
07-7 Basic instruction

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IO refresh instruction

REF/IO refresh

REF(P)

Perform a batch reset between the devices specified in (D1) and (D2) of the same type. It is used when interrupting operation, performing initial operation, or resetting control data.

Refresh n points at the beginning of the device specified in (s) to obtain or output external inputs

-[REF (S) (N)]

Content, range and data type

Parameter

Range

(S) The start number of refreshed device

When using X and Y: The lowest bit number could only be 0;
When using HSC: HSC0 to HSC7

(N) Refresh points

When using X and Y: It can only be the multiples of 8;
When using HSC: 1 to 8

Device used

Instruction Parameter Devices

Instruction	Parameter	Devices												Offset modification [D]	Pulse extension XXP	
		X	Y	KnY	KnM	KnS	T	C	D	R	SD	K	H			
REF	Parameter 1	●	●													●
	Parameter 2			●	●	●	●	●	●	●	●	●	●			●

Features

It is a function that only refreshes the corresponding device during a scan, and obtains or outputs external inputs.

Acquisition of input and external output are performed in batches only after the END instruction of the program is executed, so pulse signals could not be output to the outside in one scan. When the I/O refresh instruction is executed, the corresponding input (X) or output (Y) will be forced to refresh during program execution, so pulse signals could be output to the outside in one scan.

It can be used between FOR to NEXT and CJ instructions.

It can be used to refresh the input and output in the interrupt subroutine to obtain the latest input information and output the operation result in time.

The actual input port state change delay is determined by the filter time of the input components.

The actual output port status change delay is determined by the response time of the output components (such as relays). The output contact during output refresh will act after the response time of the output relay (transistor).

The response lag time of the relay output type is about 10ms (maximum 20ms), the transistor output type high-speed output port is about 10us, and the ordinary point output port is about 0.5ms.

There will still be a certain delay when X0 to X17 filter time is set to 0.

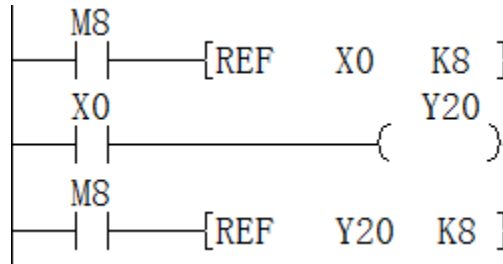
REF instruction could also refresh the value of high-speed counter HSC device. The value of high-speed counter is updated every 100us in normal use, if you need to get the latest values of high-speed counter immediately, you could use the REF instruction to do a count refresh. After the instruction is executed, the value in HSC device is the latest high-speed counter.

Error code

Error code	Content
4085H	The read address of (S) and (N) exceeds the device range. #Note: if (S)+(N) exceeds the maximum range of the device corresponding (s), an error will be reported (S) use numbered device whose low bit is not 0
4084H	When (S) use X and Y, (N) is not the multiples of 8 When (S) use HSC: (N) exceeds the range of K1 to K8
2585H	Use REF instruction to refresh high-speed counter value, but there is no OUT HSC instruction to open the high-speed counter of the channel.

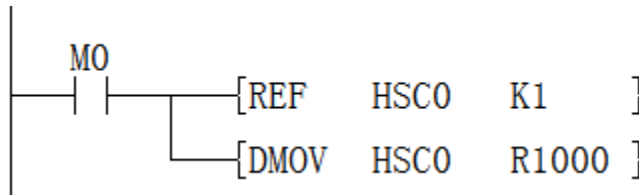
Example

(1) REF refreshes the X input or Y output



As in the example above, X0 to X7 can quickly update the input signal after M8 is turned on. After X0 triggers Y20, output Y20 to Y27 quickly through the next REF Y20 K8 instruction.

(2) REF refreshes the high-speed counter HSC



As in the example above, turn M0 OM, and refresh the current input pulse of high-speed counter, and store the latest high-speed counter value in HSC0, and store the current high-speed counter value in R1000 address.

REF/REF (with filter setting)

REF(P)

Temporarily change the filter effect of the digital filter of X0 to X17 to (N) ms. (N) The range is 0 to 60ms.

-[REF (N)]

Content, range and data type

Parameter	Content	Range	Data type	Data type (label)
(N)	Filter value of X0 to X17	0 to 60	BIN16 bit	ANY16

Device used

Instruction	Parameter								Offset modification [D]	Pulse extension XXP
	X	Y	D	R	SD	K	H			

REFF Parameter 1 ● ● ● ● ● ● ● ● ●

Features

In programmable controller, X0 to X17 use a digital filter. The default filter time constant is set by SD2280 and SD2281, and the filter could be temporarily changed to 0 to 60ms through the REFF instruction.

When the high-speed counter or X input terminal interrupt function is used, the filter time of the relevant port is automatically the shortest time, and the filter time of the irrelevant port is still the original set value.

MOV instruction could also be used to directly assign to SD2280 and SD2281 to change the filter time, but it would not change the value of SD2280 and SD2281.

#Note:

The X point filtering before this instruction may be out of control (if SD2280 and SD2281 are set to 0, the X point before the instruction will be completely out of control).

Error code

Error code

4085H

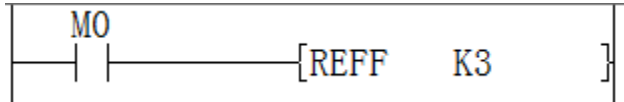
Content

The (N) read address exceeds the device range

4084H

(N) is not in the range of 0 to 60

Example



After M0 is turned on, the filter wave of X0 to X17 in the ladder program after the REFF instruction will temporarily be 3ms, and SD2280 and SD2281 would not change.

Timing measure instruction

DUTY/Clock pulse generation instruction

DUTY

Set the user's timing clock output destination (SM340 to SM344) specified in (D) to ON according to the number of scans specified in (N1), and set it OFF according to the number of scans specified in (N2).

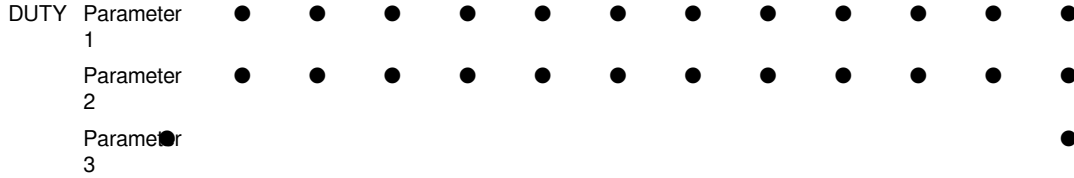
-[DUTY (N1) (N2) (D)]

Content, range and data type

Parameter	Content	Range	Data type	Data type (label)
(N1)	The number of scans that set to ON	0 to 32,767	Unsigned BIN16	ANY16
(N2)	The number of scans that set to ON	0 to 32,767	Unsigned BIN16	ANY16
(D)	Special register for timing clock output destination	SM340 to SM344	Bit	ANY_BOOL

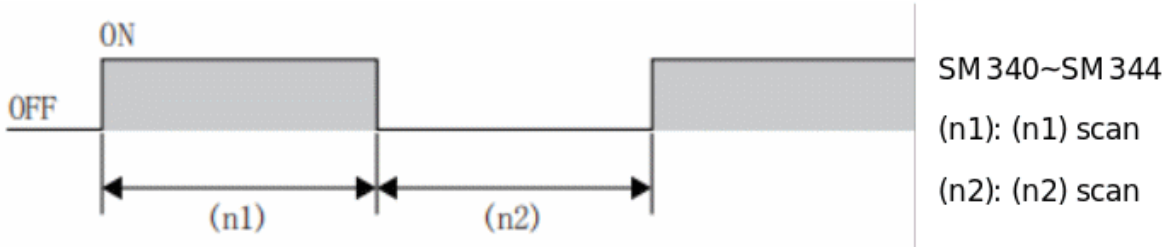
Device used

Instruction	Parameter	Devices	Offset modification	Pulse extension
	SM	KnX KnY KnM KnS T C D R SD K H	[D]	XXP



Features

Set the user's timing clock output destination (SM340 to SM344) specified in (D) to ON according to the number of scans specified in (N1), and set it OFF according to the number of scans specified in (N2).



- The output destination special relay of the timing clock specified in (D) should be SM340 to SM344.
- Store the count value of the number of scans in SD340 to SD344 corresponding to the output destination special relay of the timing clock specified in (D).
- The count value of the number of scans, SD340 to SD344, becomes (N1)+(N2) or reset when the instruction input (instruction) is turned ON.

Special relay (D) for timing clock output

SM340
SM341
SM342
SM343
SM344

Device for counting the number of scans

SD340
SD341
SD342
SD343
SD344

• The operation starts at the rising edge of instruction input, and the output destination special relay of the timing clock is turned ON/OFF by the END instruction. Even if the instruction input is disconnected, the operation would not stop. It stops when it is STOP or the power is off.

- The cases where (N1) and (N2) are set to 0 are as follows.

The status of (N1) and (N2)

(N1)=0, (N2)≥0
(N1)>0, (N2)=0

The ON/OFF status of (D)

Fixed as (D)=OFF
Fixed as (D)=ON

- The related devices are shown below.

Special relay

SM340
SM341
SM342
SM343
SM344

Name

Timing clock output 1
Timing clock output 2
Timing clock output 3
Timing clock output 4
Timing clock output 5

Content

Timing clock output of DUTY instruction

Special register

SD340

Name

Timing clock output 1 counts with scan number

Content

DUTY instruction timing clock output 1 scan count count value

SD341	Timing clock output 2 counts with scan number	DUTY instruction timing clock output 2 scan count count value
SD342	Timing clock output 3 counts with scan number	DUTY instruction timing clock output 3 scan count count value
SD343	Timing clock output 4 counts with scan number	DUTY instruction timing clock output 4 scan count count value
SD344	Timing clock output 5 counts with scan number	DUTY instruction timing clock output 5 scan count count value

#Note:

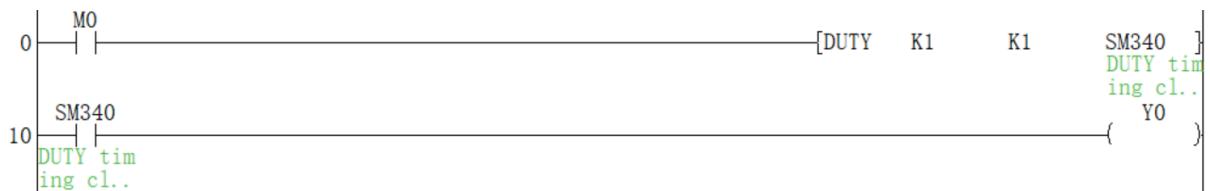
The DUTY instruction could be used up to 5 times (dots). However, the same timing clock output destination could not be used in multiple DUTY instructions.

Error code

Error code	Content
4084H	The written value of (N1) and (N2) exceed the range
4085H	The device address of (N1) and (N2) exceed the range
4086H	(D) is not in SM340 to SM344
408EH	(D) of multiple DUTY instructions use the same SM device

Example

Use the DUTY instruction to make Y0 flip once every cycle.



Set M0, SM340 will be ON for one cycle and OFF for one cycle.

Random number instruction

RND/Random number instruction

RND(P)

A pseudo-random number from 0 to 32767 is generated, and the value is stored as a random number in the device specified in (d).

-[RND (P) (d)]

Content, range and data type

Parameter	Content	Range	Data type	Data type (label)
(d)	The start number of the device storing random number	---	Signed BIN16	ANY16

Device used

Instruction	Parameter	Devices	Offset modification	Pulse extension
	KnY	KnM KnS	T C D R SD	[D] XXP

RND Parameter ● ● ● ● ● ● ● ● ● ●
 1

Features

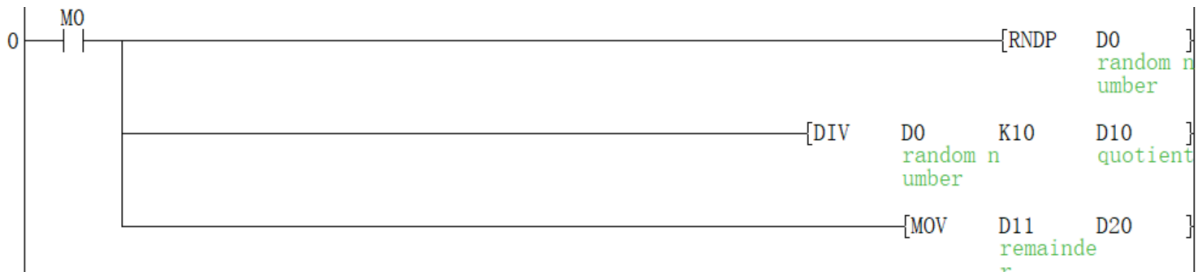
A pseudo-random number from 0 to 32767 is generated, and the value is stored as a random number in the device specified in (d).

Error code

Error code	Content
4086H	The write address of (d) exceeds the device range

Example

Pseudo-random numbers from 0 to 9 would be generated.



Turn on M0 to generate a pseudo-random number between 0-9.

Preferred instruction

DEXMN/Preferred instruction

DEXMN(P)

The position of the given value that is closest to the target value in multiple given values is selected through calculation.

-[DEXMN (s1) (s2) (s3) (d1) (d2)]

Content, range and data type

Parameter	Content	Range	Data type	Data type (label)
(s1)	Input data parameter array start device number		Form type	LIST
(s2)	Select the maximum number of data and the start device number of the output mode		Form type	LIST
(s3)	Target value	0 to 16777215	Unsigned BIN32	ANY32_U
(d1)	Select result array start device number		Form type	LIST
(d2)	Operation result array start device number		Form type	LIST

Device used

Instruction	Parameter	Devices	Offset modification	Pulse extension
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		D	R	[D]	XXP
DEXMN	Parameter 1	●	●		●
	Parameter 2	●	●		●
	Parameter 3	●	●		●
	Parameter 4	●	●		●
	Parameter 5	●	●		●

Feature

(1) Instruction function description

From the data set given by S1, Select the data combination whose number is less than or equal to S2 (select the maximum number of data) and the sum value is closest to S3 (target value). The selected result is stored in array D1 according to the position corresponding to array S1.

The error code of the instruction execution is stored in D2, and the number of the selected is stored in D2+2, and the difference between the selected array and the target value is stored in D2+4.

(2) Detailed parameter description

Input parameter S1

Unit	Number of bytes	Features	Description	Range
s1	Double word	The number of input data	Specify the number of input data	1 to 32
s1+1				
s1+2	Double word	The first data	Input data	0 to 16777215
s1+3				
s1+4	Double word	The second data		
s1+5				
...		
s1+64	Double word	The 32nd data		
s1+65				

Input parameter S3

Unit	Number of bytes	Features	Parameter Description	Range
s2	Double word	Specify the maximum number of selected data	Specify the maximum number of selected data	1 to s1. Due to the time limit, please refer the notes.
s2+1				
s2+2	Double word	Output mode	Output mode selection:	
s2+3			0: the 0 value in the input array is not added to the output combination 1. Add the 0 value in the input array to the output combination	

Input parameter S3

Unit	Number of bytes	Features	Parameter Description	Range
s3	Double word	Specify target data	Specify the selected target data	0 to 16777215
s3+1				

Parameter d1

Unit	Number of bytes	Features	Parameter Description	Range
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d1 d1+1	Double word	Selection result, each bit represents a data	Use bits to indicate the position of data	Read-only
			Bit 0 corresponds to S1+2	
			Bit 1 corresponds to S1+4	
d1+2 d1+3	Double word	Select the position of the 1st data	The position of the data, relative to the offset of S1+2,	Read-only
d1+4 d1+5	Double word	Select the position of the 2nd data	0 means the data is in S1+2	
d1+N*2+2 d1+N*2+3	Double word	Select the position of the Nth data	3 means the data is in S1+8	
d1+64 d1+65	Double word	Select the position of the 32th data	And so on	
Parameter d2				
Unit	Number of bytes	Features	Parameter Description	Remarks
d2 d2+1	Double word	Select the execution result OR Error code	Error code	≥0: execute correctly <0: Error code
				-1: The number entered is out of range -2: The number of selected data is out of range -3: The target data is out of range -4: The input data is out of range (If there are repeated errors, the top error will be reported first. For example, the number of inputs is 0 and the target data is -30. At this time, an error of -1 will be reported)
d2+2 d2+3	Double word	The number selected	The number of Actually selected data	Read-only
d2+4 d2+5	Double word	Minimum deviation	The current result minus the target value	Read-only
d2+6 d2+7	Double word	Operation time	Total time used (ms)	
d2+8 d2+9	Double word	Reserved	Number of combinations (where the result is)	
d2+10 to d1+73	Double word	Internal use	Cache for internal calculation	

#Note:

In the case of a large number of data, a watchdog timeout may occur. This is because the calculation takes a lot of time.

The current timetable for this instruction is as below. Please use the maximum number of data selected according to the timetable.

The number of arrays	1	2	3	4	5	6	7	8
The number of selected	Time unit (ms)							
1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4				<0.1	<0.1	<0.1	<0.1	<0.1
5					<0.1	<0.1	<0.1	<0.1
6						<0.1	<0.2	<0.2
7							<0.2	<0.2
8								<0.2
The number of arrays	9	10	11	12	13	14	15	16
The number of selected	Time unit (ms)							
1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
4	<0.1	<0.1	<0.2	<0.2	<0.2	<0.4	<0.4	<0.4
5	<0.2	<0.2	<0.3	<0.4	<0.5	<0.6	<0.9	1.1
6	<0.2	<0.3	<0.3	<0.6	<0.9	1.2	1.8	2.5
7	<0.2	<0.4	<0.6	<0.9	1.4	2.2	3.4	5.9
8	<0.3	<0.4	<0.7	1.4	2.0	3.3	5.5	8.9
9	<0.3	<0.5	<0.9	1.5	2.6	4.6	7.9	13.4
10		<0.6	<1.0	1.7	3.2	5.8	10.4	18.4
11			1.1	2.2	3.7	6.9	12.8	23.3
12				2.3	4.4	8.2	15.2	28.8
13					4.9	9.3	17.5	32.8
14						10.5	19.8	37.5
15							23.0	43.0
16								46.8
The number of arrays	17	18	19	20	21	22	23	24
The number of selected	Time unit (ms)							
1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
4	<0.5	<0.6	<0.7	<0.8	<0.9	1.2	1.3	1.5
5	1.4	1.8	2.3	2.9	3.7	4.6	5.7	6.9
6	3.6	5.0	6.8	9.9	12.2	15.9	20.8	26.8

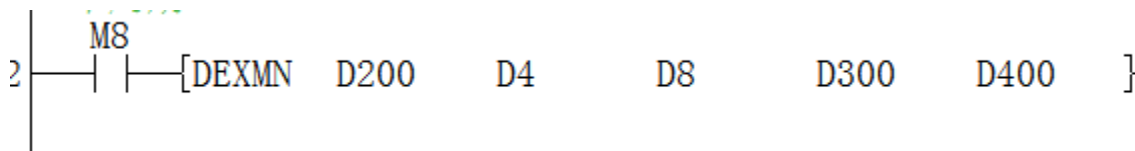
7	7.7	11.4	16.5	23.5	32.9	45.7	62.5	84.4
8	14.2	22.9	33.4	51.2	75.8	110.6	158.9	225.1
9	22.6	37.2	60.2	95.3	148.6	227.6	342.9	
10	32.2	55.4	93.8	156.9	255.2			
11	42.4	75.3	132.2	222.8				
12	51.8	94.9	171.9					
13	61.4	114.3	221.2					
14	70.7	133.2						
15	80.6	151.9						
16	89.4	170.5						
17	98.6	189.7						
18		207.7						
The number of arrays	25	26	27	28	29	30	31	32
The number of selected	Time unit (ms)							
1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3	<0.3	<0.3	<0.4	<0.4	<0.5	<0.5	<0.6	<0.6
4	1.7	1.9	2.3	2.6	3.0	3.5	3.8	4.4
5	8.4	10.2	12.3	14.7	17.5	20.6	24.2	28.3
6	34.2	43.3	54.2	15.9	83.3	102.2	124.3	150.5
7	112.6	148.6	194.2	251.4	322.6	410.5	515.4	649.8
8	314.4	433.7	591.6					
9								

#Note: Red text is the limit of exceeding the default scan cycle.

Error code

Error code	Content
4084H	Data range error. For details, see the error code of parameter d2
4085H	The device addresses of (s1), (s2) and (s3) are out of range
4086H	The device addresses of (d1) and (d2) are out of range

Example



When D200 = 8, D4 = 2, it means to take out two data from 8 groups of data, and the sum of the two data is closest to the data in D8.

Array data of D200 (S1):

D200	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	8
D201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D202	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	150
D203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D204	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	99
D205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D206	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	56
D207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D208	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	200
D209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D210	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	86
D211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D212	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	76
D213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D214	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	160
D215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D216	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	153
D217	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Select a combination with a sum close to 300 from the data above, and the results selected by D300 (D1) are as below:

Device	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
D300	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	10
D301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D302	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
D303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D304	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
D305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D306	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D307	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D309	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D311	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D312	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Bit 1 and Bit 3 of D300 are 1, and the data positions of 1 and 3 are currently selected. The indicated positions are D204 (99) and D208 (200).

D400 (D2) running results are as below:

Device	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
D400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D402	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
D403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D404	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1
D405	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1
D406	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
D407	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D408	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	255
D409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D410	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D411	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D412	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D414	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D416	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D418	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D419	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

If D400 is 0, the execution is correct.

If D402 is 2, the number of selected is 2.

If D404 is -1, the selected data combination sum value minus the target value difference is -1.

If D406 is 2, the use time is 2ms.