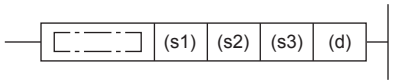
10 PID CONTROL INSTRUCTION

10.1 PID Control Loop

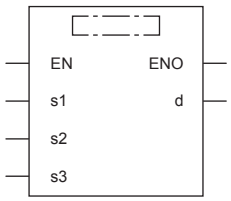
PID

FX5S FX5UJ FX5U FX5UC

This instruction executes PID control which changes the output value according to the input variation.

Ladder diagram	Structured text
	ENO:=PID(EN,s1,s2,s3,d);

FBD/LD



Setting data

■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s1)	Device number storing the target value (SV)	-32768 to +32767	16-bit signed binary	ANY16*1
(s2)	Device number storing the measured value (PV)	-32768 to +32767	16-bit signed binary	ANY16*1
(s3)	Device number storing a parameter	1 to 32767	16-bit signed binary	ANY16*1
(d)	Device number storing the output value (MV)	-32768 to +32767	16-bit signed binary	ANY16*1
EN	Execution condition	—	Bit	BOOL
ENO	Execution result	—	Bit	BOOL

*1 When setting using a label, use the global label assigned to the device.

■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)	—	○*1	○	—	—	—	—	—	—	—	—
(s2)	—	○*1	○	—	—	—	—	—	—	—	—
(s3)	—	○*1	—	—	—	—	—	—	—	—	—
(d)	—	○*1	○	—	—	—	—	—	—	—	—

*1 Only D, SD, R can be used.

Processing details

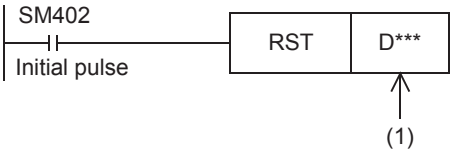
When the target value (s1), measured value (s2), and parameters (s3) to (s3)+6 are set and a program is executed, the operation result (MV) is stored to the output value (d) at every sampling time (s3). For details, refer to the MELSEC iQ-F FX5 User's Manual (Application).

Precautions

- When auto tuning is not used, twenty-five devices are occupied from the head device specified in (s3).
- When auto tuning (limit cycle method) is used, twenty-nine devices are occupied from the head device specified in (s3).
- When auto tuning (step response method) is used, the number of devices occupied from the devices specified in (s3) differs depending on the ON/OFF status of b8 of (s3)+1.

Operation of b8	Occupied device points
ON	Twenty-eight devices are occupied from the device specified in (s3).
OFF	Twenty-five devices are occupied from the device specified in (s3).

- Two or more PID instructions can be executed at the same time. (There is no limitation in the number of loops.) However, make sure that (s3), (d) and other operands specified in each instruction are different to each other.
- For the output value (MV) in the PID instruction, specify an unlatched data register. If specifying a latched data register, make sure to clear the backup contents when the PLC mode is set to RUN using the following program.



(1): Latched data register number specified to (d)

Operation error

Error code (SD0/SD8067)	Description
2820H	The connection number specified by (s1) is other than 1 to 8.
2822H	The device number specified by (s2), (d), or (n) is outside the range of the number of device points.
3500H	Incorrect sampling time (TS) (TS ≤ 0)
3502H	Incompatible input filter constant (α) (α < 0 or 100 ≤ α)
3503H	Incompatible proportional gain (KP) (KP ≤ 0)
3504H	Incompatible integral time (TI) (TI < 0)
3505H	Incompatible derivative gain (KD) (KD < 0 or 100 ≤ KD)
3506H	Incompatible derivative time (TD) (TD < 0)
350AH	Sampling time (TS) ≤ Scan time
350CH	Variation of measured value exceeds limit. (△PV < -32768 or +32767 < △PV)
350DH	Deviation exceeds limit. (EV < -32768 or +32767 < EV)
350EH	Integral result exceeds limit. (Outside range from -32768 to +32767)
350FH	Derivative value exceeds limit due to derivative gain (KD).
3510H	Derivative result exceeds limit. (Outside range from -32768 to +32767)
3511H	PID operation result exceeds limit. (Outside range from -32768 to +32767)
3512H	PID output upper limit set value < PID output lower limit set value.
3513H	Abnormal PID input variation alarm set value or output variation alarm set value. (Set value < 0)
3514H	Step response method Improper auto tuning result.
3515H	Step response method Auto tuning operation direction mismatch.
3516H	Step response method Improper auto tuning operation.
3517H	Limit cycle method Abnormal output set value for auto tuning [ULV (upper limit) ≤ LLV (lower limit)]
3518H	Limit cycle method Abnormal PV threshold (hysteresis) set value for auto tuning (SHPV < 0)
3519H	Limit cycle method Abnormal auto tuning transfer status (Data of device controlling transfer status is abnormally overwritten.)
351AH	Limit cycle method Abnormal result due to excessive auto tuning measurement time (τon > τ, τon < 0, τ < 0)

Error code (SD0/SD8067)	Description
351BH	Limit cycle method Auto tuning result exceeds proportional gain. (KP = outside range from 1 to 32767)
351CH	Limit cycle method Auto tuning result exceeds integral time. (TI = outside range from 0 to 32767)
351DH	Limit cycle method Auto tuning result exceeds derivative time. (TD = outside range from 0 to 32767)
351EH	Step response method Abnormal timeout time set value after maximum ramp for auto tuning