to the contents of a previously set parameter table. The input (*Input*) to the LAG operation must be integer or real number data. Double-length integer data cannot be used. The configurations of the parameter tables for integer and real number data are different. Operations are performed by processing each parameter as an integer consisting of the lower-place 16 bits.

Table of Integer Type LAG Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *S[1]	IN/OUT
1	W	T	First-order lag time constant	First-order lag time constant(ms)	IN
2	W	Y	LAG output	LAG output (also output to the A register)	OUT
3	W	REM	Remainder	Storage of remainder	OUT

*[1] : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	LAG reset	"ON" is input when LAG is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Table of Real Type LAG Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *S[1]	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	F	T	First-order lag time constant	First-order lag time constant(s)	IN
4	F	Y	LAG output	LAG output (also output to the F register)	OUT

*[1] : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	LAG reset	"ON" is input when LAG is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Here, the LAG operation is expressed as follows:

$$\frac{Y}{X} = \frac{1}{1+T\times S} \quad \text{; ie. } T\times (dY/dt) + Y = X$$

The following operation is performed within the LAG instruction with dt = Ts and dY = Y-Y':

$$Y = \frac{T\times Y' + Ts\times X + REM}{T + Ts}$$

X : input value

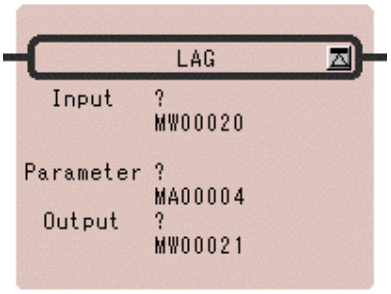
Y : output value

Y' : previous output value

Ts : scan time set value

Y = 0 and REM = 0 are output when the LAG reset (RST) is "ON".

[Format]



Symbol : LAG
Full Name : First Order Lag
Category : DDC
Icon : 

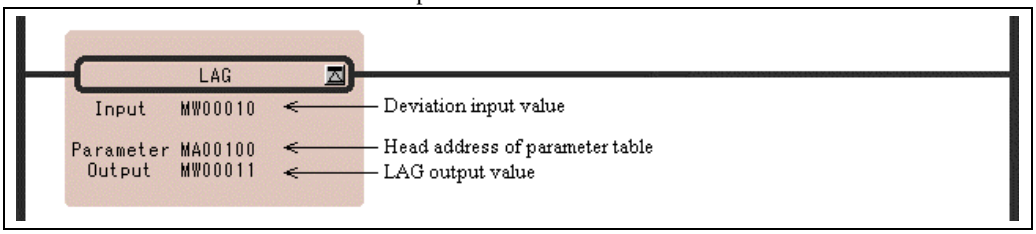
[Parameter]

Parameter Name	Setting
Input	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

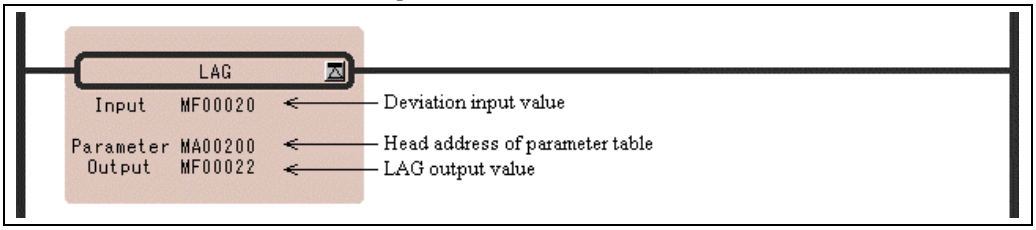
Integer type operation

MW00100 to MW00103 are used for the parameter table.



Real number type operation

MF00200 to MF00204 are used for the parameter table.



7.8 PHASE LEAD/LAG Instruction (LLAG)

[Outline]

The LLAG instruction calculates the phase lead/lag according to the contents of a previously set parameter table. The input (*Input*) to the LLAG operation must be integer or real number data. Double-length integer data cannot be used. The configurations of the parameter tables for integer and real number data are different. Operations are performed by processing each parameter as an integer consisting of the lower-place 16 bits.

Table of Integer Type LLAG Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	T2	Phase lead time constant	Phase lead time constant (ms)	IN
2	W	T1	Phase lag time constant	Phase lag time constant (ms)	OUT
3	W	Y	LLAG output	LLAG output (may also be output to the A register)	OUT
4	W	REM	Remainder	Storage of remainder	OUT
5	W	X	Input value storage	Storage of the input value	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	LLAG reset	"ON" is input when LLAG is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Table of Real Type LLAG Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	W	T2	Phase lead time constant	Phase lead time constant (s)	IN
3	W	T1	Phase lag time constant	Phase lag time constant (s)	IN
4	W	Y	LLAG output	LLAG output (may also be output to the F register)	OUT
5	W	X	Input value storage	Storage of the input value	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	IRST	LLAG reset	"ON" is input when LLAG is reset.	IN
1 to 7	—	(Reserve)	Reserve relay for input	IN
8 to F	—	(Reserve)	Reserve relay for output	OUT

Here, the LLAG operation is expressed as follows:

$$\frac{Y}{X} = \frac{1 + T2 \times S}{1 + T1 \times S} \quad ; \text{ie.} \quad T \times (dY/dt) + Y = T2 \times (dX/dt) + X$$

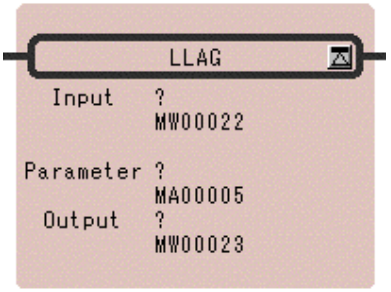
The following operation is performed within the LLAG instruction with dt = Ts, dY = Y-Y', and dX = X-X'

$$Y = \frac{T1 \times Y' + (T2 + Ts) \times X - T2 \times X' + REM}{T1 + Ts}$$

X : input value
Y : output value
X' : previous input value
Y' : previous output value
Ts : scan time set value

Y = 0, REM = 0, X = 0, are output when the LLAG reset (RST) is "ON".

[Format]



Symbol : LLAG
Full Name : Phase Lead Lag
Category : DDC
Icon : 

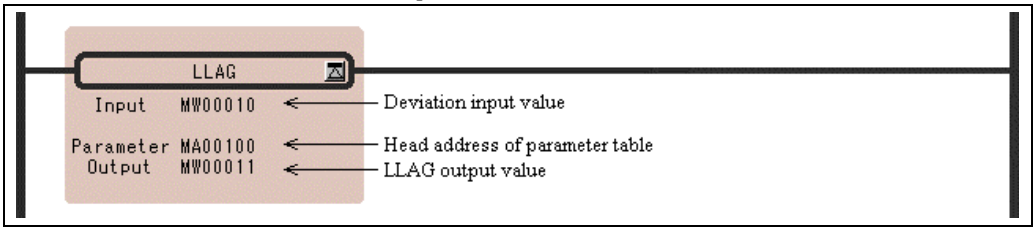
[Parameter]

Parameter Name	Setting
Input	· Any integer type and real number type register · Any integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type and real number type register (except for # and C registers) · Any integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

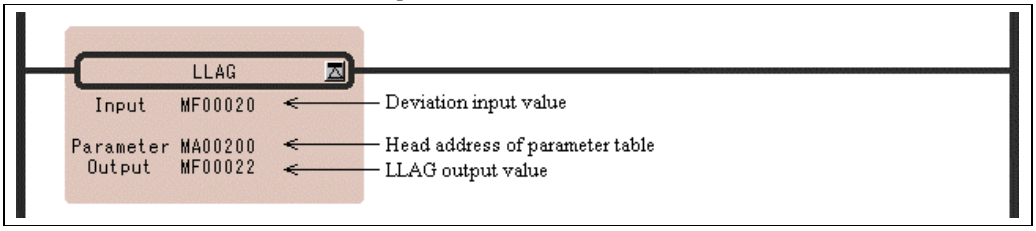
Integer type operation

MW00100 to MW00105 are used for the parameter table.



Real number type operation

MF00200 to MF00208 are used for the parameter table.



7.9 FUNCTION GENERATOR Instruction (FGN)

[Outline]

The FGN instruction generates a function curve according to the contents of a previously set parameter table. The input to the FGN instruction can be integer, double-length integer, or real number data. The configuration of the parameter table differs according to the type of data.

Table of Integer Type FGN Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	N	Number of data	Number of pairs of X and Y	IN
1	W	X1	Data 1		IN
2	W	Y1	Data 1		IN
3	W	X2	Data 2		IN
4	W	Y2	Data 2		IN
…	…	…	…	…	…
2N-1	W	XN	Data N		IN
2N	W	YN	Data N		IN

Table of Real Type FGN Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	N	Number of data	Number of pairs of X and Y	IN
1	W	—	(Reserve)	Reserve register	IN
2	L/F	X1	Data 1		IN
4	L/F	Y1	Data 1		IN
6	L/F	X2	Data 2		IN
8	L/F	Y2	Data 2		IN
…	…	…	…	…	…
2N-1	L/F	XN	Data N		IN
2N	L/F	YN	Data N		IN

If the data set in the parameter table for the FGN instruction are X_n and Y_n, the data must be set so that $X_n \leqq Y_{n+1}$. The FGN instruction searches for an X_n/ Y_n pair within the parameter table for which $X_n \leqq X \leqq Y_{n+1}$ and computes the output value Y according to the following formula:

$$Y = Y_n + \frac{Y_{n+1} - Y_n}{X_{n+1} - X_n} \times (X - X_n) \quad (1 \leqq n \leqq N - 1)$$

If the X_n/ Y_n pair, which satisfies $X_n \leqq X \leqq Y_{n+1}$ for an input value X, does not exist in the parameter table, the result will be as follows:

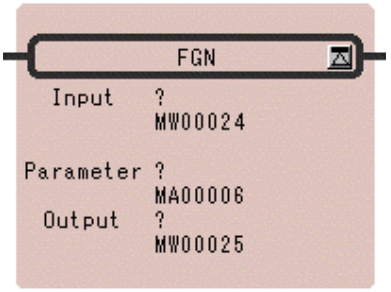
- IF $X < X_1$

$$Y = Y_1 + \frac{Y_2 - Y_1}{X_2 - X_1} (X - X_1)$$

- IF $X > X_1$

$$Y = Y_{n+1} + \frac{Y_n - Y_{n-1}}{X_n - X_{n-1}} (X - X_1)$$

[Format]



Symbol : FGN
Full Name : Function Generator
Category : DDC
Icon : FGN

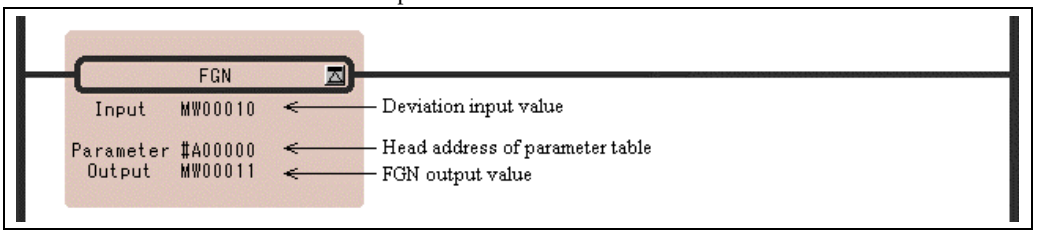
[Parameter]

Parameter Name	Setting
Input	· Any integer type, double-length integer and real number type register · Any integer type register with subscript · Any integer type, double-length integer and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type, double-length integer and real number type register (except for # and C registers) · Any integer type, double-length integer and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

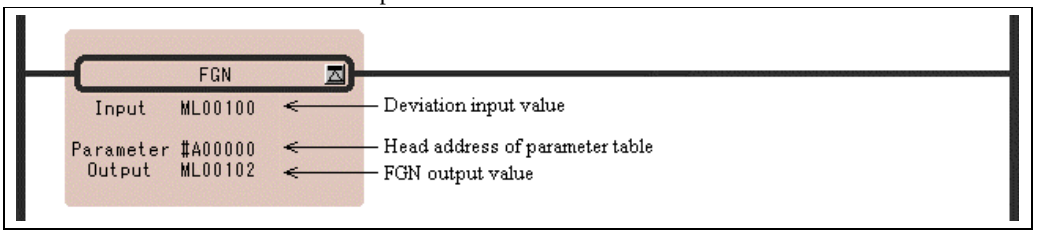
Integer type operation (number of data: N=20)

#W00000 to #W00040 are used for the parameter table.



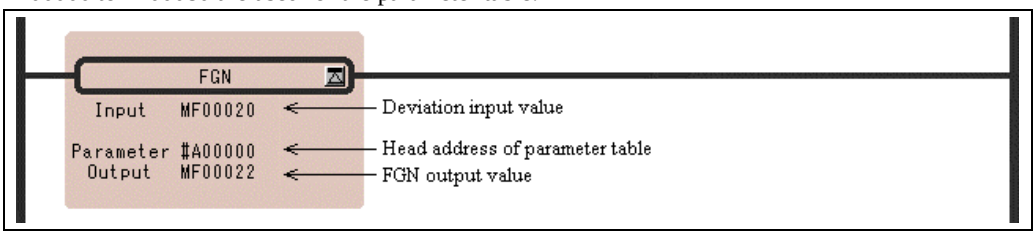
Double-length integer type operation (number of data: N=20)

#L00000 to #L00080 are used for the parameter table.



Real number type operation (number of data: N=20)

#F00000 to #F00080 are used for the parameter table.



7.10 INVERSE FUNCTION GENERATOR Instruction (IFGN)

[Outline]

The IFGN instruction generates a function curve according to the contents of a previously set parameter table. The input to the IFGN instruction can be integer, double-length integer, or real number data.

The configuration of the parameter table differs according to the type of data.

If the data set in the parameter table for the IFGN instruction are Xn and Yn, the data must be set so that Yn is less than or equal to Yn+1. The IFGN instruction searches for an Xn/Yn pair within the parameter table in which Yn is less than or equal to Y which is less than or equal to Yn+1 from input value Y and calculates the output value X.

Table of Integer Type IFGN Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	N	Number of data	Number of pairs of X and Y	IN
1	W	X1	Data 1		IN
2	W	Y1	Data 1		IN
3	W	X2	Data 2		IN
4	W	Y2	Data 2		IN
…	…	…	…	…	…
2N-1	W	XN	Data N		IN
2N	W	YN	Data N		IN

Table of Real Type IFGN Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	N	Number of data	Number of pairs of X and Y	IN
1	W	—	(Reserve)	Reserve register	IN
2	L/F	X1	Data 1		IN
4	L/F	Y1	Data 1		IN
6	L/F	X2	Data 2		IN
8	L/F	Y2	Data 2		IN
…	…	…	…	…	…
2N-1	L/F	XN	Data N		IN
2N	L/F	YN	Data N		IN

If the data set in the parameter table for the IFGN instruction are X_n and Y_n, the data must be set so that $X_n \leqq Y_{n+1}$. The IFGN instruction searches for an X_n/ Y_n pair within the parameter table for which $Y_n \leqq Y \leqq Y_{n+1}$ and computes the output value Y according to the following formula:

$$X = X_n + \frac{X_{n+1} - X_n}{Y_{n+1} - Y_n} \times (Y - Y_n) \quad (1 \leqq n \leqq N - 1)$$

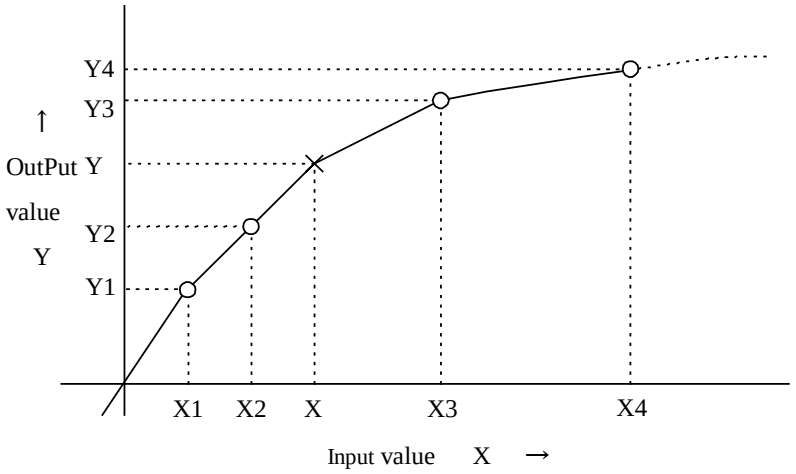
If the X_n/ Y_n pair, which satisfies $Y_n \leqq Y \leqq Y_{n+1}$ for an input value Y, does not exist in the parameter table, the result will be as follows:

- IF $Y < Y_1$

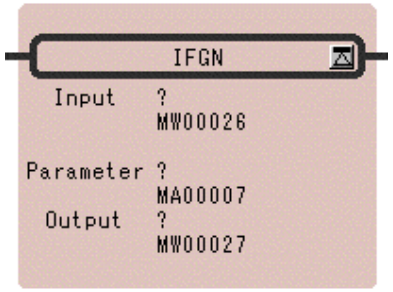
$$X = X_1 + \frac{X_2 - X_1}{Y_2 - Y_1} (Y - Y_1)$$

- IF $Y > Y_1$

$$X = X_{n+1} + \frac{X_n - X_{n-1}}{Y_n - Y_{n-1}} (Y - Y_1)$$



[Format]



Symbol : IFGN
Full Name : Inverse Function Generator
Category : DDC
Icon : 

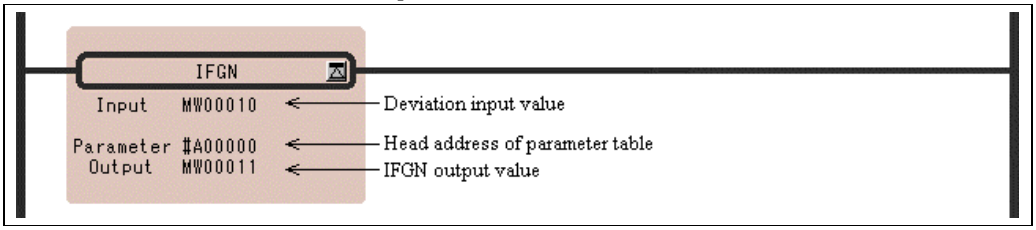
[Parameter]

Parameter Name	Setting
Input	· Any integer type, double-length integer and real number type register · Any integer type register with subscript · Any integer type, double-length integer and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type, double-length integer and real number type register (except for # and C registers) · Any integer type, double-length integer and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

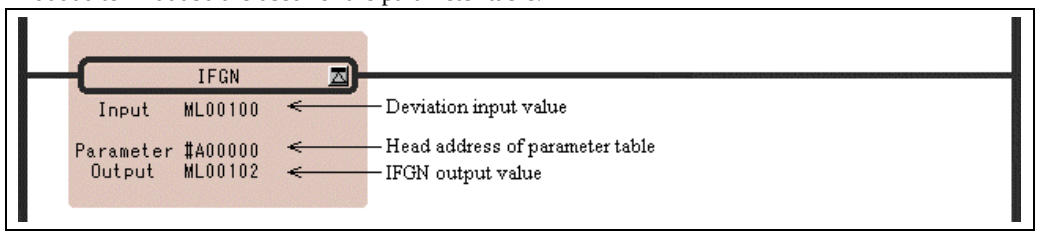
Integer type operation (number of data: N=20)

#W00000 to #W00040 are used for the parameter table.



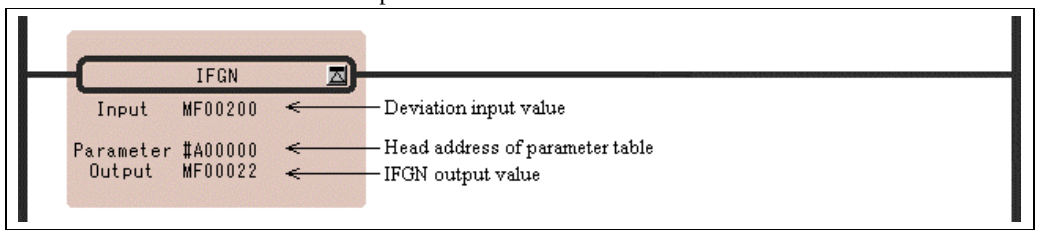
Double-length integer type operation (number of data: N=20)

#L00000 to #L00080 are used for the parameter table.



Real number type operation (number of data: N=20)

#F00000 to #F00080 are used for the parameter table.



7.11 LINEAR ACCELERATOR/DECELERATOR 1 Instruction (LAU)

[Outline]

The LAU instruction performs acceleration and deceleration at a fixed acceleration/ deceleration rate upon input of a speed reference (*Input*). The operation is performed according to the contents of a previously set parameter table.

The input to the LAU operation must be integer or real number data. Double-length data cannot be used. The configurations of the parameter tables for integer and real number data are different. Operations are performed by processing each parameter as an integer consisting of the lower-place 16 bits.

Table of Integer Type LAU Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	LV	100% input level	Scale of the 100% input	IN
2	W	AT	Acceleration time	Time for acceleration from 0% to100% (0.1s)	IN
3	W	BT	Deceleration time	Time for deceleration from 0% to100% (0.1s)	IN
4	W	QT	Quick stop time	Time for quick stop from 100% to 0% (0.1s)	IN
5	W	V	Current speed	LAU output (also output to the A register)	OUT
6	W	DVDT	Current acceleration / deceleration speed	Scaled with the normal acceleration rate being set to 5000.	OUT
7	W	—	(Reserve)	Reserve register	—
8	W	VIM	Previous speed reference	For storage of the previous value of the speed reference input	OUT
9	W	DVDTK	Remainder	Scaling coefficient of the current acceleration / deceleration speed (DVDT) (-32768 to 32767)	IN
10	L	REM	Remainder	Remainder of the acceleration / deceleration rate	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	RN	Line is running	"ON" is input while the line is running.	IN
1	QS	Quick stop	"OFF" is input upon quick stop. *1	IN
2	DVDTF	DVDT Operation not executed	"ON" is input at non-execution of DVDT operation.	IN
3	DVDTS	DVDT Operation selection	Selection DVDT operation type	IN
4 to 7	—	(Reserve)	Reserve relay for input	IN
8	ARY	In acceleration	"ON" is output during acceleration.	OUT
9	BRY	In deceleration	"ON" is output during deceleration.	OUT
A	LSP	Zero speed	"ON" is output at a speed of 0.	OUT
B	EQU	Coincidence	"ON" is output when input value = output value.	OUT
C to F	—	(Reserve)	Reserve relay for input	OUT

*1 : When the quick stop (QS) is "OFF", the quick stop time is used for the acceleration / deceleration time.

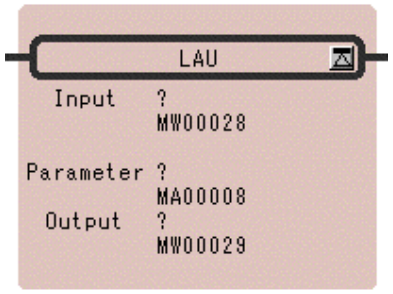
Table of Real Type LAU Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	F	LV	100% input level	Scale of the 100% input	IN
4	F	AT	Acceleration time	Time for acceleration from 0% to100% (s)	IN
6	F	BT	Deceleration time	Time for deceleration from 0% to100% (s)	IN
8	F	QT	Quick stop time	Time for quick stop from 100% to 0% (s)	IN
10	F	V	Current speed	LAU output (also output to the A register)	OUT
12	F	DVDT	Current acceleration / deceleration speed	Current acceleration/ deceleration is output	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	RN	Line is running	"ON" is input while the line is running.	IN
1	QS	Quick stop	"OFF" is input upon quick stop.	IN
2 to 7	—	(Reserve)	Reserve relay for input	IN
8	ARY	In acceleration	"ON" is output during acceleration.	OUT
9	BRY	In deceleration	"ON" is output during deceleration.	OUT
A	LSP	Zero speed	"ON" is output at a speed of 0.	OUT
B	EQU	Coincidence	"ON" is output when input value = output value.	OUT
C to F	—	(Reserve)	Reserve relay for input	OUT

[Format]



Symbol : LAU
Full Name : Linear Accelerator
Category : DDC
Icon :

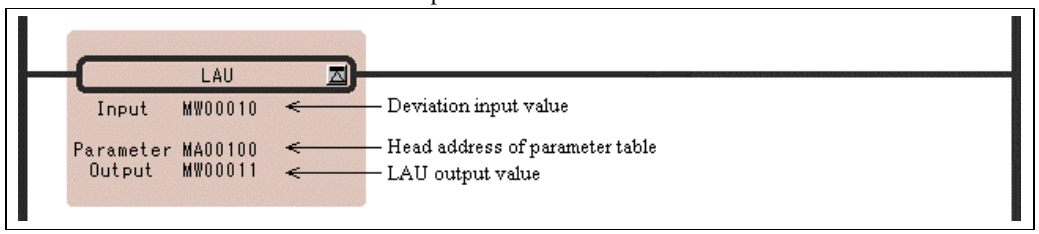
[Parameter]

Parameter Name	Setting
Input	· Any integer, double-length integer type and real number type register · Any integer, double-length integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer, double-length integer type and real number type register (except for # and C registers) · Any integer, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

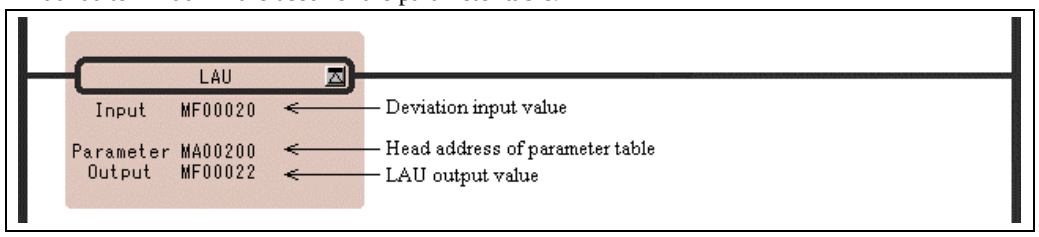
Integer type operation

MW00100 to MW000106 are used for the parameter table.



Real number type operation

MF00200 to MF00212 are used for the parameter table.



7.12 LINEAR ACCELERATOR/DECELERATOR 2 Instruction (SLAU)

[Outline]

The SLAU instruction performs acceleration and deceleration at a variable acceleration/deceleration rate upon input of a speed reference (*Input*). The operation is performed according to the contents of the previously set parameter table.

Positive and negative values can be entered for speed reference input. Always set a value so that the linear acceleration or deceleration time (AT or BT) is greater than or equal to the S-curve acceleration or deceleration time (AAT or BBT).

The input to the SLAU operation must be integer or real number data. Double-length integer data cannot be used. The configurations of the parameter tables for integer and real number data are different.

Table of Integer Type SLAU Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	LV	100% input level	Scale of the 100% input	IN
2	W	AT	Acceleration time	Time for acceleration from 0% to100% (0.1s)	IN
3	W	BT	Deceleration time	Time for deceleration from 0% to100% (0.1s)	IN
4	W	QT	Quick stop time	Time for quick stop from 100% to 0% (0.1s)	IN
5	W	AAT	S-curve acceleration time	Time spent in the S-curve region of acceleration (0.01-32.00s)	IN
6	W	BBT	S-curve deceleration time	Time spent in the S-curve region of deceleration (0.01-32.00s)	IN
7	W	V	Current speed	SLAU output (also output to the A register)	IN
8	W	DVDT1	Current acceleration /deceleration speed1 (DVDT1)	Scaled with the normal acceleration rate being set to 5000.	OUT
9	W	—	(Reserve)	Reserve register	—
10	W	ABMD	Speed increase upon holding	Amount of change in speed after hold instruction and until stabilization.	OUT
11	W	REM1	Remainder	Remainder of the acceleration and deceleration rate	OUT
12	W	—	(Reserve)	Reserve register	—
13	W	VIM	Previous speed reference	For storage of the previous value of the speed reference.	OUT
14	L	DVDT2	Current acceleration /deceleration speed2 (DVDT2)	1000 times of the current acceleration / deceleration speed	OUT
16	L	DVDT3	Current acceleration /deceleration speed3 (DVDT3)	Current acceleration / deceleration speed (=DCDT2/1000)	OUT
18	L	REM2	Remainder	Remainder of the S-curve region acceleration and deceleration rate	OUT
20	W	REM3	Remainder	Remainder of the current speed	OUT
21	W	DVDTK	DVDT1 coefficient	Scaling coefficient of the current acceleration / deceleration speed (DVDT) (-32768 to 32767)	IN

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	RN	Line is running	"ON" is input while the line is running.	IN
1	QS	Quick stop	"OFF" is input upon quick stop.	IN
2	DVDTF	DVDT Operation not executed	"OFF" is input at non-execution of DVDT1 operation.	IN
3	DVDTS	DVDT Operation selection	Selection DVDT1 operation type	IN
4 to 7	—	(Reserve)	Reserve relay for input	IN
8	ARY	In acceleration	"ON" is output during acceleration.	OUT
9	BRY	In deceleration	"ON" is output during deceleration.	OUT
A	LSP	Zero speed	"ON" is output at a speed of 0.	OUT
B	EQU	Coincidence	"ON" is output when input value = output value.	OUT
C	EQU	(Reserve)	Reserve relay for output	OUT
D	CCF	Work relay	System internal work relay	OUT
E	BBF	Work relay	System internal work relay	OUT
F	AAF	Work relay	System internal work relay	OUT

*1: When the quick stop (QS) is "OFF", the quick stop time is used for the acceleration / deceleration time.

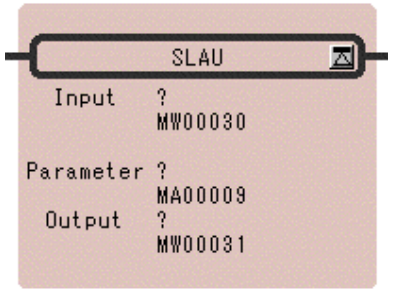
Table of Real Type SLAU Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *[1]	IN/OUT
1	W	—	(Reserve)	Reserve register	—
2	F	LV	100% input level	Scale of the 100% input	IN
4	F	AT	Acceleration time	Time for acceleration from 0% to100% (s)	IN
6	F	BT	Deceleration time	Time for deceleration from 0% to100% (s)	IN
8	F	QT	Quick stop time	Time for quick stop from 100% to 0% (s)	IN
10	F	AAT	S-curve acceleration time	Time spent in the S-curve region of acceleration (s)	IN
12	F	BBT	S-curve deceleration time	Time spent in the S-curve region of deceleration (s)	OUT
14	F	V	Current speed	SLAU output (also output to the F register)	OUT
16	F	DVDT1	Current acceleration /deceleration	Current acceleration / deceleration speed is output.	OUT
18	F	ABMD	Speed increase upon holding	Amount of change in speed after hold instruction and until stabilization.	OUT

*[1] : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	RN	Line is running	"ON" is input while the line is running.	IN
1	QS	Quick stop	"OFF" is input upon quick stop.	IN
2 to 7	—	(Reserve)	Reserve relay for input	IN
8	ARY	In acceleration	"ON" is output during acceleration.	OUT
9	BRY	In deceleration	"ON" is output during deceleration.	OUT
A	LSP	Zero speed	"ON" is output at a speed of 0.	OUT
B	EQU	Coincidence	"ON" is output when input value = output value.	OUT
C to F	—	(Reserve)	Reserve relay for output	OUT

[Format]



Symbol : SLAU
Full Name : S-Curve Linear Accelerator
Category : DDC
Icon :

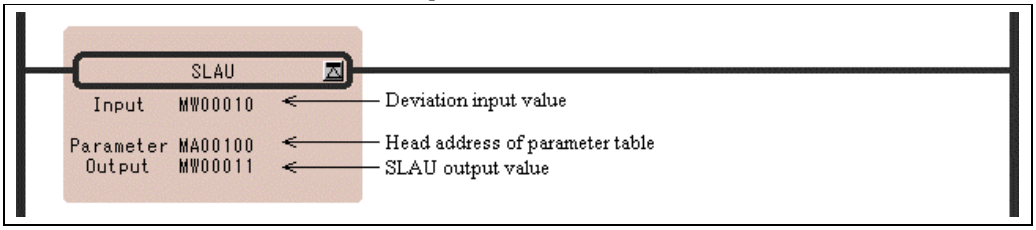
[Parameter]

Parameter Name	Setting
Input	· Any integer, double-length integer type and real number type register · Any integer, double-length integer type and real number type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer, double-length integer type and real number type register (except for # and C registers) · Any integer, double-length integer type and real number type register with subscript (except for # and C registers) · Subscript register

[Program Example]

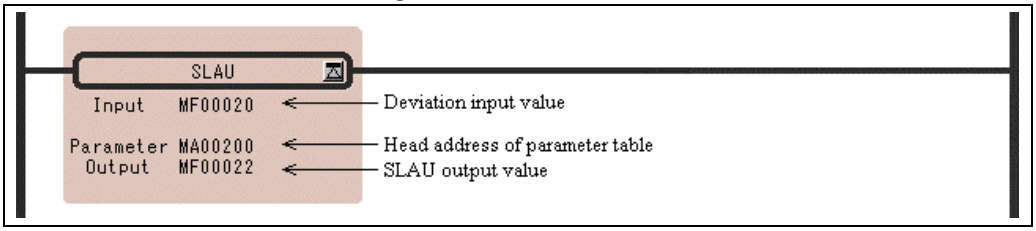
Integer type operation

MW00100 to MW000111 are used for the parameter table.



Real number type operation

MF00200 to MF00218 are used for the parameter table.



7.13 PULSE WIDTH MODULATION Instruction (PWM)

[Outline]

The PWM instruction converts the value of the *Input* to PWM as an input value (between -100.00 and 100.00%, with increments of 0.01%) and outputs the result to the *Output* and the parameter table.

Double-length integer and real number operations are not allowed.

$$\text{Time of ON output} = \frac{\text{PWMT}\ (X + 10000\ )}{20000}$$

$$\text{Number of ON outputs} = \frac{\text{PWMT}\ (\ X + 10000\ )}{Ts \times 20000}$$

X : input value

Ts : scan time set value (ms)

When 100.00% is input : all ON

When 0% is input : 50% duty (50%ON)

When －100.00% is input : all OFF

When the PWM reset (PWMRST) is ON, all internal operations are reset and PWM operations are performed with that instant as the starting point. After turning the power ON, set PWMRST to ON to clear all internal operations, then use the PWM instruction.

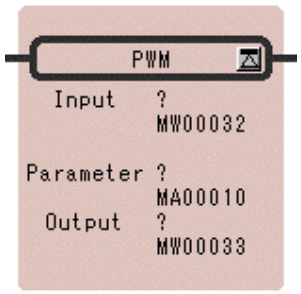
Table of Integer Type PWM Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	W	RLY	Relay I/O	Relay input, relay output *1	IN/OUT
1	W	PWMT	PWM cycle	PWM cycle (1MS) (1 to 327676ms)	IN
2	W	ONCNT	ON output setting timer	ON output setting timer (1ms)	OUT
3	W	CVON	ON output count timer	ON output count timer (1ms)	OUT
4	W	CVON REM	ON output count timer remainder	ON output count timer remainder (0.1ms)	OUT
5	W	OFFCNT	OFF output setting timer	OFF output setting timer (1ms)	OUT
6	W	CVOFF	OFF output count timer	OFF output count timer (1ms)	OUT
7	W	CVOFF REM	OFF output count timer remainder	OFF output count timer remainder (0.1ms)	OUT

*1 : Relay I/O Bit Assignment

BIT	Symbol	Name	Specification	I/O
0	PWM RST	PWM reset	"ON" is input when PWM is reset	IN
2 to 7	－	(Reserve)	Reserve relay for input	IN
8	PWM OUT	PWM output	PWM is output (two-value output: ON = 1, OFF = 0)	OUT
9 to F	－	(Reserve)	Reserve relay for output	OUT

[Format]



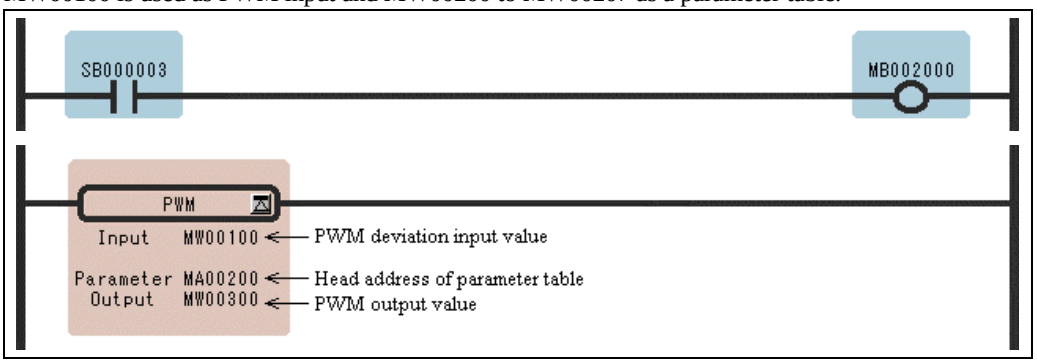
Symbol : PWM
Full Name : Pulse Width Modulation
Category : DDC
Icon : 

[Parameter]

Parameter Name	Setting
Input	· Any integer type register · Any integer type register with subscript · Subscript register · Constant
Parameter	· Register address (except for # and C registers) · Register address with subscript (except for # and C registers)
Output	· Any integer type register (except for # and C registers) · Any integer type register with subscript (except for # and C registers) · Subscript register · Constant

[Program Example]

MW00100 is used as PWM input and MW00200 to MW00207 as a parameter table.



PWM reset with the first scan of DWG.L. (SB000001 when used with DWG.H)

8 Table Data Manipulation Instructions

8.1 BLOCK READ Instruction (TBLBR)

[Outline]

The TBLBR instruction consecutively reads file register table elements in block format that are specified by table name(*Table Name*), row number, and column number. It then stores the elements in a continuous region starting with the specified register(*Read Data*). The type of the element being read is automatically determined according to the specified table. The type of the storage destination register is ignored and the read data is stored according to the table element type without converting the data type.

If errors such as invalid table names, invalid row numbers, invalid column numbers, or insufficient storage register data length are found, they are reported and the contents of the storage destination register is retained without reading the data.

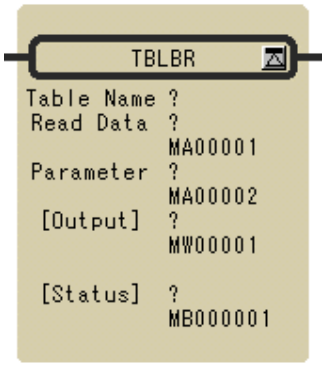
Upon normal termination, the number of words transferred is set in the *[Output]*, and the *[Status]* is turned OFF.

When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON.

Table of Block Read Instruction Parameter

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW1	Table element beginning row number	Target table element beginning row number (1 to 65535)	IN
2	L	COL1	Table element beginning column number	Target table element beginning column number (1 to 32767)	IN
4	W	RLEN	Number of row elements	Number of row elements (1 to 32767)	IN
5	W	CLEN	Number of column elements	Number of column elements (1 to 32767)	IN

[Format]



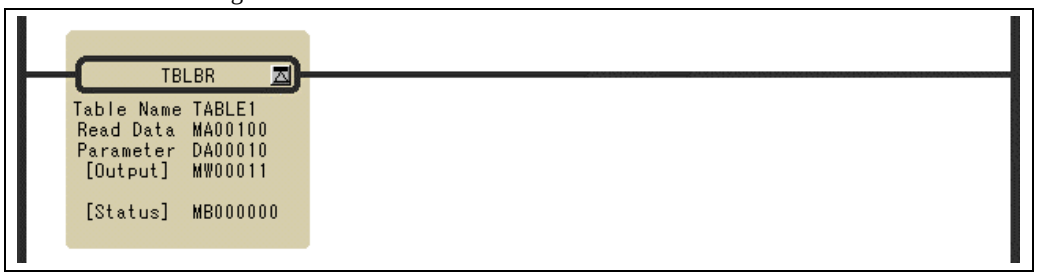
Symbol : TBLBR
Full Name : Table Block Read
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Table Name	Table name
Read Data	· Register address (except for # and C registers) · Register address with subscript
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

From the table defined as TABLE1, with DW00010 to DW00013 as a parameter table, data (element type is integer type) from the starting table element position to the end position are stored in block form in the area starting from MW00100.



8.2 BLOCK WRITE Instruction (TBLBW)

[Outline]

The TBLBW instruction writes the contents of a continuous region starting with the specified register(*Write Data*) to the file register table elements in block format that are specified by table name(*Table Name*), row number, and column number. The data is processed assuming that the type of the table elements in the storage destination register is the same as that of the table elements in the storage source register.

If errors such as invalid table names, invalid row numbers, invalid column numbers, or insufficient storage register data length are found, they are reported and the contents of the storage destination register is retained without writing the data.

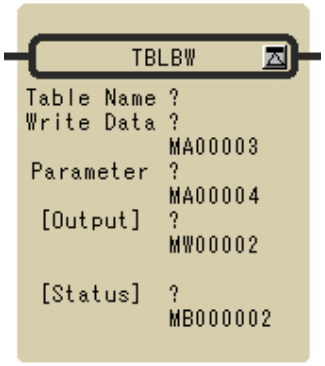
Upon normal termination, the number of words transferred is set in the *[Output]* and the *[Status]* is turned OFF.

When an error occurs, the corresponding error code is set in the *[Output]* and the *[Status]* is turned ON.

Table of Block Write Instruction Parameter

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW1	Table element beginning row number	Target table element beginning row number (1 to 65535)	IN
2	L	COL1	Table element beginning column number	Target table element beginning column number (1 to 32767)	IN
4	W	RLEN	Number of row elements	Number of row elements (1 to 32767)	IN
5	W	CLEN	Number of column elements	Number of column elements (1 to 32767)	IN

[Format]



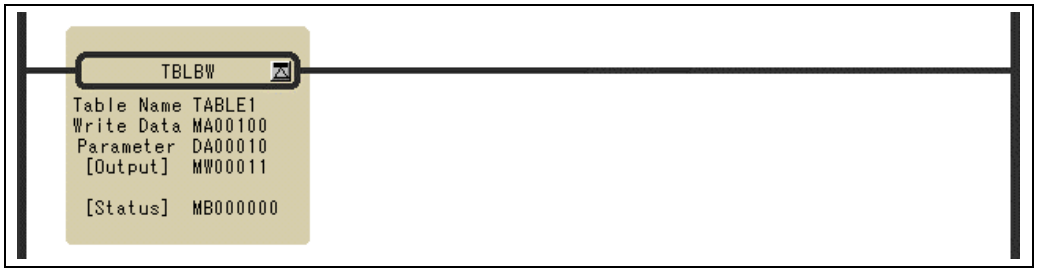
Symbol ：TBLBW
Full Name：Table Block Write
Category ：TABLE
Icon ： 

[Parameter]

Parameter Name	Setting
Table Name	Table name
Write Data	· Register address (except for # and C registers) · Register address with subscript
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

From the table defined as TABLE1, with DW00010 to DW00013 as a parameter table, area (element type is integer type) from the starting table element position to the end position are stored in block form in the data from MW00100.



8.3 ROW SEARCH Instruction (TBLSRL)

[Outline]

The TBLSRL instruction searches for the column element of the file register table specified by the table name(*Table Name*), row number, and column number. If there is data that matches the data in the specified register(*Search Data*), the instruction reports that row number. The type of the data to be searched is automatically determined according to the specified table.

If errors such as invalid table names, invalid row numbers, invalid column numbers, or insufficient storage register data length are found, they are reported.

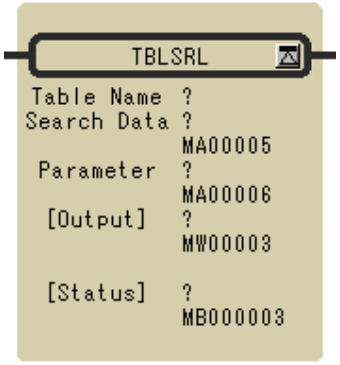
Upon normal termination, if a matching column element is found, 1 is set in the search result, the row number is set in the *[Output]*, and the *[Status]* is turned OFF. If no matching column element is found, 0 is set in the search result.

When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON.

Table of Row Search Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW1	Head row number of table element	Head row number of the target table element (1 to 65535)	IN
2	L	ROW2	Last row number of table element	Last row number of the target table element (1 to 65535)	IN
4	L	COLUMN	Table element column number	Column number of the target table element (1 to 32767)	IN
6	W	FIND	Search result	Search results 0 : No matching row 1 : Matching row exists	OUT

[Format]



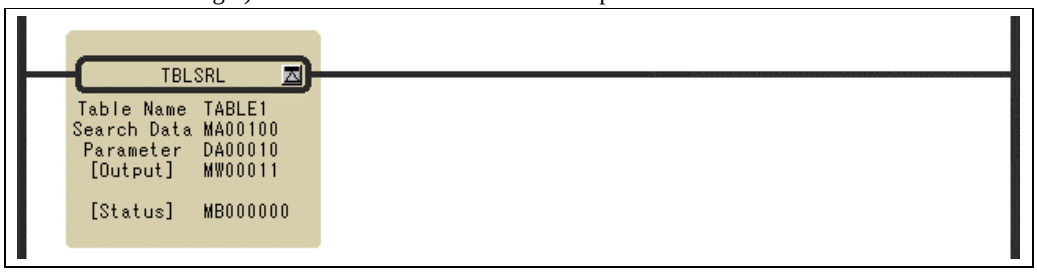
Symbol : TBLSRL
Full Name : Table Row Search
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Table Name	Table name
Search Data	· Register address · Register address with subscript
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

The table defined as TABLE1 is searched for data which matchers MW00100 (when the type of the searched table is integer) with DW00010 to DW00013 as a parameter table.



8.4 COLUMN SEARCH Instruction (TBLSRC)

[Outline]

The TBLSRC instruction searches for the row element of the file register table specified by a table name(*Table Name*), row number, and column number. If there is data that matches the data of the specified register(*Search Data*), the instruction reports that column number. The type of the data to searched is automatically determined according to the specified table.

If errors such as invalid table names, invalid row numbers, invalid column numbers, or insufficient storage register data length are found, they are reported.

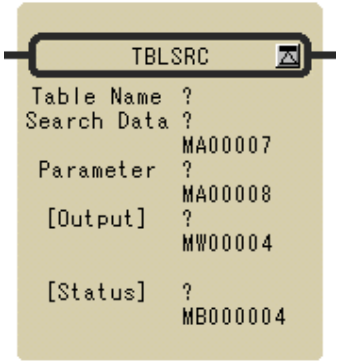
Upon normal termination, if a matching row element is found, 1 is set in the search result, the row number is set in the *[Output]*, and the *[Status]* is turned OFF. If no matching column element is found, 0 is set in the search result.

When an error occurs, the corresponding error code is set in the *[Output]* and the *[Status]* is turned ON.

Table of Column Search Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW1	Table element row number	Row number of the target table element (1 to 65535)	IN
2	L	COLUMN1	Head column number of table element	Head column number of the target table element (1 to 32767)	IN
4	L	COLUMN2	Last column number of table element	Last column number of the target table element (1 to 32767)	IN
6	W	FIND	Search result	Search result 0 : No matching row 1 : Matching row exists	OUT

[Format]



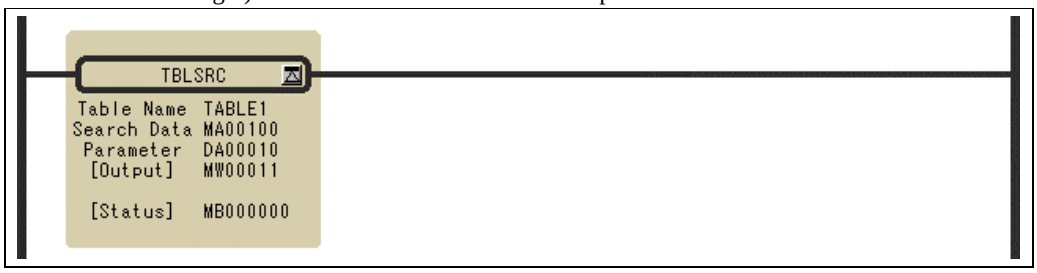
Symbol : TBLSRC
Full Name : Table Column Search
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Table Name	Table name
Search Data	· Register address · Register address with subscript
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

The table defined as TABLE1 is searched for data which matchers MW00100 (when the type of the searched table is integer) with DW00010 to DW00013 as a parameter table.



8.5 BLOCK CLEAR Instruction (TBLCL)

[Outline]

The TBLCL instruction clears the data of the block element of the file register table specified by a table name(*Table Name*), row number, and column number. If the element type is a character string, space is written. If the element type is a numeric value, 0 is written.

If both the table element leading row number and the table element leading column number are 0, the entire table is cleared.

If errors such as invalid table names, invalid row numbers, invalid column numbers, or insufficient storage register data length are found, they are reported and data is not written.

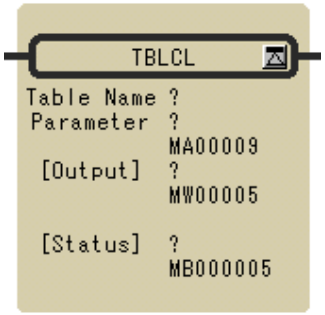
Upon normal termination, the number of words cleared is set in the *[Output]*, and the *[Status]* is turned OFF.

When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON.

Table of Block Clear Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW	Head row number of table element	Head row number of the target table element (1 to 65535)	IN
2	L	COL	Head column number of table element	Head column number of the target table element (1 to 32767)	IN
4	W	RLEN	Number of row elements	Number of row elements (1 to 32767)	IN
5	W	CLEN	Number of column elements	Number of column elements (1 to 32767)	IN

[Format]



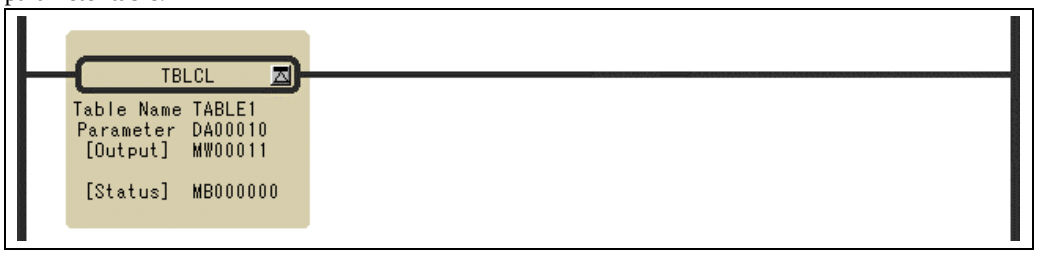
Symbol ：TBLCL
Full Name：Table Block Clear
Category ：TABLE
Icon ： 

[Parameter]

Parameter Name	Setting
Table Name	Table name
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

The designated block in the table defined as TABLE1 is cleared using DW00010 to DW00013 as a parameter table.



8.6 BLOCK MOVE Instruction (TBLMV)

[Outline]

The TBLMV instruction transfers the data of the block elements of the file register table specified by the table name(*Table Name*), row number, and column number to another block. Block transfer between different tables and data transfer within the same table are both possible. If the column element types of the source and destination blocks are different, an error is reported and data is not written.

If errors such as invalid table names, invalid row numbers, invalid column numbers, or unmatched storage destination element type are found, they are reported and data is not written.

Upon normal termination, the number of words transferred is set in the *[Output]*, and the *[Status]* is turned OFF.

When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON.

Table of Inter Table Block Transfer Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW1	Head row number of table element	Head row number of the transfer source table element (1 to 65535)	IN
2	L	COLUMN1	Head column number of table element	Head column number of the transfer source table element (1 to 32767)	IN
4	W	RLEN	Number of row elements	Number of transfer row elements (1 to 32767)	IN
5	W	CLEN	Number of column elements	Number of transfer column elements (1 to 32767)	IN
6	L	ROW2	Head row number of table element	Head row number of the transfer destination table element (1 to 65535)	IN
7	L	COLUMN2	Head column number of table element	Head column number of the transfer destination table element (1 to 32767)	IN

[Format]

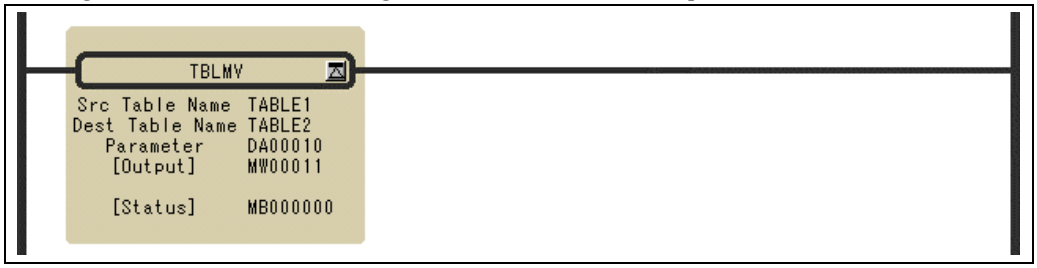
Symbol : TBLMV
Full Name : Table Block Move
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Src Table Name	Table name
Dest Table Name	Table name
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

There are tables defined as TABLE1 and TABLE2. The designated block in TABLE1 is transferred to the designated block in TABLE2 using DW00010 to DW00015 as a parameter table.



8.7 QUEUE TABLE READ Instructions (QTBLR, QTBLRI)

[Outline]

The QTBLR/QTBLRI instruction consecutively reads file register table column elements specified by table name(*Table Name*), row numbers, and column numbers and stores the elements in the continuous region starting with the specified register(*Read Data*). The type of the element being read is automatically determined according to the specified table. The type of the storage destination register is ignored and the read data is stored according to the table element type without converting the data type.

The QTBLR instruction does not change the queue table read pointer. The QTBLRI instruction advances the queue table read pointer by one row.

If errors such as invalid table names, invalid row numbers, invalid column numbers, insufficient storage register data length, or empty queue buffers are found, they are reported, data is not read, and the queue table read pointer does not advance. The contents of the storage destination register are retained.

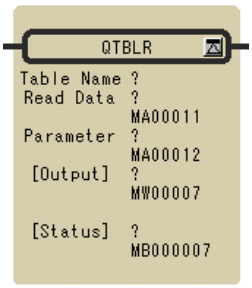
Upon normal termination, the number of words transferred is set in the *[Output]*, and the *[Status]* is turned OFF.

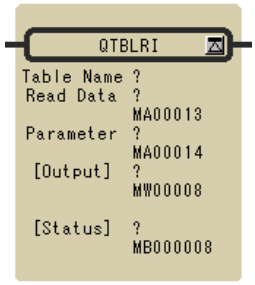
When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON. The pointer value does not change.

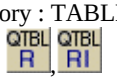
Table of Queue Table Read Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW	Relative row number for table elements	Relative row number of the target table elements (1 to 65535)	IN
2	L	COLUMN	Head column number of table element	Head column number of the target table element (1 to 32767)	IN
4	W	CLEN	Number of column elements	Number of column elements to be continuously read out (1 to 32767)	IN
5	W	Reserve			
6	L	RPTR	Read pointer	Read pointer of the queue after execution	OUT
8	L	WPTR	Write pointer	Write pointer of the queue after execution	OUT

[Format]





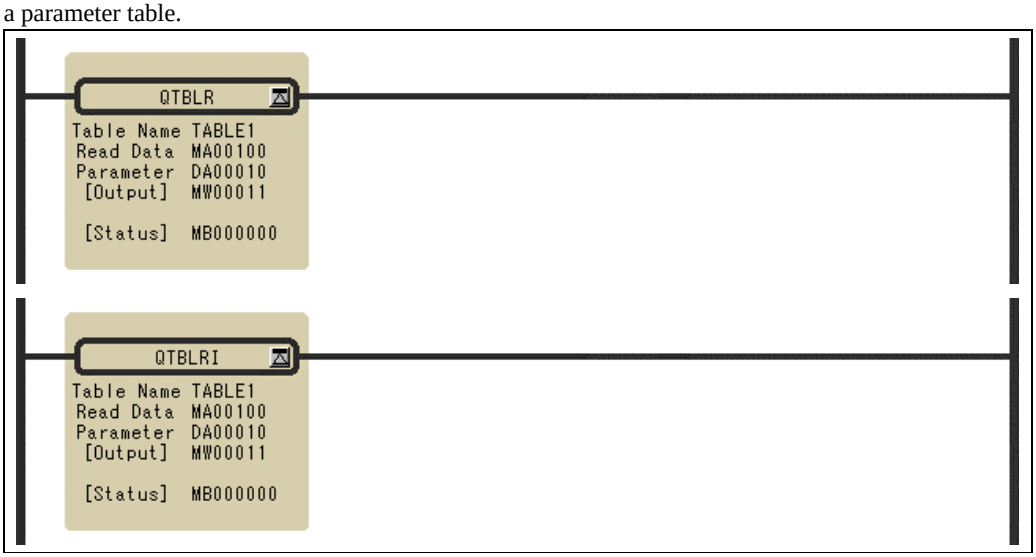
Symbol : QTBLR
QTBLRI
Full Name : Queue Table Read
Queue Table Read
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Table Name	Table name
Read Data	· Register address (except for # and C registers) · Register address with subscript
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

Column element data (element format assumed to be integer) from the table defined as TABLE1 is stored for the number of column elements beginning with MW00100 using DW00010 to DW00012 as a parameter table.



8.8 QUEUE TABLE WRITE Instructions (QTBLW, QTBLWI)

[Outline]

The QTBLW/QTBLWI instruction writes the contents of the continuous region starting with the specified register(*Write Data*) to the file register table column elements specified by table name(*Table Name*), row numbers, and column numbers. The data is processed assuming that the type of the table elements in the storage destination register is the same as that of the table elements in the storage source register.

The QTBLW instruction does not change the queue table write pointer. The QTBLWI instruction advances the queue table write pointer by one row.

If errors such as invalid table names, invalid row numbers, invalid column numbers, insufficient storage register data length, or full queue buffers are found, they are reported, data is not written, and the queue table write pointer does not advance.

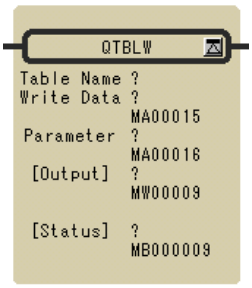
Upon normal termination, the number of words transferred is set in the *[Output]*, and the *[Status]* is turned OFF.

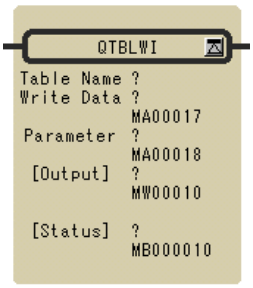
When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON. The pointer value does not change.

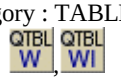
Table of Queue Table Write Instruction Parameters

ADR	Type	Symbol	Name	Specification	I/O
0	L	ROW	Relative row number for table elements	Relative row number of the target table elements (1 to 65535)	IN
2	L	COLUMN	Head column number of table element	Head column number of the target table element (1 to 32767)	IN
4	W	CLEN	Number of column elements	Number of column elements to be continuously written (1 to 32767)	IN
5	W	Reserve			
6	L	RPTR	Read pointer	Read pointer of the queue after execution	OUT
8	L	WPTR	Write pointer	Write pointer of the queue after execution	OUT

[Format]





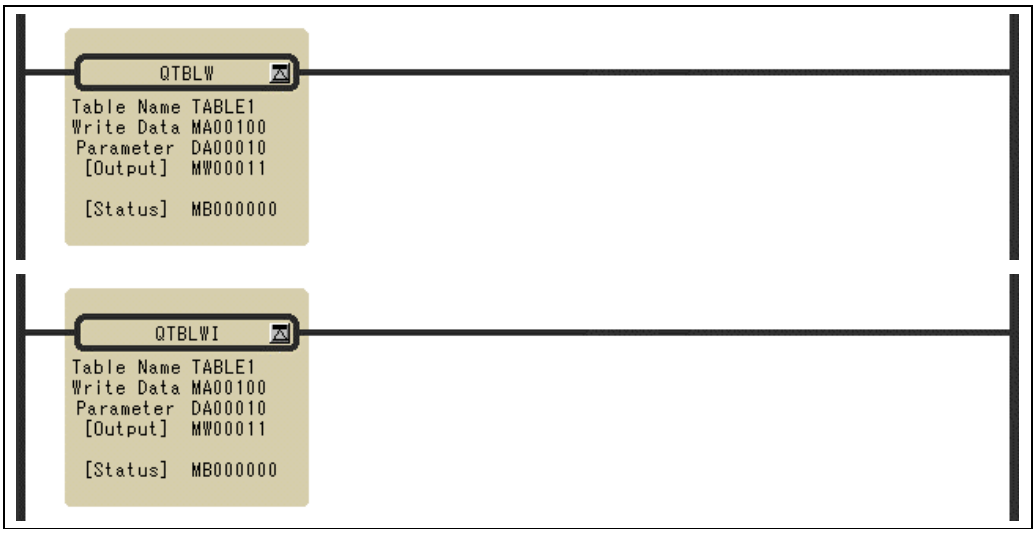
Symbol : QTBLW
QTBLWI
Full Name : Queue Table White
Queue Table Pointer Clear
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Table Name	**表名称**
Write Data	· Register address (except for # and C registers) · Register address with subscript
Parameter	· Register address · Register address with subscript
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

Integer form consecutive data for the number of column elements beginning with MW00100 is written in column element data in the table defined as TABLE1 using DW00010 to DW00013 as a parameter table.



8.9 QUEUE POINTER CLEAR Instruction (QTBLCL)

[Outline]

The QTBLCL instruction returns the queue read and queue write pointers of the file register table specified by a table name(*Table Name*) to their initial state (first row).

Upon normal termination, 0 is set in the *[Output]*, and the *[Status]* is turned OFF.

When an error occurs, the corresponding error code is set in the *[Output]*, and the *[Status]* is turned ON.

[Format]

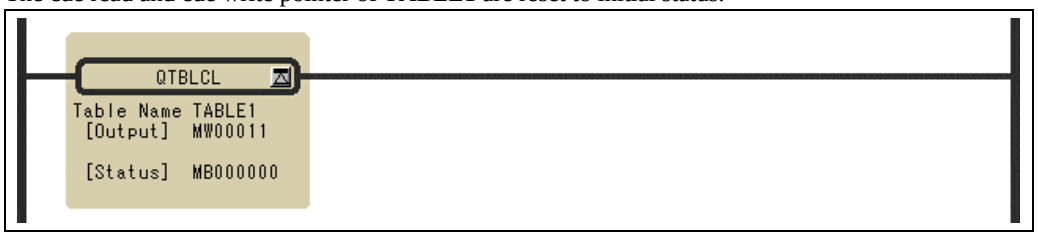
Symbol : QTBLCL
Full Name : Queue Table Pointer Clear
Category : TABLE
Icon : 

[Parameter]

Parameter Name	Setting
Table Name	Table name
[Output]	· Any integer type register (except for # and C registers) · Any integer type register with subscript · Subscript register * possible to omit
[Status]	· Any bit type register (except for # and C registers) · Any bit type register with subscript * possible to omit

[Program Example]

The cue read and cue write pointer of TABLE1 are reset to initial status.



9 Standard System Function

9.1 Counter Function (COUNTER)

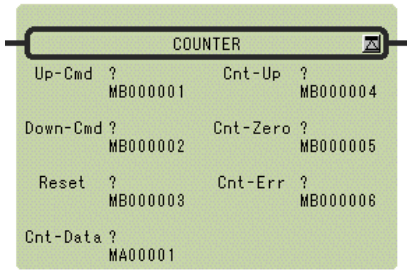
[Outline]

Increments or decrements the current value when the count up/down command (*Up-Cmd*, *Down-Cmd*) changes from OFF to ON.

When the counter reset command (*Reset*) becomes ON, the current counter value is set to 0. Also, the current counter value and the set value are compared and the comparison result is output.

* The current value will not be incremented neither decremented if a counter error (current value > set value) occurs.

[Format]



Symbol : COUNTER
Full Name : Counter
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting	
Input	Up-Cmd	B-VAL	Count up command (OFF→ON)	Data area for counter process 1 : Set value 2 : Current value 3 : Work flag
	Down-Cmd	B-VAL	Count down command (OFF→ON)	
	Reset	B-VAL	Counter reset command	
	Cnt-Data	Address input	Head address of data area for counter process (MW or DW register)	
Output	Cnt-Up	B-VAL	Becomes ON when current counter value = set value.	
	Cnt-Zero	B-VAL	Becomes ON when current counter value = 0.	
	Cnt-Err	B-VAL	Becomes ON when current counter value > set value.	

The forms of parameter input and output are shown in below.

Input Data Form	Input Designation	Description
Bit input	B-VAL	Designates the output to be of a bit type. The bit type data become the input to the function.
Integer type input	I-VAL	Designates the input to be of an integer type. The contents (integer data) of the register with the designated number become the input to the function.
	I-REG	Designates the input to be the contents of an integer type register. The number of the integer type register is designated when referencing the function. The contents (integer data) of the register with the designated number become the input to the function.
Double-length integer type input	L-VAL	Designates the input to be of a double-length integer type. When reference the function, the contents (double-length integer data) of the register with the designated number become the input to the function.
	L-REG	Designates the input to be the contents of a double-length integer type register. When reference the function, the contents (double-length integer data) of the register with the designated number become the input to the function.
Real number type input	F-VAL	Designates the input to be of a real number type. The contents (real number data) of the register with the designated number become the input to the function.
	F-REG	Designates the input to be the contents of a real number type register. The number of the real number type register is designated when referencing the function. The contents (real number data) of the register with the designated number become the input to the function.
Address input	—	Hands over the address of the designated register (an arbitrary integer register) to the function. Only 1 input is allowed in the case of a user function.

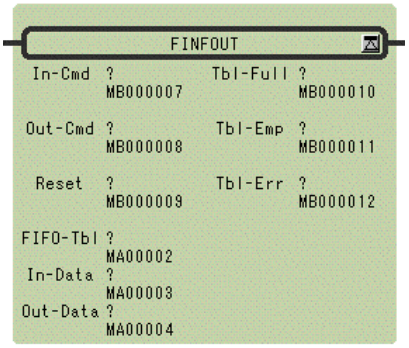
9.2 First-in First-out Function (FINFOUT)

[Outline]

This is a first-in first-out type block data transfer function. The FIFO data table is composed of a 4-word header part and a data buffer. 3 words of the header part (data size, input size, output size) must be set before this function is referenced.

- When the data input command (*In-Cmd*) becomes ON, the designated number of data is sequentially stored from the designated input data area to the data area of the FIFO table.
- When the data output command (*Out-Cmd*) becomes ON, the designated number of data are transferred from the head of the data area of the FIFO table to the designated output data area.
- When the reset command (*Reset*) becomes ON, the number (amount) of data stored is set to zero and the FIFO table empty output (*Tbl-Emp*) becomes ON.
- If "size of available space for data (empty size) < input size" or if "data size < output size," the FIFO table error (*Tbl-Err*) becomes ON.

[Format]



Symbol : FINFOUT
Full Name : First-in First-out
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting	
Input	In-Cmd	B-VAL	Data input command (IN-CMD)	FIFO Table Configuration 0 : data size 1 : input size 2 : output size 3 : number of data stored 4 : data
	Out-Cmd	B-VAL	Data output command (OUT-CMD)	
	Reset	B-VAL	Reset command	
	FIFO-Tbl	Address input	Head address of FIFO table (MW or DW address)	
	In-Data	Address input	Head address of input data (MW or DW address)	
	Out-Data	Address input	Head address of output data (MW or DW address)	
Output	Tbl-Full	B-VAL	FIFO table is full.	
	Tbl-Emp	B-VAL	FIFO table is empty.	
	Tbl-Err	B-VAL	FIFO table error.	

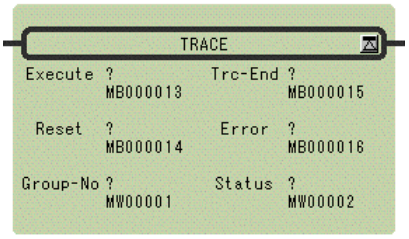
9.3 Trace Function (TRACE)

[Outline]

Performs execution control of the traces of the trace data designated by the trace group No. The trace is defined as "Data Trace Definition" screen.

- Tracing is executed when the trace execution command (*Execute*) is set to ON.
- The trace counter is reset when the trace reset command (*Reset*) is set to ON.
  The trace end (*Trc-End*) output is also reset at this time.
- The trace end (*Trc-End*) output is set to ON when the trace execution count becomes equal to the set count (set as Trace Definition).

[Format]



Symbol : TRACE
Full Name : Trace
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Trace execution command
	Reset	B-VAL	Trace reset command
	Group-No	I-REG	Designation of the trace group
Output	Trc-End	B-VAL	End of Trace
	Error	B-VAL	Occurrence of error
	Status	I-REG	Trace execution status

Configuration of the Trace execution status (STATUS) is described below.

Table 9.1 Configuration of the Trace Execution Status

Name	Bit No.	Remarks
Trace Data full	Bit 0	This becomes ON after one round of reading of the contents in the data trace memory of the designated group has been competed.
System Reserved	Bit 1 to Bit 7	
No trace definition	Bit8	The function will not be executed.
Designated group No. error	Bit9	The function will not be executed.
System Reserved	Bit 10 to Bit 12	
Execution timing error	Bit13	The function will not be executed.
System Reserved	Bit14	
System Reserved	Bit15	

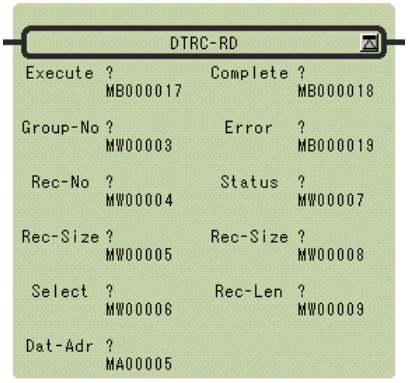
9.4 Data Trace Read Function (DTRC-RD)

[Outline]

Reads out the trace data of the main controller unit and stores this data in the user registers.

The data in the trace memory can be read out upon designating the record number and the number of records. The readout can be performed by designating just the necessary items in the record.

[Format]



Symbol : DTRC-RD
Full Name : Data-Trace Read
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Designation of the execution of data trace read
	Group-No	I-REG	Designation of the data trace group No. (1 to 4)
	Rec-No	I-REG	Designation of the head record No. for readout (0 to maximum record number-1)
	Rec-Size	I-REG	Designation of the number of records requested for readout (1 to maximum record number)
	Select	I-REG	Item to be read out (0001H to FFFFH) Bits 0 to F correspond to data designations 1 to 16 of the trace definition.
	Dat-Adr	Address input	Designation of the No. of the head register for readout (address of MW or DW)
Output	Complete	B-VAL	Completion of trace read
	Error	B-VAL	Occurrence of error
	Status	I-REG	Data trace read execution status
	Rec-Size	I-REG	Number of records read
	Rec-Len	I-REG	Length (in words) of 1 record that is read

9.4.1 Readout of Data

Readout of Data is described Figure 9.1.

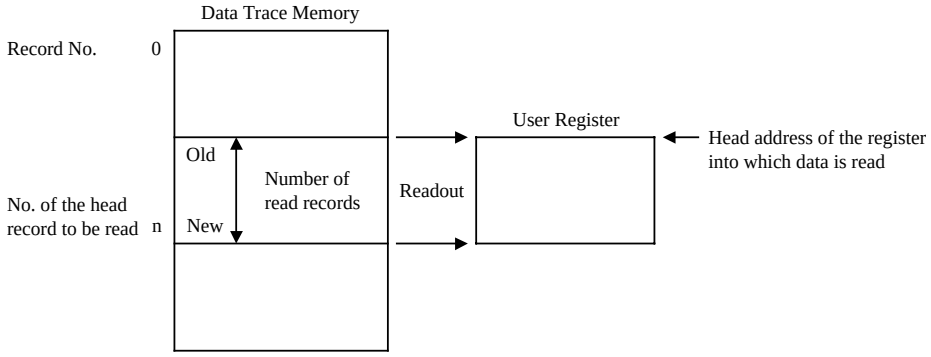


Figure 9.1 Data read

The most recent record No. of trace groups are each stored in SW00100 to SW00103.

Table 9.2 Newest Records Number

System register number	Data trace definition
SW00100	For group 1
SW00101	For group 2
SW00102	For group 3
SW00103	For group 4
SW00104	—
SW00105	—
SW00106	—
SW00107	—

9.4.2 Configuration of the Read Data

Configuration of the read data is described Figure 9.2.

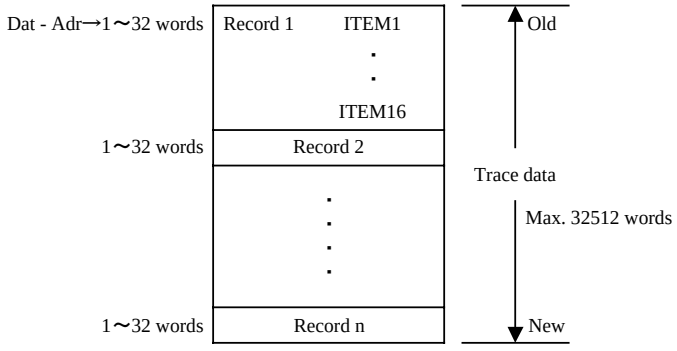


Figure 9.2 Configuration of the Read Data

■ Record Length

A Record is composed of the data for the selected items.

Word length of 1 record = Bn 1 word + Wn × 1 word + Ln + 2 words + Fn × 2 words

Bn : Number of bit type register selected points

Wn : Number of word type register selected points

Ln : Number of double-length integer type register selected points

Fn : Number of real number type register selected points

Maximum of record length = 32 words (e.g. when there are 16 double-length integer type or real number type registers)

Minimum of record length = 1 words (e.g. when there is one bit type or integer type register)

■ Number of Records

The Number of Records is the following.

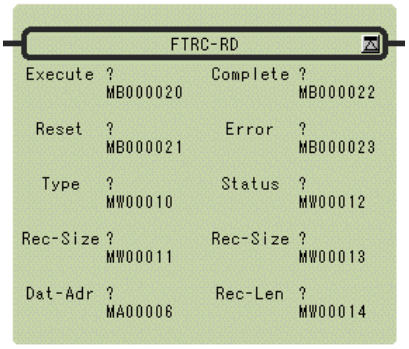
Maximum number of records	32512/ record length
Number of records when the record length is the maximum	0 to 1015
Number of records when the record length is the minimum	0 to 32511

9.5 Failure Trace Read Function (FTRC-RD)

[Outline]

Reads the failure trace data and stores them in the user register. The data in the trace buffer can be read out upon designating the number of records needed. Either the failure occurrence data or the restoration data are designated for readout. Enables the reset (initialization) of the failure trace buffer.

[Format]



Symbol : FTRC-RD
Full Name : Failure-Trace Read
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Failure trace readout command
	Reset	B-VAL	Failure trace buffer reset command
	Type	I-REG	Type of data read 1 : Occurrence data 2 : Restoration data
	Rec-Size	I-REG	Number of read records Occurrence data : 1 to 64 Restoration data : 450
	Dat-Adr	Address input	Head register address for reading (address of MW or DW)
Output	Complete	B-VAL	Completion of failure trace read
	Error	B-VAL	Occurrence of error
	Status	I-REG	Failure trace read execution status
	Rec-Size	I-REG	Number of read records
	Rec-Len	I-REG	Length of read record

Table 9.3 Failure Trace Read Execution Status (STATUS)

Name	Bit No.	Remarks
System Reserved	Bit 0～Bit 7	
No trace definition	Bit8	The function will not be executed.
Designated type No. error	Bit9	The function will not be executed.
System Reserved	Bit10	
Error in the designated number of records	Bit11	The function will not be executed.
Data storage error	Bit12	The function will not be executed.
System Reserved	Bit13	
System Reserved	Bit14	
Address input error	Bit15	The function will not be executed.

9.5.1 Failure Occurrence Data Readout

Failure occurrence data readout is described in figure 9.3. The readout will always be started from the most recent record.

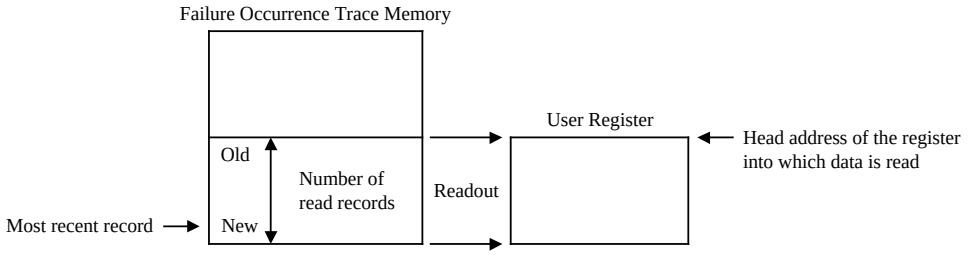


Figure 9.3 Failure Occurrence Data Readout

9.5.2 Readout Data Configuration (Failure Occurrence Data)

■ Data Configuration

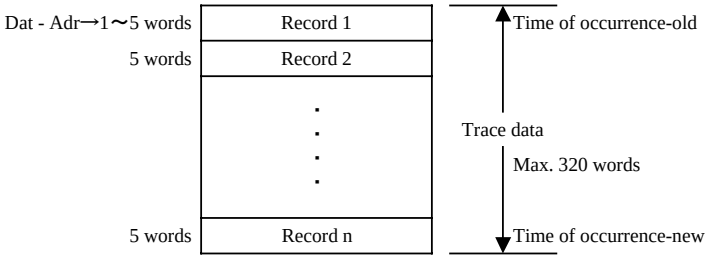


Figure 9.4 Data Configuration

■ Record Configuration

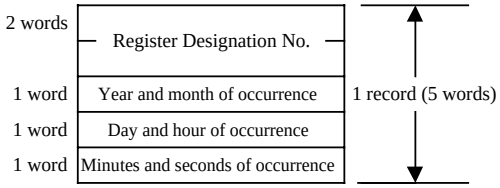


Figure 9.5 Record Configuration

■ Structure of Register Designation No. (2 words)

Contain the failure detection relay information.

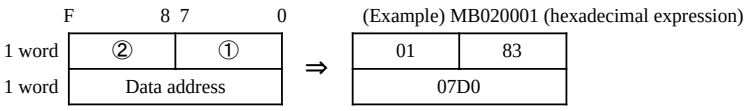


Figure 9.6 Structure of Register Designation No.

Table 9.4 Bit Configuration

No.	Bit Configuration of ①	Bit Configuration of ②
7	Defined flag (1 = defined, 0 = undefined)	System Reserve (= 0)
6	System Reserve (= 0)	Data Type Bit = 0, Integer = 1, Double-length integer = 2, Real Number = 3
5		
4	0 = NO contact designation, 1 = NC contact designation	
3	Type of variable S = 0, I = 1, O = 2, M = 3	Bit Address 0～F
2		
1		
0		

■ Number of Records

The Number of Records is the following.

Minimum number of records	0 (no failure restoration data)
Maximum number of records	64

9.5.3 Failure Restoration Data

Failure restoration data is described in figure 9.7. The number (amount) of restoration data is stored in SW00093 (ring counter for 1 to 9999).

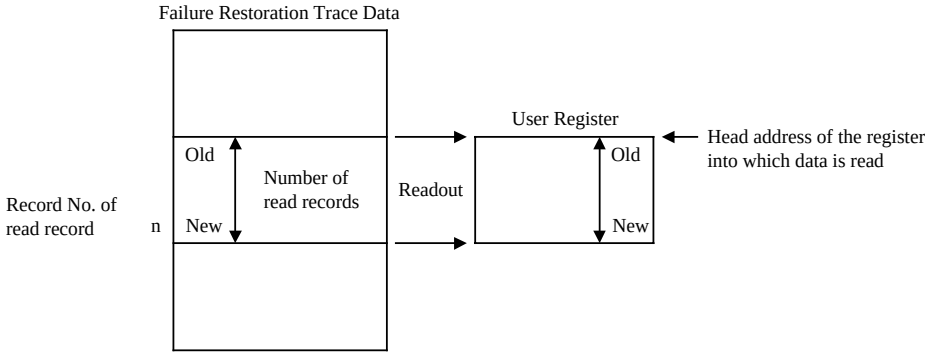


Figure 9.7 Failure Restoration Data

9.5.4 Readout Data Configuration (Failure Restoration Data)

Data configuration is described in figure 9.8.

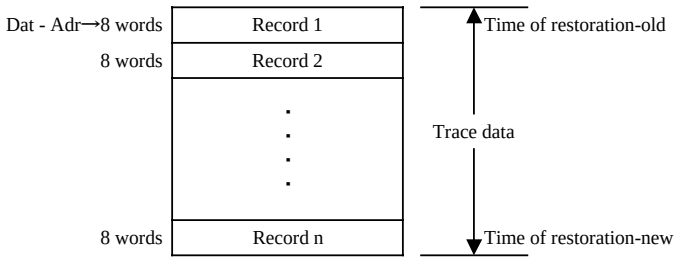


Figure 9.8 Data Configuration

Record Configuration

Record composition is shown in figure 9.9.

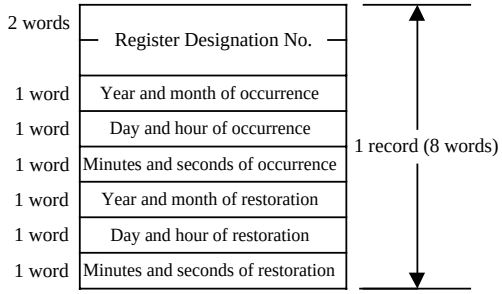


Figure 9.9 Record Configuration

Number of Record

The Number of Records is the following.

Minimum number of records	0 (no failure restoration data)
Maximum number of records	450

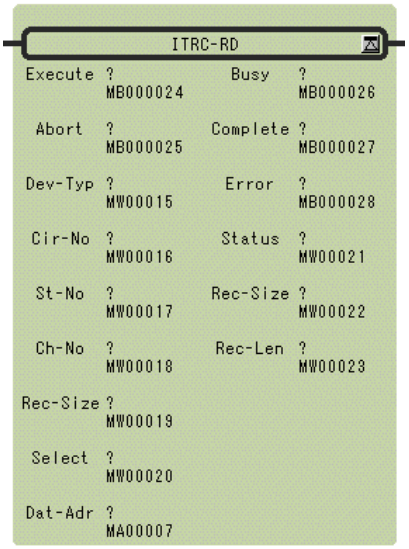
9.6 Inverter Trace Read Function (ITRC-RD)

[Outline]

Reads out the trace data of the inverter and stores this data in the user registers. The data in the trace buffer can be read out upon designating the number of records needed. The readout can be performed upon designating just the necessary items in the record.

[Applicable inverters] : MP930, SVB-01, connected via 215IF

[Format]



Symbol : ITRC-RD
Full Name : Inverter-Trace Read
Category : SYSTEM
Icon : 

[Parameter]

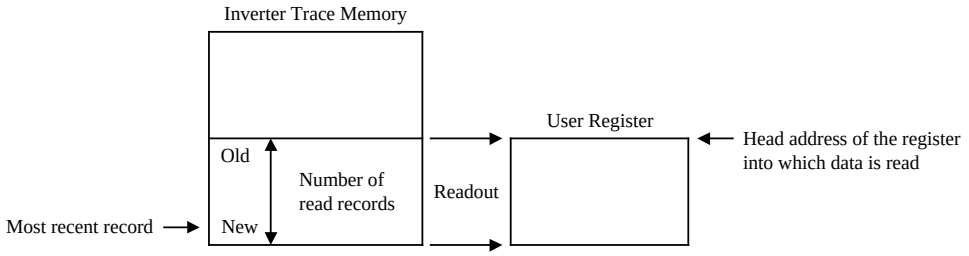
I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Inverter trace read command
	Abort	B-VAL	Inverter trace read forced interruption command
	Dev-Typ	I-REG	Type of transmission device 215IF = 1 MP930 = 4 SVB-01 = 11
	Cir-No	I-REG	Line No. 215IF = 1 MP930 = 1 SVB-01 = 1 to 16
	St-No	I-REG	Slave station No. 215IF = 1 to 64 MP930 = 1 to 14 SVB-01 = 1 to 14
	Ch-No	I-REG	Transmission buffer channel No. (No designation) 215IF = 1 to 3 MP930 = 1 SVB-01 = 1 to 8
	Rec-Size	I-REG	Number of records to be read (1 to 64)
	Select	I-REG	Items to be read (0001H to FFFFH) Bits 0 to F correspond to trace data items 1 to 26
	Dat-Adr	Address input	Head address of data buffer register (address of MW or DW)
Output	Busy	B-VAL	The reading of inverter trace data is in progress.
	Complete	B-VAL	Completion of inverter trace read
	Error	B-VAL	Occurrence of error
	Status	I-REG	Inverter trace read execution status
	Rec-Size	I-REG	Number of read records
	Rec-Len	I-REG	Length of read record (for 1 record)

Table 9.5 Configuration of the Inverter Trace Read Execution Status (STATUS)

Name	Bit Name	Remarks
System reserved	Bit 0 to Bit 8	
Transmission parameter error	Bit9	The function will not be executed.
System reserved	Bit10	
Error in the designated number of records	Bit11	The function will not be executed.
Data storage error	Bit12	The function will not be executed.
Transmission error	Bit13	The function will not be executed.
System reserved	Bit14	
Address input error	Bit15	The function will not be executed.

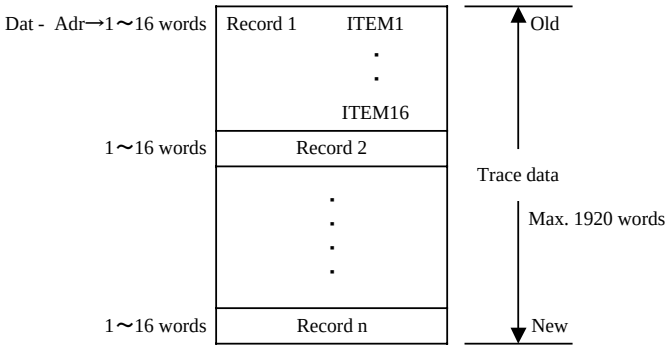
9.6.1 Readout of Inverter Trace Data

The readout will always be started from the most recent record.



9.6.2 Readout Data Configuration

■ Data Configuration



■ Record Length

A record is composed of the data of the selected items.
Word length of 1 record = 1 to 16 words

■ Number of Records

Maximum number of records = 120

9.7 Send Message Function (MSG-SND)

[Outline]

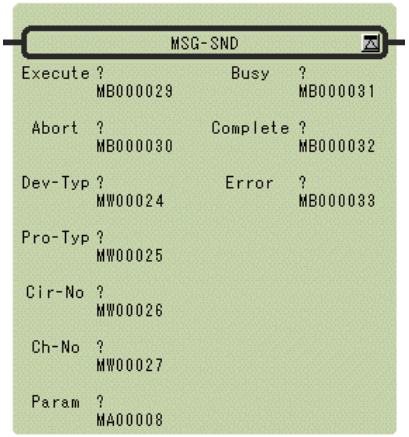
Sends a message to the called station which is on the line and which is designated by the transmission device type. Supports a plurality of protocol types.

The execution command (*Execute*) must be held until *Complete* or *Error* becomes ON.

[Transmission Devices] CPU Module, 215IF, 217IF, 218IF, SV-01

[Protocols] MEMOBUS, non-procedural

[Format]



Symbol : MSG-SND
Full Name : Message Send
Category : SYSTEM
Icon : MSG-SND

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Send message command
	Abort	B-VAL	Send message forced interruption command
	Dev-Typ	I-REG	Type of transmission device CPU module = 8 215IF = 1 217IF = 5 218IF = 6 SVB-01 = 11
	Pro-Typ	I-REG	Transmission protocol MEMOBUS = 1 non-procedural = 2
	Cir-No	I-REG	Line No. CPU module = 1, 2 215IF = 1 to 8 217IF = 1 to 24 218IF = 1 to 8 SVB-01 = 1 to 16
	Ch-No	I-REG	Transmission buffer channel No. CPU module＝1, 2 215IF = 1 to 13 217IF = 1 218IF = 1 to 10 SVB-01 = 1 to 8
	Param	Address input	Head address of set data (MW, DW, #W)
Output	Busy	B-VAL	Message is being sent.
	Complete	B-VAL	The sending of the message has been completed.
	Error	B-VAL	Occurrence of error

9.7.1 Parameters

They adhere to contents-functions and so on and are collected into parameter numerical order. Table 9.6 is Parameter List.

Table 9.6 Parameter List

Parameter No.	IN/OUT	Contents	
		MEMOBUS	Non-procedural
PARAM 00	OUT	Process result	Process result
PARAM 01	OUT	Status	Status
PARAM 02	IN	Called station #	Called station #
PARAM 03	SYS	System reserved	System reserved
PARAM 04	IN	Function code	
PARAM 05	IN	Data address	Data address
PARAM 06	IN	Data size	Data size
PARAM 07	IN	Called CPU#	Called CPU#
PARAM 08	IN	Coil offset	
PARAM 09	IN	Input relay offset	
PARAM 10	IN	Input register offset	
PARAM 11	IN	Holding register offset	Register offset
PARAM 12	SYS	For system use	For system use
PARAM 13	SYS	System reserved	System reserved
PARAM 14	SYS	System reserved	System reserved
PARAM 15	SYS	System reserved	System reserved
PARAM 16	SYS	System reserved	System reserved

■ Process Result (PARAM00)

The process result is output to the upper byte. The lower byte is for system analysis.

- 00xx : In process (BUSY)
- 10xx : End of process (COMPLETE)
- 8xxx : Occurrence of error (ERROR)

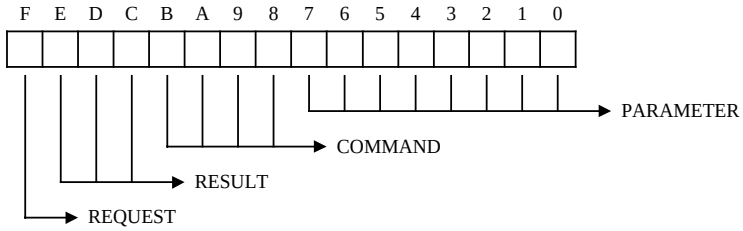
Error Classification

- 81xx : Function code error
  The sending of an unused function code was attempted. Or, an unused function code was received.
- 82xx : Address setting error
  The data address, coil offset, input relay offset, input register offset, or holding register offset setting is out of range.
- 83xx : Data size error
  The size of the sent or received data is out of range.
- 84xx : Line No. setting error
  The line No. setting is out of range.
- 85xx : Channel No. Setting error
  The channel No. setting error.
- 86xx : Station address error
  The station No. setting is out of range.
- 88xx : Transmission unit error
  An error response was returned from the transmission unit.
- 89xx : Device selection error
  A non-applicable device is selected.

■ Status (PARAM01)

Output the status of the transmission unit.

Bit Assignment



COMMAND

Command list is described below.

Code	Symbol	Meaning
1	U_SEND	Send generic message
2	U_REC	Receive generic message
3	ABORT	Forced interruption
8	M_SEND	Send MEMOBUS command ... completed upon receipt of response.
9	M_REC	Receive MEMOBUS command ... accompanies sending of response.
C	MR_SEND	Send MEMOBUS response.

RESULT

Symbol and Meaning of the Result list is described Table 9.7.

Table 9.7 Result List

Code	Symbol	Meaning
0	—	Executing
1	SEND_OK	Sending has been completed correctly.
2	REC_OK	Receiving has been completed correctly.
3	ABORT_OK	Completion of forced interruption
4	FMT_NG	Parameter format error
5	SEQ_NG, or INIT_NG	Command sequence error The token has not been received yet. Not connected to a transmission system.
6	RESET_NG, or O_RING_NG	Reset state Out-of-ring. The token could not be received even when the token monitor time was exceeded.
7	REC_NG	Data receive error (error detected by a program of a lower rank)

PARAMETER

One of the error codes of Table 9.8 is indicated if RESULT = 4 (FMT_NG). Otherwise, this indicates the address of the called station.

Table 9.8 Error Codes List

Code	Error
00	No errors
01	Station address is out of range.
02	Monitored MEMOBUS response receiving time error
03	Resending count setting error
04	Cyclic area setting error
05	Message signal CPU No. error
06	Message signal register No. error
07	Message signal word count error

REQUEST

1 = Request

0 = Completion of receipt report

■ Called Station # (PARAM02)

Serial

1～254 : Message is sent to the station of designated device address.

■ Function Code (PARAM04)

The MEMOBUS function code to be sent is set. Refer to Table 9.9.

Table 9.9 Function Codes

Function Code		Setting
00H	Unused	×
01H	Read coil status	○
02H	Read input relay status	○
03H	Read contents of holding register	○
04H	Read contents of input register	○
05H	Change status of single coil	○
06H	Write into a single holding register	○
07H	Unused	×
08H	Loop-back test	○
09H	Read contents of holding register (expanded)	○
0AH	Read contents of input register (expanded)	○
0BH	Write into holding register (expanded)	○
0CH	Unused	×
0DH	Discontinuous readout of holding register (expanded)	○
0EH	Discontinuous write into holding register (expanded)	○
0FH	Change status of a multiple coil	○
10H	Write into a plurality of holding register	○
11H to 20H	Unused	×
21H to 3FH	System reserved	×
40H to 4FH	System reserved	×
50H to	Unused	×

(× : cannot be set, ○ :can be set)

Note : Only MW (MB) can be used as the sending/receiving register during master operation. The MB, MW, IB, and IW registers can be used respectively as the coil, holding register, input relay, and input registers during slave operation.

■ Data Address

The set contents will differ according to the function code as Table 9.10.

Table 9.10 Address Setting Range

Function Code		Data Address Setting Range
00H	Unused	Invalid
01H	Read coil status	0 to 65535 (0 to FFFFH) ①
02H	Read input relay status	0 to 65535 (0 to FFFFH) ①
03H	Read contents of holding register	0 to 32767 (0 to 7FFFH) ②
04H	Read contents of input register	0 to 32767 (0 to 7FFFH) ②
05H	Change status of single coil	0 to 65535 (0 to FFFFH) ①
06H	Write into a single holding register	0 to 32767 (0 to 7FFFH) ②
07H	Unused	Invalid
08H	Loop-back test	Invalid
09H	Read contents of holding register (expanded)	0 to 32767 (0 to 7FFFH) ②
0AH	Read contents of input register (expanded)	0 to 32767 (0 to 7FFFH) ②
0BH	Write into holding register (expanded)	0 to 32767 (0 to 7FFFH) ②
0CH	Unused	Invalid
0DH	Discontinuous readout of holding register (expanded)	0 to 32767 (0 to 7FFFH) ③
0EH	Discontinuous write into holding register (expanded)	0 to 32767 (0 to 7FFFH) ③
0FH	Change status of a multiple coil	0 to 65535 (0 to FFFFH) ①
10H	Write into a plurality of holding register	0 to 32767 (0 to 7FFFH) ②

① Request for readout from/write-in to coil or relay: Set the head bit address of the data.

② Request for continuous readout from/write-in to a register: Set head word address of the data.

③ Request for discontinuous readout from/write-in to a register: Set head word address of the data.

■ Data Size (PARAM06)

Set the size (in number of bits or number of words) of the data that is requested for readout or write-in. The setting range will differ according to the transmission module and the function code to be used. Refer to Table 9.11.

Table 9.11 Serial Data Size Setting Range

Function Code		Data Address Setting Range	
		215IF/218IF	CPU Module/ 217IF/SVB-01
00H	Unused	Invalid	
01H	Read coil status	1 to 2000 (1 to 07D0H) bits	
02H	Read input relay status	1 to 2000 (1 to 07D0H) bits	
03H	Read contents of holding register	1 to 125 (1 to 007DH) words	
04H	Read contents of input register	1 to 125 (1 to 007DH) words	
05H	Change status of single coil	Invalid	
06H	Write into a single holding register	Invalid	
07H1	Unused	Invalid	
08H	Loop-back test	Invalid	
09H	Read contents of holding register (expanded)	1 to 508 (1 to 01FCH) words	1 to 252 (1 to 00FCH) words
0AH	Read contents of input register (expanded)	1 to 508 (1 to 01FCH) words	1 to 252 (1 to 00FCH) words
0BH	Write into holding register (expanded)	1 to 507 (1 to 01FBH) words	1 to 252 (1 to 00FBH) words
0CH	Unused	Invalid	

0DH	Discontinuous readout of holding register (expanded)	1 to 508 (1 to 01FCH) words	1 to 252 (1 to 00FCH) words
0EH	Discontinuous write into holding register (expanded)	1 to 254 (1 to 01FEH) words	1 to 126 (1 to 007EH) words
0FH	Change status of a multiple coil	1 to 800 (1 to 0320H) bits	
10H	Write into a plurality of holding register	1 to 100 (1 to 0064H) words	

■ Called CPU # (PARAM07)

Set the called CPU No.

■ Coil Offset (PARAM08)

Set the offset word address of the coil. This is valid in the case of function codes 01H, 05H, and 0FH.

■ Input Relay Offset (PARAM09)

Set the offset word address of the input relay. This is valid in the case of function code 02H.

■ Input Register Offset (PARAM10)

Set the offset word address of the input register. This is valid in the case of function codes 04H and 0AH.

■ Holding Register Offset (PARAM11)

Set the offset word address of the holding register. This is valid in the case of function codes 03H, 06H, 09H, 0BH, 0DH, 0EH, and 10H.

■ For System Use (PARAM12)

The channel No. being used is stored. Make sure that this will be set to 0000H by the user program on the first scan after turning on the power. This parameter must not be changed by the user program thereafter since this parameter will then be used by the system.

■ Relationship between the Data Address, Size and Offset

Relationship between the data address, size and offset are described Figure 9.10.

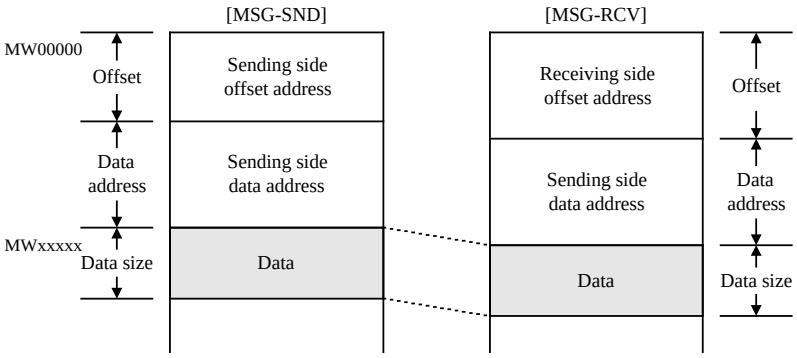


Figure 9.10 Relationship between the Data Address, Size and Offset

■ When transmission protocol is set to non-procedural

The setting of PARAM04, PARAM08, PARAM09, and PARAM10 are not necessary. Transmission enabled register is only MW.

9.7.2 Input

■ EXCUTE (Send Message Execution Command)

When the command becomes "ON", the message is sent.

■ ABOUT (Send Message Forced Interruption Command)

This command forcibly interrupts the sending of the message. This has priority over EXECUTE (send message forced interruption command).

■ DEV-TYP (Transmission Device Type)

Designates transmission device type.

■ PRO-TYP (Transmission Protocol)

Designates transmission protocol. In non-procedural transmission, a response is not received from the other station.

MEMOBUS : Setting = 1

Non-procedural : Setting = 2

■ CIR-NO (Circuit No.)

Designate the Circuit No.

CPU Module = 1, 2, 215IF = 1 to 8, 217IF = 1 to 24, 218IF = 1 to 8, SVB-01 = 1 to 16

■ CH-NO (Channel No.)

Designate the channel No. of the transmission unit. However, the channel number should be set so as not to be duplicated on a single line.

CPU Module = 1, 215IF = 1 to 13, 217IF = 1, 218IF = 1 to 10, SVB-01 = 1 to 8

■ PARAM (Set Data Head Address)

The head address of the set data is designated. For details of the set data refer to 5.5.1."Parameters".

■ BUSY (In Process)

Indicates that the process is being executed. Keep EXECUTE set to "ON".

■ COMPLETE (Completion of Process)

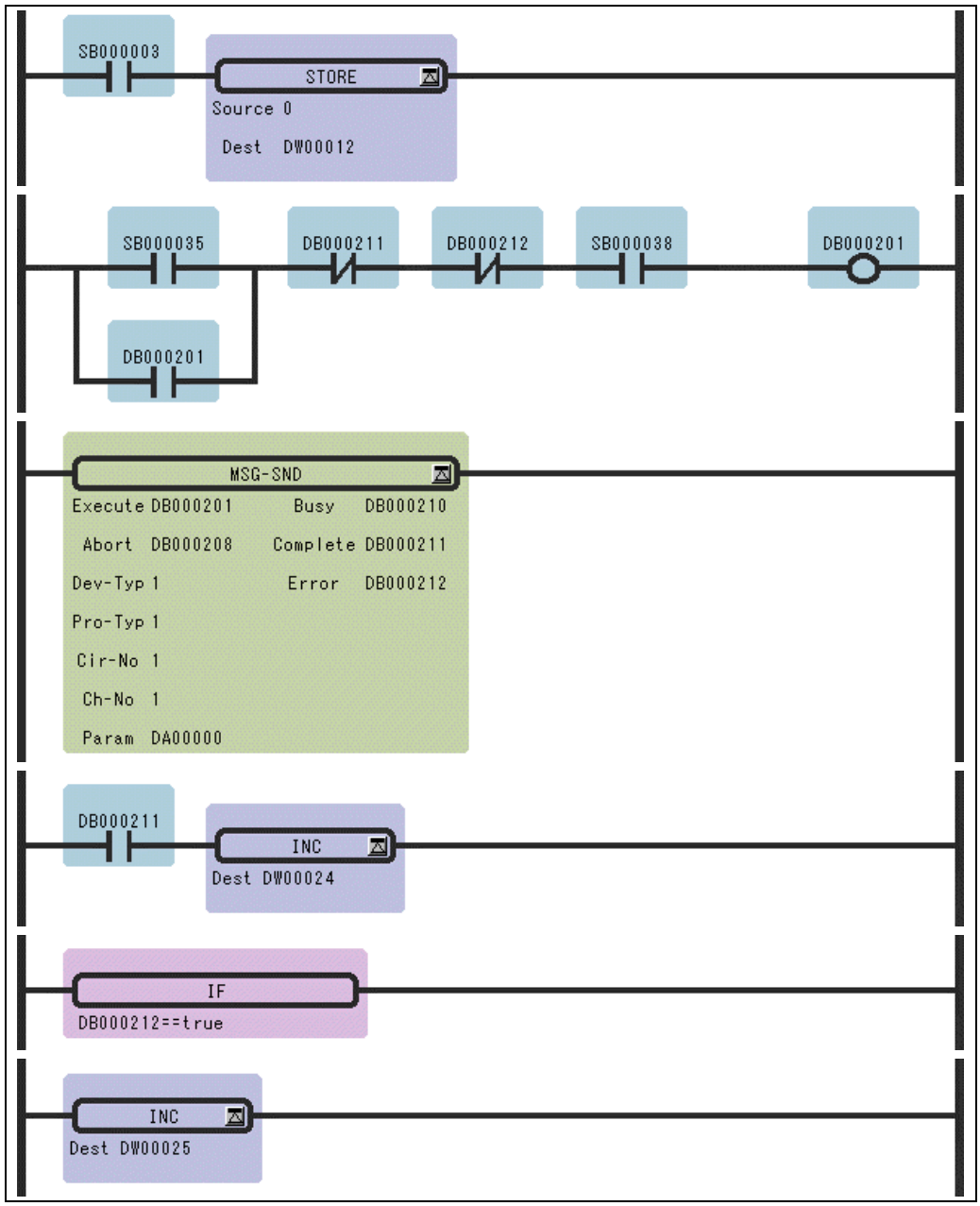
Becomes "ON" for only 1 scan upon normal completion.

■ ERROR (Occurrence of Error)

Becomes "ON" for only 1 scan upon occurrence of error. Refer to PARAM00 and PARAM 01 of 5.5.4.

9.7.3 Program Example

Program example is described Figure 9.11.



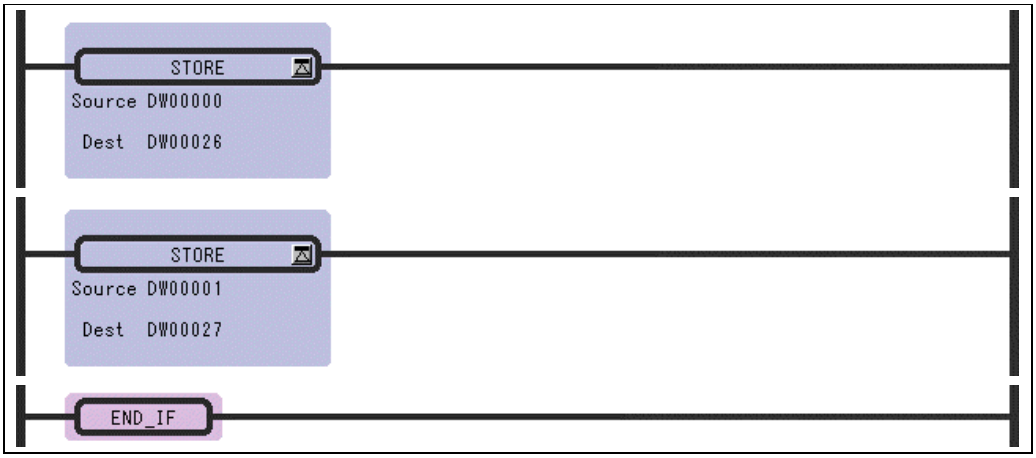


Figure 9.11 Program Sample

9.8 Receive Message Function (MSG-RCV)

[Outline]

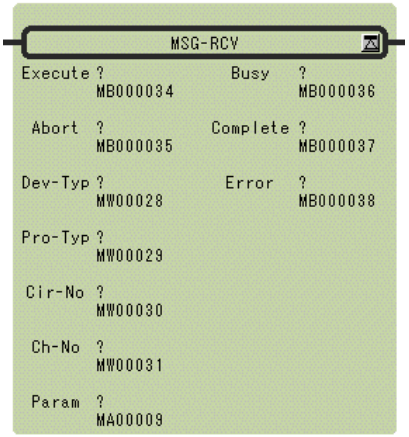
Receives a message from a calling station which is on the line and which is designated by the transmission device type. Supports a plurality of protocol types.

The execution command (*Execute*) must be held until *Complete* or *Error* becomes ON.

[Transmission Devices] CPU module, 215IF, 217IF, 218IF, SVB-01

[Protocols] MEMOBUS, non-procedural

[Format]



Symbol : MSG-RCV
Full Name : Message Receive
Category : SYSTEM
Icon : MSG-RCV

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Receive message command
	Abort	B-VAL	Receive message forced interruption command
	Dev-Typ	I-REG	Type of transmission device CPU module=8 215IF = 1 217IF = 5 218IF = 6 SVB-01 = 11
	Pro-Typ	I-REG	Transmission protocol (Set up of RTU and ASCII is module configuration definition.) MEMOBUS = 1 non-procedural = 2
	Cir-No	I-REG	Line No. CPU module = 1 215IF = 1 to 8 217IF = 1 to 24 218IF = 1 to 8 SVB-01 = 1 to 16
	Ch-No	I-REG	Transmission buffer channel No. CPU module = 1 215IF = 1 to 13 217IF = 1 218IF = 1 to 10 SVB-01 = 1 to 8
	Param	Address input	Head address of set data (MW, DW, #W)
Output	Busy	B-VAL	Message is being received.
	Complete	B-VAL	The receiving of the message has been completed.
	Error	B-VAL	Occurrence of error

9.8.1 Parameters

They adhere to contents-functions and so on and are collected into parameter numerical order. Table 9.12 is Parameter List.

Table 9.12 Parameter List

Parameter No.	IN/OUT	Contents	
		MEMOBUS	Non-procedural
PARAM 00	OUT	Process result	Process result
PARAM 01	OUT	Status	Status
PARAM 02	OUT	Called station #	Called station #
PARAM 03	SYS	System reserved	System reserved
PARAM 04	OUT	Function code	
PARAM 05	OUT	Data address	Data address
PARAM 06	OUT	Data size	Data size
PARAM 07	OUT	Called CPU#	Called CPU#
PARAM 08	IN	Coil offset	
PARAM 09	IN	Input relay offset	
PARAM 10	IN	Input register offset	
PARAM 11	IN	Holding register offset	Register offset
PARAM 12	IN	Write-in range LO	Register offset
PARAM 13	IN	Write-in range HI	Register offset
PARAM 14	SYS	For system use	For system use
PARAM 15	SYS	System reserved	System reserved
PARAM 16	SYS	System reserved	System reserved

■ Process Result (PARAM00)

The process result is output to the upper byte. The lower byte is for system analysis.

- 00xx : In process (BUSY)
- 10xx : End of process (COMPLETE)
- 8xxx : Occurrence of error (ERROR)

Error Classification

- 81xx : Function cord error
  The sending of an unused function code was attempted. Or, an unused function code was received.
- 82xx : Address setting error
  The data address, coil offset, input relay offset, input register offset, or holding register offset setting is out of range.
- 83xx : Data size error
  The size of the sent or received data is out of range.
- 84xx : Line No. setting error
  The line No. setting is out of range.
- 85xx : Channel No. Setting error
  The channel No. setting error.
- 86xx : Station address error
  The station No. setting is out of range.
- 88xx : Transmission unit error
  An error response was returned from the transmission unit. (Refer to 5.6.1)
- 89xx : Device selection error
  A non-applicable device is selected.

■ Status (PARAM01)

Output the status of the transmission unit. See 5.5.1."Parameters" of "Status (PARAM01)" for details.

■ Called Station # (PARAM02)

The station number of sending side is output.

■ Function Code (PARAM04)

Output the MEMOBUS function code received. Refer to Table 9.13.

Table 9.13 Function Codes

Function Code		Setting
00H	Unused	×
01H	Read coil status	○
02H	Read input relay status	○
03H	Read contents of holding register	○
04H	Read contents of input register	○
05H	Change status of single coil	○
06H	Write into a single holding register	○
07H	Unused	×
08H	Loop-back test	○
09H	Read contents of holding register (expanded)	○
0AH	Read contents of input register (expanded)	○
0BH	Write into holding register (expanded)	○
0CH	Unused	×
0DH	Discontinuous readout of holding register (expanded)	○
0EH	Discontinuous write into holding register (expanded)	○
0FH	Change status of a multiple coil	○
10H	Write into a plurality of holding register	○
11H to 20H	Unused	×
21H to 3FH	System reserved	×
40H to 4FH	System reserved	×
50H to	Unused	×

Note : The MB, MW, IB, and IW registers can be used respectively as the coil, holding register, input relay, and input registers during slave operation.

■ Data Address (PARAM05)

The data address requested by the sending side is output.

■ Data Size (PARAM06)

The data size (number of bits or number of words) of the requested read or write is output.

■ Called CPU # (PARAM07)

The called CPU NO. is output.

■ Coil Offset (PARAM08)

Set the offset word address of the coil. This is valid in the case of function codes 01H, 05H, and 0FH.

■ Input Relay Offset (PARAM09)

Set the offset word address of the input relay. This is valid in the case of function code 02H.

■ Input Register Offset (PARAM10)

Set the offset word address of the input register. This is valid in the case of function codes 04H and 0AH.

■ Holding Register Offset (PARAM11)

Set the offset word address of the holding register. This is valid in the case of function codes 03H, 06H, 09H, 0BH, 0DH, 0EH, and 10H.

■ Write-in Range LO (PARAM12), Write-in Range HI (PARAM13)

Set the write allowable range for the request for write-in. A request which is outside of this range will cause an error. This is valid in the case of function code 0BH, 0EH, 0FH, and 10H.

0≦Write-in Range LO≦Write-in Range HI≦Maximum value of MW Address

■ For System Use (PARAM14)

The channel No. being used is stored. Make sure that this will be set to 0000H by the user program on the first scan after turning on the power. This parameter must not be changed by the user program thereafter since this parameter will then be used by the system.

■ When Non-procedural is set for Transmission Protocol

PARAM04 has no function. The settings of PARAM08, PARAM09, and PARAM10 are not necessary. The message receivable register is only MW.

9.8.2 Input

■ EXCUTE (Receive Message Exection Command)

When the command becomes "ON", the message is receive. This must be held until COMPLETE (completion of process) or ERROR (occurrence of error) becomes "ON".

■ ABORT (Receive Message Forced Interruption Command)

This command forcibly interrupts the receiving of the message. This has priority over EXECUTE (receive message execution command).

■ DEV-TYP (Transmission Device Type)

Designates transmission device type.

CPU Module = 8, 215IF = 1, 217IF = 5, 218IF = 6, SVB-01 = 11

■ PRO-TYP (Transmission Protocol)

Designates transmission protocol. In non-procedural transmission, a response is not sent to the called station.

MEMOBUS : Setting = 1

Non-procedural : Setting = 2

■ CIR-NO (Circuit No.)

Designate the circuit No.

CPU Module = 1, 2, 215IF = 1 to 8, 217IF = 1 to 24, 218IF = 1 to 8, SVB-01 = 1 to 16

■ CH-NO (Channel No.)

Designate the channel No. of the transmission unit. However, the channel number should be set so as not to be duplicated on a single line.

CPU Module = 1, 215IF = 1 to 13, 217IF = 1, 218IF = 1 to 10, SVB-01 = 1 to 8

■ PARAM (Setting Data Head Address)

The head address of the set data is designated. For details of the set data refer to 5.6.1."Parameters".

9.8.3 Output

■ BUSY (In Process)

Indicates that the process is being executed. Keep EXECUTE set to "ON".

■ COMPLETE (Completion of Process)

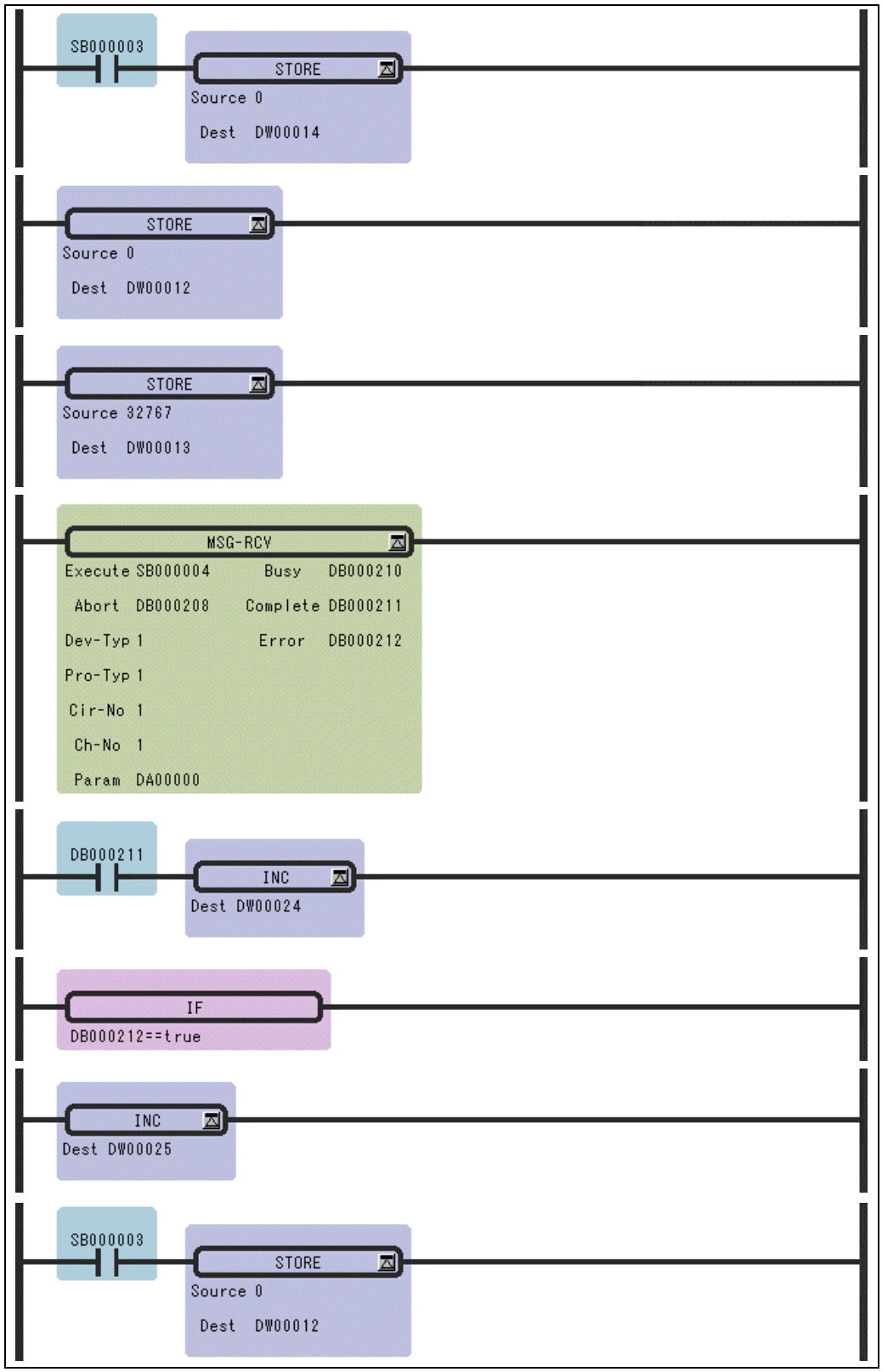
Becomes "ON" for only 1 scan upon normal completion.

■ ERROR (Occurrence of Error)

Becomes "ON" for only 1 scan upon occurrence of error. Refer to PARAM00 and PARAM01 of 5.6.1."Parameters".

9.8.4 Program Example

Program example is described Figure 9.12.



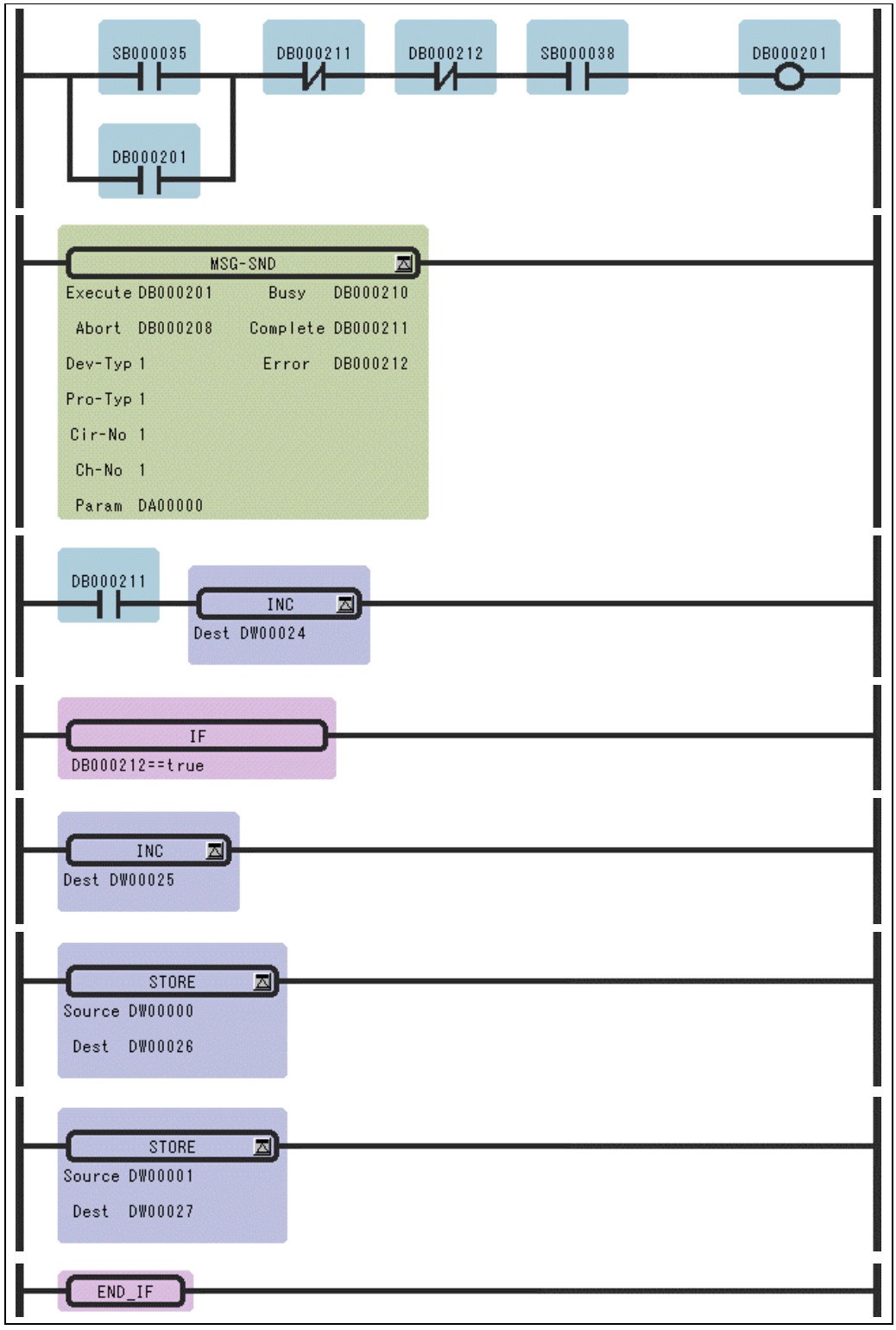


Figure 9.12 Program Sample

9.9 Inverter Constant Write Function (ICNS-WR)

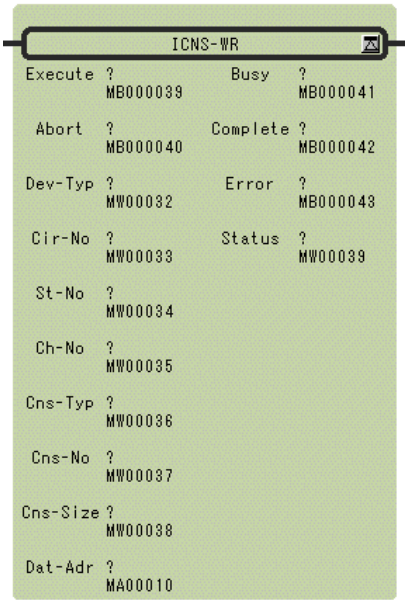
[Outline]

Writes the inverter constants.

The types and ranges of the inverter constants to be written can be designated.

[Applicable inverters] connected via MP930, SVB-01, CP-215

[Format]



Symbol : ICNS-WR
Full Name : Inverter-Constant Write
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Inverter constant write command
	Abort	B-VAL	Inverter constant write forced interruption command
	Dev-Typ	I-REG	Type of transmission device 215IF = 1 MP930 = 4 SVB-01 = 11
	Cir-No	I-REG	Line No. 215IF = 1, 2 MP930 = 1 SVB-01 = 1 to 16
	St-No	I-REG	Slave station No. 215IF = 1 to 64 MP930 = 1 to 14 SVB-01 = 1 to 14
	Ch-No	I-REG	Transmission buffer channel No. 215IF = 1 to 3 MP930 = 1 SVB-01 = 1 to 8
	Cns-Typ	I-REG	Type of inverter constant 0 = direct designation of reference No. 1 = An, 2 = Bn, 3 = Cn, 4 = Dn, 5 = En, 6 = Fn, 7 = Hn, 8 = Ln, 9 = On, 10 = Tn
	Cns-No	I-REG	Inverter constant No. (1 to 99) The upper limit will differ according to the type of inverter. If Cns-Typ = 0, designate the reference No.
	Cns-Size	I-REG	Number of inverter constants (number of data to be written)1 to 100
	Dat-Adr	Address input	Register address of set data (address of MW, DW, or #W)
Output	Busy	B-VAL	Inverter constants are being written in.
	Complete	B-VAL	The write-in of inverter constants has been completed.
	Error	B-VAL	Occurrence of error
	Status	I-REG	Inverter constant write execution status

Table 9.14 Configuration of Inverter Constant Write Execution Status (STATUS)

Name	Bit No.	Remarks
System Reserved	Bit 0 to Bit 7	
Execution sequence error	Bit8	The function will not be executed.
Transmission parameter error	Bit9	The function will not be executed.
Designated type error	Bit10	The function will not be executed.
Designated No. error	Bit11	The function will not be executed.
Error in number (amount) of the designated data	Bit12	The function will not be executed.
Transmission error	Bit13	The function will not be executed.
Inverter response error	Bit14	The function will not be executed.
Address input error	Bit15	The function will not be executed.

Note : In the case of an inverter response error, the error codes from the inverter are indicated in bit 0 to bit 7.

01H(1) : function code error

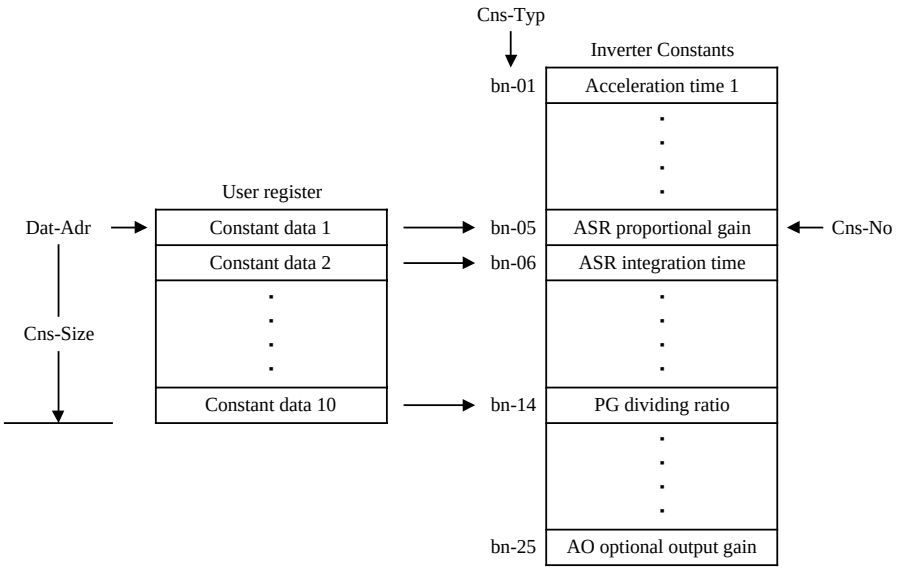
02H(2) : reference No. error

03H(3) : write-in count error

21H(33) : write-in data upper/lower limit error

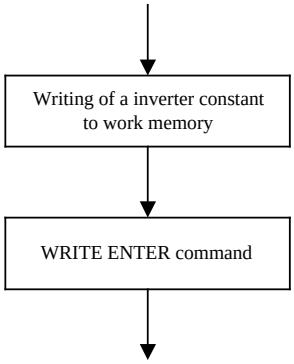
22H(34) : write-in error (during running, during UV)

9.9.1 Configuration of the Write-in Data

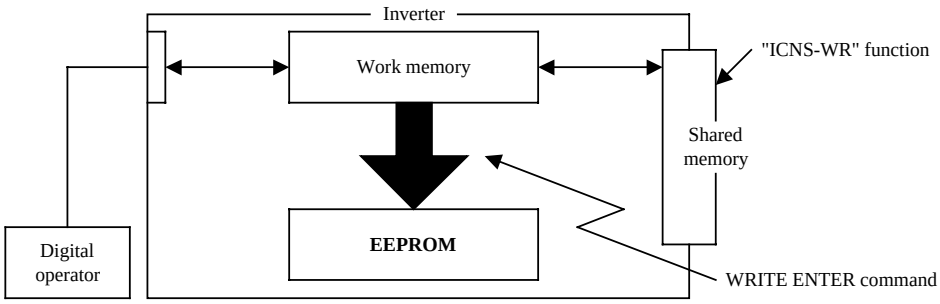


9.9.2 Method of Writing to an EEPROM

Procedures for writing constants to an EEPROM (inverter internal constant storage memory) are shown in below.



Constants written with the system function "ICNS-WR" are once entered in work memory. In order to actually store these in EEPROM, it is necessary to bring up the WRITE ENTER command as shown in below.

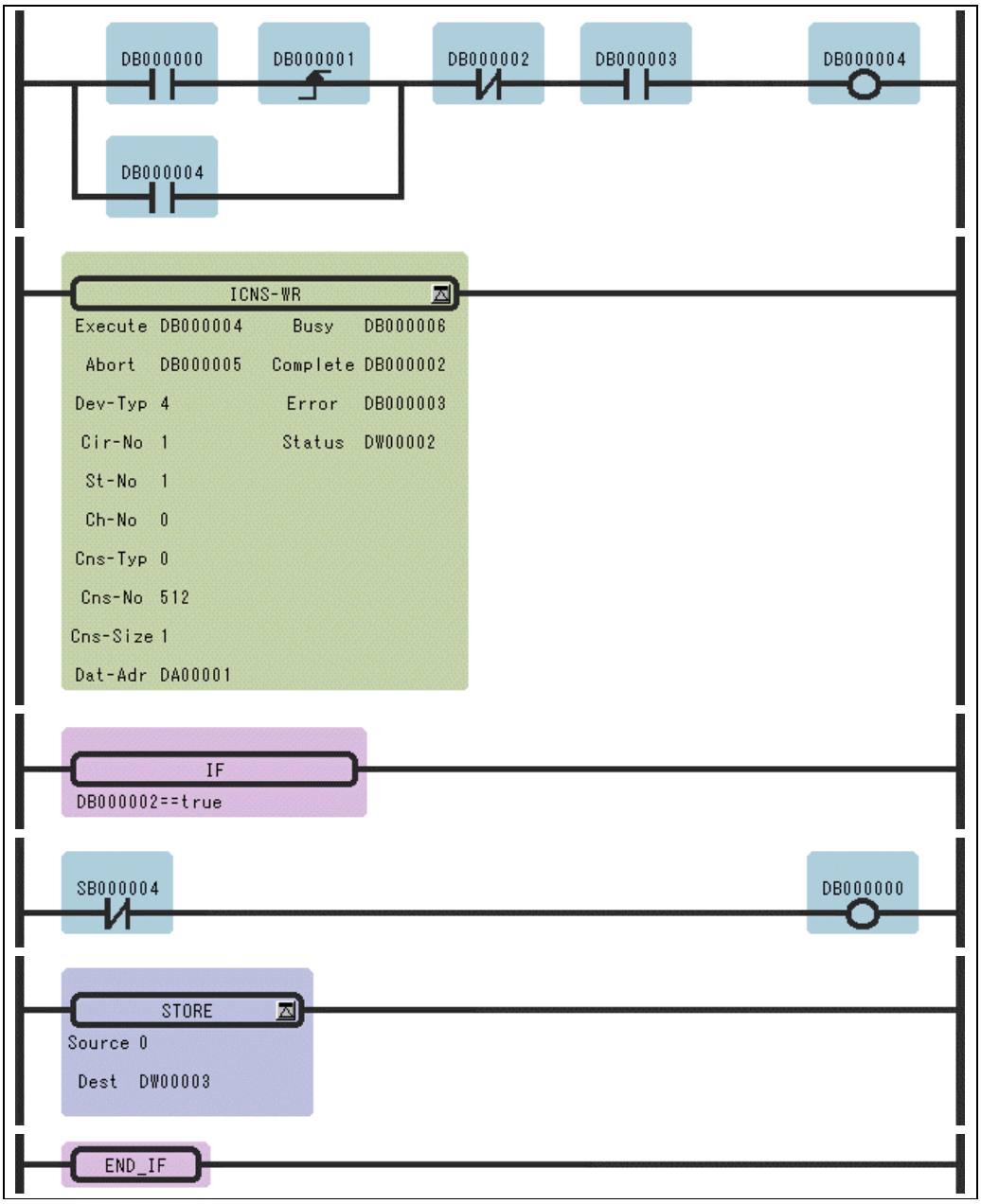


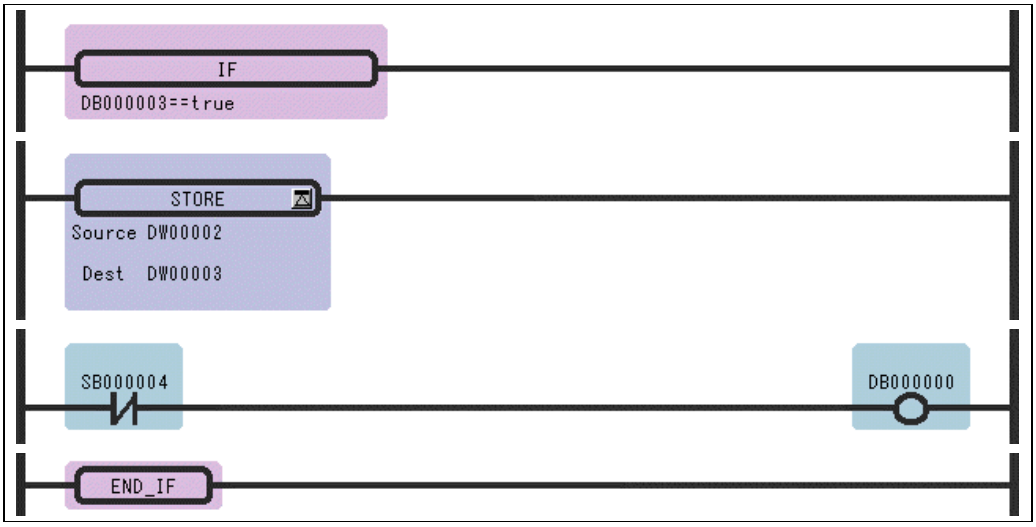
■ WRITE ENTER Command

Using the "ICNS-WR" function, by writing the data "0" in the reference number "FFFD" the WRITE ENTER command is entered for the inverter.

9.9.3 Program Example

An example of a program (if MP930) that writes "200" in the constant "C1-01" is shown below.




IF
DB000003==true
STORE
Source DW00002
Dest DW00003
SB000004
DB000000
END_IF

9.10 Inverter Constant Read Function (ICNS-RD)

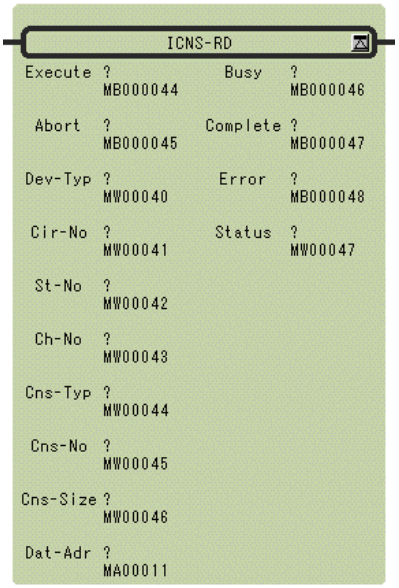
[Outline]

Reads the inverter constants.

The types and ranges of the inverter constants to be read can be designated.

[Applicable inverters] connected via MP930, SVB-01, CP-215

[Format]



Symbol : ICNS-RD
Full Name : Inverter-Constant Read
Category : SYSTEM
Icon : 

[Parameter]

I/O Definition	Parameter Name	I/O Designation	Setting
Input	Execute	B-VAL	Inverter constant read execution command
	Abort	B-VAL	Inverter constant read forced interruption command
	Dev-Typ	I-REG	Type of transmission device 215IF = 1 MP930 = 4 SVB-01 = 11
	Cir-No	I-REG	Line No. 215IF = 1, 2 MP930 = 1 SVB-01 = 1 to 16
	St-No	I-REG	Slave station No. 215IF = 1 to 64 MP930 = 1 to 14 SVB-01 = 1 to 14
	Ch-No	I-REG	Transmission buffer channel No. 215IF = 1 to 3 MP930 = 1 SVB-01 = 1 to 8
	Cns-Typ	I-REG	Type of inverter constant 0 = direct designation of reference No. 1 = An. 2 = Bn, 3 = Cn, 4 = Dn, 5 = En, 6 = Fn, 7 = Hn, 8 = Ln, 9VOn, 10 = Tn
	Cns-No	I-REG	Inverter constant No. (1 to 99) The upper limit will differ according to the type of inverter. If CNS-TYP = 0, designate the reference No.
	Cns-Size	I-REG	Number of inverter constants (number of data to be read) 1 to 100
	Dat-Adr	Address input	Register address of the data to be read (address of MW, DW or #W)
Output	Busy	B-VAL	Inverter constants are being read.
	Complete	B-VAL	The reading of inverter constants has been completed.
	Error	B-VAL	Occurrence of error
	Status	I-REG	Inverter constant read execution status

Table 9.15 Configuration of Inverter Constant Read Execution Status (STASTUS)

Name	Bit No.	Remarks
System Reserved	Bit 0 to Bit 7	
Execution sequence error	Bit8	The function will not be executed.
Transmission parameter error	Bit9	The function will not be executed.
Designated type error	Bit10	The function will not be executed.
Designated No. error	Bit11	The function will not be executed.
Error in number (amount) of the designated data	Bit12	The function will not be executed.
Transmission error	Bit13	The function will not be executed.
Inverter response error	Bit14	The function will not be executed.
Address input error	Bit15	The function will not be executed.

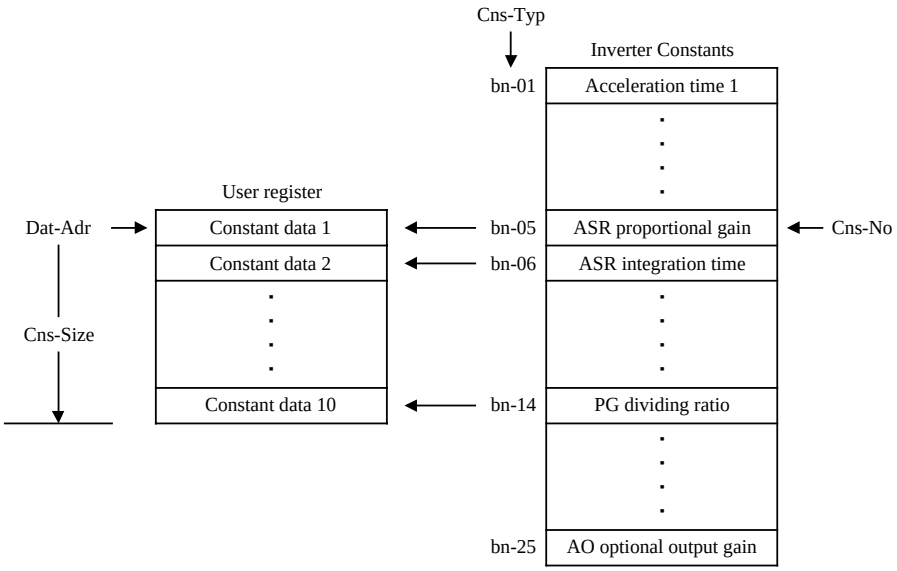
Note : In the case of an inverter response error, the error codes from the inverter are indicated in bit0 to bit7.

01H(1) : function code error

02H(2) : reference No. error

Numbers in ( ) are of decimal expressions.

9.10.1 Configuration of the Data Readout



Appendix Expression

Outline

It is necessary to describe the conditional expression and the operational expression in IF, WHILE, and the EXPRESSION instruction in the ladder instruction. Those expressions can be described by using “Expression”.

The use rule of the Expression is explained as follows.

1. Expression

The Expression is composed of the operator, the operand (constant and variable), and functions. The end of one Expression is shown by the semicolon‘;’. The expressions can be united by using parentheses '(',')'.

Each component of the Expression is explained here.

1.1 Operator

○ Usable operator

There is the following kinds of usable operators.

・Arithmetic operator

+	Addition
-	Subtraction
*	Multiplication
/	Division
%	Surplus
&	AND of each bit
|	OR of each bit

・Logic operator (Only for the bit type)

&&	Logical product
||	Logical add
!	Logical denial

・Comparison operator

==	Equal to a right value
!=	Not equal to a right value
>	Greater than a right value
>=	Greater than or equal to a right value
<	Less than a right value
<=	Less than or equal to a right value

・Substitution operator

= A right value is substituted for a left value

・Reserved word

true/false Value to logical expression

○ Priority level and uniting rule

There is a priority level in the operator, and the uniting rule is applied.

The priority level and the uniting rule (order from which the operand is evaluated) of the operator are settled in the next table. The table is sequentially shown from the operator with a high priority level. The operator of the same line has the same priority level, and is evaluated according to the uniting rule.

Operator	Explanation	Uniting rule
[ ] ( )	expression	right from left
- !	monadic	left from right
* / %	multiplication, division, surplus	right from left
+ -	addition, subtraction	right from left
< > <= >=	relation	right from left
== !=	relation（value）	right from left
&	AND of each bit	right from left
|	OR of each bit	right from left
&&	logical AND	right from left
||	logical OR	right from left

1.2 Operand

○ Constant

The constant is either the integer or the real number.

・ Integer

The integer can use the value within the range which can be expressed by 32 bit integer value.(-2147483648～2147483647)

・ Real number

The real number can use the value within the range which can be expressed by 32 bit float type.

±（1.175494351e-38F～3.402823466e+38F）

○ Variable

In Expression, it is possible to describe by associating the arbitrary variable name permitted by C language with controller's register.

Controller's bit type register is handled as bool type though the bool type variable does not exist

in C language. The bool type variable takes only either of value of true or false. It can be used only for the logical expression.

The following limitations are installed in the variable name which can be used.

It is started from characters other than the numerical value.

The character which can be used is alphabet and underscore '_', and figures among ASCII characters.

The same variable name as the following function names cannot be used.

Ex: Abc	OK
get_input0	OK
1ab	NG
Sin	NG

1.2 Function

The following arithmetic functions can be used.

cos(), sin(), arctan(), tan()

2. Recognizable expression

The Expression is described by combining the operand and the operator. There are some restrictions in the description method. The restriction is explained as follows.

○ Arithmetic operator

This operator can be used for the operand of the integer type and the real type.

The monadic minus can be used only once. The bit operation can use only the integer type. The arithmetic operation cannot be used for the operand of the bit type.

Even if the calculation value exceeds the range of the register, the type conversion is not automatically done. Therefore, the user should allocate an appropriate type in the variable.

Example:

MW00001 = MW00002 + MW00003	OK
MW00001 = MW00002 / 345	OK
MF00002 = (MW00004 + MF00002) / (ML00018 + MW00008)	OK
MW00001 = MW00002 & 4096	OK
MB000010 = MB000011 – MB000012	NG
MW00001 = MB000011 * MW00001	NG

○ Comparison operator

This operator can be used for the operand of the integer type and the real type. The register of the bit type should come left. In the case to do the comparison which uses '==' or '!=' for the operand of the integer bit type, the comparison object should be an expression of true/false.

ex)

MB000010 = MW00002 != MW00003	OK
MB000010 = MF00002 < 99.99	OK
MB000010 = MW00002 >= MW00003	OK
MB000010 = MB000011 == true	OK
MB000010 = MB000011 != 0	NG
MB000010 = MB000011 == 1	NG

○ Logic operator

This operator can be used only for the operand of the bit type.

ex)

MB000010 = MB000011 && MB000012	OK
MB000010 = !MB000011	OK
MB000010 = (MW000020 >= 50) && MB000011	OK
MB000010 = MW00001 || MW00002	NG
MB000010 = !MW00001	NG

○ Substitution operator

If it is a difference of the real type or the integer type even if a right, left type is different, substitution is possible. However, the rounding error is caused when substituting from the real type to the integer type. Substitution for the bit type register can do only a logical value (bit type register or true/false). In the case to substitute the values other than a logical value for the bit type register, the values are compared with 0(Or, 0.0), and the truth is converted into the substituted code. The substitution of the bit type excluding the bit type register is assumed to be impossible.

ex)

MW00001 = MW00002	OK
ML00003 = MW00002	OK
MF00006 = MW00002 * 343	OK
MB000010 = MB000011	OK

MW00001 = MF00012	OK
MB000102 = MW00010	OK
MB000102 = true	OK
MW00010 = MB000101	NG
MW00010 = true	NG

○ Function

The argument and the return value to the function depend on the specification of controller's function. That is, the output value is returned by the integer when the register of the integer and the integer type is input to sin(), cos(), and arctan(), and when the register of the real number and the real type is input, the output value is returned by the real number. When the register of the integer type is input because the argument of tan() is a real number, is treated as a real type.

ex）

MW00001 = sin(MW00002)	OK
MF00001 = cos(MF00002 * 3.14)	OK
MW00001 = - arctan(MF00002)	OK

○ Others

・Parentheses

Two or more expressions can be united by using‘(’and‘)’.

ex）

MW00001 = - ((MW00002 – MW00003) / (MW00004 + MW00005))　　OK

・Array

The array can be specified by using‘[’and‘]’ B as well as C language.

ex）

MW00001 = MW00002[100]	OK
MW00001 = MW00002[MW00100]	OK
MB00001 = MB000020[0]	OK

3. Application to ladder program

The use of Expression in the ladder program is divided into three kinds of the following.

① Conditional expression of IF instruction

② Conditional expression of WHILE instruction

③ Operational expression of EXPRESSION instruction

The use example is explained as follows.

① Conditional expression of IF instruction

The Expression is described in the conditional expression description area of the IF instruction and the ELSE instruction. However, only Expression which outputs the result of the bool type can be described. Therefore, the description of the Expression which includes the substitution operator is not recognized.

ex）

MB000001 == true	OK
MW00002 < 100	OK
MW00003 != MW00004	OK
MB000005 = false	NG
MW00007 = MW00010	NG

② Conditional expression of WHILE instruction

The Expression is described in the conditional expression description area of the WHILE instruction. However, only Expression which outputs the result of the bool type can be described. Therefore, the description of the Expression which includes the substitution operator is not recognized.

ex）Refer to the example of ①.

③ Operational expression of EXPRESSION instruction

The Expression is described in the conditional expression description area of the EXPRESSION instruction. The operational expression can be described according to the description rule of Expression. However, Expression which outputs the result of the bool type cannot be described.

ex)

MB000010 = MB000001 && MB000005;	OK
MB000011 = MB000010 == true;	OK
MW00000 = (MW00001 + MW00005) / MW00004;	OK

MW00003 = MW00000/50;	OK
MW00002 = MW00001 & 300;	OK
MW00010 = MW00003 – MW00002;	OK
MB000001 == true;	NG
MW00006 >= 100;	NG
MW00007 != MW00009;	NG

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YASKAWA ELECTRIC AMERICA, INC.
Chicago-Corporate Headquarters 2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone: (847) 887-7000 Fax: (847) 887-7310 Internet: http://www.yaskawa.com

MOTOMAN INC.
805 Liberty Lane, West Carrollton, OH 45449, U.S.A.
Phone: (937) 847-6200 Fax: (937) 847-6277 Internet: http://www.motoman.com

YASKAWA ELECTRIC CORPORATION
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo, 105-0022, Japan
Phone: 81-3-5402-4511 Fax: 81-3-5402-4580 Internet: http://www.yaskawa.co.jp

YASKAWA ELETRICO DO BRASIL COMERCIO LTDA.
Avenida Fagundes Filho, 620 Bairro Saude Sao Paolo-SP, Brasil CEP: 04304-000
Phone: 55-11-5071-2552 Fax: 55-11-5581-8795 Internet: http://www.yaskawa.com.br

YASKAWA ELECTRIC EUROPE GmbH
Am Kronberger Hang 2, 65824 Schwalbach, Germany
Phone: 49-6196-569-300 Fax: 49-6196-888-301 Internet: http://www.yaskawa.de

MOTOMAN ROBOTICS AB
Box 504 S38525, Torsas, Sweden
Phone: 46-486-48800 Fax: 46-486-41410

MOTOMAN ROBOTEC GmbH
Kammerfeldstraβe 1, 85391 Allershausen, Germany
Phone: 49-8166-900 Fax: 49-8166-9039

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, Scotland, United Kingdom
Phone: 44-12-3673-5000 Fax: 44-12-3645-8182

YASKAWA ELECTRIC KOREA CORPORATION
Paik Nam Bldg. 901 188-3, 1-Ga Euljiro, Joong-Gu, Seoul, Korea
Phone: 82-2-776-7844 Fax: 82-2-753-2639

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
Head Office: 151 Lorong Chuan, #04-01, New Tech Park Singapore 556741, SINGAPORE
Phone: 65-282-3003 Fax: 65-289-3003

TAIPEI OFFICE (AND YATEC ENGINEERING CORPORATION)
10F 146 Sung Chiang Road, Taipei, Taiwan
Phone: 886-2-2563-0010 Fax: 886-2-2567-4677

YASKAWA JASON (HK) COMPANY LIMITED
Rm. 2909-10, Hong Kong Plaza, 186-191 Connaught Road West, Hong Kong
Phone: 852-2803-2385 Fax: 852-2547-5773

BEIJING OFFICE
Room No. 301 Office Building of Beijing International Club,
21 Jianguomanwai Avenue, Beijing 100020, China
Phone: 86-10-6532-1850 Fax: 86-10-6532-1851

SHANGHAI OFFICE
27 Hui He Road Shanghai 200437 China
Phone: 86-21-6553-6600 Fax: 86-21-6531-4242

SHANGHAI YASKAWA-TONJI M & E CO., LTD.
27 Hui He Road Shanghai 200437 China
Phone: 86-21-6533-2828 Fax: 86-21-6553-6677

BEIJING YASKAWA BEIKE AUTOMATION ENGINEERING CO., LTD.
30 Xue Yuan Road, Haidian, Beijing 100083 China
Phone: 86-10-6232-9943 Fax: 86-10-6234-5002

SHOUGANG MOTOMAN ROBOT CO., LTD.
7, Yongchang-North Street, Beijing Economic & Technological Development Area,
Beijing 100076 China
Phone: 86-10-6788-0551 Fax: 86-10-6788-2878

YEA, TAICHUNG OFFICE IN TAIWAN
B1, 6F, No. 51, Section 2, Kung-Yi Road, Taichung City, Taiwan, R.O.C.
Phone: 886-4-2320-2227 Fax: 886-4-2320-2239

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