

FP7 CPU Unit
Ver 3.20
Additional Functions Manual

December 15, 2014

Introduction

Thank you for buying a Panasonic product. Before you use the product, please carefully read the installation instructions and the users manual, and understand their contents in detail to use the product properly.

Types of Manual

- There are different types of users manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded on our website:
http://industrial.panasonic.com/ac/e/dl_center/manual/

Unit name or purpose of use	Manual name	Manual code
FP7 Power Supply Unit		
FP7 CPU Unit	FP7 CPU Unit Users Manual (Hardware)	WUME-FP7CPUH
	FP7 CPU Unit Command Reference Manual	WUME-FP7CPUPGR
Instructions for Built-in COM Port	FP7 series Users Manual (SCU communication)	WUME-FP7COM
FP7 Extension Cassette (Communication)		
Instructions for Built-in LAN Port	FP7 CPU Unit Users Manual (LAN Port Communication)	WUME-FP7LAN
FP7 Digital Input/Output Unit	FP7 Digital Input/Output Unit Users Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit Users Manual	WUME-FP7AIH
FP7 Analog Output Unit	FP7 Analog Output Unit Users Manual	WUME-FP7AOH
FP7 Positioning Unit	FP7 Positioning Unit Users Manual	WUME-FP7POSP
PHLS System	PHLS System Users Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

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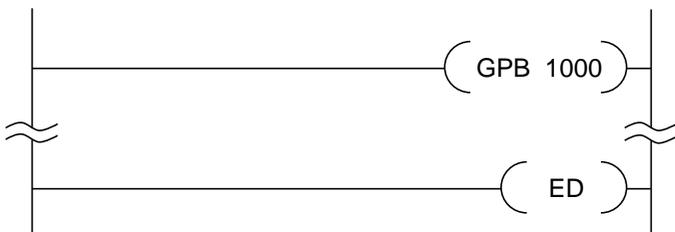
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Basic Instructions

1.1 GPB (Global PB Number Setting)

■ Ladder diagram



■ List of operands

Operand	Description
n	Global PB number Data settable range: 1000 to 1999

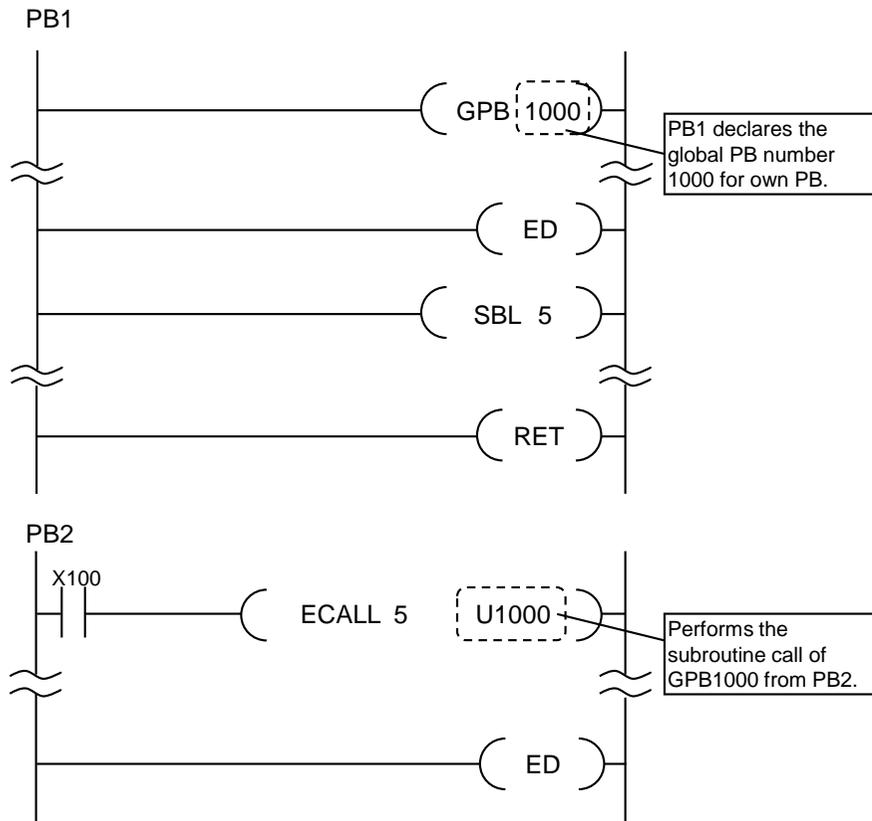
■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
n																A					

■ Outline of operation

- Declares the global PB number of [n] for the PB in which GPB instruction is written.
- This instruction should be described at the beginning of a main program area.
- Sets an active PB number to a specified global PB number table in the preprocessing of arithmetic operation (when switching PROG to RUN, during rewriting during RUN).
- A syntax error occurs when the same global PB number is specified in a project.
- When multiple GPB instructions are described in the same PB, multiple global PB numbers are set for one PB.
- Specify PB numbers as follows for instructions that use PB numbers (ECALL, EFCALL, LCWT, LCRD, STARTPG, an STOPPG).
PB number specification: 1 to 468
Global PB number specification: 1000 to 1999
- A syntax error occurs when a number (other than 1000 to 1999) that is out of the range of the settable global PB numbers is specified by the GPB instruction.
- An operation error occurs when an global PB number that is not set is specified for an instruction that uses a PB number.

■ Example of operation

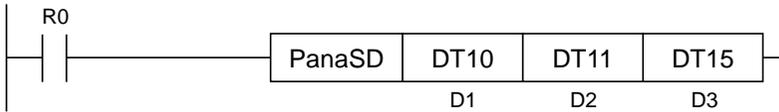


2

High-level Instructions

2.1 PanaSD (Panasonic SD Card Lifetime Information Read)

■ Ladder diagram



■ Available operation units (A: Available)

No operation unit.

■ List of operands

Operand	Description
D1	The device address storing an execution result code
D2	The starting address of the device storing the acquisition time of SD card lifetime information
D3	The device address storing the number of rewrites information

■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
D1	A	A	A	A			A	A													
D2	A	A	A	A			A	A													
D3	A	A	A	A			A	A													

■ Outline of operation

- This instruction is used to read the lifetime information of Panasonic SD card.
- This instruction and SD card access instruction can be used simultaneously.
- Stores the execution result of this instruction in the area starting with [D1], [D2] and [D3].
- The duplicate execution of this instruction is not possible.
- Do not use this instruction frequently. Executing this event by a differential instruction is recommended
- This instruction is exclusive to industrial SD cards made by Panasonic. This cannot be used for other SD cards.
The SD cards that support this instruction are as follows.

SD card series supports the PanaSD instruction (as of October 2014)

Type	Series
SLC	FX, EX
MLC	JD, GD, PC

Operand [D1]

- The starting number of the device area storing execution results (1-word, unsigned 16-bit integer)

■ Execution result

Execution result	Value
Execution active	0xffff *1
Normal end	0
Double startup error	1
SD card cover open error	2
SD card not mounted error	3
Unsupported SD card error *2	4

*1 The most significant bit of the execution result code can be used as an instruction active flag.

*2 The SD card series which support this instruction is described in the outline of operation.

Operand [D2]

- The starting number of the device area storing the acquisition time of SD card lifetime information is specified.

Contents

Device	Acquisition time	(Example) Value	Remarks
[D2]	Year, month	1410	October 2014
[D2+1]	Day, hour	0318	18 o'clock on 3rd
[D3+2]	Minute, second	5530	55 minutes and 30 seconds

Operand [D3]

- The starting number of the device area storing the number of rewrites information (1-word, unsigned 16-bit integer) is specified.

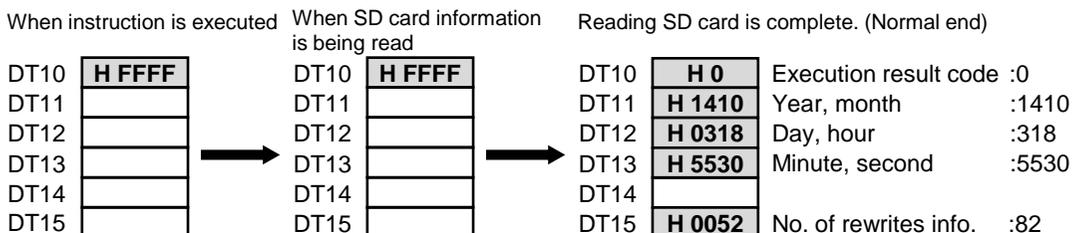
Contents

Number of rewrites information
Ratio (%) of [Average number of rewrites of management blocks] to [Max. number of possible rewrites] = Number of rewrites (average of all management blocks) / Max. number of possible rewrites * 100

■ Example of processing

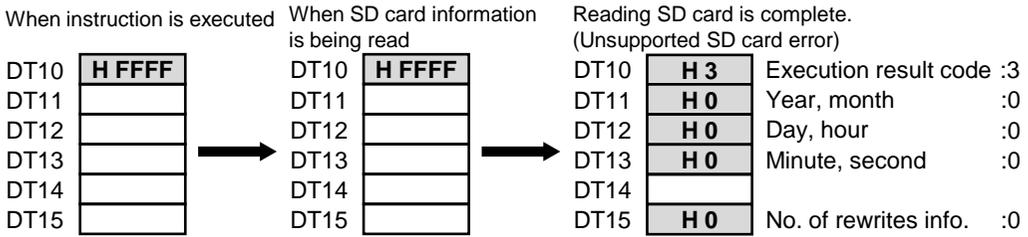
Example 1) When the execution result of PanaSD instruction is Normal

[D1]...DT10 [D2]...DT11~DT13 [D3]...DT15



Example 2) When the execution result of PanaSD instruction is Error.

[D1]...DT10 [D2]...DT11~DT13 [D3]...DT15

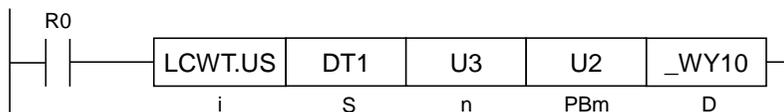


■ Flag operation

Name	Description
SR7	To be set when the range between [D2] to [D2+2] is out of the accessible range.
SR8 (ER)	To be set when executed in an interrupt program.

2.2 LCWT (Specified PB Local Device Write)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A	A	A		

■ List of operands

Operand	Description
S	The starting address of a source device
n	No. of written devices (Settable range: 1 to 65535)
PBm	Destination PB number (Settable range: 1 to Max. number of PB)
D	The starting address of a source local device

■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX *2	K	U	H	SF	DF	" "	*1
S	A	A	A	A			A	A				A	A	A							A
n	A	A	A	A			A	A								A	A				A
PBm	A	A	A	A			A	A								A	A				A
D	A	A	A	A			A	A				A	A								

*1: Only 16-bit devices, and 32-bit devices can be modified. (Integer constants, real number constants and character constants cannot be specified.)

*2: Index registers (I0 to IE)

■ Outline of operation

- Writes the data for [n] from the area specified by [S] to the area specified by [PBm:D (local device)] and subsequent areas all at once.
- Global device and local device (of the PB in which this instruction is executed) can be specified for [S].
- Only local devices (of PB numbers specified by [PBm]) can be specified for [D].
- * Pseudo argument specification is possible by combining this instruction with the ECALL instruction.
Refer to "Argument, return value operation of ECALL instruction"
- “.
- * Local devices of multiple PBs can be preset by one PB.
Refer to "Presetting of specified PB local devices“.

■ Processing

Example 1) When global device is specified for S

[S]...DT1 [n]...3 [PBm]...2 [D]..._WY10

DT0	H 0011		PB2:_WY8	H 0000
DT1	H 2233	↘	PB2:_WY9	H 0000
DT2	H 4455	↘	PB2:_WY10	H 2233
DT3	H 6677	↘	PB2:_WY11	H 4455
DT4	H 8899		PB2:_WY12	H 6677

Example 2) When local device is specified for S (Instruction is executed in PB5.)

[S]..._LD10 [n]...2 [PBm]...3 [D]..._DT8

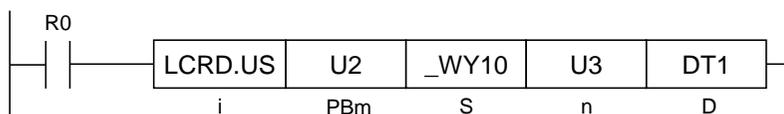
PB5:_LD9	H 8899		PB3:_DT7	H 0000
PB5:_LD10	H AABB	→	PB3:_DT8	H AABB
PB5:_LD11	H CCDD	→	PB3:_DT9	H CCDD
PB5:_LD12	H EEFF		PB3:_DT10	H 0000
PB5:_LD13	H FFEE		PB3:_DT11	H 0000

■ Flag operation

Name	Description
SR7 SR8 (ER)	To be set when an out-of-range value is specified for parameters.
	To be set when the device address specified by [S+n] exceeds the upper limit of the device.
	To be set when [PBm] exceeds the maximum PB number.
	To be set when [D] is specified for a global device.
	To be set when the device address specified by [PBm];[D+n] exceeds the upper limit of the device.

2.3 LCRD (Specified PB Local Device Read)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A	A	A		

■ List of operands

Operand	Description
PBm	Source PB number (Settable range: 1 to Max. number of PB)
S	The starting address of source local device
n	The number of read devices (Settable range: 1 to 65535)
D	The starting address of destination device

■ Available devices (A: Available)

Operand	16-bit device											32-bit device *1			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX *2	K	U	H	SF	DF	" "	
PBm	A	A	A	A			A	A								A	A				A
S	A	A	A	A			A	A				A	A								
n	A	A	A	A			A	A							A	A					A
D	A	A	A	A			A	A				A	A	A							A

*1: Cannot be specified when the operation unit is 16-bit integer (SS, US).

*2: Index registers (I0 to IE)

■ Outline of operation

- Reads the data for [n] from the area specified by [PBm]:[S] (local device) to the area specified by [D] and subsequent areas all at once.
- Only local devices (of PB numbers specified by [PBm]) can be specified for [S].
- Global device and local device (of the PB in which this instruction is executed) can be specified for [D].
- * Pseudo argument specification is possible by combining this instruction with the ECALL instruction.
Refer to Argument, return value operation of ECALL instruction
- .

■ Processing

Example 1) When global device is specified for D

[PBm]...2 [S]..._WY10 [n]...3 [D]...DT1

PB2:_WY8	H 0000		DT0	H 0011
PB2:_WY9	H 0000		DT1	H 2233
PB2:_WY10	H 2233	→	DT2	H 4455
PB2:_WY11	H 4455	→	DT3	H 6677
PB2:_WY12	H 6677	→	DT4	H 8899

Example 2) When local device is specified for D (Instruction is executed in PB5.)

[PBm]...3 [S]..._DT8 [n]...2 [D]..._LD10

PB3:_DT7	H 0000		PB5:_LD9	H 8899
PB3:_DT8	H AABB	→	PB5:_LD10	H AABB
PB3:_DT9	H CCDD	→	PB5:_LD11	H CCDD
PB3:_DT10	H 0000		PB5:_LD12	H EEEF
PB3:_DT11	H 0000		PB5:_LD13	H FFEE

■ Flag operation

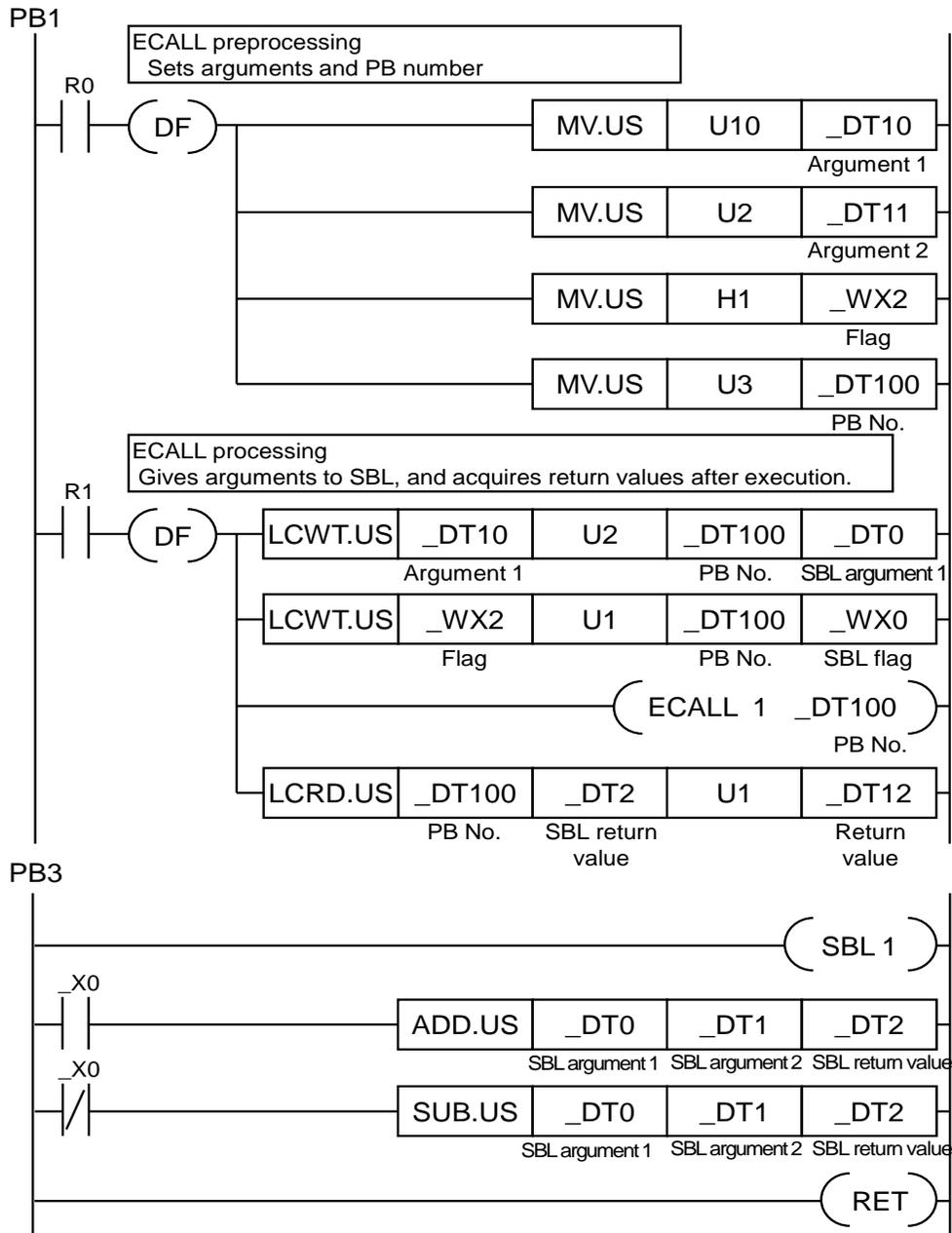
Name	Description
SR7 SR8 (ER)	To be set when an out-of-range value is specified for parameters.
	To be set when [PBm] exceeds the maximum PB number.
	To be set when [S] is specified for a global device.
	To be set when the device address specified by [PBm]:[S+n] exceeds the upper limit of the device.
	To be set when the device address specified by [D+n] exceeds the upper limit of the device.

■ Argument, return value operation of ECALL instruction

Method of giving argument to subroutine in another PB by LCWT and receiving return value by LCRD
 Example of processing

Calls SBL1 in PB3 from PB1, and receives the result.

SBL1 is the subroutine which calculates "Argument 1 + Argument 2 → Return value" or "Argument 1 - Argument 2 → Return value".



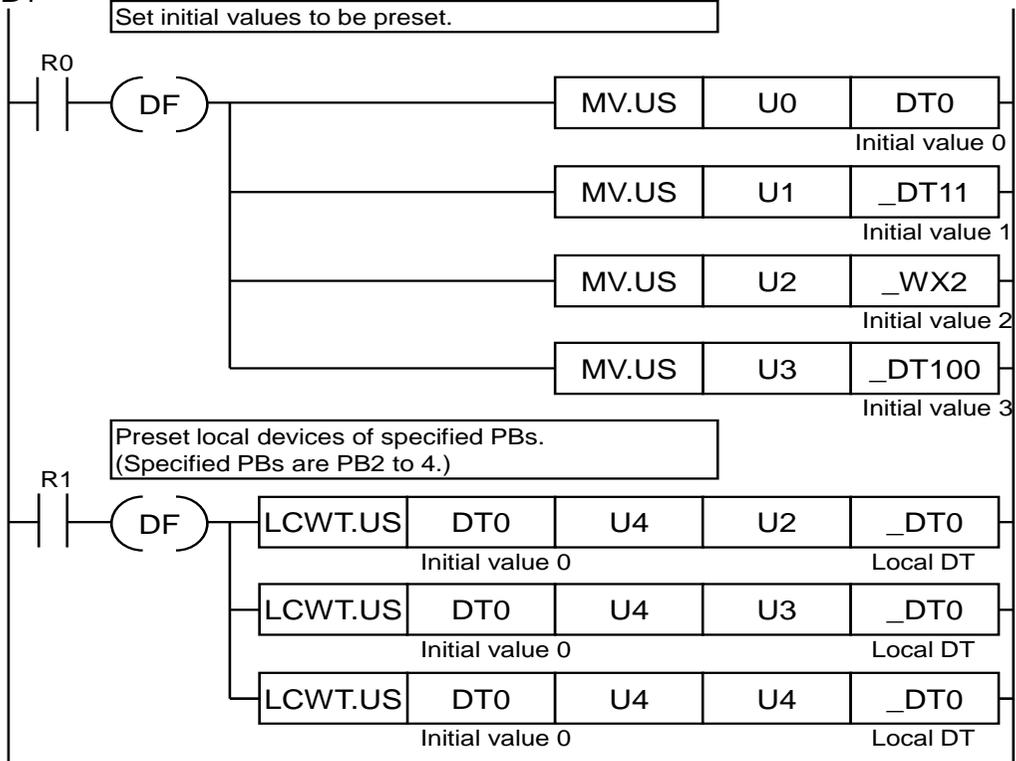
■ Presetting of specified PB local devices

Method of initializing devices to the local devices of specified PBs from one PB

Example of processing

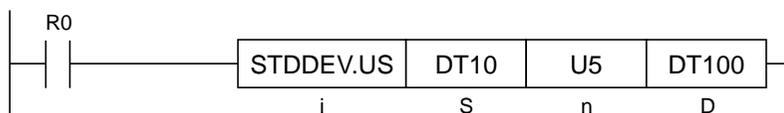
Executes the instruction in PB1, and sets to initialize devices to the local devices of PB2 to 4 collectively.

PB1



2.4 STDDEV (Variance and Standard Deviation Acquisition)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A				

■ List of operands

Operand	Description
S	Specify the starting position of a target area. (Data format: according to the operation unit)
n	Specify the number of target data. (Data format: unsigned 16-bit integer)
D	Specify the device address storing results.

■ Available devices (A: Available)

Operand	16-bit device										32-bit device			Integer			Real number		String	Index modifier *1		
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U *2	H *3	SF	DF		" "	
S	A	A	A	A			A	A	A	A	A											A
n	A	A	A	A			A	A	A	A	A					A	A					A
D	A	A	A	A			A	A	A		A											A

*1: Only 16-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

*2: Can be specified only when the operation unit is unsigned integer (US).

*3: Can be specified only when the operation unit is integer (US, SS).

■ Outline of operation

- Stores the variance and standard deviation within the range of the device area specified by [S] and [n] into the device area specified by [D].
- Up to 30000 data can be specified.
- The result [D] is output as single-precision real numbers.

16-bit device	Output content
[D], [D]+1	Stores variance.
[D]+2, [D]+3	Stores standard deviation.

■ Processing

Method for calculating variance and standard deviation

[Condition] N data x_1, x_2, \dots, x_n

① Mean Value

$$m = \frac{x_1 + x_2 + \dots + x_n}{N}$$

② Variance

$$\sigma^2 = \frac{(x_1 - m)^2 + (x_2 - m)^2 + \dots + (x_n - m)^2}{N}$$

③ Standard deviation

$$\sigma = \sqrt{\sigma^2}$$

Example 1) When the operation unit is 16-bit (US)

[S]...DT10

[n]...U5

[D]...DT100

<Calculation range>

DT10	U 2
DT11	U 4
DT12	U 5
DT13	U 6
DT14	U 8



<Output result>

DT100	SF 4.00E+00	Variance
DT101		* Single-precision real number (32-bit)
DT102	SF 2.00E+00	Standard deviation
DT103		* Single-precision real number (32-bit)

The following results are stored.

- Variance of S to S+4 is stored in (D, D+1).
- Standard deviation of S to S+4 is stored in (D+2, D+3).

Example 2) When the operation unit is 16-bit (SS)

[S]...DT10 [n]...U5 [D]...DT100

<Calculation range>

DT10	K 16
DT11	K -20
DT12	K 32
DT13	K -35
DT14	K -12



<Output result>

DT100	SF 5.9536E+02	Variance
DT101		* Single-precision real number (32-bit)
DT102	SF 2.4400E+01	Standard deviation
DT103		* Single-precision real number (32-bit)

The following results are stored.

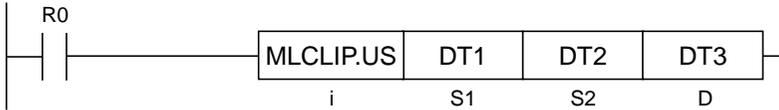
- Variance of S to S+4 is stored in (D, D+1).
- Standard deviation of S to S+4 is stored in (D+2, D+3).

■ Flag operation

Name	Description
SR7 SR8 (ER)	To be set in case of out-of-range values in indirect access (index modification, pointer access).
	To be set when [S+n] exceeds the device address.
	To be set when the result storage area exceeds the device address.
	To be set when the specified ranges of [S1] and [D] overlap.

2.5 MLCLIP (Saturated Multiplication)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A	A	A		

■ List of operands

Operand	Description
S1	Target data 1 for operation (Device address or constant)
S2	Target data 2 for operation (Device address or constant)
D	Operation result data (Device address)

■ Available devices (A: Available)

Operand	16-bit device											32-bit device *1			Integer			Real number		String	Index modifier *2
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX *3	K *4	U *5	H *6	SF *7	DF *8	" "	
S1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A				A
S2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A				A
D	A	A	A	A			A	A	A		A	A	A	A							A

*1: Cannot be specified when the operation unit is 16-bit integer (SS, US).

*2: Only 16-bit devices, 32-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

*3: Index registers (I0 to IE)

*4: Can be specified only when the operation unit is signed integer (SS, SL).

*5: Can be specified only when the operation unit is unsigned integer (US, UL).

*6: Can be specified only when the operation unit is integer (US, SS, UL, SL).

■ Outline of operation

- Multiplies [S1] by [S2] according to the operation unit of [i].
- Stores operation results in the address starting with [D].
[S1] x [S2] → [D]
- As for the unsigned operation, if the result exceeds the operation unit, it is corrected to the maximum value.
- As for the signed operation, if the result exceeds the operation unit, it is corrected to the maximum or minimum value.

■ Processing

Example 1) When the operation unit is 16-bit (US, SS) Example 2) When the operation unit is 32-bit (UL, SL, SF)

[i]...US,SS

[S1]...DT1 [S2]...DT2 [D]...DT3

DT0	K 100	DT0	K 100
DT1	K 110	DT1	K 110
DT2	K 120	DT2	K 120
DT3	K 130	DT3	K 13200
DT4	K 140	DT4	K 10

[i]...UL,SL,SF

[S1]...TS2 [S2]...TS3 [D]...TS0

TS0	K 500	TS0	K 3000000
TS1	K 1000	TS1	K 1000
TS2	K 1500	TS2	K 1500
TS3	K 2000	TS3	K 2000
TS4	K 2500	TS4	K 2500

Example 3) When the operation unit is unsigned 16-bit (US) and exceeds the max. value

[i]...US

[S1]...DT1 [S2]...DT4 [D]...DT3

DT0	U 200	DT0	U 1
DT1	U 240	DT1	U 2
DT2	U 280	DT2	U 3
DT3	U 320	DT3	U 65535
DT4	U 340	DT4	U 10

■ Flag operation

Name	Description
SR7 SR8 (ER)	To be set in case of out-of-range values in indirect access (index modification).
SR9 (CY)	To be set when the result is corrected, and cleared when it is not corrected.

2.6 TIMEstr (Date and Time Character String Conversion)

■ Ladder diagram



■ Available Operation Units (A: Available)

No operation unit.

■ List of operands

Operand	Description
S1	The starting address storing date and time information
S2	The device address stroing conversion patterns
D	The starting address of the device storing character strings

■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier *1
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S1	A	A	A	A		A	A	A													A
S2	A	A	A	A			A	A									A				A
D	A	A	A	A			A	A													A

*1: Only 16-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

■ Outline of operation

- Converts data and time information to character strings.
- Outputs character strings according to a specified conversion pattern.
- The date and time information to be output is year, month, day, day of the week, hour, minute, and second.
- This instruction can be used when data and time information is required for creating mail texts.
- This instruction is used in combination with the PRINT instruction.
- Converts the date and time information specified by [S1] according to the conversion pattern specified by [S2], and stores the character string in the storage location specified by [D].

Operand [S1] setting

- Specify the starting address storing the date and time information.
- Checking the combination of year, month, day, or day of the week is not performed.
- Specify SD50 if you want to output the current time and date of PLC. When SD50 is specified, the combination of year, month, day, or day of the week is correct.
- Always store the data in the order mentioned in the table below regardless of the conversion pattern of [S2].

■ Specified contents

Operand	Contents	Specified range
[S1]	Year *	0 to 99
[S1+1]	Month	1 to 12
[S1+2]	Day	1 to 31
[S1+3]	Hour	0 to 23
[S1+4]	Minute	0 to 59
[S1+5]	Second	0 to 59
[S1+6]	Day of the week	0 to 6

* The character string after conversion is 2000 to 2099.

Operand [S2] setting

- Specify the device address storing a conversion pattern.
- The conversion pattern is specified by 4-digit hex. Refer to the following tables as the contents specified for each digit are predetermined.

■ Specified contents

4th digit	3rd digit	2nd digit	1st digit
Output pattern	Date and time specification	Addition of day of the week	Delimiter

■ Details of specified contents

4th digit: Output pattern

Value	Constitution (Order)	Format	Major regions	Month display	Day of the week display
0	Year/Month/Day/ (Day of the week)	1x1	Japan, Korea	Number	Chinese character
1	Year/Month/Day/ (Day of the week)	2x1	Japan, Korea	Number	Chinese character
2	Year/Month/Day/ (Day of the week)	1x1	China	Number	Chinese character (China)
3	Year/Month/Day/ (Day of the week)	2x1	China	Number	Chinese character (China)
4	Day of the week/ Day/Month/Year	1x1	Asia, Europe	Number	English
5(*1)	Day of the week/ Day/Month/Year	1x1	Asia, Europe	English	English
6	Day of the week/ Day/Month/Year	1x1	US	Number	English
7(*2)	Day of the week/ Day/Month/Year	1x1	US	English	English

(*1) 5 is processed as 4 when 5 or 6 is specified for the delimiter of the first digit.

(*2) 7 is processed as 6 when 5 or 6 is specified for the delimiter of the first digit.

Month display correspondence table

Notation	1	2	3	4	5	6	7	8	9	10	11	12
Chinese character	01	02	03	04	05	06	07	08	09	10	11	12
English	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

The display type is numbers or English. It depends on the output pattern.

Day of the week correspondence table

Notation	0	1	2	3	4	5	6
Chinese character	日	月	火	水	木	金	土
Chinese character (China)	天	一	二	三	四	五	六
English	Sun	Mon	Tue	Wed	Thu	Fri	Sat

The display type is Chinese characters, Chinese characters (China), or English. It depends on the output pattern.

In the case of Chinese character or Chinese character (China), day of the week is output as a double-word character.

3rd digit: Date and time specification

Value	Content
0	Date and time
1	Date only
2	Time only

2nd digit: Addition of day of the week

Value	Content
0	Not add
1(*3) (*4)	Add

(*3) 1 is processed as 0 when 5 or 6 is specified for the delimiter of the first digit.

(*4) 1 is processed as 0 when 2 is specified for the date and time specification of the third digit.

1st digit: Delimiter specification

Value	Date	Between date and time	Time
0	/ (slash)	_ (space)	: (colon)
1	_ (space)	_ (space)	_ (space)
2	- (hyphen)	_ (space)	: (colon)
3	. (period)	_ (space)	. (period)
4(*5)	Chinese character	_ (space)	Chinese character
5	None	_ (space)	None
6	None	_ (underbar)	None

(*5) 4 is processed as 5 when a value other than 0 to 3 is specified for the output pattern of the fourth digit.

■ Example of specification

Conversion pattern	Output content	Output image
H0000	yyyy/mm/dd_hh:mm:ss	2014/09/05_05:06:32
H0001	yyyy_mm_dd_hh_mm_ss	2014_09_05_05_06_32
H0004	yyyy年mm月dd日_hh時mm分ss秒	2014年09月05日_05時06分32秒
H0005	yyyymmdd_hhmmss	20140905_050632
H0006	yyyymmdd_hhmmss	20140905_050632
H0014	yyyy年mm月dd日(d)_hh時mm分ss秒	2014年09月05日(金)_05時06分32秒
H0102	yyyy-mm-dd	2014-09-05
H0203	hh.mm.ss	05.06.32
H1000	yyyy/mm/dd_hh:mm:ss	2014/09/05_05:06:32
H1010	yyyy/mm/dd(d)_hh:mm:ss	2014/09/05(金)_05:06:32
H2014	yyyy年mm月dd日(d)_hh時mm分ss秒	2014年09月05日(五)_05時06分32秒
H3010	yyyy/mm/dd(d)_hh:mm:ss	2014/09/05(五)_05:06:32
H4000	dd/mm/yyyy_hh:mm:ss	05/09/2014_05:06:32
H4006	ddmmyyyy_hhmmss	05092014_050632
H4012	d_dd-mm-yyyy_hh:mm:ss	Fri_05-09-2014_05:06:32
H4112	d_dd-mm-yyyy	Fri_05-09-2014
H5000	dd/mm/yyyy_hh:mm:ss	05/Sep/2014_05:06:32
H5012	d_dd-mm-yyyy_hh:mm:ss	Fri_05-Sep-2014_05:06:32
H6000	mm/dd/yyyy_hh:mm:ss	09/05/2014_05:06:32
H6006	mmdyyyy_hhmmss	09052014_050632
H6012	d_mm-dd-yyyy	Fri_09-05-2014
H7000	mm/dd/yyyy_hh:mm:ss	Sep/05/2014_05:06:32
H7012	d_mm-dd-yyyy_hh:mm:ss	Fri_Sep-05-2014_05:06:32
H7112	d_mm-dd-yyyy	Fri_Sep-05-2014

■ Example of special specification (when automatically corrected)

Conversion pattern	Output content	Output image
H5005(*1)	ddmmyyyy_hhmmss	05092014_050632
H7006(*2)	mmdyyyy_hhmmss	09052014_050632
H7016(*3)	mmdyyyy_hhmmss	09052014_050632
H5216(*4)	hhmmss	050632
H4014(*5)	ddmmyyyy_hhmmss	05092014_050632

Operand [D] setting

- Specify the starting address storing character strings.

例1)

[S1]...SD50 [S2]...DT0 [D]...DT10

・出カイメージ 2014年09月25日(木),12時54分31秒

SD50	K 14	年	DT10	H 001F		バイト数
SD51	K 9	月	DT11	H 30(0)	H 32(2)	
SD52	K25	日	DT12	H 34(4)	H 31(1)	
SD53	K 12	時	DT13	H 4E94(年)		
SD54	K 54	分	DT14	H 39(9)	H 30(0)	
SD55	K31	秒	DT15	H 8E8C(月)		
SD56	K4	曜日	DT16	H 35(5)	H 32(2)	
			DT17	H FA93(日)		
			DT18	H 96(木)	H 28(0)	
			DT19	H 29(0)	H D8(木)	
DT0	H 0014		DT20	H 31(1)	H 20(,)	
			DT21	H 8E(時)	H 32(2)	
			DT22	H 35(5)	H 9E(時)	
			DT23	H 95(分)	H 34(4)	
			DT24	H 33(3)	H AA(分)	
			DT25	H 95(秒)	H 31(1)	
			DT26		H 62(秒)	

Example 1)

[S1]...DT100 [S2]...DT0 [D]...DT150

・ Output image Wed_08-06-2020_23:20:05

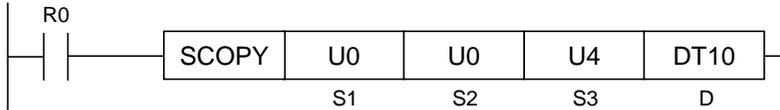
DT100	K 20	Year	DT150	H 0017		No. of bytes
DT101	K 6	Month	DT151	H 65(e)	H 57(W)	
DT102	K8	Day	DT152	H 20(,)	H 64(d)	
DT103	K 23	Hour	DT153	H 38(8)	H 30(0)	
DT104	K 20	Minute	DT154	H 30(0)	H 2D(-)	
DT105	K5	Second	DT155	H 2D(-)	H 36(6)	
DT106	K3	Day of the week	DT156	H 30(0)	H 32(2)	
			DT157	H 30(0)	H 32(2)	
			DT158	H 32(2)	H 20(,)	
			DT159	H 3A(:)	H 33(3)	
			DT160	H 30(0)	H 32(2)	
			DT161	H 30(0)	H 3A(:)	
			DT162		H 35(5)	
DT0	H 4012					

■ Flag operation

Name	Description
SR7 SR8 (ER)	To be set in case of out-of-range values in indirect access (index modification).
	To be set when the parameter of [S1] is out of the setting range.
	To be set when the parameter of [S2] is out of the setting range.
	To be set when the range between [S1] to [S1+6] is out of the accessible range.
	To be set when the destination range is out of the accessible range.

2.7 SCOPY (System Area Copy)

■ Ladder diagram



■ Available Operation Units (A: Available)

No operation unit.

■ List of operands

Operand	Description
S1	The device address storing the system area number to be copied or constant
S2	The device address storing the starting number of system area or constant
S3	The device address storing the terminating number of system area or constant
D	The starting device address of destination area

■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier *1
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S1	A	A	A	A			A	A								A	A				A
S2	A	A	A	A			A	A								A	A				A
S3	A	A	A	A			A	A								A	A				A
D	A	A	A	A			A	A													A

*1: Only 16-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

■ Outline of operation

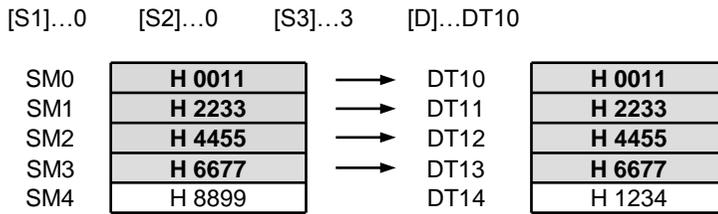
- Copies data in the area specified by S1, S2, and S3 to a specified area.

■ Precautions during programming

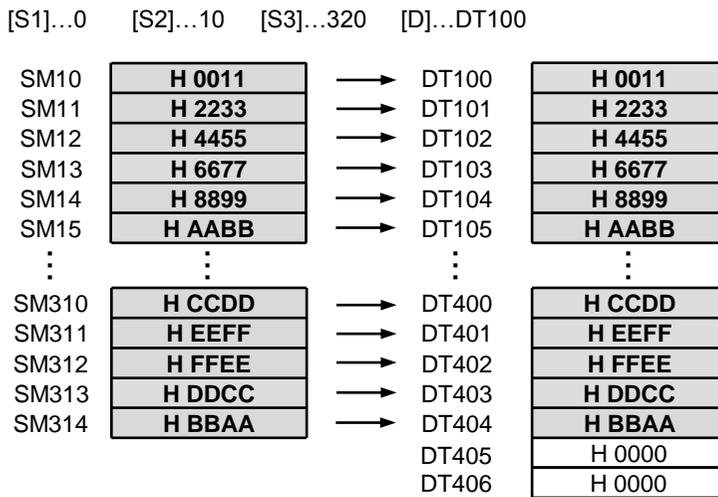
- S1 is always zero. An operation error occurs when numbers other than zero are specified.
- Specify S3 to be larger than S2.
- When S3 exceeds the upper limit of the system area, an operation error does not occur. The area up to the upper limit of the system area is copied from S2.

■ Processing

Example 1) When S2 and S3 are within the system monitor area



Example 2) When S3 exceeds the upper limit of the system monitor area
(when the upper limit of the system monitor area is 315)

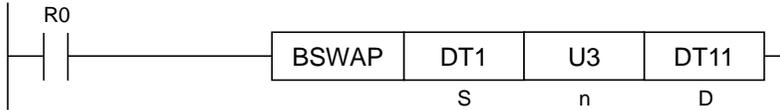


■ Flag operation

Name	Description
SR7 SR8 (ER)	To be set in case of out-of-range values in indirect access (index modification).
	To be set when [S1] is other than 0.
	To be set when [S2] is larger than [S3].
	To be set when [S2] is out of the accessible range.
	To be set when the destination range is outside the accessible range.

2.8 BSWAP (High /Low Byte in n Block Exchange)

■ Ladder diagram



■ Available Operation Units (A: Available)

No operation unit.

■ List of operands

Operand	Description
S	The starting address of the device to exchange the high and low bytes
n	The number of words to exchange the high and low bytes
D	Destination device address to transfer exchanged data

■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier *1	
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "		
S	A	A	A	A	A	A	A	A														A
n	A	A	A	A			A	A								A	A					A
D	A	A	A	A			A	A														A

*1: Only 16-bit devices can be modified. (32-bit devices, integer constants, real number constants and character constants cannot be specified.)

■ Outline of operation

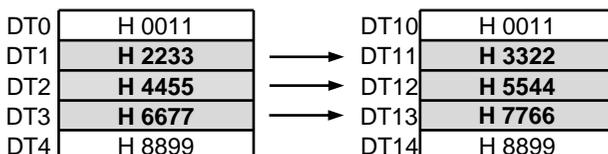
- Exchanges the high byte and low byte for [n] words from the device address specified by [S], and transfers it to the area starting from [D].
- The maximum number of exchanged words is 65535.
- When [n] is 0, no operation is performed.

■ Processing

Example) When the operation unit is 16-bit (US, SS)

[i]...US,SS

[S]...DT1 [n]...K3 [D]...DT11



■ Flag operation

Name	Description
SR7	To be set in case of out-of-range values in indirect access (index modification).
SR8 (ER)	To be set when the transfer range is outside the accessible range.

2.9 MV2 (2 Data Move)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A	A	A	A	A

■ List of operands

Operand	Description
S1	The device address of the source 1 or constant
S2	The device address of the source 2 or constant
D	Destination device address

■ Available devices (A: Available)

Operand	16-bit device											32-bit device *1			Integer			Real number		String	Index modifier *2
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX *3	K *4	U *5	H *6	SF *7	DF *8	" "	
S1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A
S2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A
D	A	A	A	A			A	A	A		A	A	A								A

*1: Cannot be specified when the operation unit is 16-bit integer (SS, US).

*2: Only 16-bit devices, 32-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

*3: Index registers (I0 to IE)

*4: Can be specified only when the operation unit is signed integer (SS, SL).

*5: Can be specified only when the operation unit is unsigned integer (US, UL).

*6: Can be specified only when the operation unit is integer (US, SS, UL, SL).

*7: Can be specified only when the operation unit is single-precision floating point real number (SF).

*8: Can be specified only when the operation unit is double-precision floating point real number (DF).

■ Outline of operation

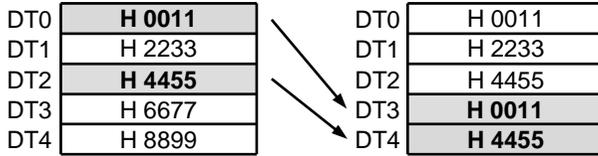
- Transfers two data specified by [S1] and [S2] to the area starting from [D] all at once according to the operation unit specified by [i].

■ Processing

Example 1) When the operation unit is 16-bit (US, SS)

[i]...US,SS

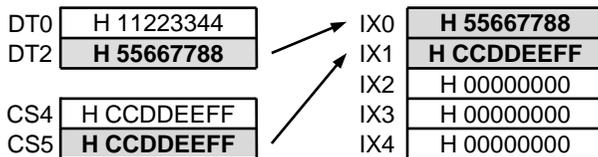
[S1] ...DT0 [S2] ...DT2 [D] ...DT3



Example 2) When the operation unit is 32-bit (UL, SL, SF)

[i]...UL,SL,SF

[S1] ...DT2 [S2] ...CS5 [D] ...IX0

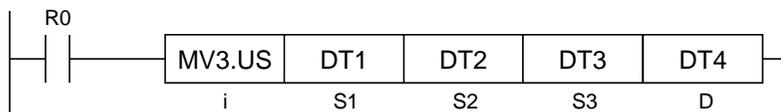


■ Flag operation

Name	Description
SR7	To be set in case of out-of-range values in indirect access (index modification).
SR8	To be set when the transfer range is outside the accessible range.
(ER)	

2.10 MV3 (3 Data Move)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A	A	A	A	A

■ List of operands

Operand	Description
S1	The device address of the source 1 or constant
S2	The device address of the source 2 or constant
S3	The device address of the source 3 or constant
D	Destination device address

■ Available devices (A: Available)

Operand	16-bit device											32-bit device *1			Integer			Real number		String	Index modifier *2
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX *3	K *4	U *5	H *6	SF *7	DF *8	" "	
S1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A
S2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A
S3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A
D	A	A	A	A			A	A	A		A	A	A	A							A

*1: Cannot be specified when the operation unit is 16-bit integer (SS, US).

*2: Only 16-bit devices, 32-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

*3: Index registers (I0 to IE)

*4: Can be specified only when the operation unit is signed integer (SS, SL).

*5: Can be specified only when the operation unit is unsigned integer (US, UL).

*6: Can be specified only when the operation unit is integer (US, SS, UL, SL).

*7: Can be specified only when the operation unit is single-precision floating point real number (SF).

*8: Can be specified only when the operation unit is double-precision floating point real number (DF).

■ Outline of operation

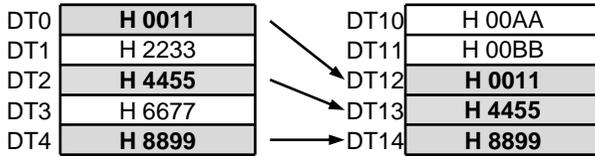
- Transfers three data specified by [S1], [S2] and [S3] to the area starting from [D] all at once according to the operation unit specified by [i].

■ Processing

Example 1) When the operation unit is 16-bit (US, SS)

[i]...US,SS

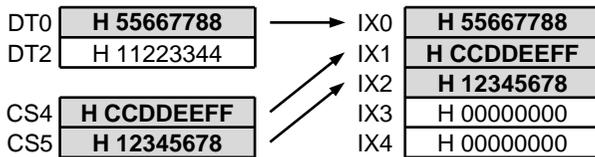
[S1] ...DT0 [S2] ...DT2 [S3] ...DT4 [D] ...DT12



Example 2) When the operation unit is 32-bit (UL, SL, SF)

[i]...UL,SL,SF

[S1] ...DT0 [S2] ...CS4 [S3] ...CS5 [D] ...IX0



■ Flag operation

Name	Description
SR7	To be set in case of out-of-range values in indirect access (index modification, pointer access).
SR8	
(ER)	To be set when the transfer range is outside the accessible range.

2.11 DEFRBUF (Ring Buffer Definition)

■ Ladder diagram



■ Available Operation Units (A: Available)

No operation unit.

■ List of operands

Operand	Description
n	The device address storing the buffer size or constant (Settable range: 1 to 30000)
D	The starting device address of a ring buffer

■ Available devices (A: Available)

Operand	16-bit device										32-bit device			Integer			Real number		String	Index modifier *1		
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF		" "	
n	A	A	A	A			A	A	A	A	A					A	A					A
D							A	A														A

*1: Only 16-bit devices, 32-bit devices, and integer constants can be modified. (Real number constants and character constants cannot be specified.)

■ Outline of operation

- Data can be written to the ring buffer defined by this instruction by RBUFW instruction, and the total value and moving average value can be calculated at high speed.
 - * Do not use other instructions than RBUFW instruction to write data into the ring buffer.
- Defines the ring buffer for [n] data starting from the area of [D].
- The range of [D+1] (No. of stored data) to [D+6] (write pointer) is initialized (cleared to zero).
- The total value of stored data is stored in [D+2, D+3] (total value).
- The moving average value of stored data is stored in [D+4, D+5] (moving average value).
- When the number of stored data reaches the buffer size, the next data is written from the beginning of the ring buffer and the previous values are overwritten.

Ring buffer

			Data type
[D]	Buffer size	*** Size of ring buffer area	US
[D+1]	No. of stored data	*** Number of stored data	US
[D+2]	Total value	*** Total value of stored data	SL/UL
[D+3]			
[D+4]	Moving average value	*** Moving average value of stored data	SF
[D+5]			
[D+6]	Write pointer	*** Relative number from [D+7]	US
...		} Size of ring buffer area	
...			
...			
...			

* Ring buffer area is not cleared.

■ Processing

- 1) [n] (buffer size) is set to [D] (the beginning of the buffer).
- 2) The range of [D+1] (No. of stored data) to [D+6] (write pointer) is cleared to zero.

Example 1)

n=U4

D=DT0

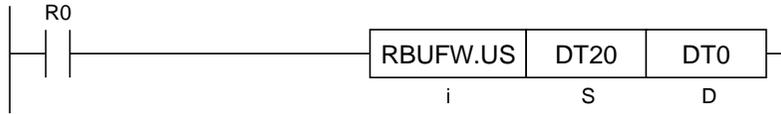
DT0	K 0	DT0	K 4	Buffer size
DT1	K 1	DT1	K 0	Number of stored data
DT2	K 2	DT2	K 0	Total value
DT3	K 3	DT3	K 0	Moving average value
DT4	K 4	DT4	K 0	
DT5	K 5	DT5	K 0	Write pointer
DT6	K 6	DT6	K 0	
DT7	K 7	DT7	K 5	
DT8	K 8	DT8	K 6	
DT9	K 9	DT9	K 7	
DT10	K 10	DT10	K 8	

■ Flag operation

Name	Description
SR7	To be set in case of out-of-range values in indirect access (index modification).
SR8	To be set when [n] (buffer size) is outside the settable range.
(ER)	To be set when the range of [D (the beginning of a buffer) + n (buffer size)] is out of the accessible range.

2.12 RBUFV (Write to Ring Buffer, Calculation of Total Value and Moving Average Value)

■ Ladder diagram



■ Available Operation Units (A: Available)

Operation unit	bit	US	SS	UL	SL	SF	DF
i		A	A				

■ List of operands

Operand	Description
S	The device address storing written data or constant
D	The starting device address of a ring buffer

■ Available devices (A: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier *1
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K *2	U *3	H	SF	DF	" "	
S	A	A	A	A	A	A	A	A	A	A	A				A	A	A				A
D							A	A													A

*1: Only 16-bit devices and integer constants can be modified.

*2: Can be specified only when the operation unit is signed integer (SS).

*3: Can be specified only when the operation unit is unsigned integer (US).

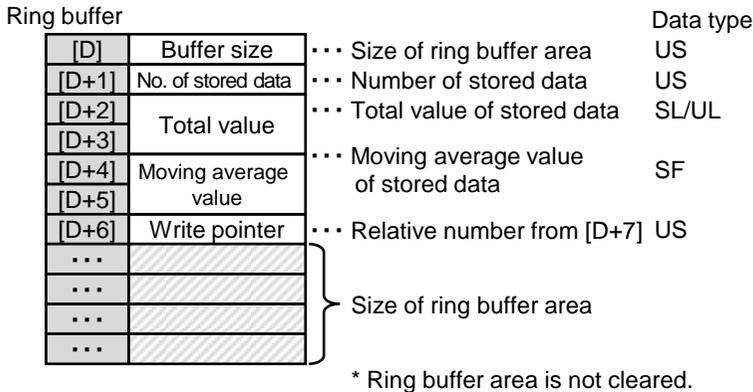
■ Outline of operation

- Data can be written to the ring buffer defined by DEFRBUF instruction by this instruction, and the total value and moving average value can be calculated at high speed.
- Sets the data specified by [S] in the ring buffer area specified by [D], and stores the total value of stored data into [D+2, D+3] and the moving average value into [D+4, D+5]. (Buffer in the buffer area of [D] should be defined in advance by DEFRBUF instruction.)
* If the stored data in the ring buffer is changed by other instruction than this instruction, the total value and moving average value cannot be guaranteed.
- Checking the consistency of buffer before the execution (An operation error occurs under the following conditions.)
 - 1) [D] (buffer size) is larger than 30000, or [D] (buffer size) is 0.
 - 2) [D+1] (Number of stored data) is larger than [D] (buffer size)
 - 3) [D+4] (write pointer) is equal to or larger than [D] (buffer size)
 - 4) The ring buffer area exceeds the upper limit of a specified device.
- Sets [S] in the area specified by [D+6] (write pointer) according to the operation unit of [i].
- Increments [D+6] (write pointer).
When [D+4] (write point) is [D] (buffer size), zero is set to [D+6] (write pointer) after

increment.

* Data is overwritten from the beginning of the ring buffer area when the next instruction is executed. However, the number of stored data does not change.

- Increments [D+1] (number of stored data).
- Calculates the total value of stored data, and stores it in [D+2, D+3].
- Calculates the moving average value of stored data, and stores it in [D+4, D+5].

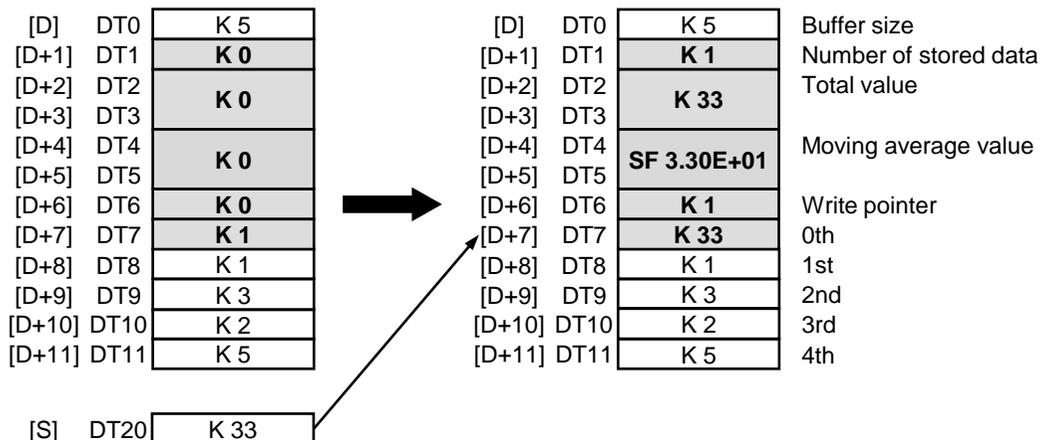


■ Processing

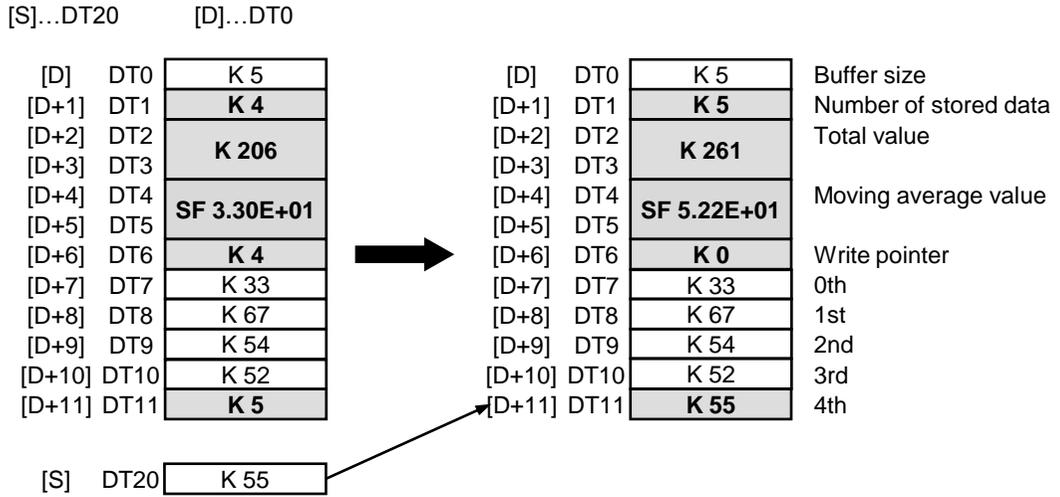
Example 1) The first execution (US)

[S]...DT20

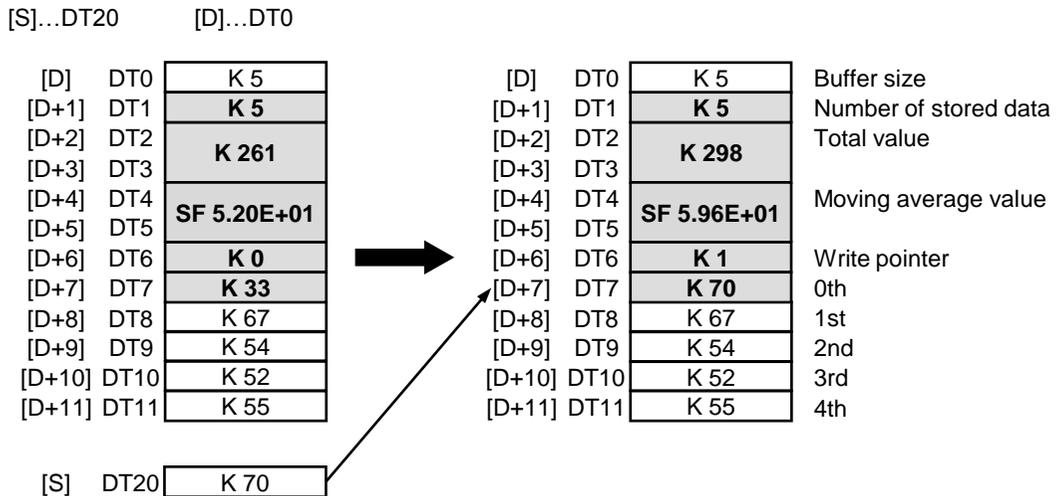
[D]...DT0



Example 2) The fifth execution (US)



Example 3) The sixth execution (US)



Example 4) The first execution (SS)

[S]...DT20

[D]...DT0

[D]	DT0	K 4
[D+1]	DT1	K 2
[D+2]	DT2	K -2
[D+3]	DT3	K -2
[D+4]	DT4	SF -1.00E+00
[D+5]	DT5	K 2
[D+6]	DT6	K 2
[D+7]	DT7	K -5
[D+8]	DT8	K 3
[D+9]	DT9	K 0
[D+10]	DT10	K 0



[D]	DT0	K 4
[D+1]	DT1	K 3
[D+2]	DT2	K -3
[D+3]	DT3	K -3
[D+4]	DT4	SF -1.00E+00
[D+5]	DT5	K 3
[D+6]	DT6	K 3
[D+7]	DT7	K -5
[D+8]	DT8	K 3
[D+9]	DT9	K -1
[D+10]	DT10	K 0

Buffer size
 Number of stored data
 Total value
 Moving average value
 Write pointer
 0th
 1st
 2nd
 3rd

[S]	DT20	K -1
-----	------	------

■ Flag operation

Name	Description
SR7 SR8 (ER)	To be set in case of out-of-range values in indirect access (index modification).
	To be set when [D1] (buffer size) is larger than 30000, or [D1] (buffer size) is 0.
	To be set when [D1+1] (No. of stored data) is larger than [D1] (buffer size).
	To be set when [D1+3] (write pointer) is larger than or equal to [D1] (buffer size).
	To be set when the buffer area exceeds the upper limit of a specified device.

3

List of Instructions

3.1 List of Basic Instructions

Name	Boolean	Symbol	Function overview	On page
Global PB number setting instruction				
Global PB number setting	GPB		Declares the global PB number of [n] for the PB in which GPB instruction is written.	1-2

3.2 List of High-level Instructions

Name	Operation unit	Boolean	Operand	Function overview	Execution condition		On page	
					Level	↑		
SD card access instruction								
Panasonic SD card lifetime information read	-	PanaSD	(P)	D1, D2, D3	Reads the lifetime information of a Panasonic SD card.	—	●	2-2
Data processing instruction								
Variance and standard deviation acquisition	US, SS	STDDEV	(P)	S, n, D	Stores the variance and standard deviation within the range of the device area specified by [S] and [n] into the device area specified by [D].	●	●	2-11
Four arithmetic operations instruction								
Saturated multiplication	US, SS, UL, SL,	MLCLIP	(P)	S1, S2, D	$(S1) \times (S2) \rightarrow (D)$	●	●	2-14
Character string conversion instruction								
Date and time character string conversion	-	TIMEstr	(P)	S1, S2, D	Converts the date and time information specified by [S1] according to the conversion pattern specified by [S2], and stores the character string in the storage location specified by [D].	●	●	2-16
Data transfer instructions								
Specified PB local device write	US, SS, UL, SL,	LCWT	(P)	S, n, PBm, D	Transfers the data for [n] from the area specified by [S] to the area specified by [PBm:D (local device)] and subsequent areas.	●	●	2-5
Specified PB local device read	US, SS, UL, SL,	LCRD	(P)	PBm, S, n, D	Transfers the data for [n] from the area specified by [PBm:S] (local device) to the area specified by [D] and subsequent areas.	●	●	2-7
System area copy	-	SCOPY	(P)	S1, S2, S3, D	Transfers data to the area specified by S1, S2, and S3 to a specified area.	●	●	2-21
High /low byte in n block exchange	-	BSWAP	(P)	S, n, D	Exchanges the high byte and low byte for [n] words from the device address specified by [S], and transfers it to the area starting from [D].	●	●	2-23
2 data move	US, SS, UL, SL, SF, DF	MV2	(P)	S1, S2, D	Transfers two data specified by [S1] and [S2] to the area starting from [D].	●	●	2-25
3 data move	US, SS, UL, SL, SF, DF	MV3	(P)	S1, S2, S3, D	Transfers three data specified by [S1] and [S2] to the area starting from [D].	●	●	2-27

Data buffer instructions								
Ring buffer definition	-	DEFRBUF	(P)	n, D	Defines the area of [n] words starting from [D] as the data buffer area to be used for FIFR/BUFW/LIFR instructions.	●	●	2-29
Write to ring buffer, calculation of total value and moving average value	US, SS	RBUFW	(P)	S, D	Reads data from the area indicated by the read pointer of the FIFO buffer starting from [S], and stores it in [D].	●	●	2-31

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