7.2 Arithmetic Operation Instructions

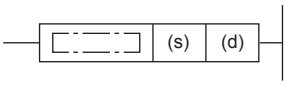
Adding 16-bit binary data

+(P)(_U) instruction and ADD(P)(_U) instruction can be used for addition of 16-bit binary data.

+(P)(_U) [using two operands]

FX5S FX5UJ FX5U FX5UC

These instructions add the 16-bit binary data in the device specified by (d) and the 16-bit binary data in the device specified by (s), and store the result in the device specified by (d).

Ladder diagram	Structured text
	Not supported ☞ Page 210 +(P)(_U) [using three operands]

FBD/LD
Not supported. ☞ Page 210 +(P)(_U) [using three operands]

Setting data

■Descriptions, ranges, and data types

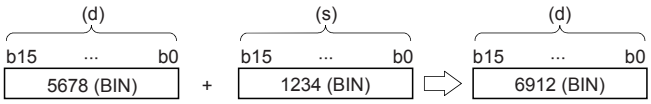
Operand		Description	Range	Data type	Data type (label)
(s)	+(P)	Addend data or the device where the data that is added to another is stored	-32768 to +32767	16-bit signed binary	ANY16_S
	+(P)_U		0 to 65535	16-bit unsigned binary	ANY16_U
(d)	+(P)	Device where the data to which another is added is stored	-32768 to +32767	16-bit signed binary	ANY16_S
	+(P)_U		0 to 65535	16-bit unsigned binary	ANY16_U

■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s)	○	○	○	○	—	—	○	○	—	—	—
(d)	○	○	○	○	—	—	○	—	—	—	—

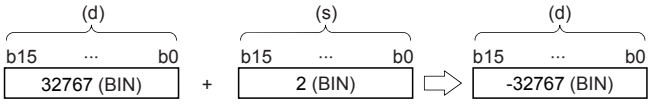
Processing details

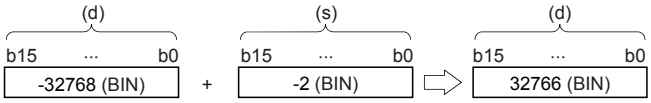
- These instructions add the 16-bit binary data in the device specified by (s) to the 16-bit binary data in the device specified by (d), and store the addition result in the device specified by (d).



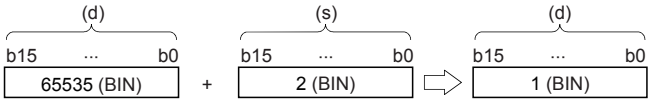
- When underflow or overflow occurs in the operation result, the following processing is executed. In this case, the carry flag (SM700, SM8022) does not turn ON.

In case of +(P)





In case of +(P)(_U)



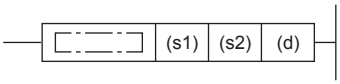
Operation error

There is no operation error.

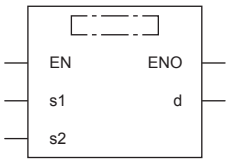
+(P)(_U) [using three operands]

FX5S FX5UJ FX5U FX5UC

These instructions add the 16-bit binary data in the device specified by (s1) and the 16-bit binary data in the device specified by (s2), and store the result in the device specified by (d).

Ladder diagram	Structured text	
	ENO:=PLUS(EN,s1,s2,d); ENO:=PLUSP(EN,s1,s2,d);	ENO:=PLUS_U(EN,s1,s2,d); ENO:=PLUSP_U(EN,s1,s2,d);

FBD/LD



("PLUS", "PLUSP", "PLUS_U", "PLUSP_U" enters □.)

Setting data

■Descriptions, ranges, and data types

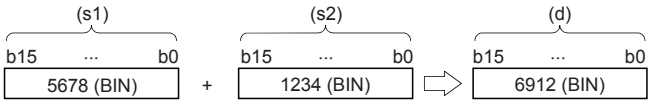
Operand		Description	Range	Data type	Data type (label)
(s1)	+(P)	Augend data or the device where the data to which another is added is stored	-32768 to +32767	16-bit signed binary	ANY16_S
	+(P)_U		0 to 65535	16-bit unsigned binary	ANY16_U
(s2)	+(P)	Addend data or the device where the data that is added to another is stored	-32768 to +32767	16-bit signed binary	ANY16_S
	+(P)_U		0 to 65535	16-bit unsigned binary	ANY16_U
(d)	+(P)	Device for storing the operation result	—	16-bit signed binary	ANY16_S
	+(P)_U		—	16-bit unsigned binary	ANY16_U
EN		Execution condition	—	Bit	BOOL
ENO		Execution result	—	Bit	BOOL

■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	○	○	○	—	—	○	○	—	—	—
(s2)	○	○	○	○	—	—	○	○	—	—	—
(d)	○	○	○	○	—	—	○	—	—	—	—

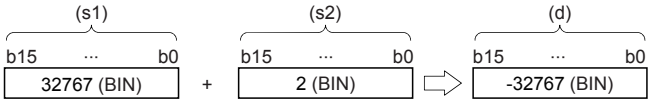
Processing details

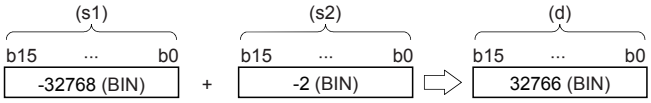
- These instructions add the 16-bit binary data in the device specified by (s1) and the 16-bit binary data in the device specified by (s2), and store the addition result in the device specified by (d).



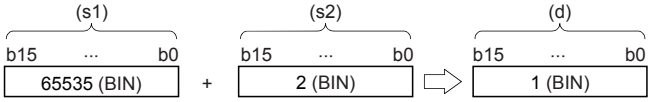
- When underflow or overflow occurs in the operation result, the following processing is executed. In this case, the carry flag (SM700, SM8022) does not turn ON.

In case of +(P)





In case of +(P)(_U)



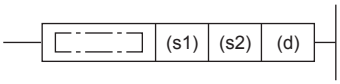
Operation error

There is no operation error.

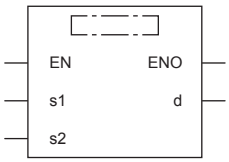
ADD(P)(_U)

FX5S FX5UJ FX5U FX5UC

These instructions add the 16-bit binary data in the device specified by (s1) and the 16-bit binary data in the device specified by (s2), and store the result in the device specified by (d).

Ladder diagram	Structured text*1	
	ENO:=ADDP(EN,s1,s2,d);	ENO:=ADD_U(EN,s1,s2,d); ENO:=ADDP_U(EN,s1,s2,d);

FBD/LD*1



("ADDP", "ADD_U", "ADDP_U" enters □.)

*1 The ADD instruction is not supported by the ST language and the FBD/LD language. Use ADD of the standard function.
☞ Page 1300 ADD(_E)

Setting data

■Descriptions, ranges, and data types

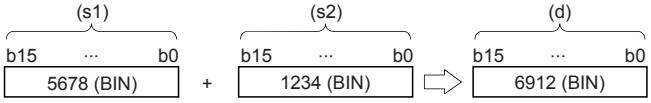
Operand		Description	Range	Data type	Data type (label)
(s1)	ADD(P)	Addend data or the device where the data that is added to another is stored	-32768 to +32767	16-bit signed binary	ANY16_S
	ADD(P)_U		0 to 65535	16-bit unsigned binary	ANY16_U
(s2)	ADD(P)	Addend data or the device where the data that is added to another is stored	-32768 to +32767	16-bit signed binary	ANY16_S
	ADD(P)_U		0 to 65535	16-bit unsigned binary	ANY16_U
(d)	ADD(P)	Device for storing the operation result	—	16-bit signed binary	ANY16_S
	ADD(P)_U		—	16-bit unsigned binary	ANY16_U
EN		Execution condition	—	Bit	BOOL
ENO		Execution result	—	Bit	BOOL

■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	○	○	○	—	—	○	○	—	—	—
(s2)	○	○	○	○	—	—	○	○	—	—	—
(d)	○	○	○	○	—	—	○	—	—	—	—

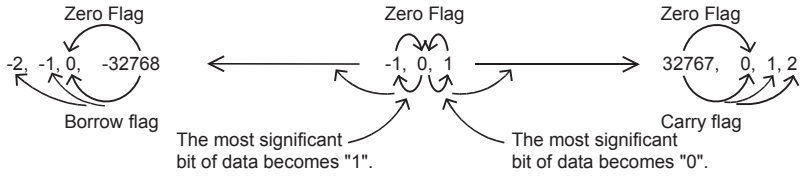
Processing details

- These instructions add the 16-bit binary data in the device specified by (s1) and the 16-bit binary data in the device specified by (s2), and store the addition result in the device specified by (d).



■Relationship between the flag operation and the sign (positive or negative) of a numeric value

Device	Name	Description
SM700, SM8022	Carry	When the operation result exceeds the upper limit of the data setting range, the carry flag is turned ON.
SM8020	Zero	When the operation result is 0, the zero flag is turned ON.
SM8021	Borrow	When the operation result is less than the lower limit of the data setting range, the borrow flag is turned ON.



Precautions

■When specifying the same device in the source and destination

The same device number can be specified for both the source and the destination. In this case, note that the addition result changes in every operation cycle if a continuous operation type ADD instruction is used.

■Difference between ADD(P) instruction, +(P) instruction, and INC(P) instruction in a program for adding "+1"

When ADD(P) instruction is used to add 1 to the contents of D0 every time X1 turns from OFF to ON, ADD(P) instruction is similar to +(P) instruction and INC(P) instruction described later except for the contents shown in the table below

		ADD(P) instruction	+(P) instruction, INC(P) instruction
Flag (zero, borrow or carry)		Operates	Does not operate
Operation result	(s)+1=(d)	+32767 → 0 → +1 → +2 →…	+32767 → -32768 → -32767 →…

Program example

Operation error

There is no operation error.