User's Manual

A1SD61 (High Speed Counter Module)

A Series Programmable Controllers

MITSUBISHI

Cat. No **A1SHSC**

REVISIONS

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INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

CONTENTS

1. INTRODUCTION

This manual describes the specifications, handling, and programming of the A1SD61 high speed counter (hereafter called A1SD61). The A1SD61 functions in combination with a MELSEC-A series A1SCPU module, counting pulses at a speed of up to 50K pps.

The A1SD61 counts a 1-phase and 2-phase pulse input in the following way:

1-phase pulse input:

Counts the pulse at the leading edge;

2-phase pulse input multiplied by one:

Counts the pulse at the leading edge of phase A;

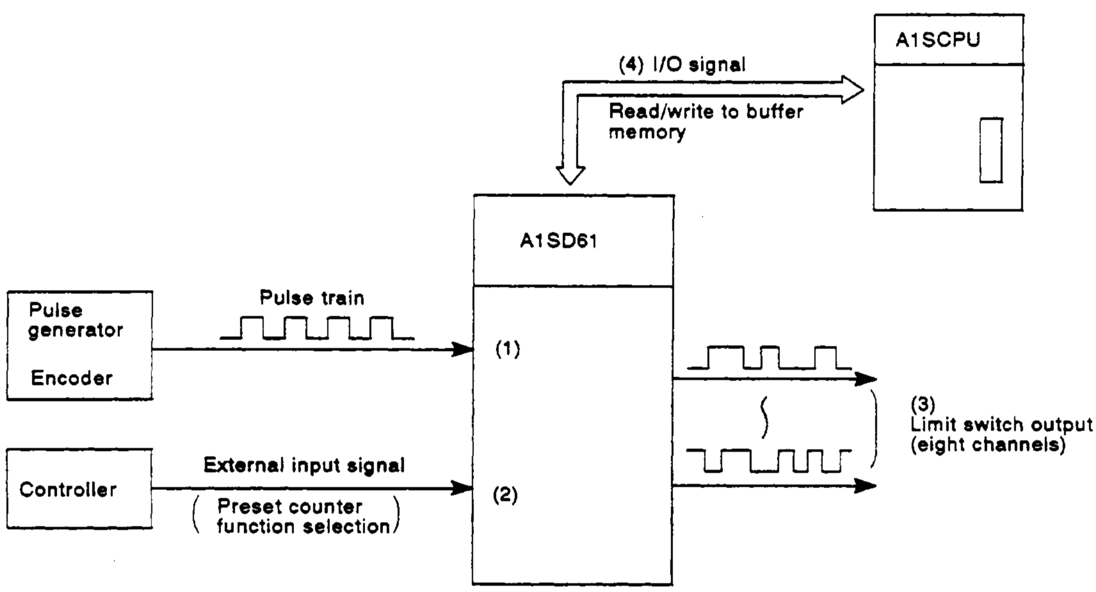
2-phase pulse input multiplied by two:

Counts the pulse at the leading edge/fall of phase A;

2-phase pulse input multiplied by four:

Counts the pulse at the leading edge/fall of phases A and B.

The following diagram shows how the A1SD61 works



(1) Counts a pulse being input into the A1SD61.
(2) External input signal allows the preset/counter selection.
(3) Allows comparison with the counter's present value and outputs the signal using the limit switch.
(4) Allows confirmation of the A1SD61 I/O signals and buffer memory using a sequence program.
Additionally, a start/stop or preset counter operation may be done.

1.1 Features

(1) Pulses can be counted within a wide range, from -2147483648 to 2147483647

The count value is stored as a signed 32-bit data in binary code.

(2) Count multiplication may be done (see Section 5).

When a 2-phase pulse is input, the count can be multiplied by either one, two, or four.

(3) The maximum counting speed can be selected between 50 and 10K pps. (See Sections 3.2 and 4.3)

When the maximum counting speed is set to 50K pps, a pulse at a maximum of 50K pps can be counted in both the 1-phase and 2-phase inputs. When the maximum counting speed is set to 10K pps, a pulse at a maximum of 10K pps in the 1-phase input or at a maximum of 7K pps in the 2-phase input can be counted.

(4) The ring counter function can be used (see Section 7).

By setting the ring counter switch, the coincidence signal is output when the counter value reaches the set value. Since the preset value is automatically and simultaneously preset, counting can be repeated.

(5) The limit switch output can be used (see Section 8).

By setting the output status of a certain channel, an ON/OFF signal may be output instead of the present value of the counter.

(a) A single module outputs to eight channels.

(b) Four dogs can be used for each channel.

(6) One out of the four counter functions can be selected (see Section 9)

Whichever function is desired from the following functions may be used:

(a) Latch counter function

(b) Sampling counter function

(c) Periodic-pulse counter function

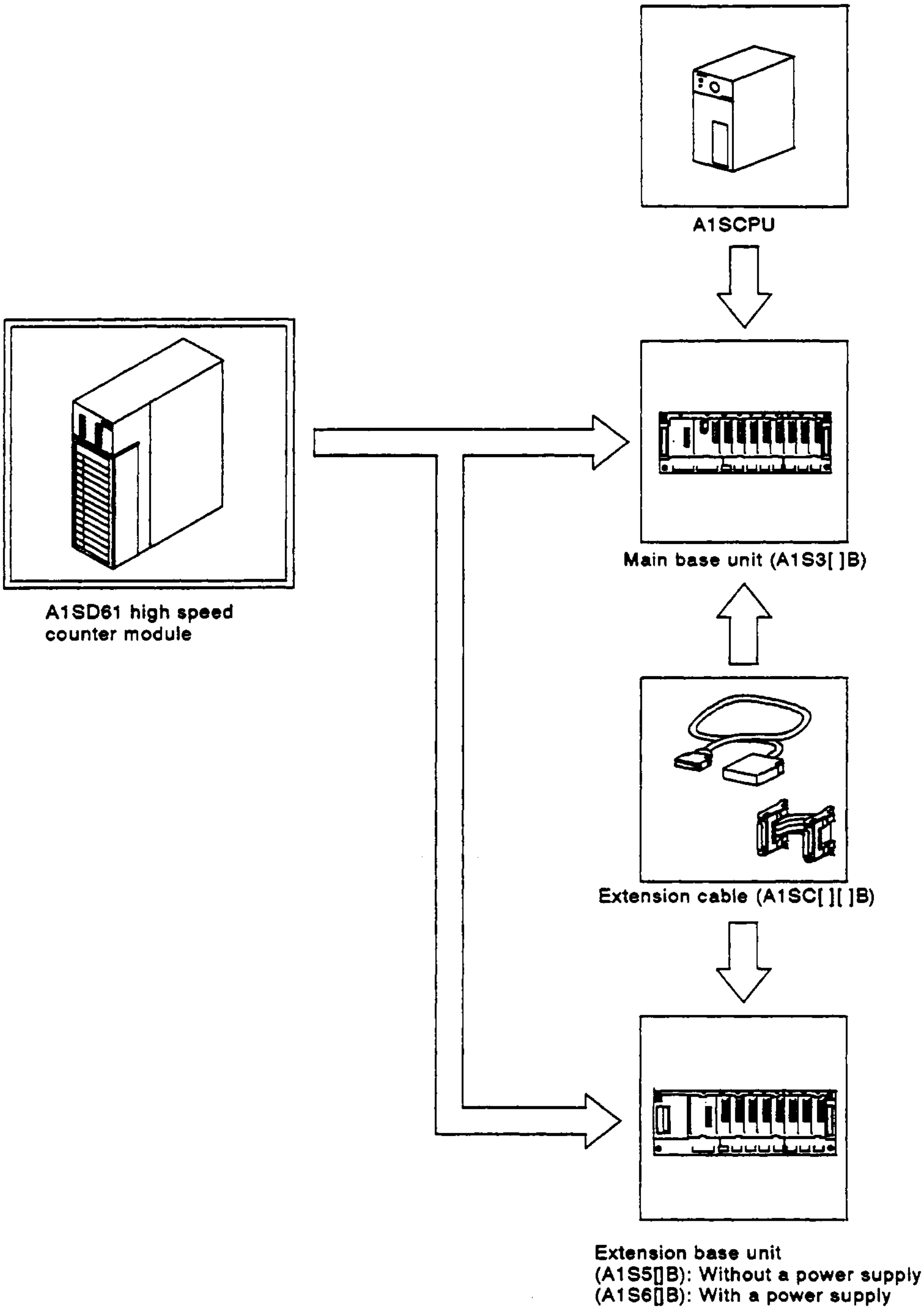
(d) Count disable function

(7) A function can be selected between the preset and the counter using the external input (see Sections 6.3 and 9)

By applying voltage to the PRESET (preset) /F.START (function start) external terminal, either the preset or the counter function can be used.

2. SYSTEM CONFIGURATION

The A1SD61 system configuration is shown below:



3. SPECIFICATIONS

This section describes the general specifications of the A-series PC CPUs, performance specifications of the A1SD61, specifications of I/O signals to a PC CPU and buffer memory.

3.1 General Specifications

Table 3.1 gives the general specifications of the A-series PC CPUs.

Table 3.1 General Specifications

Item	Specifications				
Operating ambient temperature	0 to 55 °C				
Storage ambient temperature	-20 to 75 °C				
Operating ambient humidity	10 to 90% RH, non-condensing				
Storage ambient humidity	10 to 90% RH, non-condensing				
Vibration resistance	Conforms to ** JIS C 0911	Frequency	Acceleration	Amplitude	Sweep Count
		10 to 55 Hz	—	0.075 mm (0.003 in)	10 times *(1 octave/ minute)
		55 to 150 Hz	1 g	—	
Shock resistance	Conforms to JIS C 0912 (10 g x 3 times in 3 directions)				
Noise durability	By noise simulator 1500 Vpp noise voltage, 1 µs width and 25 to 60 Hz noise frequency.				
Dielectric withstand voltage	1500 VAC for 1 minute across AC external terminals and ground 500 VAC for 1 minute across DC external terminals and ground				
Insulation resistance	5 MΩ or larger by 500 VDC insulation resistance tester across AC external terminals and ground				
Grounding	Class 3 grounding; grounding is not required when it is no possible.				
Operating ambient	Free of corrosive gases. Dust should be minimal.				
Cooling method	Self-cooling				

REMARK

One octave marked * indicates a change from the initial frequency to double or half frequency.

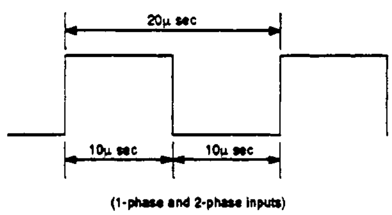
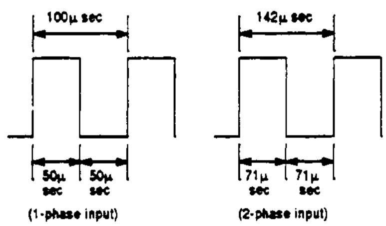
For example, any of the changes from 10 to 20 Hz, from 20 to 40 Hz, from 40 to 20 Hz, and 20 to 10 Hz are referred to as one octave.

Note: ** JIS : Japanese Industrial Standard

3.2 Performance Specifications

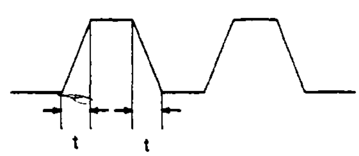
Table 3.2 gives the performance specifications of the A1SD61.

Table 3.2 Performance Specifications

Item		Specifications		
Counting speed switching pin		50K		10K
Number of I/O occupied points		32		
Number of channels		One		
Count input signal	Phase	1-phase and 2-phase inputs		
	Signal levels (øA and øB)	5 VDC, 12 VDC, 24 VDC: 2 to 5 mA		
Counter	Maximum counting speed*	1-phase input	50K pps	10K pps
		2-phase input	50K pps	7K pps
	Counting range	32-bit signed binary −2147483648 to 2147483647		
	Type	Equipped with UP/DOWN preset counter and ring counter functions		
	Minimum pulse width that can be counted(Adjust so that the leading edge/fall time of the input is 5µ sec or less. Duty ratio: 50 %)	 (1-phase and 2-phase inputs)		 (1-phase input) (2-phase input)
Limit switch output	Comparison range	32-bit signed binary		
	Comparison result	N/O contact operation: dog ON address ≤ count value ≤ dog OFF address N/C contact operation: dog OFF address ≤ count value ≤ dog ON address		
External input	Preset	12/24 VDC 3/6mA 5 VDC 5 mA		
	Function start			
External output	Comparison output	Transistor (open collector) output 12/24 VDC 0.1 A/point 0.8 A/common		
Power consumption		5 VDC 0.35 A		
Weight (kg) (lb)		0.27 (0.60)		

- The counting speed is influenced by the pulse leading edge/fall time. The following counting speeds are possible. If a pulse is counted with a leading edge/fall time that is too long, a counter error may be caused.

Counting Speed Setting Pin	50K		10K	
Leading Edge/fall Time	1-phase Input	2-phase Input	1-phase Input	2-phase Input
t=5µ sec or less	50K pps	50K pps	10K pps	7K pps
t=50µ sec or less	5K pps	5K pps	1K pps	700 pps
t=500 µ sec	—	—	500 pps	250 pps



3.3 Functions

Table 3.3 gives the functions of the A1SD61.

Table 3.3 Function Specifications

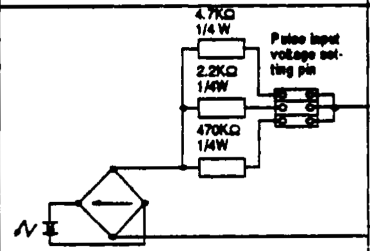
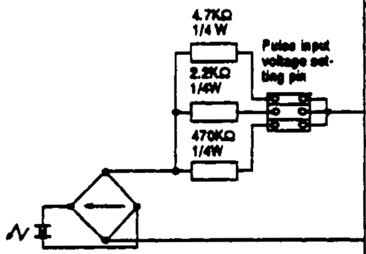
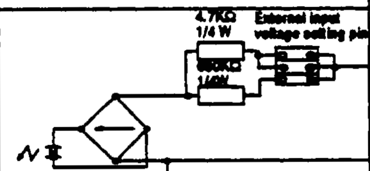
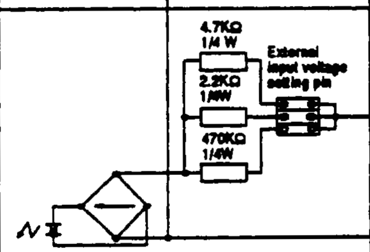
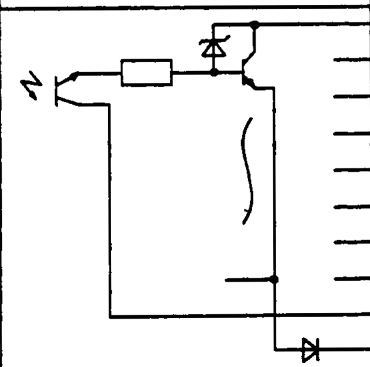
Function		Description	Reference Section
Preset		• Changes the present value of the counter. • The preset operation can be done either by a sequence program or by an external preset input.	6
Ring counter		• Counting alternates between the preset value and the ring counter value.	7
Limit switch output		• Outputs an ON/OFF signal in a specified output status, comparing it with the present value of the limit switch output command counter.	8
Counter function selection	Latch counter	• Stores the present value of the counter when the signal of the counter function selection start command is input.	9.2
	Sampling counter function	• After inputting the signal of the counter function selection start command, the input pulse is counted during a specified period and stored in the buffer memory.	9.3
	Periodic pulse counter	• While inputting the signal of the counter function selection start command, the input pulses are stored in the buffer memory at specified intervals.	9.4
	Count disable	• Stops counting pulses while the count enable command is ON.	9.5

- Counter function selection means that only one out of the four functions can be used.

3.4 External Devices Interfaces

Table 3.4 lists the external device interfaces.

Table 3.4 External Device Interfaces

Input/ Output	Internal Circuit	Terminal No.	Signal Name	Operating Status	Input Voltage (Guaranteed Value)	Operating Current
Input		1	Phase A pulse input 24V	ON	21.6 to 26.4 V	2 to 5 mA
				OFF	5 V or lower	0.1 mA or lower
			Phase A pulse input 12V	ON	10.8 to 13.2 V	2 to 5 mA
				OFF	4V or lower	0.1 mA or lower
			Phase A pulse input 5V	ON	4.5 to 5.5V	2 to 5mA
				OFF	2V or lower	0.1mA or lower
		2	COM			
		3	Phase B pulse input 24V	ON	21.6 to 26.4 V	2 to 5 mA
				OFF	5 V or lower	0.1mA
			Phase B pulse input 12 V	ON	10.8 to 13.2 V	2 to 5 mA
				OFF	4V or lower	0.1mA or lower
			Phase B pulse input 5 V	ON	4.5 to 5.5 V	2 to 5 mA
				OFF	2 V or lower	0.1 mA or lower
		4	COM			
Input		5	Preset input 12 V/24 V	ON	10.2 to 26.4 V	2 to 6 mA
				OFF	2 V or lower	0.1mA or lower
			Preset input 5V	ON	4.5 to 5.5 V	3.5 to 5.5 mA
				OFF	1.5V or lower	0.1mA or lower
		6	COM	Response time	OFF → ON 1 msec or less	ON → OFF 3.5 msec or less
Input		7	Function start input 24 V	ON	21.6 to 26.4 V	2 to 5 mA
				OFF	5 V or lower	0.1 mA or lower
			Function start input 12V	ON	10.8 to 13.2 V	2 to 5 mA
				OFF	4 V or lower	0.1 mA or lower
			Function start input 5V	ON	4.5 to 5.5 V	2 to 5 mA
				OFF	2 V or lower	0.1 mA or lower
		8	COM	Response time	OFF → ON 1 msec or less	ON → OFF 1 msec or less
Output		11	OUT 1	Operating voltage: 10.2 to 30 V Rated current: 0.5 A Rated voltage: 0.1 A/point 0.8 A/common Maximum rush current: 0.6 A 10 msec Maximum voltage drop at ON: 0.7 V(TYP) 1.3 V(MAX) Response time OFF → ON: 1 msec (MAX) 0.3 msec (MIN) ON → OFF 1 msec (MAX) 0.3 msec (MIN)		
		12	OUT 2			
		13	OUT 3			
		14	OUT 4			
		15	OUT 5			
		16	OUT 6			
		17	OUT 7			
		18	OUT 8			
		19	12/24V	Input voltage: 10.2 to 30 V Current consumption: 8 mA (TYP 24 VDC)		
		20	0V			

- In the preset input and function start input, the same external input voltage setting pin is used.

3.5 I/O Signals from/to a PC CPU

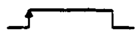
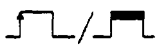
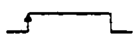
Tables 3.5 and 3.6 list the I/O signals from/to a PC CPU.

The I/O numbers and I/O addresses which are referred to in this manual are used when the A1SD61 is loaded to I/O slot 0 of a main base unit.

Table 3.5 Input Signals

Input Signal	Name A1SCPU ← A1SD61	Description	Reference Section
X00	Watchdog timer error flag	Goes ON when a watchdog timer error occurs in the A1SD61.	—
X01	CH1 limit switch output status flag	Goes ON or OFF simultaneously with a limit switch output. All channels are OFF when the limit switch command (Y15) is OFF.	8.1
X02	CH2 limit switch output status flag		
X03	CH3 limit switch output status flag		
X04	CH4 limit switch output status flag		
X05	CH5 limit switch output status flag		
X06	CH6 limit switch output status flag		
X07	CH7 limit switch output status flag		
X08	CH8 limit switch output status flag		
X09	Limit switch output enable flag	Goes ON when the limit switch is enabled.	
X0A	External preset command detection flag	Goes ON when the preset command (applied voltage) reaches the PRESET terminal. Goes OFF when the external command detection reset command (Y16) is turned ON.	6.3
X0B	Error flag	Goes ON when the write setting value contains an error. Stores the error code to the buffer memory (address 11) which is used for write data error code storage when the error flag is turned ON.	—
X0C	Fuse/external power cutoff detection flag	Goes ON when the fuse to the limit switch output part blew or when no power is supplied to the OUT terminal.	—
X0D	Sampling/periodic counter flag	Goes ON when a sampling/periodic counter function is used.	9.3 9.4
X0E to X1F	—	Unusable	—

Table 3.6 Output Signals

Output Signal	Name (A1SCPU → A1SD61)	Operating Timing	Description	Reference Section
Y00 to Y0F	—	—	Unusable	—
Y10	Count enable command		Counts pulses.	—
Y11	Decrement count command		Counts pulses by subtracting the pulsed when this signal is ON.This signal is valid only when a 1-phase pulse is input. However, this signal cannot be used along with an external input(øB).	5.1.1
Y12	Preset command		Executes the preset operation.	6.2.1
Y13	Ring counter command		Starts the ring counter.	7.1
Y14	Counter function selection start command		Selects the counter function.	9.2 9.3 9.4 9.5
Y15	Limit switch output command		Enables the limit switch output (8 channels in batch).	8,1
Y16	External preset command detection reset command		Resets the external preset command detection flag (X0A).	6.3.1
Y17	Error reset command		Resets the error code and the error flag (X0B).	—
Y18 to Y1F	—	—	Unusable	—

REMARK

(1) In table 3.6, the operating timings (, ) become valid in the following cases:

*  : Valid when the signal is ON.

*  : Valid when the signal is at leading edge.

3.6 Buffer Memory Assignment

Table 3.7 shows the buffer memory assignment of the A1SD61.

Table 3.8 gives detailed information about the settings of the addresses from 12 to 147 of the buffer memory.

Initial values are set in the buffer memory when power to the A1SCPU is ON

Table 3.8 Details for Buffer Memory Addresses 12 to 147 (Limit Switch Output Data Setting of CH1 to CH8)

Setting Contents		Buffer Memory Address							
		12 to 28 CH1	29 to 45 CH2	46 to 62 CH3	63 to 79 CH4	80 to 96 CH5	97 to 113 CH6	114 to 130 CH7	131 to 147 CH8
Number of multi-dogs of CH[ ]		12	29	46	63	80	97	114	131
ON address of dog 0 of CH[ ]	(L)	13	30	47	64	81	98	115	132
	(H)	14	31	48	65	82	99	116	133
OFF address of dog 0 of CH[ ]	(L)	15	32	49	66	83	100	117	134
	(H)	16	33	50	67	84	101	118	135
ON address of dog 1 of CH[ ]	(L)	17	34	51	68	85	102	119	136
	(H)	18	35	52	69	86	103	120	137
OFF address of dog 1 of CH[ ]	(L)	19	36	53	70	87	104	121	138
	(H)	20	37	54	71	88	105	122	139
ON address of dog 2 of CH[ ]	(L)	21	38	55	72	89	106	123	140
	(H)	22	39	56	73	90	107	124	141
OFF address of dog 2 of CH[ ]	(L)	23	40	57	74	91	108	125	142
	(H)	24	41	58	75	92	109	126	143
ON address of dog 3 of CH[ ]	(L)	25	42	59	76	93	110	127	144
	(H)	26	43	60	77	94	111	128	145
OFF address of dog 3 of CH[ ]	(L)	27	44	61	78	95	112	129	146
	(H)	28	45	62	79	96	113	130	147

[ ] indicates a channel number.

3.7 Applicable Encoders

The encoders applicable to the A1SD61 are shown below:

(1) Open-collector type

(2) CMOS output type

(Make sure that the output voltage of the encoder complies with the A1SD61 specifications.)

POINT

The following types of encoders cannot be used with the A1SD61:

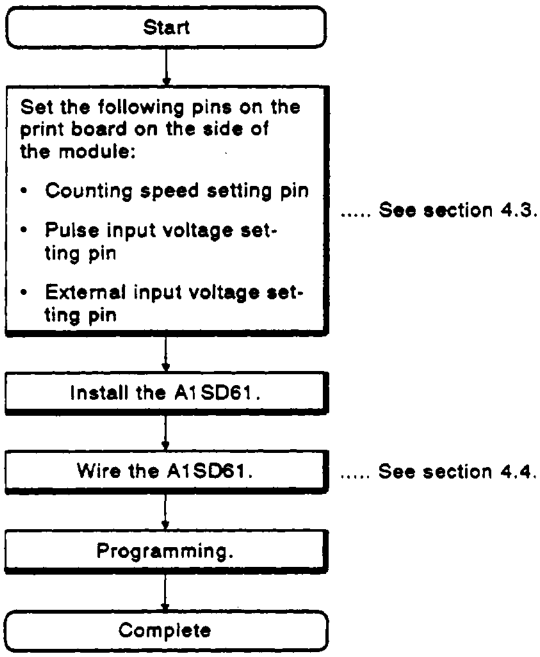
- TTL output type
- Line drive output type

4. INSTALLATION AND PRE-OPERATION SETTING PROCEDURE

This section describes the pre-operation procedure of the A1SD61, the names and settings of each part of the A1SD61, and the wiring method.

4.1 Pre-operation Setting Procedure

The pre-operation setting procedure of the A1SD61 is shown below:



4.2 Handling Precautions

Handling precautions for the A1SD61 are given below:

(1) Protect the case and the terminal block from impact, since they are made from resin.

(2) Do not remove the printed circuit board from the case.

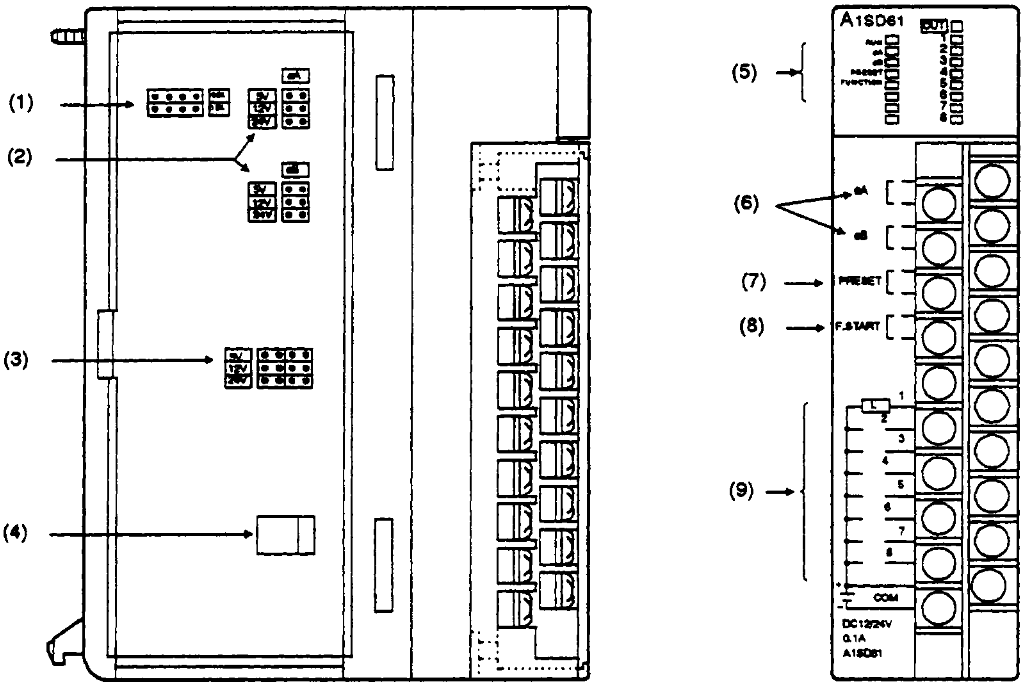
(3) When wiring, make sure that no wire offcuts remain around the terminal block.

(4) Tighten the screws to install the module to the base unit as indicated in the following table:

Screw Location	Tightening Torque Range (kg·cm) (lb·in)
Module mounting screw (M4 screw)	8 (6.93) to 12 (10.39)
Terminal block terminal screw (M3.5 screw)	6 (5.19) to 9 (7.80)
Terminal block mounting screw (M4 screw)	8 (6.93) to 12 (10.39)

4.3 Part Names and Settings

The names of each part of the A1SD61 and the settings are shown below:



No.	Name		Description
(1)	Counting speed setting pin		50K: Counts pulses at a maximum speed of 50K pps in 1-phase or 2-phase input. 10K: Counts pulses at 10K pps in 1-phase input, at 7K pps in 2-phase input. (The factory-setting is 50K.)
(2)	Pulse input voltage setting pin		Sets the pulse voltage that is input to Phase A or B. (The factory-setting is 24 V.) Mitsubishi cannot guarantee the module when a pulse whose voltage is higher than the set voltage is applied. (See section 3.4.)
(3)	External input voltage setting pin		Sets the voltage input to the PRESET/F.START terminals. (The factory-setting is 24 V.) Mitsubishi cannot guarantee the module when a pulse whose voltage is higher than the set voltage is applied. (See section 3.4.)
(4)	Fuse		Used for protecting OUTs 1 to 8 from overcurrent.
(5)	LED indicators	RUN	Lit when the module operates normally. Flashes when a data write error has occurred. OFF when a watchdog timer error has occurred.
		øA	Lit when voltage is applied to phase A pulse input terminal.
		øB	Lit when voltage is applied to phase B pulse input terminal.
		PRESET	Lit and latched when voltage is applied to the PRESET terminal. OFF when external preset detection reset signal (Y16) is turned ON.
		FUNCTION	ON when voltage is applied to the F. START terminal.
		OUTs 1 to 8	ON when a corresponding limit switch is turned ON by the limit switch output function. OFF when the limit switch is turned OFF.
(6)	øA/øB		Pulse input terminals (øB is used as decrement count command.)
(7)	PRESET		The terminal in which voltage is applied when a preset is executed from an external device.
(8)	F.START		The terminal in which voltage is applied when a counter function selection is executed.
(9)	OUTs 1 to 8		An external output terminal used for limit switch output.

4.4 Wiring

Details on how to wire a pulse generator device to the A1SD61 are described below:

4.4.1 Wiring preconditions

The preconditions when a pulse generator device is wired to the A1SD61 are described below:

(1) For a high-speed pulse input, take the following counter measures against noise:

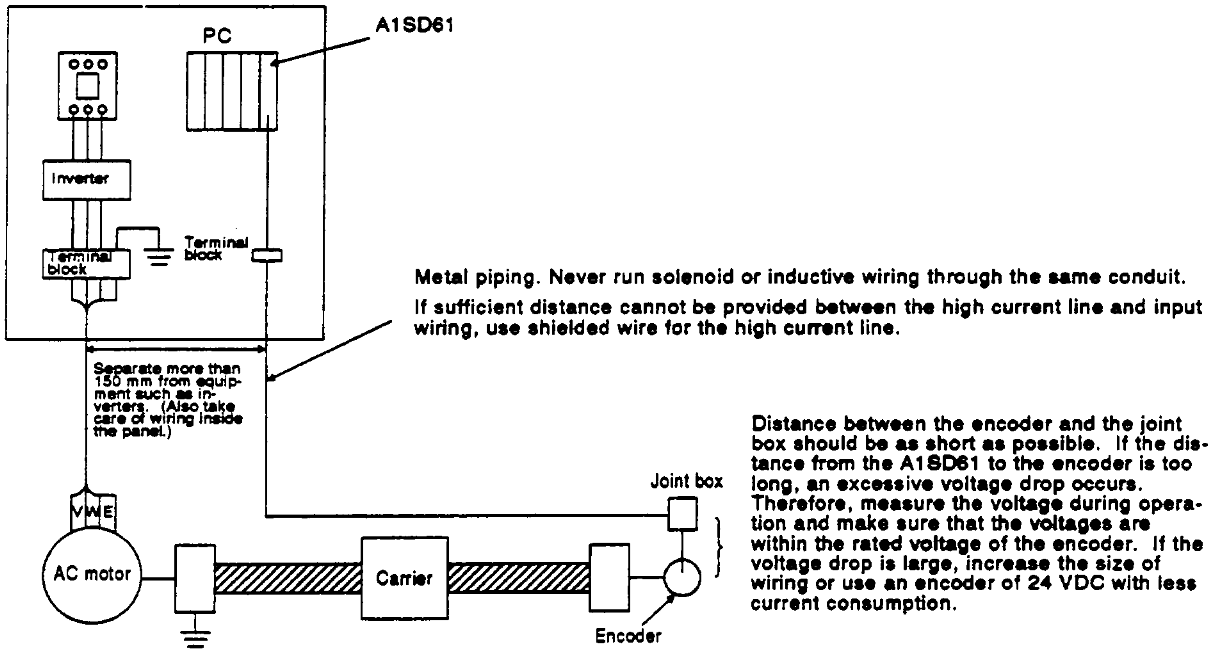
(a) Be sure to use shielded twisted pair cables. Also, make sure it is grounded to Class 3 specifications.

(b) Do not run a twisted pair cable in parallel with power cables or other I/O lines which may generate noise. Run cables at least 150 mm (5.91 in.) away from the above-mentioned lines and over the shortest distance possible.

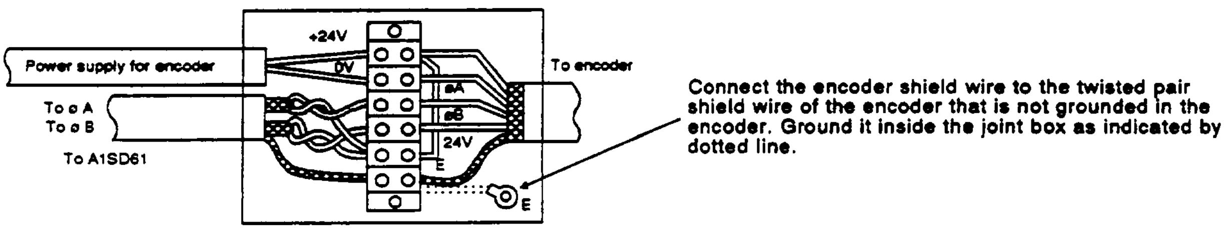
(2) For 1-phase input, connect count input signal to phase A only.

(3) If the A1SD61 picks up pulse noise, it will count incorrectly.

(4) The specific measures against noise are shown below:



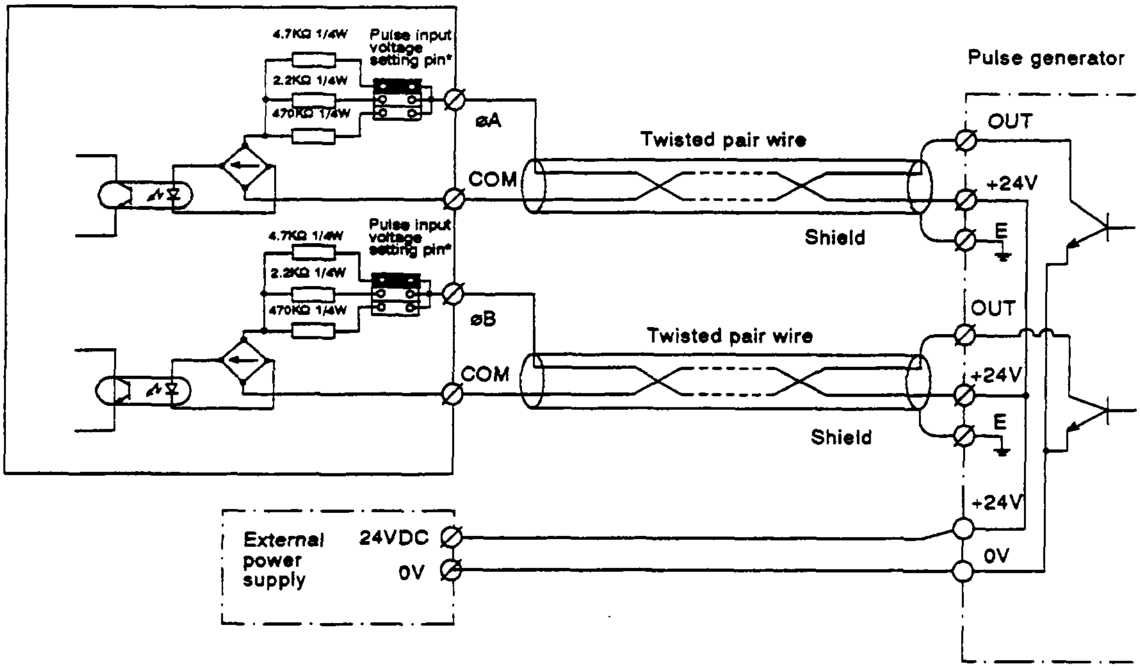
• Ground twisted shielded wire on the encoder side (joint box). (This is a connection example for 24 V send load.)



4.4.2 Wiring example for the connection with the open collector output pulse generator

A1SD61

(1) Connection of a 24 VDC pulse generator

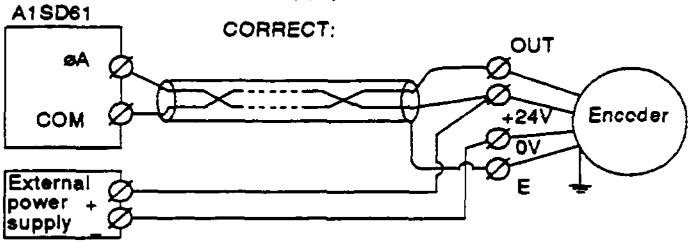


POINT

The encoder signal and supply lines should be wired as shown below:

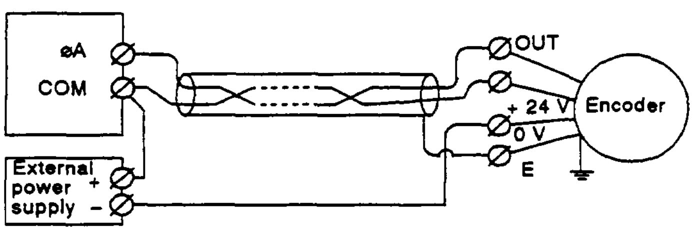
A1SD61

CORRECT:



INCORRECT:

A1SD61

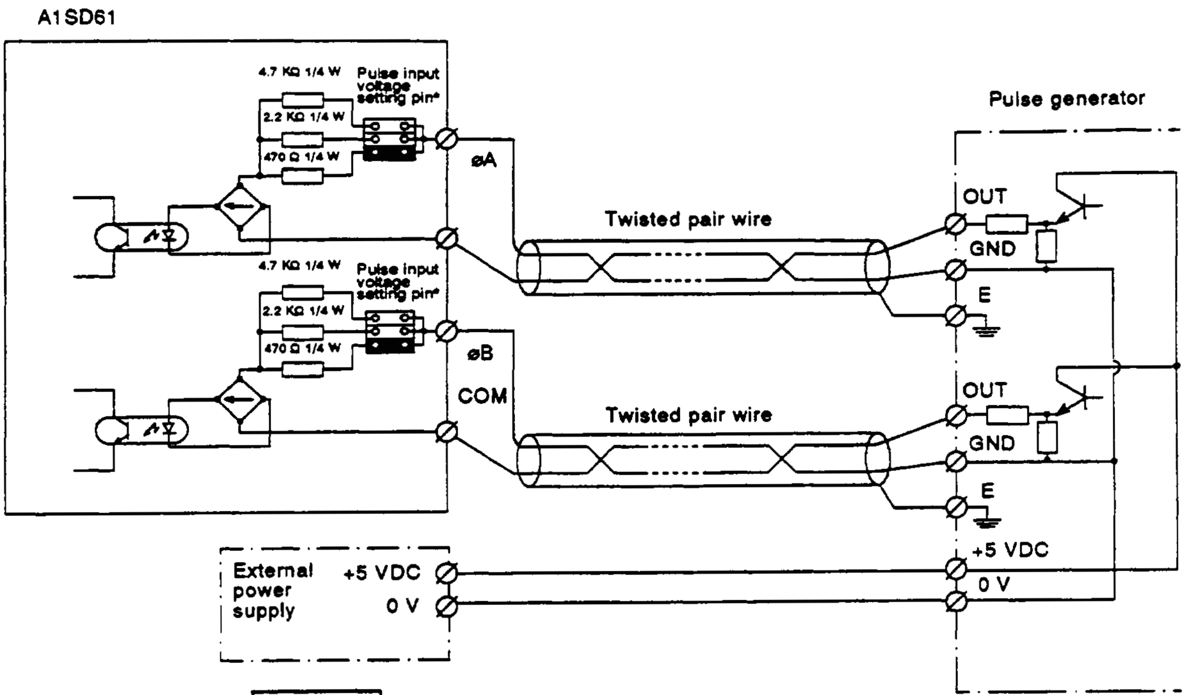


Since the same twisted pair wire is used for both the encoder signal and the power supply, a reduction in the canceling effect and electromagnetic induction may occur.

REMARK

(1) * Set the pulse input voltage setting pin to the position.

(2) Connection of a voltage output pulse generator (5 VDC)

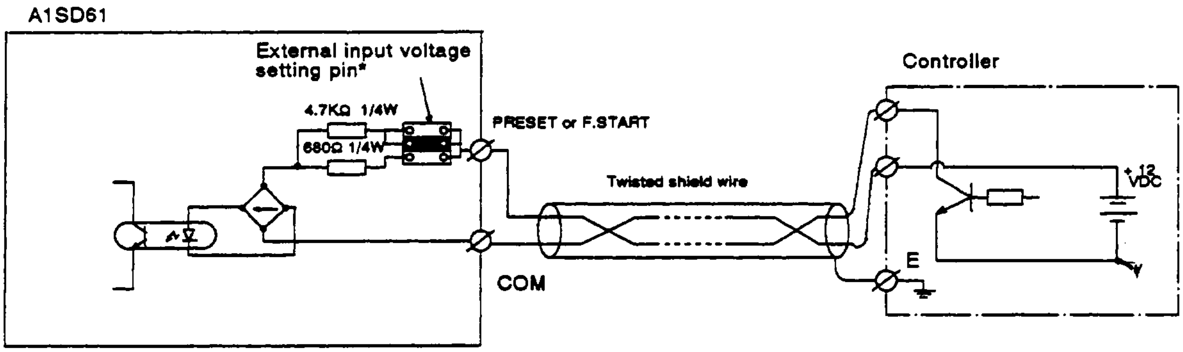


REMARK

(1) * Set the pulse input voltage setting pin to the ■●●■ position.

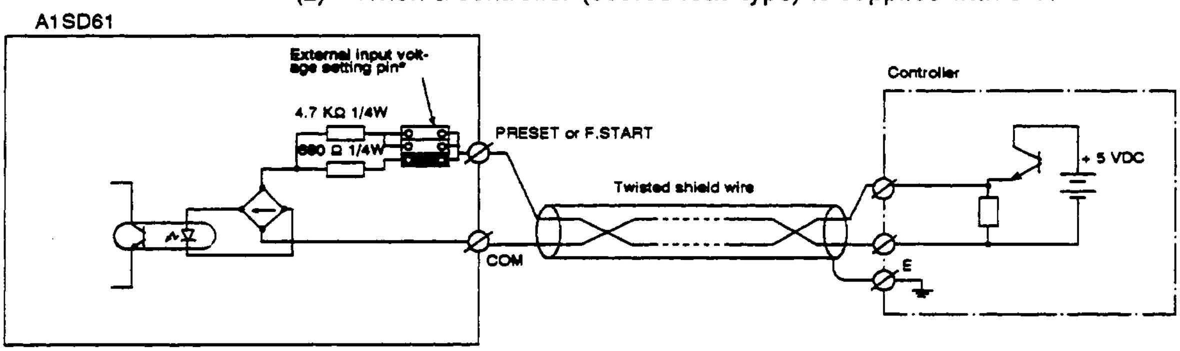
4.4.3 Wiring example for the connection of a controller to external input terminals (PRESET and F.START)

(1) When a controller (sink load type) is supplied with 12 V:



This diagram assumes that the internal circuit is set to PRESET.

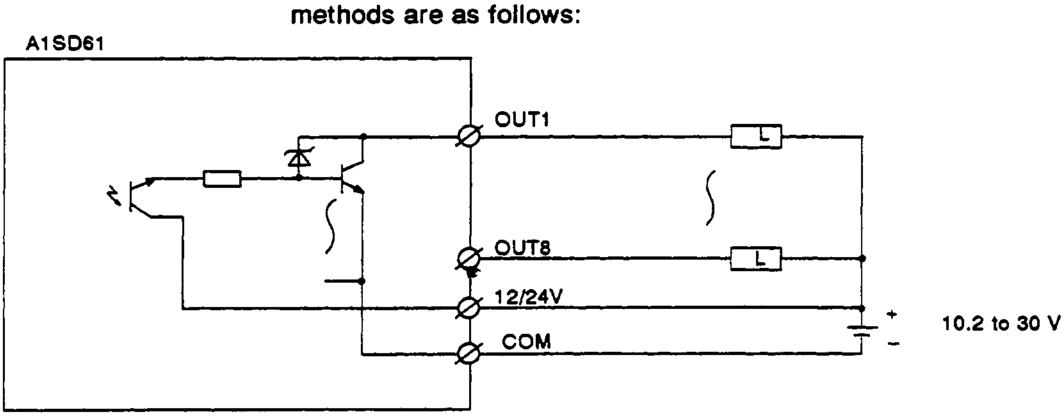
(2) When a controller (source load type) is supplied with 5 V:



This diagram assumes that the internal circuit is set to PRESET.

4.4.4 Wiring examples at external output terminals (OUTs 1 to 8)

To use an external terminal, the internal photocoupler should be activated. For this example, 10.2 to 30 VDC external power is necessary. Connection methods are as follows:



REMARK

(1) * Set the pulse input voltage setting pin to the ● ● position.

5. PULSE INPUT AND COUNTER PROCESSING METHOD

This section describes the pulse input and counter processing method.

(1) Either 1-phase or 2-phase pulse input may be executed.

(a) 1-Phase pulse input

When the 1-phase pulse input is executed, the following counts can be made:

1) Counts the phase A pulse inputs incrementally and counts the pulses by the decremental count command.

2) Counts the phase A pulse inputs incrementally and counts phase the B pulse inputs decrementally.

(b) 1-Phase pulse input

1) Multiplied by one: Counts phase A pulses at the leading edge.

2) Multiplied by two: Counts phase A pulses both at the leading edge and at the fall.

3) Multiplied by four: Counts phase A/B pulses both at the leading edge and at the fall.

(2) When 1-phase pulse input is done, the pulses are counted at leading edge.

(3) When the pulse input mode is changed, the count is made from "0".

5.1 Counting at 1-Phase Input

The following explains the counter processing method for the 1-phase input.

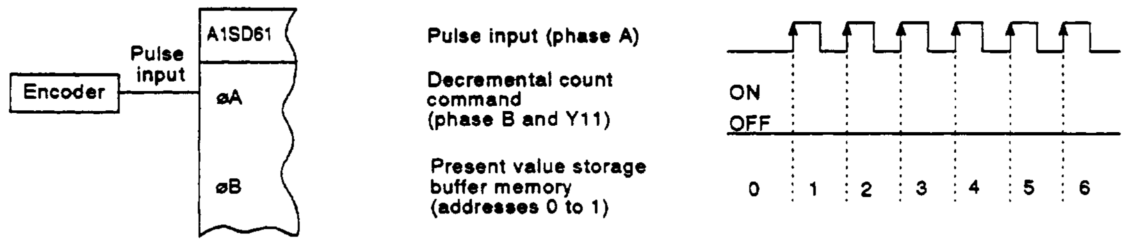
5.1.1 Counting using the phase A pulse input and decremental count command

The following counts can be made using the incremental phase A pulse input and decremental count command:

- Incrementally counts pulses input to phase A.
- Decrementally counts pulses when the decremental count command (voltage applied to phase B or Y11 turned ON by the A1SCPU) is input at the leading edge of a pulse input to phase A.

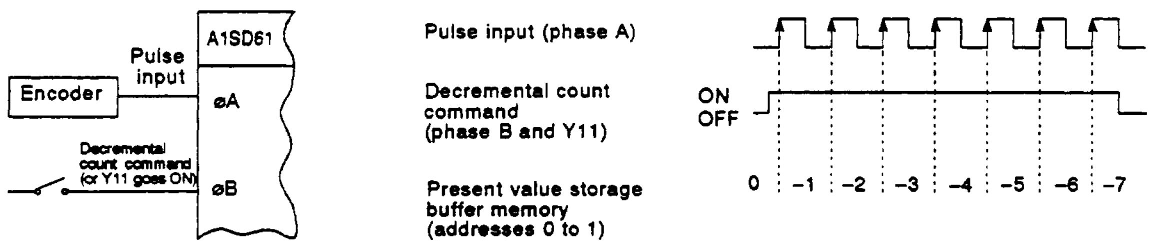
(1) Incremental count

When an incremental count is executed, the operation timing of the pulse inputs, decremental count command, and the present value of the storage buffer memory are shown below:



(2) Decremental count

When a decremental count is executed, the operation timing of pulse inputs, decremental count command, and the present value of the storage buffer memory are shown below:



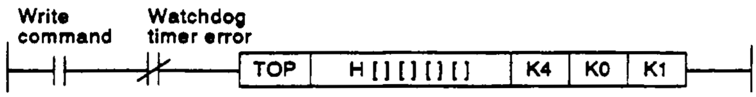
POINT

When the decremental count command is executed, apply voltage to phase B or turn ON Y11.

(3) Counter processing mode setting

To use the above-mentioned mode (counting using the phase A pulse input and decremental count command), set the A1SD61 pulse input mode setting buffer memory (address 4) to "0" using the sequence program.

[Sequence program]



REMARK

Set a higher two-digit number for the A1SD61 head I/O number to [ ][ ][ ][ ].

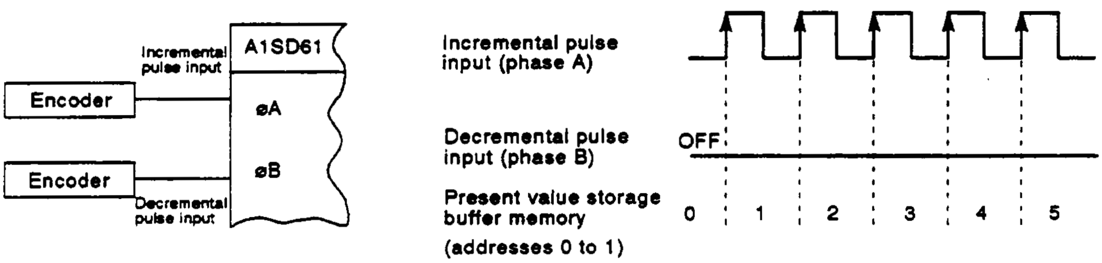
5.1.2 Counting using the incremental phase A pulse input and the decremental phase B pulse input

The following counts can be made using the incremental phase A pulse input and the decremental count command:

- Incrementally counts the pulses that are input to phase A at the leading edge.
- Decrementally counts the pulses that are input to phase A at the leading edge.
- Subtracts the number of incremental pulses from the number of decremental pulses when the pulses are input to both phases A and B.

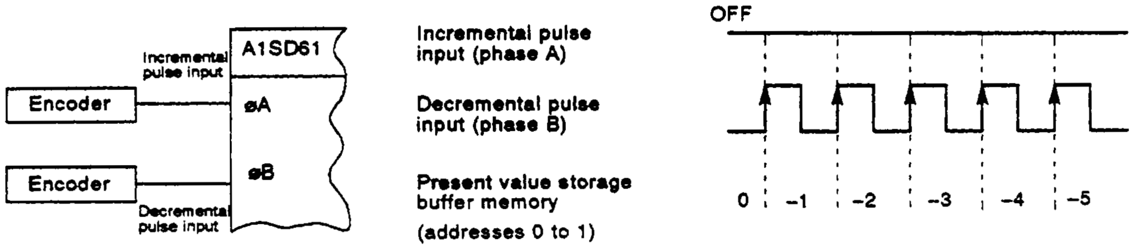
(1) Incremental count

When an incremental count is made, the operation timings of the incremental and decremental pulse inputs, and the present value of the storage buffer memory are shown below:



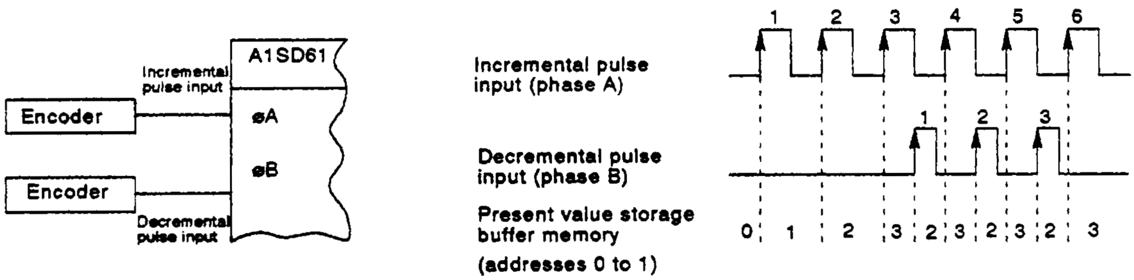
(2) Decremental count

When a decremental count is made, the operation timings of the incremental and decremental pulse inputs, and the present value of the storage buffer memory are shown below:



(3) Incremental/decremental count

When an incremental/decremental count is made, the operation timings of the incremental and decremental pulse inputs, and the present value of the storage buffer memory are shown below:



(4) Counter processing mode setting

To use the above-mentioned mode (counting using the incremental phase A pulse input and decremental phase B pulse input), set the A1SD61 pulse input mode setting buffer memory (address 4) to "0" using the sequence program.

[Sequence program]

REMARK

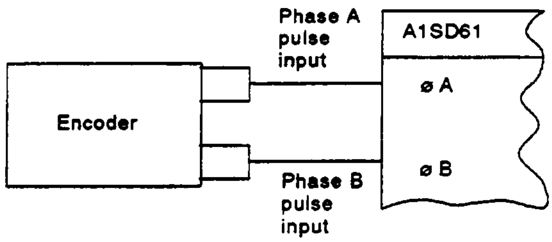
Set a higher two-digit number of the A1SD61 head I/O number to [ ][ ][ ][ ].

5.2 Counting at 2-Phase Pulse Input

When the 2-phase pulse input is done, the counting mode can be selected from multiplication by one, two, and four.

- Multiplied by one: Incrementally and decrementally counts phase A pulses at the leading edge.
- Multiplied by two: Incrementally and decrementally counts phase A pulses both at the leading edge and at the fall.
- Multiplied by four: Incrementally and decrementally counts phase A/B pulses both at the leading edge and at the fall.

(1) The relationship between the phase A pulse input and the phase B pulse input is given below:

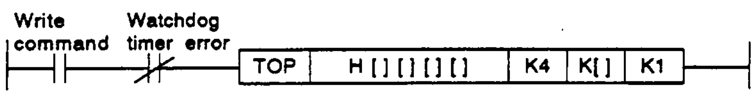


(2) Counter processing mode setting

To use the above-mentioned mode (counting using the incremental phase A pulse input and decremental phase B pulse input), set the A1SD61 pulse input mode setting buffer memory (address 4) to any number from 2 to 4 using the sequence program.

Counting Mode	Setting Value
Multiplied by one	2
Multiplied by two	3
Multiplied by ~~three~~ 4	4

[Sequence program]



REMARK

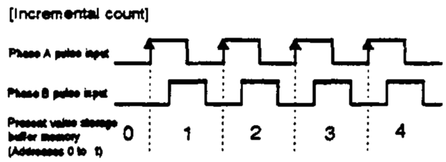
1) Set a higher two-digit number of the A1SD61 head I/O number to [ ][ ][ ][ ].

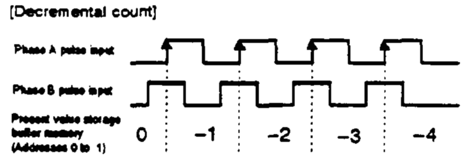
2) Set any number from 2 to 4 to [ ].

5.2.1 Counting using 2-phase pulse input multiplied by one

Count is made at leading edge of phase A pulse.

The phase difference between phase A and phase B pulses determines whether the count is made incrementally or decrementally.





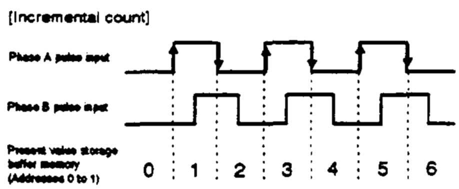
	Timings to Make an Incremental Count
Phase A	Leading edge
Phase B	OFF

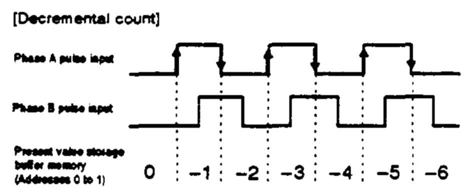
	Timings to Make a Decremental Count
Phase A	Leading edge
Phase B	ON

5.2.2 Counting using 2-phase pulse input multiplied by two

Count is made both at the leading edge and at the fall of the phase A pulse.

The phase difference between phase A and phase B pulses determines whether the count is made incrementally or decrementally.





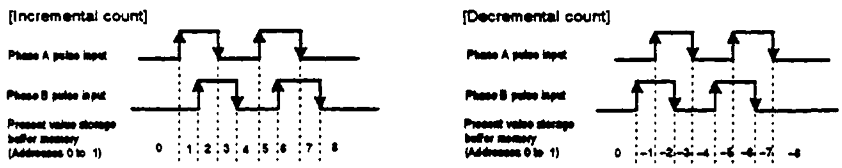
	Timings to Make an Incremental Count	
Phase A	Leading edge	Fall
Phase B	OFF	ON

	Timings to Make a Decremental Count	
Phase A	Leading edge	Fall
Phase B	ON	OFF

5.2.3 Counting using 2-phase pulse input multiplied by four

Count is made both at the leading edge and at the fall of the phase A/B pulse.

The phase difference between phase A and phase B pulses determines whether the count is made incrementally or decrementally.



	Timings to Make an Incremental Count			
Phase A	Leading edge	Fall	ON	OFF
Phase B	OFF	ON	Leading edge	Fall

	Timings to Make a Decremental Count			
Phase A	Leading edge	Fall	OFF	ON
Phase B	ON	OFF	Leading edge	Fall

5.3 Reading the Present Value

The following describes the contents of the present value stored in the addresses from 0 to 1 of the A1SD61 buffer memory and how to read the present value.

(1) In this buffer area, the count values are stored when a pulse input, preset, ring counter function, or count disable (counter function selection) is executed.

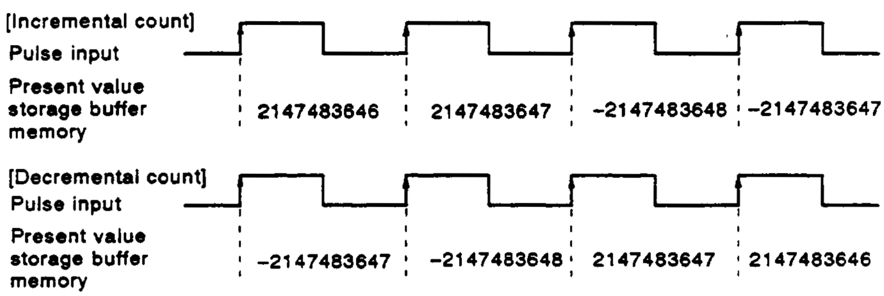
However, the counter values are stored in the counter function selection count value of the storage buffer memory (addresses 2 to 3) when a latch counter, a sampling counter, or a periodic pulse counter function is executed.

(2) The present value of –2147483648 to 2147483647 is stored in signed 32-bit binary code to the buffer memory.

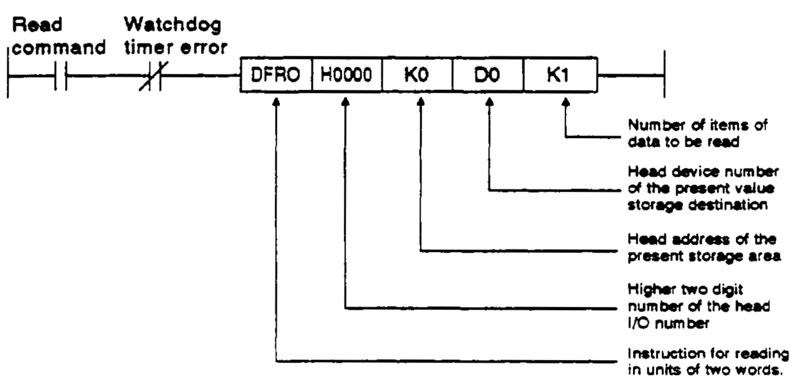
When the present value is negative, that data is stored as a complementary number of two to the present value of the storage buffer memory.

(3) When an incremental count is made, if the value exceeds 2147483647, it will jump to –2147483648.

When a decremental count is made, if the value exceeds –2147483648, it will jump to 2147483647.



(4) The sequence program used to read the present value from the buffer memory is shown below:



6. EXECUTING THE PRESET FUNCTION

This section explains the preset function.

6.1 Preset Function

The preset function is used for converting the counter's present value to a different value.

This changed value is called the preset value.

The preset function can be used when a pulse count is started from the set value.

The preset function consists of two modes: preset by the sequence program and preset from the external input (applying the voltage to the external terminal).

Preset function application example:

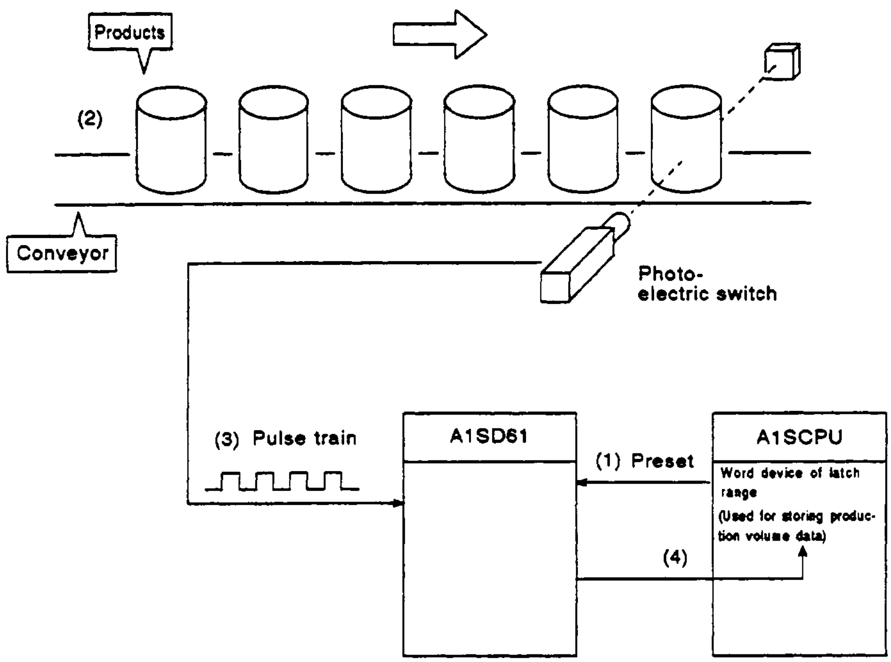
By using the preset function, the production count can be continued from the previous day.

(1) The production volume of the previous day is "preset" from the A1SCPU to the A1SD61.

(2) Products are carried by a conveyor.

(3) The production volume is counted by inputting the pulse from the photo-electric switch.

(4) At the end of the daily production, the counter value in the buffer memory is stored to a word device (D, W, etc.) in the A1SCPU latch range.

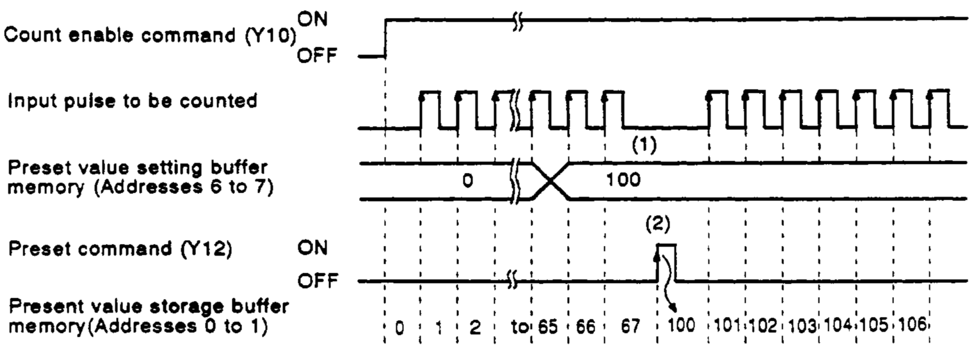


6.2 Preset Using the Sequence Program

The following describes the preset function executed by the sequence program.

6.2.1 Executing the preset function using the sequence program

Turn ON the preset command (Y12) in the sequence program to execute the preset.



1) Writes a given value to the preset value setting buffer memory (addresses 6 to 7) in 32-bit binary code.
2) Turing ON the preset command (Y12) sets the preset value in the buffer memory to the present value buffer memory.

   The preset function can be used whether the count enable command (Y10) is ON or OFF.

6.2.2 Example program

Create a program to count 2-phase pulses multiplied by one and to execute the preset function using the sequence program.

System configuration:

		X00 to X0F Y00 to Y1F	X20 to X3F	
A1S 62P	A1S CPU	A1S D61	A1S X41	

Devices to be used:

(1) Execution commands

(a) Pulse input mode setting command M9038

(b) Count operation start command X20

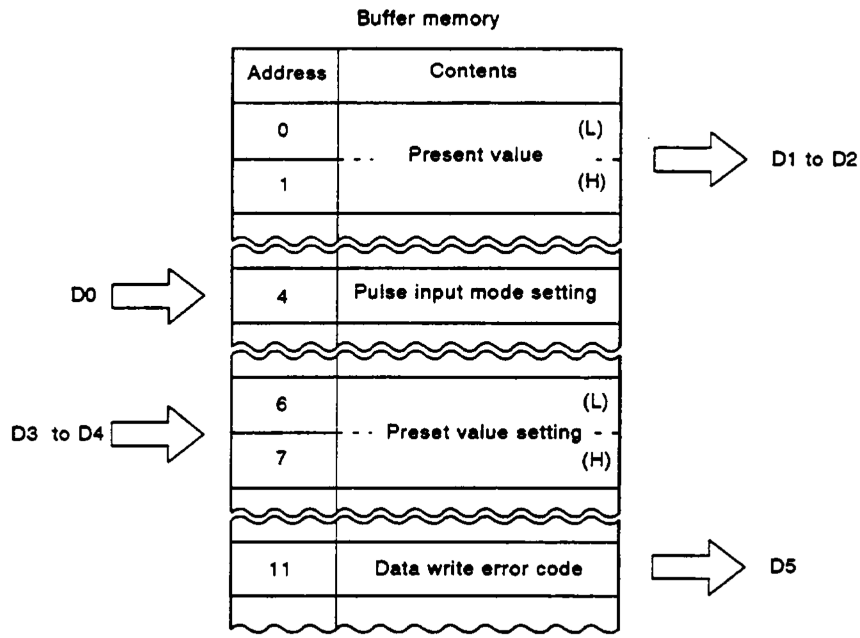
(c) Present value read command X21

(d) Preset value write command X22

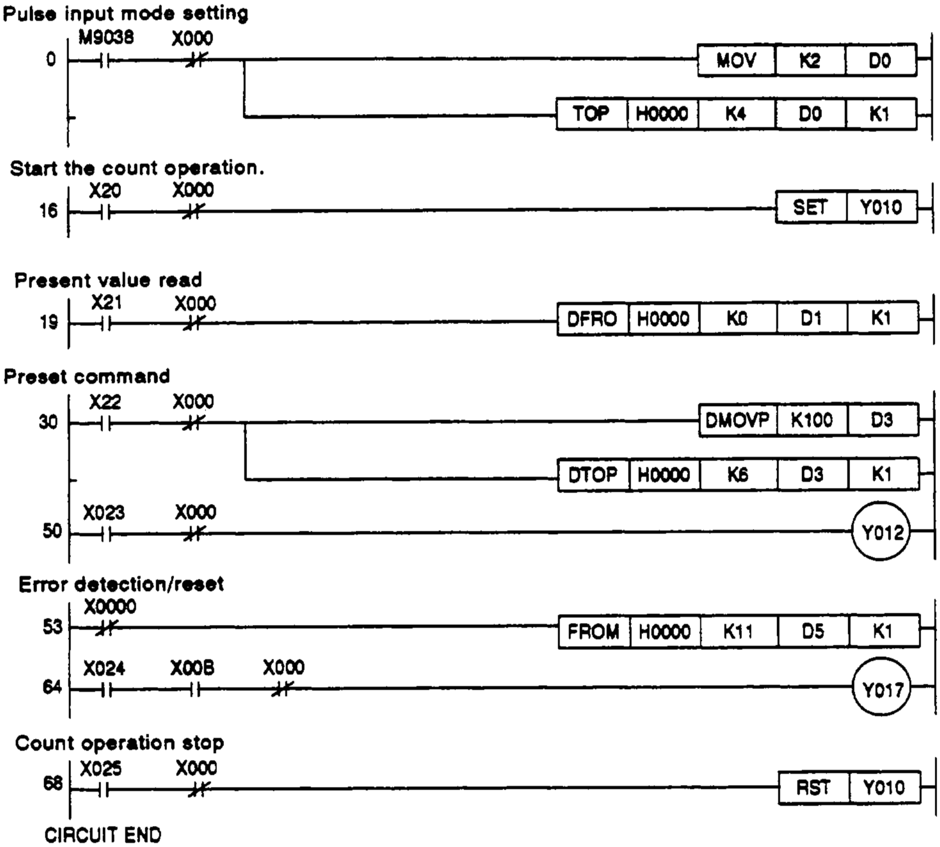
(e) Error reset command X23

(f) Count operation stop command X24

(2) Relationship between data register (D0 to D5) and buffer memory



Example program:



Set the pulse mode consistent with the 2-phase pulse input multiplied by one.

Start the pulse count with the count enable command (SET).

Read the present value and store it to devices D1 to D2.

Store the preset value of 100 to address 6 of the buffer memory.

Execute the preset.

Read the error code and store it to device D5.

Reset the error.

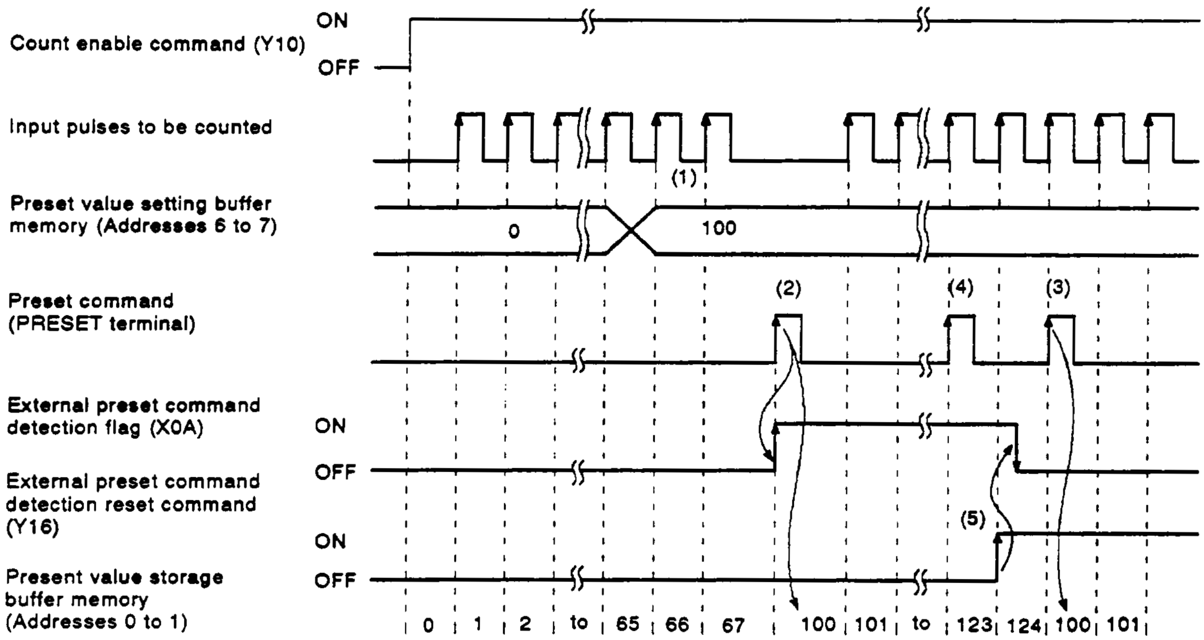
Stop the pulse count by the count enable command (RST).

6.3 Preset by External Input

The following describes the preset by the external input.

6.3.1 When the preset is executed by external input

Execute the preset by applying the voltage to the external input PRESET terminal.



1) Writes a given value to the preset value of the setting buffer memory (addresses 6 to 7) in 32-bit binary code.

2) Executing the preset command (applying the voltage to the PRESET terminal) sets the preset value in the buffer memory to the present value buffer memory.

3) Even when the external preset command, detection reset command (Y16) is ON, the preset can be executed with the preset command (applying the voltage to the PRESET terminal).

The preset function can be used whether the count enable command (Y10) is ON or OFF.

POINT

(1) When the external preset detection flag (X0A) is ON (see (4) in the above-indicated diagram), even if the voltage is applied to the PRESET terminal, the preset function cannot be executed.

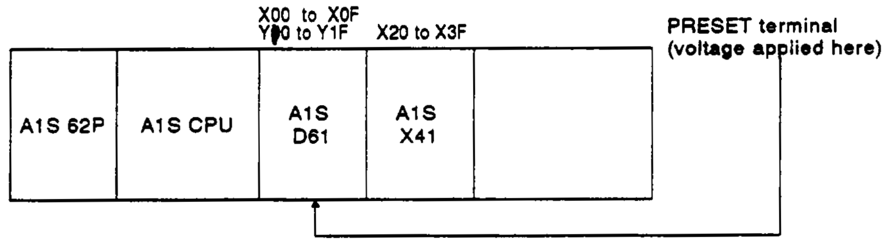
In this case, by turning ON the external preset command detection reset command (Y16) and turning OFF the external preset command detection flag (X0A), the preset function can be executed.

6.3.2 Example program

Create a program to count 2-phase pulses multiplied by one and to execute the preset function with the external input.

System configuration:

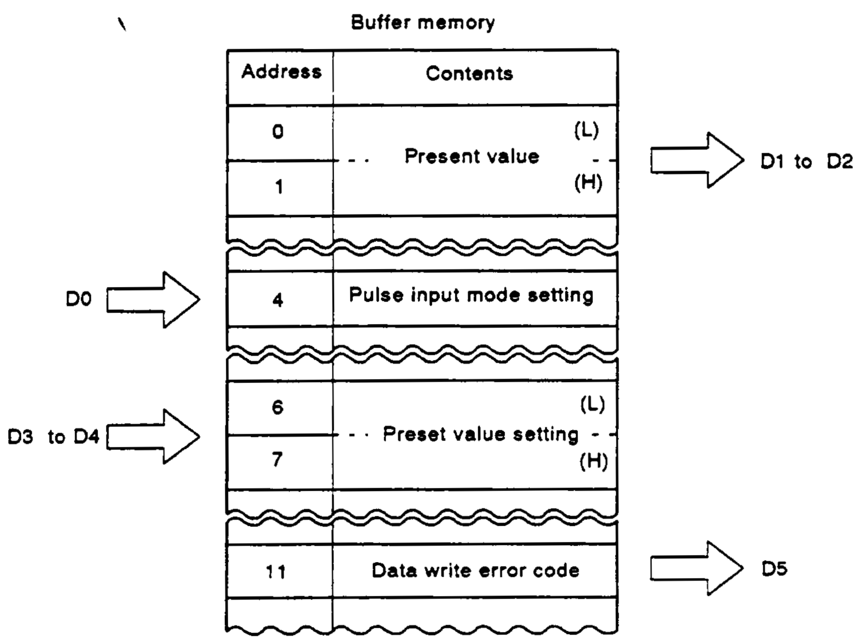
Devices to be used:



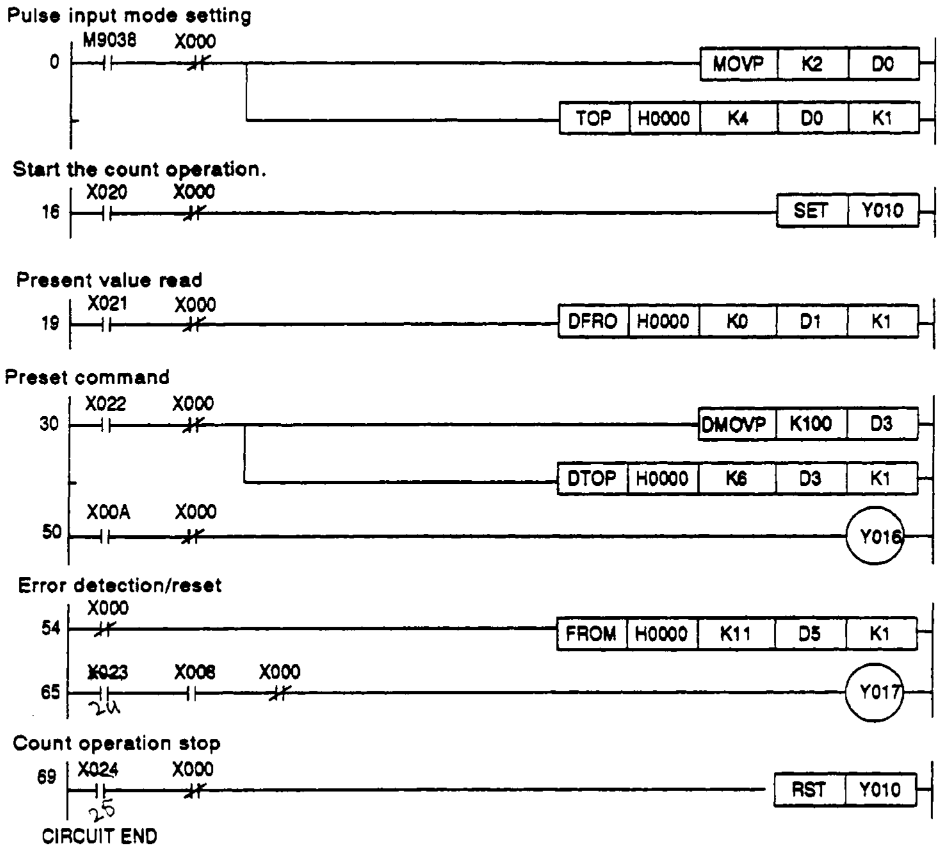
(1) Execution commands

(a) Pulse input mode setting command M9038
(b) Count operation start command X20
(c) Present value read command X21
(d) Preset value write command X22
(e) External preset command detection flag reset command X23
(f) Error reset command X24
(g) Count operation stop command X25

(2) Relationship between data register (D0 to D5) and buffer memory



Example program:



Set the pulse mode consistent with the 2-phase pulse input multiplied by one.

Start the pulse count with the count enable command (SET).

Read the present value and store it to devices D1 to D2.

Store the preset value of 100 to address 6 of the buffer memory.

Reset the external preset command detection flag.

Read the error code and store it to device D5.

Reset the error.

Stop the pulse count by the count enable command (RST).

7. EXECUTING THE RING COUNTER FUNCTION

This section describes the ring counter function.

7.1 Ring Counter Function

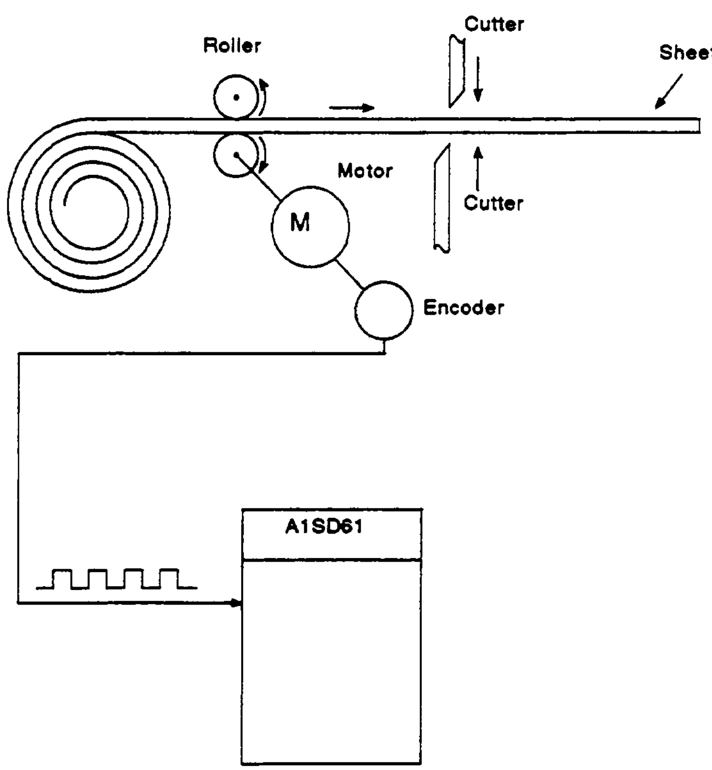
The ring counter function automatically sets the present value to the value that has been preset and executes counting operations.

The ring counter function can be used when executing controlled cycles such as incremental feed.

Ring counter function application example:

Using a system to cut a sheet to a specified size, adjust its rollers by setting the ring counter value, and cut the sheet to the specified size.

1) Set the preset and ring counter values to execute the ring counter function.
2) Turn on the motor to operate the rollers.
3) Operate the rollers so that the sheet can be cut to the specified size.
4) Cut the sheet.
5) Repeat steps 2 to 4.



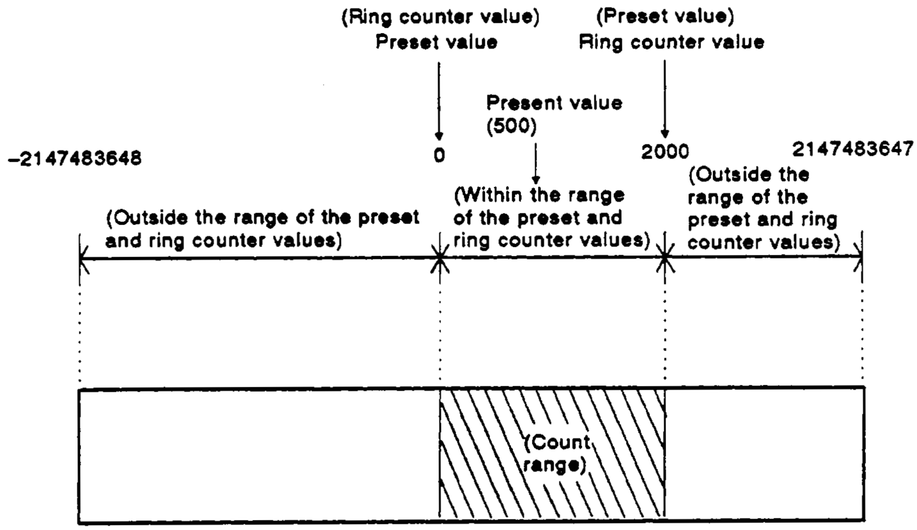
(1) The ring counter function is executed when both the count enable command (Y10) and the ring counter commands (Y13) are ON.

(2) Ring counter operation

When the counter value is between the preset value and the ring counter value, the ring counter functions within the range between the preset value and the ring counter value.

When the ring counter function is executed, if the counter present value reaches the ring counter value, the present value will be automatically set to the preset value.

Also, if the present value of the counter reaches the preset value, the preset value will remain the same.



(a) When the preset value of the storage buffer memory (addresses 6 to 7) is set to 0, the ring counter value of the storage buffer memory (addresses 8 to 9) to 2000, and the present value of the storage buffer memory (addresses 0 to 1) to 500 respectively, the ring counter is executed as shown below:

1) Increment count:

If the ring counter value reaches the ring counter set value (2000), the present value storage buffer memory (addresses 0 to 1) will be set to the preset value (0).

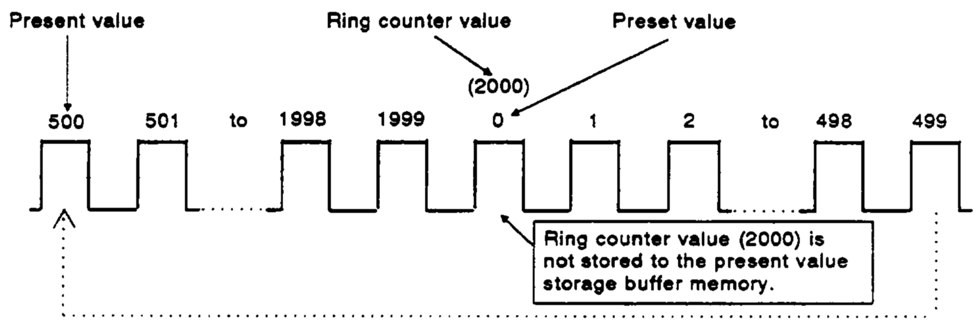
The ring counter value (2000) is stored to the present value storage buffer memory.

2) Decrement count:

If the ring counter value reaches the preset value (0), the preset value will remain.

When the next count is made, the preset value (ring counter value - 1) is stored to the present value of the storage buffer memory.

The ring counter value (2000) is not stored to the present value of the storage buffer memory.



(b) When the preset value of the storage buffer memory (addresses 6 to 7) is set to 2000, the ring counter value of the storage buffer memory (addresses 8 to 9) to 0, and the present value of the storage buffer memory (addresses 0 to 1) to 500 respectively, the ring counter is executed as shown below:

1) Increment count:

If the ring counter value reaches the preset value (2000), the preset value will remain.

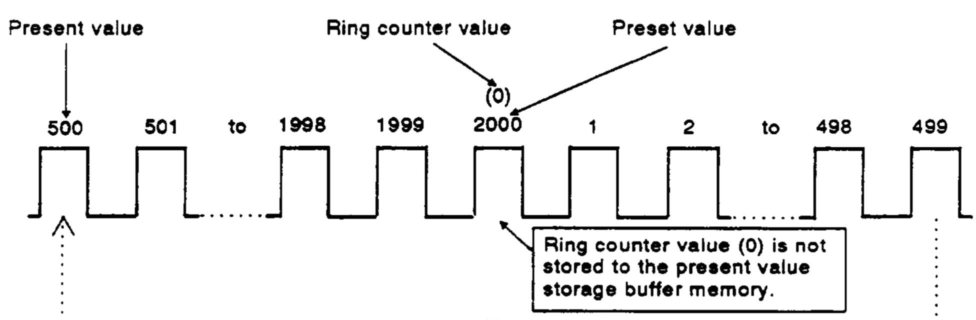
When the next count is made, the preset value (ring counter value + 1) is stored to the present value of the storage buffer memory.

The ring counter value (0) is not stored to the present value of the storage buffer memory.

2) Decrement count:

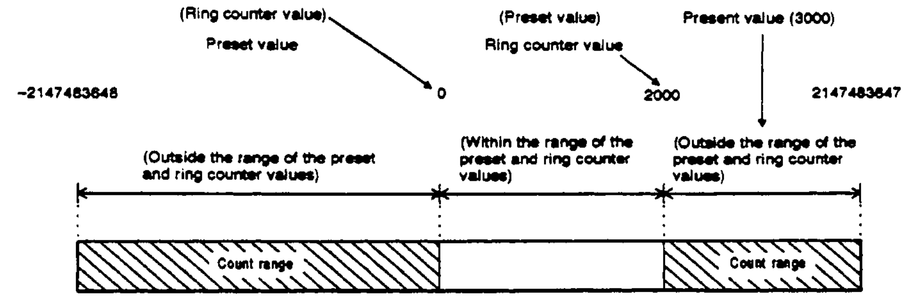
If the ring counter value reaches the preset value (0), the preset value (2000) is stored to the present value of the storage buffer memory.

The ring counter value (0) is not stored to the present value of the storage buffer memory.

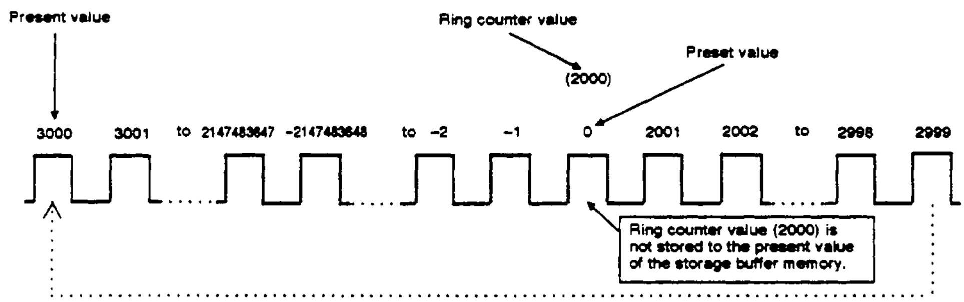


REMARK

If the ring counter starts when the present value is outside the range of the preset and ring counter values (except when the present value is equal to the preset and ring counter values), the count cannot be made within the range of the preset and ring counter values.



When the preset value storage buffer memory (addresses 6 to 7) is set to 0, the ring counter value storage buffer memory (addresses 8 to 9) to 2000, and the present value storage buffer memory (addresses 0 to 1) to 3000 respectively, the ring counter is executed as shown below:



POINT

When the present value of the counter is outside the range of the preset and ring counter values, the present value of the counter can be changed to the preset value using the preset command (Y12).

POINT

(1) When the ring counter function is executed, do not write the preset value or ring counter value.

If the write is executed, an error will occur and the error code (14) will be stored as a data error of the storage buffer memory (address 11).

(2) When the ring counter function is executed, make sure that the difference between the preset and the ring counter values is larger than the number of input pulses per msec.

| (Preset value) — (Ring counter value) | ≥ Number of pulses/msec

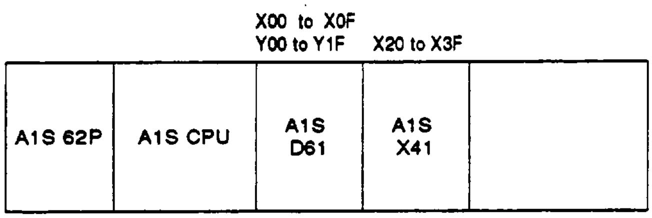
Example: When the pulse input speed is more than 50K pps:

When the pulse is input at a speed of 50K pps, make sure that the difference between the preset and the ring counter values is larger than 50 (pulses/msec).

7.2 Example Program

Create a program to count 2-phase pulses multiplied by one and to execute the ring counter function.

System configuration:



Devices to be used:

(1) Execution commands

(a) Pulse input mode setting command M9038

(b) Count operation start command X20

(c) Present value read command X21

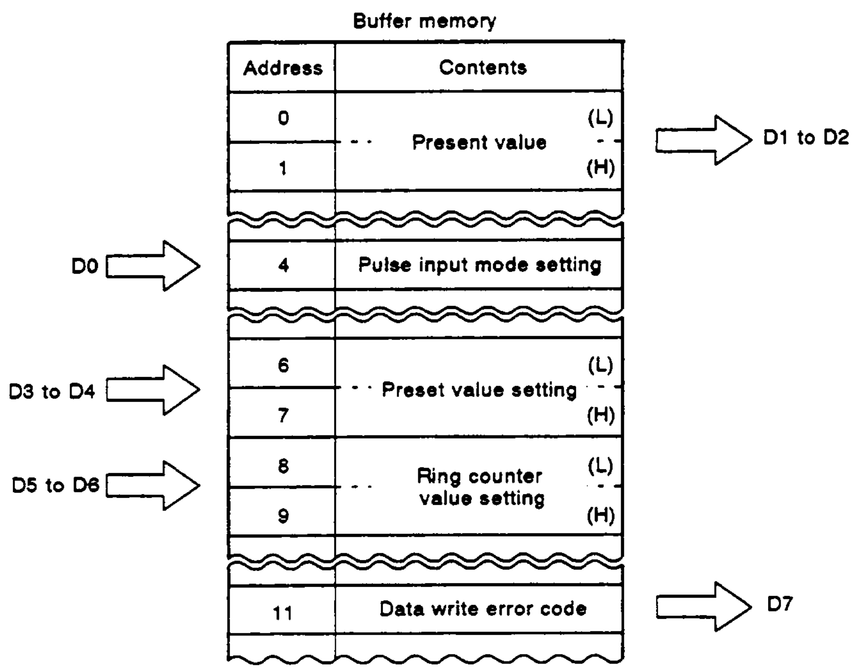
(d) Preset/ring count value write command X22

(e) Ring counter command X23

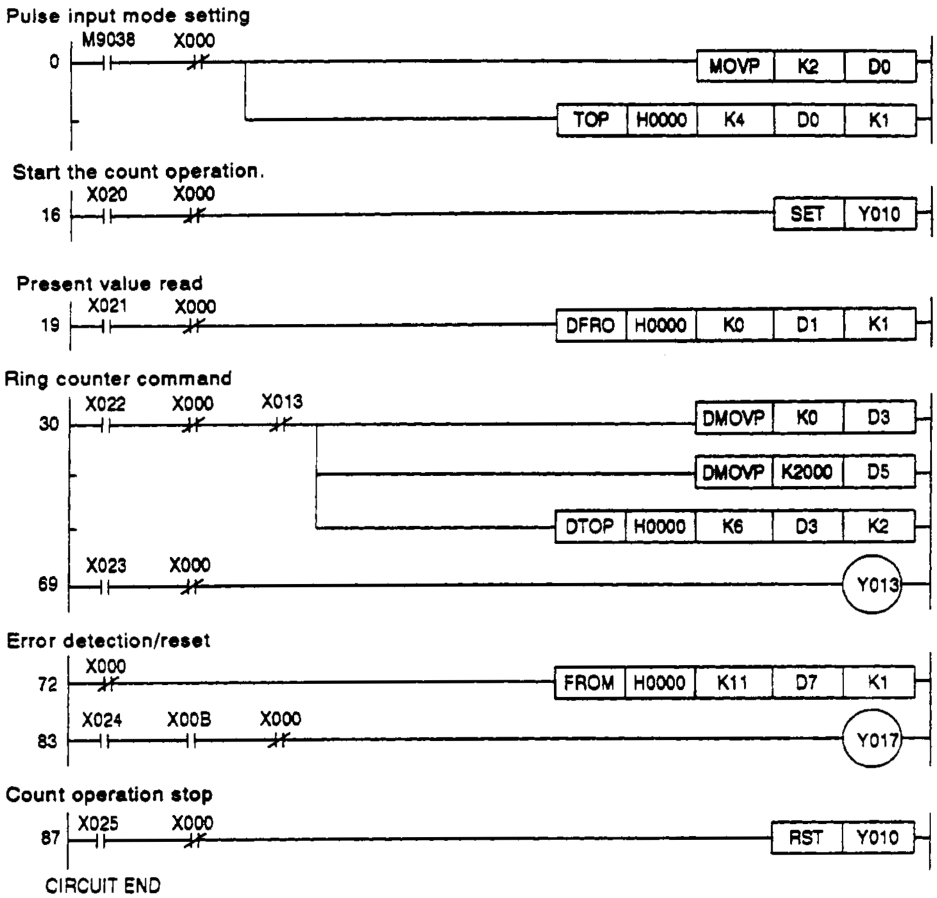
(f) Error reset command X24

(g) Count operation stop command X25

(2) Relationship between the data register (D0 to D7) and the buffer memory



Example program:



Set the pulse mode consistent with the 2-phase pulse input multiplied by one.

Start the pulse count with the count enable command (SET).

Read the present value and store it to devices D1 to D2.

Store the preset and ring counter values to addresses 6 to 9 of the buffer memory.

Execute the ring counter.

Read the error code and store it to device D7.

Reset the error.

Stop the pulse count by the count enable command (RST).

8. EXECUTING THE LIMIT SWITCH OUTPUT FUNCTION

This section describes the limit switch output function.

8.1 Limit Switch Output Function

The limit switch output function is used in the following cases:

When the counter present value is consistent with a specified limit output status (ON/OFF address) of a certain channel, the ON/OFF signal is output.

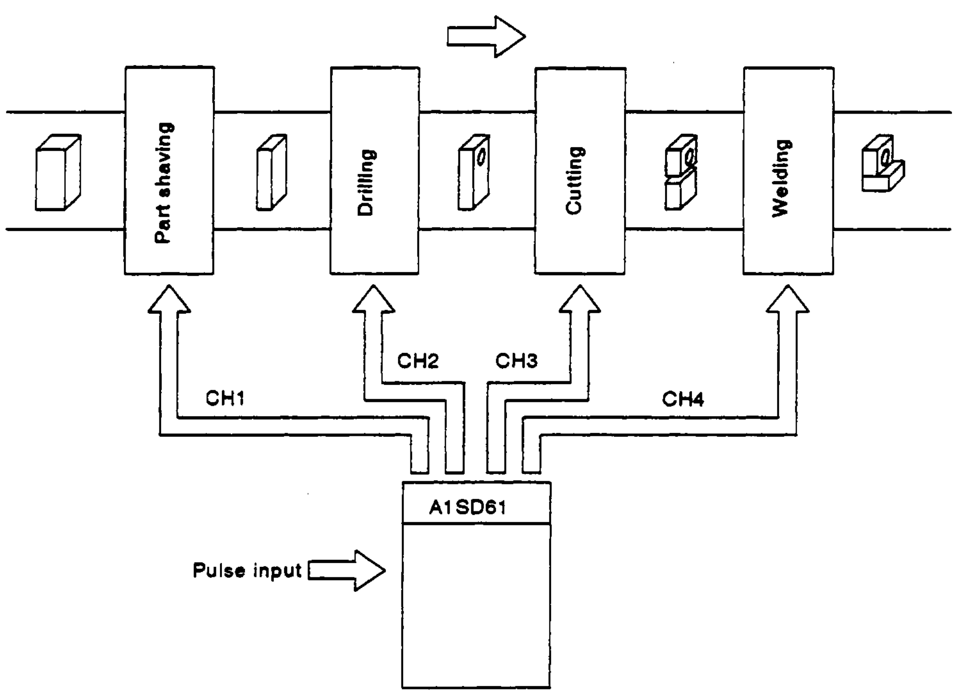
When the limit switch output enable signal is not set, turning ON the limit switch output command (Y15) does not activate the limit switch output function.

Instead of the conventional limit switch, the limit switch output can be also applied to a series of the operations on the processing line.

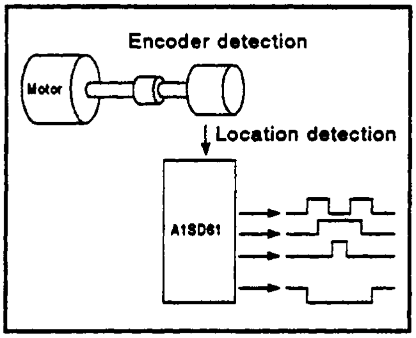
[Limit switch output function application example]

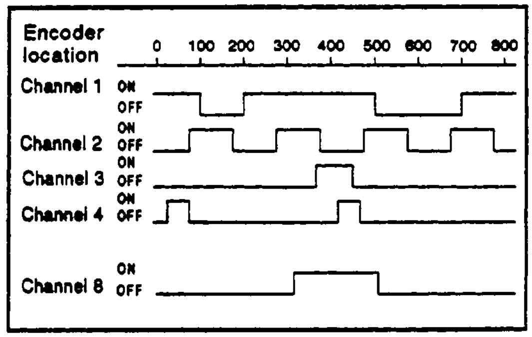
By using a processing line system, products are made through the processing operations corresponding to each channel.

1) Carries material with the belt conveyor.
2) The location of material is known through the counter present value since the pulses are input to the A1SD61.
3) The material is processed according to the limit switch output (CH1 to CH4).



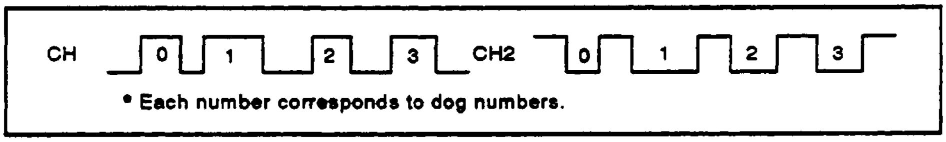
(1) In limit switch output, up to 8 channels can be used.



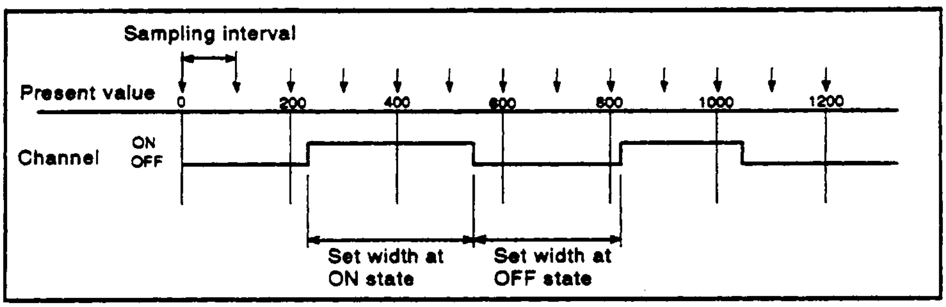


(2) These are four dogs per channel.

In this manual, the dog refers to concave of convex parts as shown below:



(3) The speed of the pulse input will determine the minimum setting width at ON/OFF states.



In the A1SD61, the location data is sampled at an interval of 1.0 msec. The limit switch signal is compared with the set ON/OFF data and is then output.

Therefore, if the pulse input speed exceeds the allowable speed, the location cannot be detected in units of minimum length and the ON/OFF signal cannot be executed according to the specification.

In this case, enlarge the set width of the ON or OFF signal.

Find the allowable speed using the following formula:

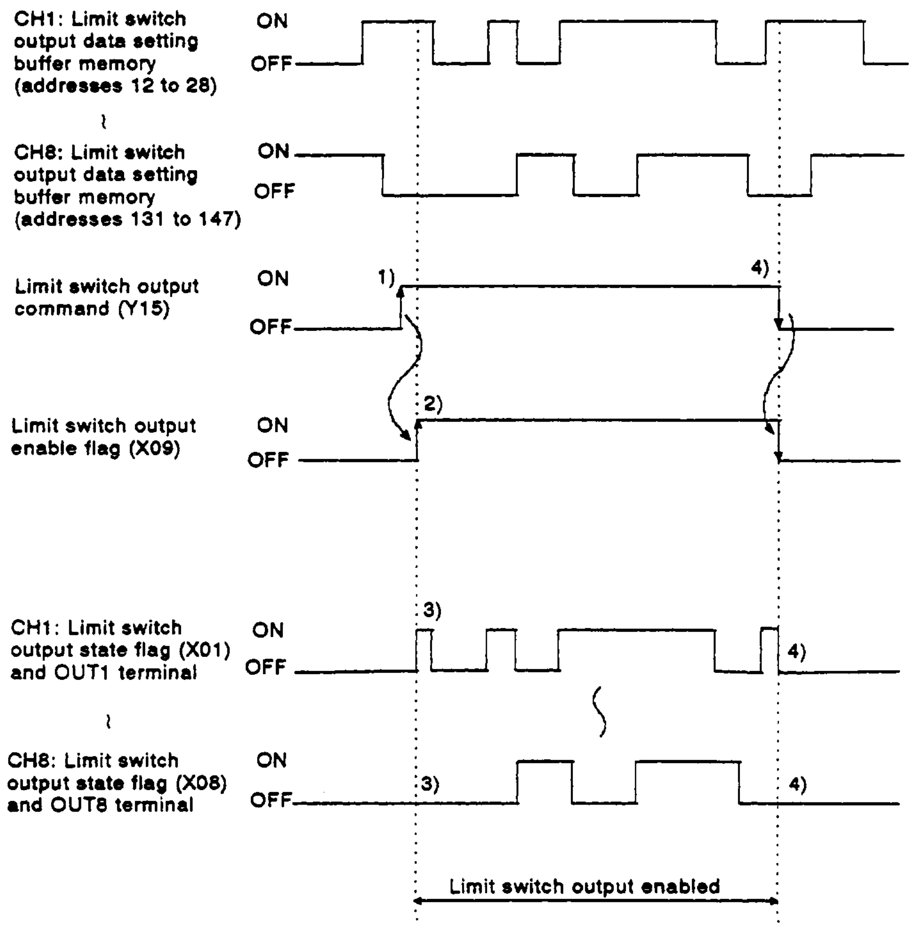
(a) Set width at ON state:

$$\frac{\text{Pulse input speed [pps]}}{1000} \times \text{(Multiplication number)} \leqq \text{(Count present value at OFF)} - \text{(Count present value at ON)}$$

(b) Set width to the OFF state:

$$\frac{\text{Pulse input speed [pps]}}{1000} \times \text{(Multiplication number)} \leqq \text{(Count present value at ON)} - \text{(Count present value at OFF)}$$

(4) The timing of each signal when the limit switch output function is executed:



1) Turning ON the limit switch output command (Y15) verifies whether or not the set limit switch output data contains an error.

   When no error is detected, the limit switch output enable flag (X09) will be set.

2) Setting the limit switch output enable flag (X09) executes the limit switch output function.

3) The present value of the counter is compared with the set limit switch output data. The data is then output to the limit switch output state flags (X01 to X08) and the OUT terminals (OUTs 1 to 8).

4) Turing OFF the limit switch output command (Y15) resets the limit switch output enable flag (X09), the limit switch output state flags (X01 to X08), and the OUT terminals (OUTs 1 to 8).

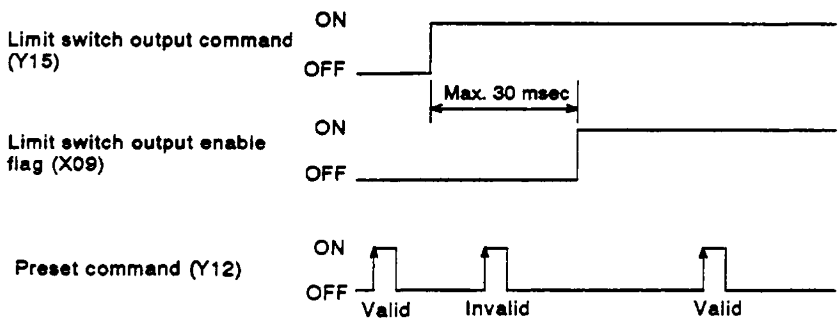
POINT

(1) The limit switch output is executed whether the count enable command (Y10) is ON or OFF.

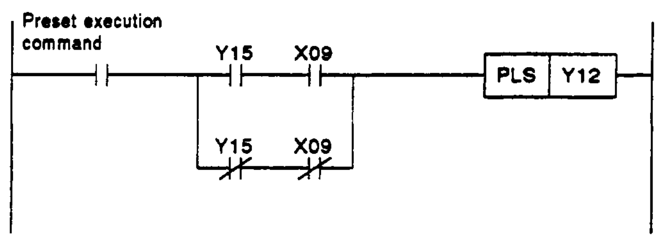
(2) In the limit switch output, the preset, latch counter, and sampling counter execution commands are ignored until the limit switch output command (Y15) is turned ON to set the limit switch enable flag (X09).

However, the execution of the external input is valid.

For example: When the preset function is executed:



Create a program as show below:



(5) Limit switch output data (CH1 to CH8) setting buffer memory (addresses 12 to 147)

This is an area in which ON/OFF data for each channel in the limit switch output function is stored.

(a) The data set consists of the number of multi-dogs and ON/OFF position data of each dog for each channel.

(b) The data set for the multi-dogs and ON/OFF position data is written in binary code.

If the number of the multi-dogs is set beyond the detection range or some dogs overlap, an error occurs.

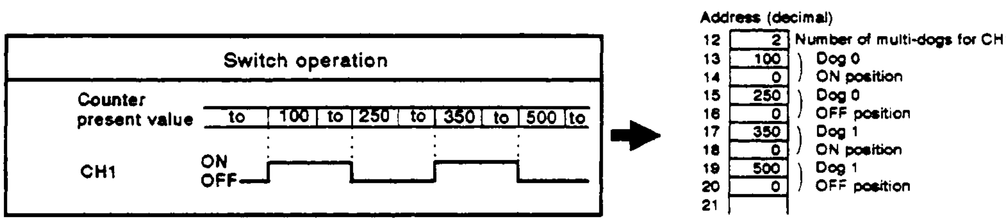
The dog position write operation is divided into two modes: the dog position write in the ON range and the dog position write in the OFF range.

The A1SD61 automatically verifies if the dog data write is done in ON or OFF range by checking the contents of dog 0.

1) ON range (limit switch NO contact operation) dog position write

In this case, the ON position data is written along with a value less than the OFF position data.

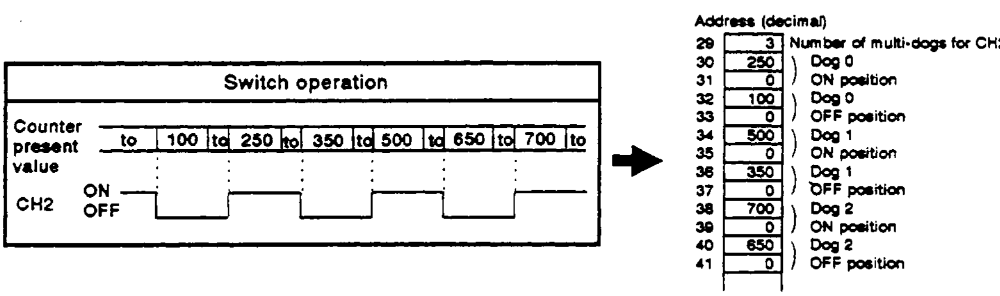
If the dogs are not written in ascending order, an error occurs.



2) OFF range (limit switch NC contact operation) dog position write

In this case, the ON position data is written along with a value larger than the OFF position data.

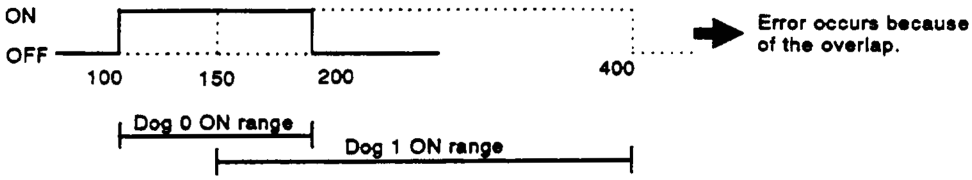
If the dogs are not written in ascending order, an error occurs.



REMARK

Both of the ON and OFF ranges cannot be used for a single channel.

Example: When the dog 0 ON position is 100, the dog 0 OFF position is 200, the dog 1 ON position is 150, and the dog 1 OFF position is 400:



3) The number of multi-dogs can be set in the following range:

0 to 4 (The lower 4 bits of the data set are valid.)

However, when this number is set to "0", the corresponding dog ON/OFF position data becomes invalid.

Also, when a value larger than "4" is set, an error occurs, disabling the limit switch output function.

(c) The following occurs when an multi-dog setting error occurred:

1) Limit switch output enable flag (X09): OFF

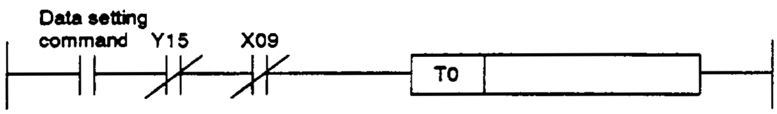
2) Limit switch output states (X01 to X08 and OUTs 1 to 8): All channels are OFF

POINT

(1) When the limit switch output data is set or changed, make sure that the following conditions are satisfied:

(a) The limit switch output enable command (Y15) is OFF.

(b) The limit switch output enable flag (X09) is OFF.



(2) When the multi-dog data setting contains an error (error codes: 110 to 183 and 201 and 208), turning ON the limit switch output command (Y15) sets the limit switch output enable flag (X09).

In this case, reset the error, and turn ON the limit switch output command (Y15) again.

8.1.1 Example program

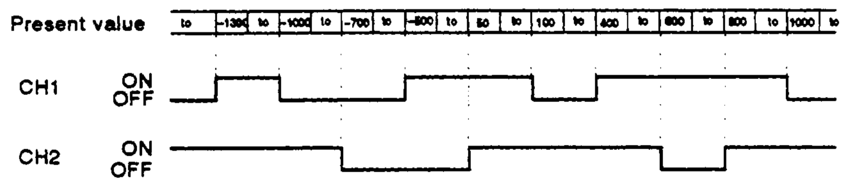
Create a program to count 2-phase pulses multiplied by one and to execute the limit switch function.

[System configuration]

		X00 to X0F Y00 to Y1F	X20 to X3F	X40 to Y4F	
A1S 62P	A1S CPU	A1S D61	A1S X41	A1S Y14	

[Operation status]

ON/OFF status of the limit switch output is shown below:



[Devices to be used]

(1) Execution commands

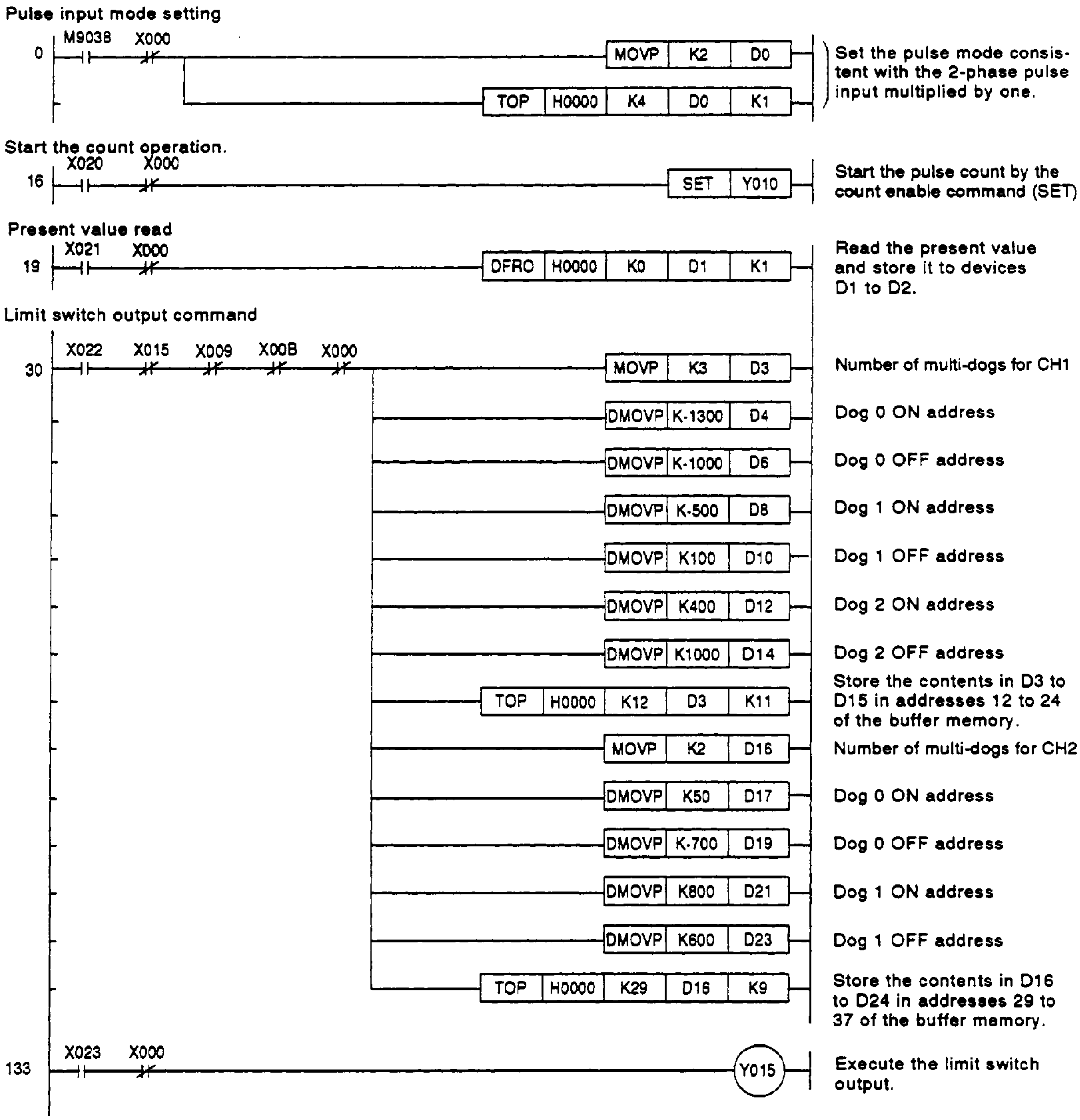
(a) Pulse input mode setting command M9038
(b) Fuse blown detection X0C
(c) Count operation start command X20
(d) Present value read command X21
(e) Limit switch output data setting command X22
(f) Limit switch output command X23
(g) Error reset command X24
(h) Count operation stop command X25

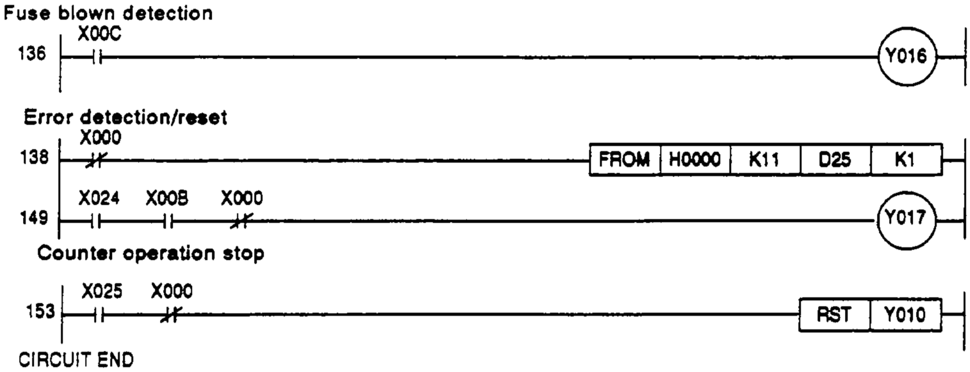
(2) Relationship between the data register (D0 to D25) and buffer memory

Buffer memory

Data register	Address	Contents	Data register
	0	Present value (L)	D1 to D2
	1	Present value (H)	
D0	4	Pulse input mode setting	
	11	Data write error code	D25
D3	12	Number of multi-dogs for CH1	
D4 to D5	13	Dog 0 for CH1 ON address (L)	
	14	Dog 0 for CH1 ON address (H)	
D6 to D7	15	Dog 0 for CH1 OFF address (L)	
	16	Dog 0 for CH1 OFF address (H)	
D8 to D9	17	Dog 1 for CH1 ON address (L)	
	18	Dog 1 for CH1 ON address (H)	
D10 to D11	19	Dog 1 for CH1 OFF address (L)	
	20	Dog 1 for CH1 OFF address (H)	
D12 to D13	21	Dog 2 for CH1 ON address (L)	
	22	Dog 2 for CH1 ON address (H)	
D14 to D15	23	Dog 2 for CH1 OFF address (L)	
	24	Dog 2 for CH1 OFF address (H)	
D16	29	Number of multi-dogs for CH2	
D17 to D18	30	Dog 0 for CH2 ON address (L)	
	31	Dog 0 for CH2 ON address (H)	
D19 to D20	32	Dog 0 for CH2 OFF address (L)	
	33	Dog 0 for CH2 OFF address (H)	
D21 to D22	34	Dog 1 for CH2 ON address (L)	
	35	Dog 1 for CH2 ON address (H)	
D23 to D24	36	Dog 1 for CH2 OFF address (L)	
	37	Dog 1 for CH2 OFF address (H)	

Example program:





Detects blown fuse and output voltage cutoff.

Read the error code and store the code to D25.

Reset the error.

Stop the pulse count by the count enable command (RST).

9. SELECTING AND EXECUTING THE COUNTER FUNCTION

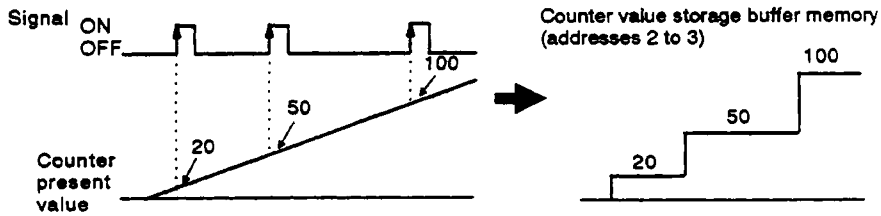
9.1 Selecting a Counter Function

Select one of the four counter functions and execute it.

Execute the selected function by turning ON the counter function selection start command (Y14) or applying voltage to the external F.START terminal.

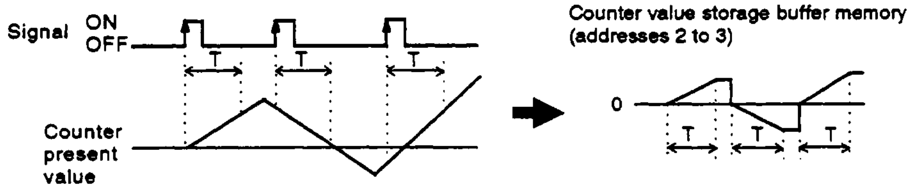
1) Latch counter function: See section 9.2.

Latches the present value of the counter when the signal is input.



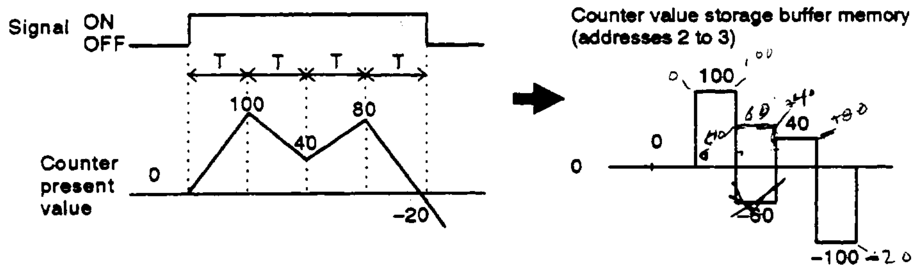
2) Sampling the counter function: See section 9.3.

Counts the input pulse times that are specified by the signal.



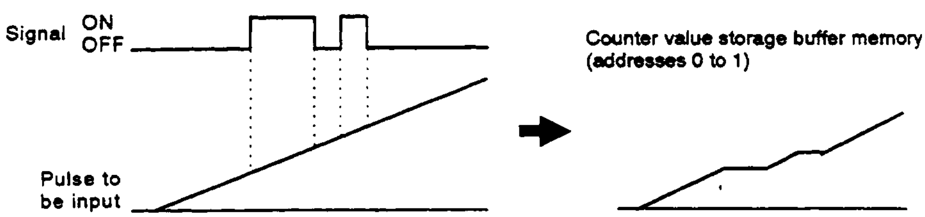
3) Periodic pulse counter function: See section 9.4.

Stores the number of input pulses at specified intervals while a signal input is done.



4) Count disable function: See section 9.5.

Inputs the signals when the count enable command is ON, stopping the pulse count.



(1) Select a counter function by writing a value to the counter setting buffer memory (address 5) as shown in the following table:

However, when the counter function is changed, make sure that the counter start command (Y14, F.START terminal) is OFF.

Counter Function Selection	Setting Value
None	0
Latch counter function	1
Sampling counter function	2
Periodic pulse counter function	3
Count disable function	4

(2) The counter function can be selected by using either the counter start command (Y14) or the F.START terminal (external input).

When both of the signals are input during a certain period, priority is given to the first signal input.

9.1.1 Reading the counter value when executing the counter function selection

Read the counter value when the counter function is selected.

The following explains the counter contents stored in the A1SD61 counter value storage buffer memory (addresses 2 to 3) and how to read the counter value:

(1) In the counter storage buffer memory, the value of the latch counter, sampling counter, or periodic pulse counter is stored.

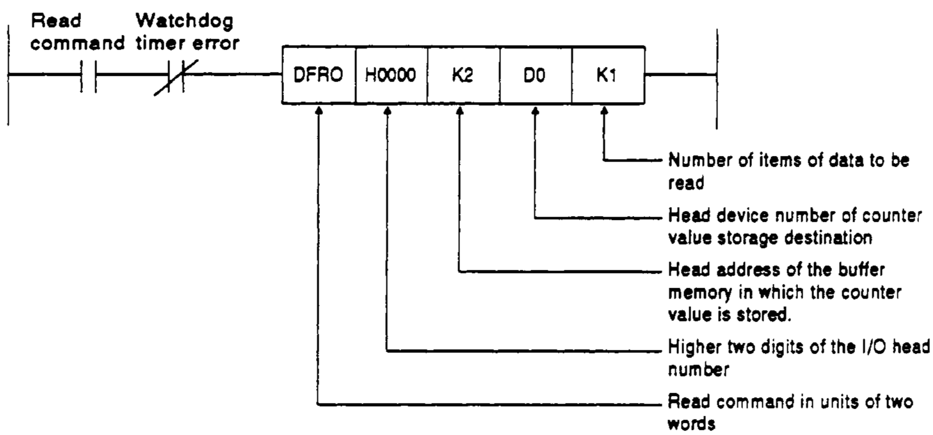
(2) The counter value (2147483648 to –2147483647) is stored in a signed 32-bit binary code.

When the counter value is negative, this value is stored as a complementary number of two.

(3) When an incremental count is made, if the counter value exceeds 2147483647, it will jump to –2147483648.

When a decremental count is made, if the counter value exceeds –2147483648, it will jump to 2147483647.

(4) The sequence program to read the value of the counter is shown below.



9.1.2 Count errors

When the counter function selection is executed by the external input (applying the voltage to the F.START terminal) or by the sequence program (turning ON the counter function selection start command), there is an error in counting.

(1) The error range when the counter function is executed by the external input is shown below:

Max. count error:

1 [msec] x pulse input speed [pps] x multiplication number [count]

Min. count error:

0.1 [msec] x pulse input speed [pps] x multiplication number [count]

(2) When the counter function is executed by the sequence program, there is an additional error for one scan of the PC CPU besides the error as shown in (1).

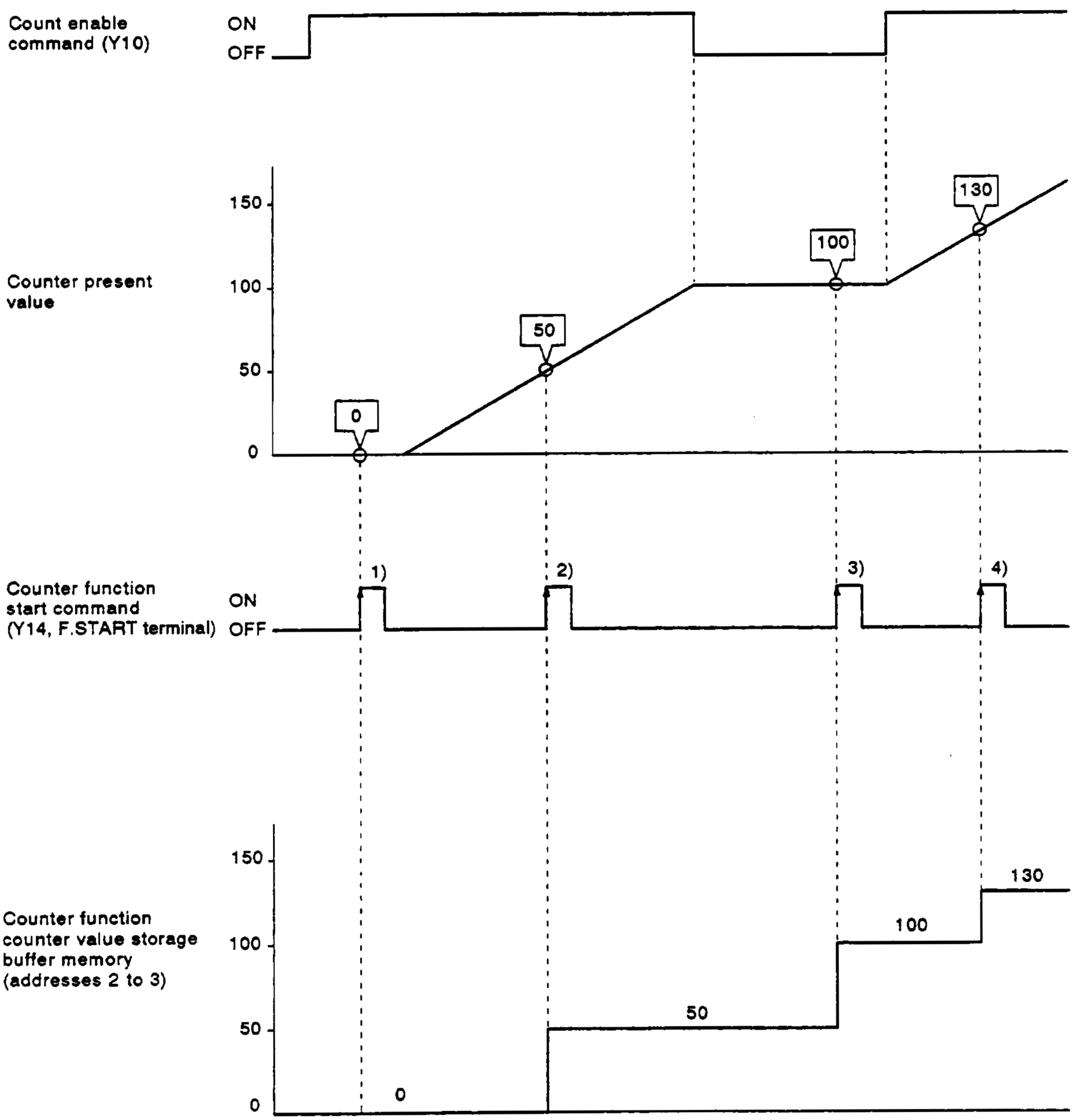
POINT

Mitsubishi recommends that the counter function selection should be executed by the external input.

9.2 Latch Counter Function

Latch the present value of the counter when a signal input is done.

The relationships between the counter present value and the counter start command and between the present value and the counter buffer memory are shown below:



At the leading edge of the counter function start command (Y14, F.START terminal)(corresponding to 1) to 4) in the above diagram), the counter present value is stored to the counter value buffer memory (addresses 2 to 3).

The latch counter function works whether the count enable command (Y10) is ON or OFF.

9.2.1 Example program

Create a program to count 2-phase pulses multiplied by one and to execute the latch counter.

System configuration:

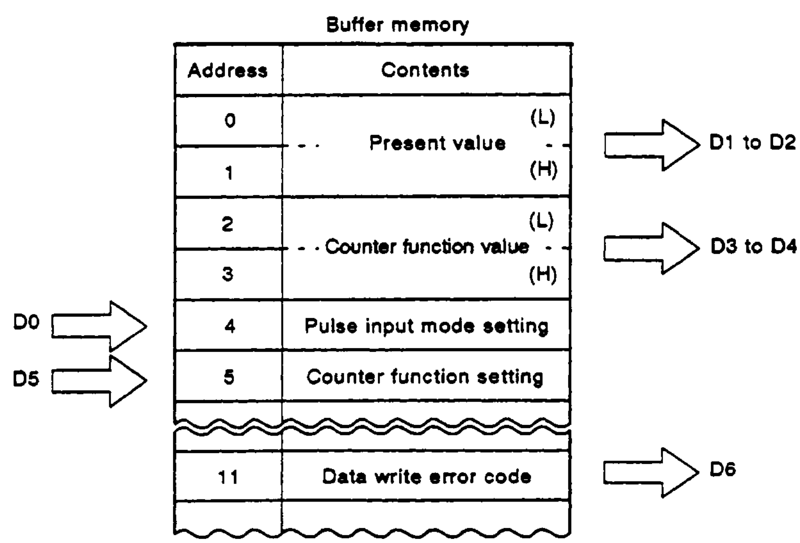
		X00 to X0F Y00 to Y1F	X20 to X3F	
A1S 62P	A1S CPU	A1S D61	A1S X41	

Devices to be used:

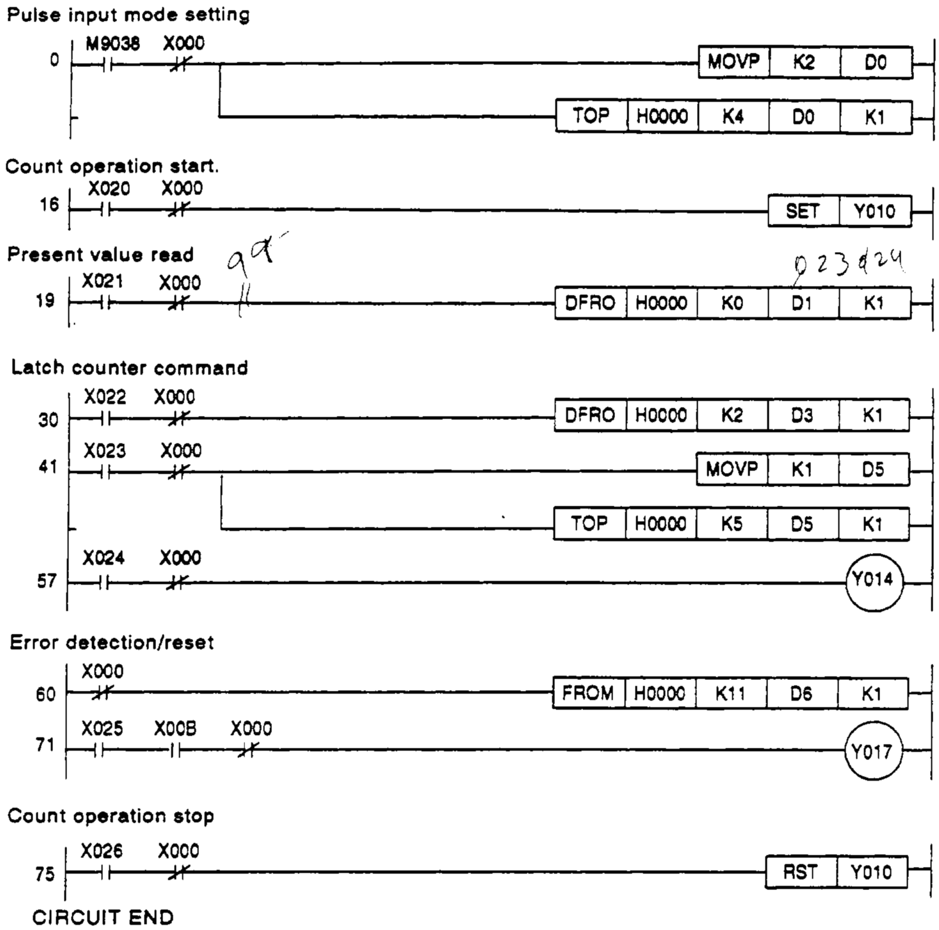
(1) Execution commands

(a) Pulse input mode setting command M9038
(b) Count operation start command X20
(c) Present value read command X21
(d) Counter function value read command X22
(e) Counter function setting command X23
(f) Latch counter command X24
(g) Error reset command X25
(h) Count operation stop command X26

(2) Relationship between the data register (D0 to D6) and the buffer memory



Example program:



Set the pulse mode consistent with the 2-phase pulse input multiplied by one.

Start the pulse count with the count enable command (SET).

Read the present value and store it to devices ~~D1~~ to D2.

Read the counter value and store it to devices D3 to D4.

Set the latch counter function.

Execute the latch counter.

Read the error code and store it to device D6.

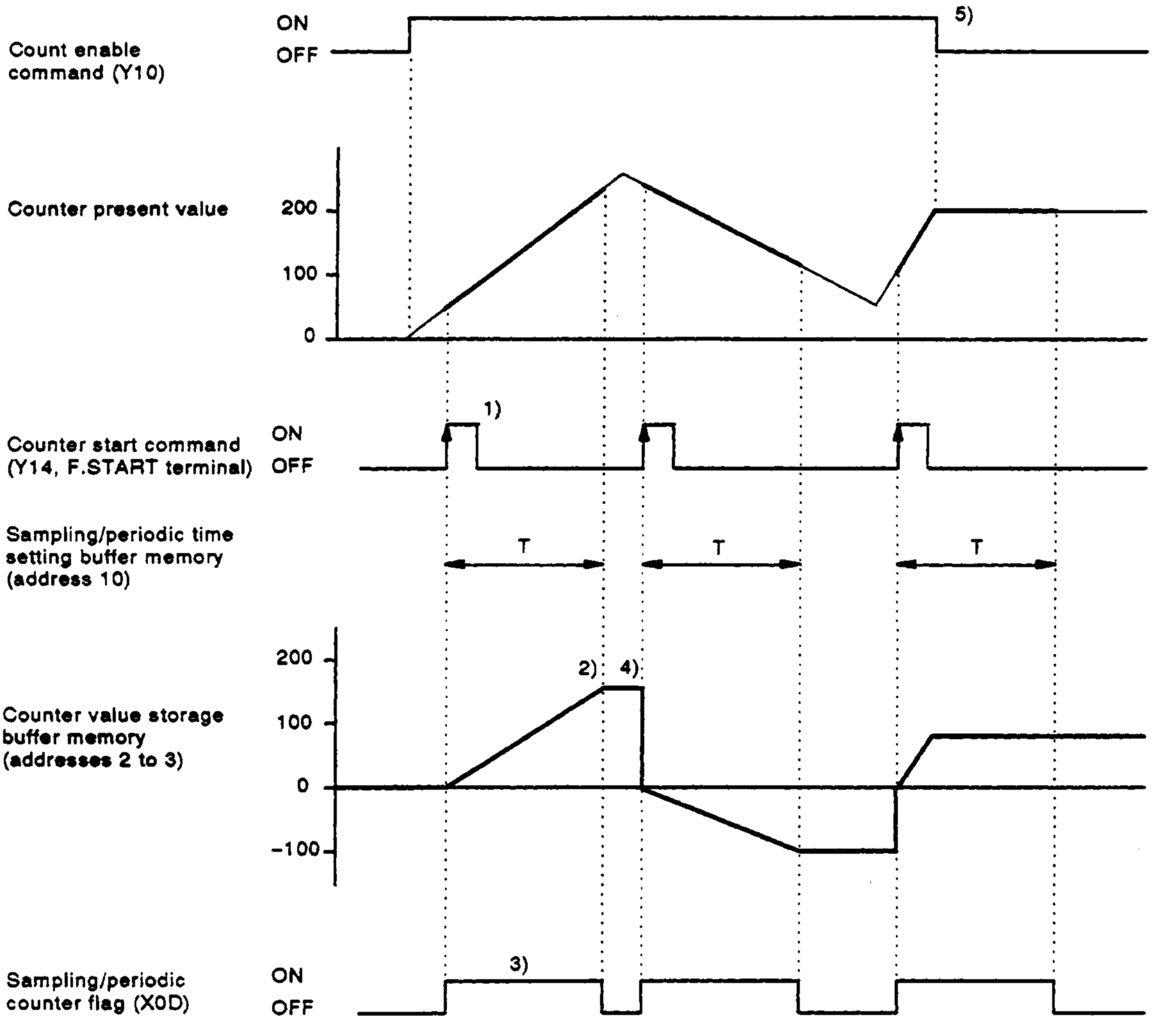
Reset the error.

Stop the pulse count with the count enable command (RST).

9.3 Sampling Counter Function

Count the pulses when a sampling time is specified.

The relationship between each signal and the buffer memory is shown below:



1) Starts counting input pulses from 0 at the leading edge of the counter function command (Y14, F.START terminal).
2) Stops counting after the specified sampling time.
3) Keeps the sampling/periodic counter flag (X0D) set while executing the sampling counter function.
4) Retains the value in the buffer memory after completing the sampling counter function.
5) The sampling counter function works whether the count enable command (Y10) is ON or OFF.

9.3.1 Example program

Create a program to count 2-phase pulses multiplied by one and to execute the sampling counter.

System configuration:

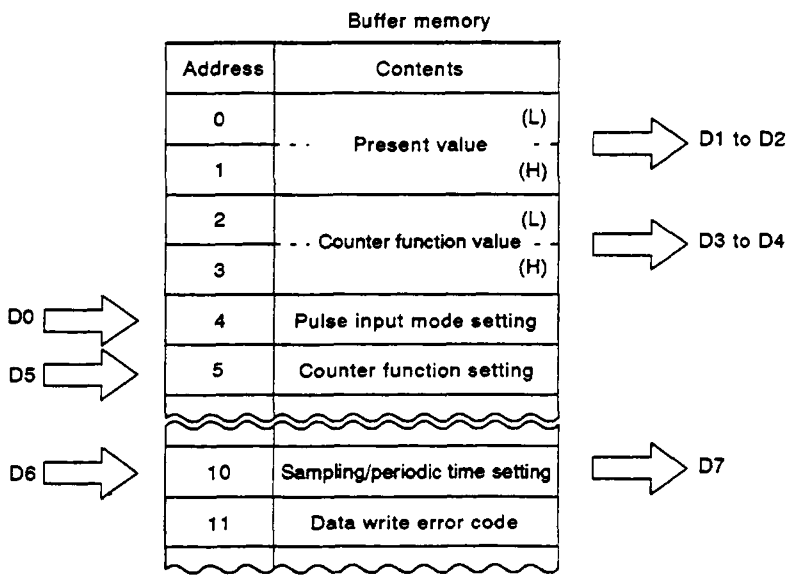
		X00 to X0F Y00 to Y1F	X20 to X3F	
A1S 62P	A1S CPU	A1S D61	A1S X41	

Devices to be used:

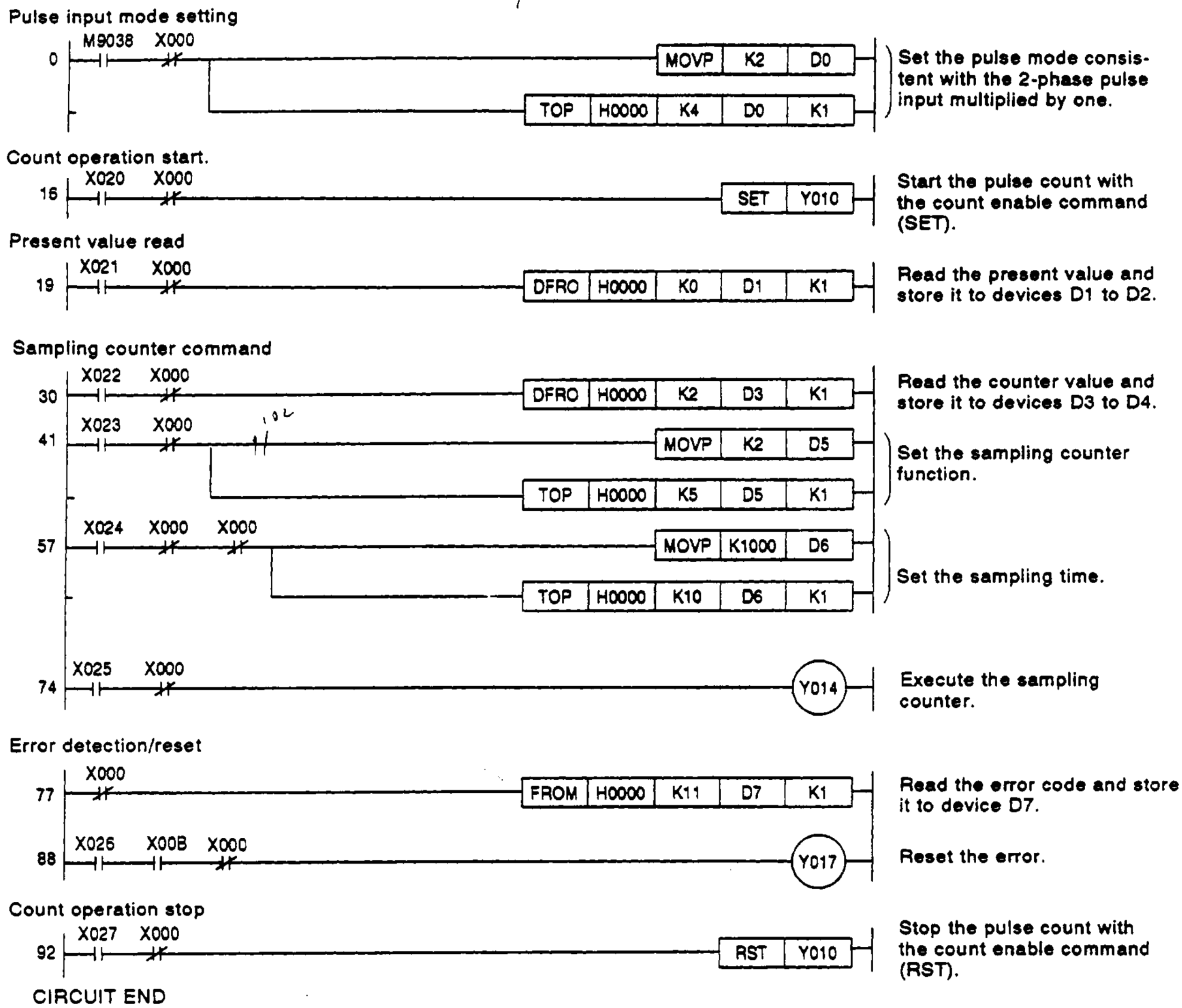
(1) Execution commands

(a) Pulse input mode setting command M9038
(b) Count operation start command X20
(c) Present value read command X21
(d) Counter function value read command X22
(e) Counter function setting command X23
(f) Sampling time setting command X24
(g) Sampling counter command: X25
(h) Error reset command: X26
(i) Count operation stop command: X27

(2) Relationship between the data register (D0 to D7) and the buffer memory



Example program:



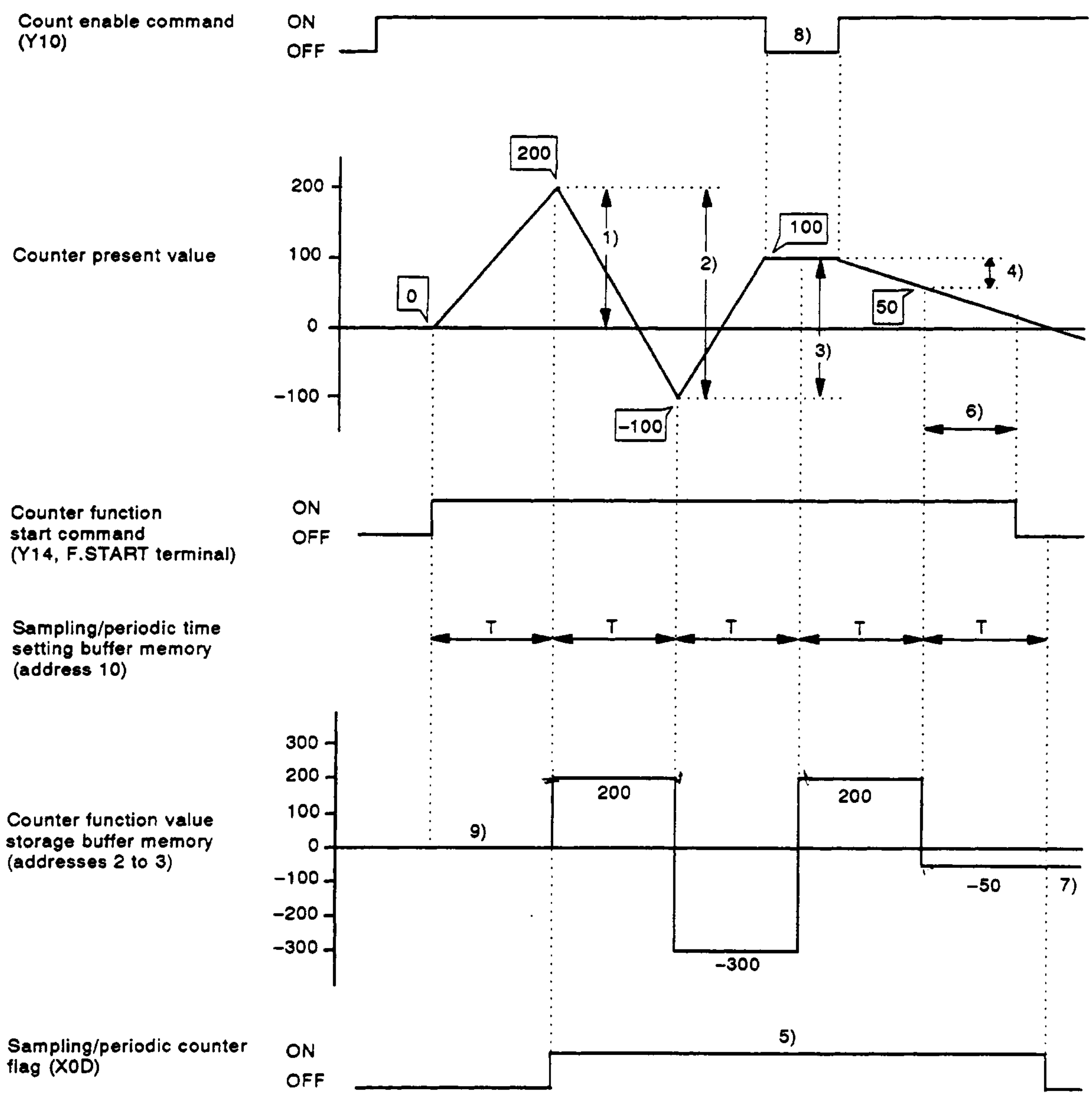
9.4 Periodic Pulse Counter Function

Count pulses that are input at specified intervals, and store the counter value to the counter value storage buffer memory.

Find the value stored in the counter storage buffer memory using the following formula:

Stored value = (Counter present value after the periodic time) - (Counter present value at the start)

The relationship between the each signal and the buffer memory is shown below:



1) Stores the counter present value (200 – 0 = 200) to the counter function value storage buffer memory, after the periodic time (set in address 10).

   9) is set to the "0" state.
2) Stores the counter present value of –300 to the counter function value storage buffer memory.
3) Stores the counter present value of 200 to the counter function value storage buffer memory.
4) Stores the counter present value of –50 to the counter function value storage buffer memory.
5) Keeps the sampling/periodic counter flag (X0D) set while executing the periodic pulse counter.
6) Ignores the counter value of the periodic pulse, since the counter function start command is turned OFF.
7) Retains the value of –50 [item 4)] after the periodic pulse counter is executed.
8) The periodic pulse counter function works whether the count enable command (Y10) is ON or OFF.

9.4.1 Example program

Create a program to count 2-phase pulses multiplied by one and to execute the periodic pulse counter function.

System configuration:

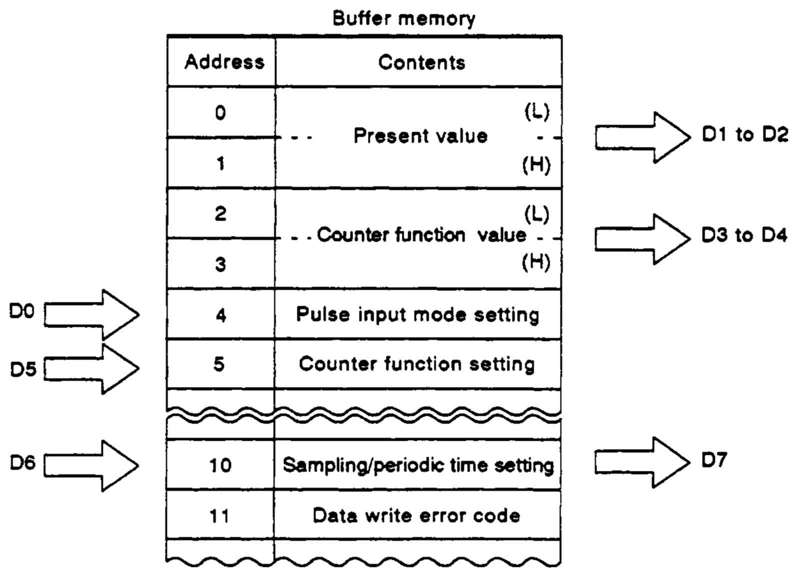
		X00 to X0F Y00 to Y1F	X20 to X3F	
A1S 62P	A1S CPU	A1S D61	A1S X41	

Devices to be used:

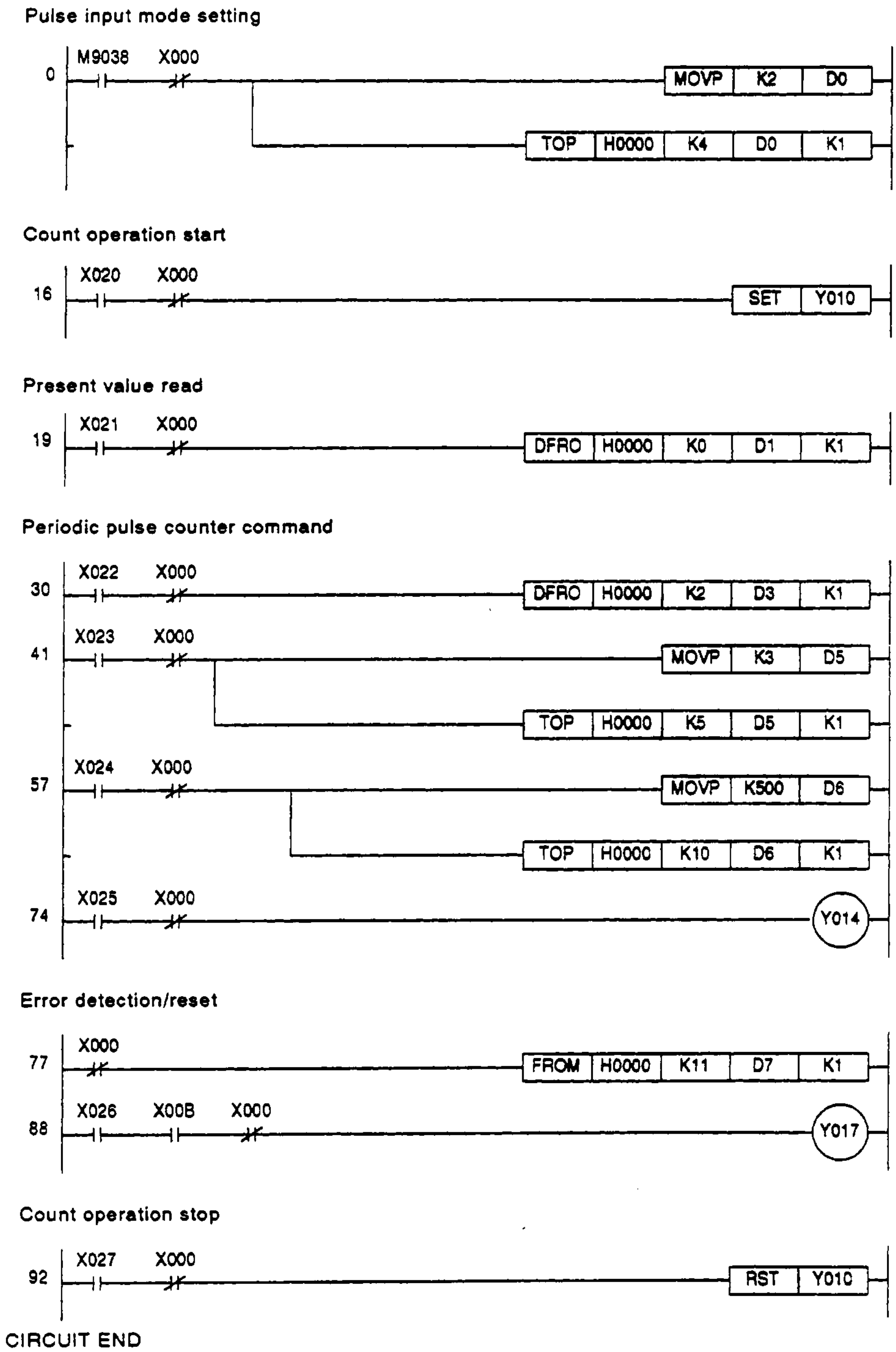
(1) Execution commands

(a) Pulse input mode setting command M9038
(b) Count operation start command X20
(c) Present value read command X21
(d) Counter function value read command X22
(e) Counter function setting command X23
(f) Periodic time setting command X24
(g) Periodic pulse counter command X25
(H) Error reset command X26
(i) Count operation stop command X27

(2) Relationship between the data register (D0 to D7) and the buffer memory



Example program:

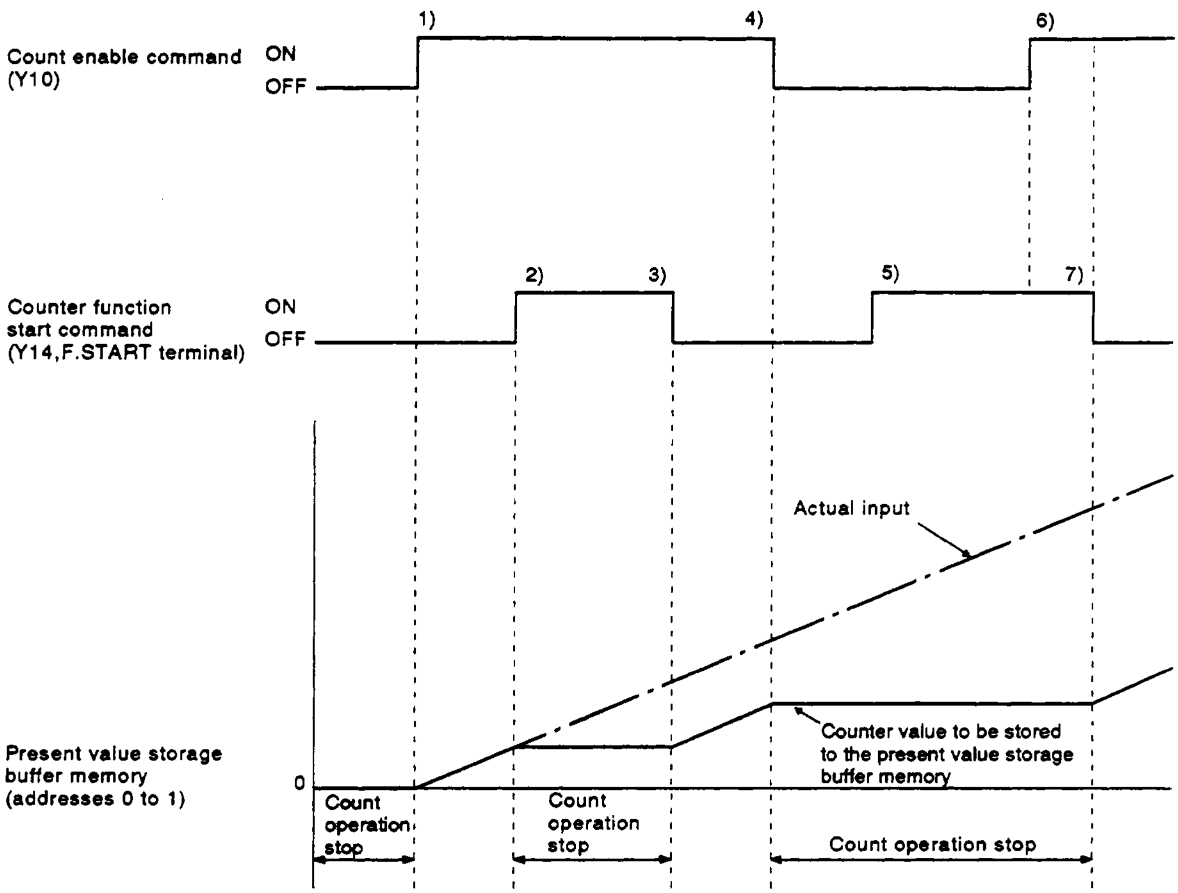


- Set the pulse mode consistent with the 2-phase pulse input multiplied by one.
- Start the pulse count with the count enable command (SET).
- Read the present value and store it to devices D1 to D2.
- Read the counter function selection counter value and store it to devices D3 to D4.
- Set the periodic pulse counter function.
- Set the periodic time.
- Execute the periodic pulse counter.
- Read the error code and store it to device D7.
- Reset the error.
- Stop the pulse count with the count enable command (RST).

9.5 Count Disable Function

Stop the count operation while the count enable command is ON.

The relationships between the count enable command and the counter start command and between them and the counter present value are shown below:

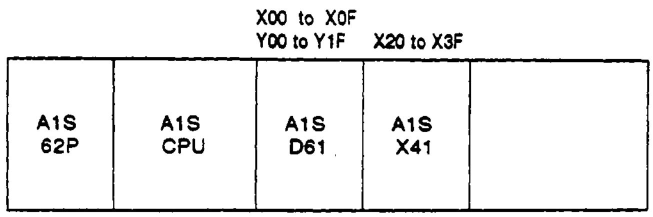


1) Starts counting pulses when the count enable command (Y10) is turned ON.
2) Stops counting when the counter function start command (Y14, F.START terminal) is turned ON.
3) Resumes the counting when the counter function start command (Y14, F.START terminal) is turned OFF.
4) Stops the counting when the count enable command (Y10) is turned OFF.
5) Stops counting independently of the counter function start command (Y14, F.START terminal), since the count enable command (Y10) is OFF.
6) Continues to stop the counting even when the count enable command (Y10) is turned ON, since the counter function start command (Y14, F.START terminal) is OFF.
7) Resumes the counting when the counter function start command (Y14, F.START terminal).

9.5.1 Example program

Create a program to count 2-phase pulses multiplied by one and to execute the count disable function.

System configuration:

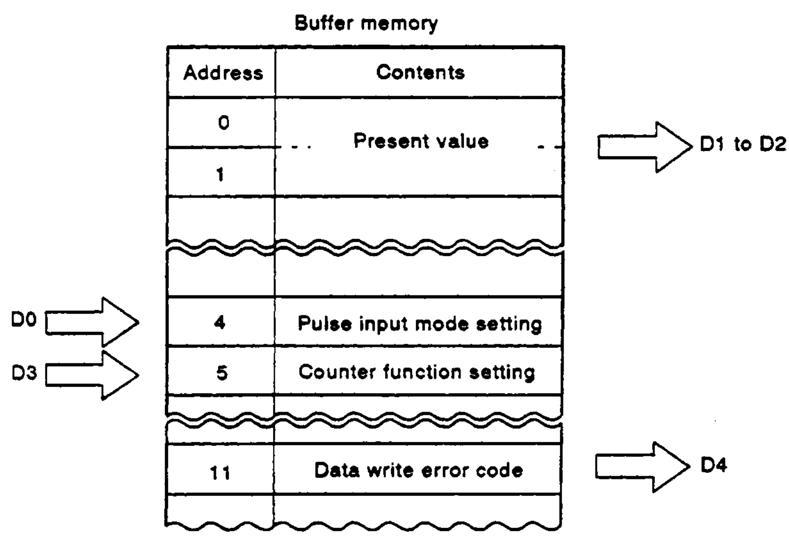


Devices to be used:

(1) Execution commands

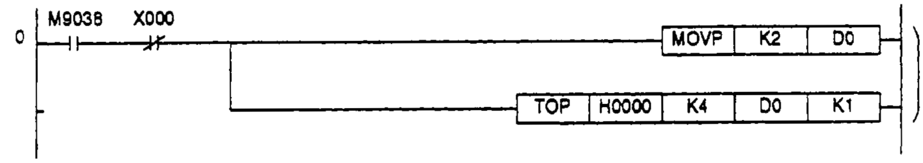
(a) Pulse input mode setting command M9038
(b) Count operation start command X20
(c) Present value read command X21
(d) Count disable start command X22
(e) Count disable stop command X23
(f) Error reset command X24
(g) Count operation stop command X25

(2) Relationship between the data register (D0 to D4) and the buffer memory



Example program:

Pulse input mode setting



Set the pulse mode consistent with the 2-phase pulse input multiplied by one.

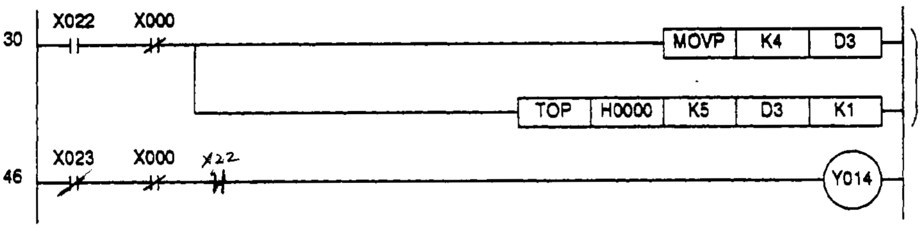
Count operation start

Start the pulse count with the count enable command (SET).

Present value read

Read the present value and store it to devices D1 to D2.

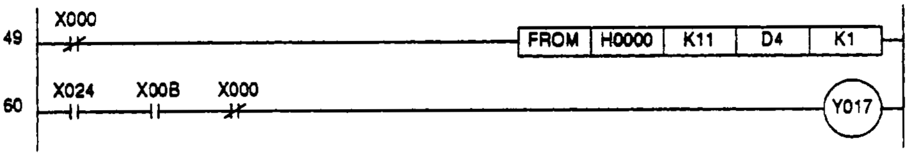
Count disable command



Set the count disable function.

Execute the count disable.

Error detection/reset



Read the error code and store it to device D4.

Reset the error.

Count operation stop

Stop the pulse count with the count enable command (RST).

CIRCUIT END

10. TROUBLESHOOTING

This section explains the A1SD61 error codes, LED indication, and troubleshooting for the count operation errors.

10.1 Error Codes

(1) When the FROM/TO instruction is executed, if an error occurs (RUN LED flashes), the corresponding error code number will be stored to the error code storage buffer memory (address 11) as shown in table 10.1:

Table 10.1 Error Codes

Error Code	Cause	Corrective Action
10	A value outside the range of 0 to 4 was set to the pulse input mode setting buffer memory (address 4).	See section 5, and set a value from 0 to 4.
11	A value outside the range of 0 to 4 was set to the counter setting buffer memory (address 5).	See section 9, and set a value from 0 to 4.
12	"0" was set to the sampling/periodic time setting buffer memory (address 10).	Set a value within the range of 1 to 65535.
13	The preset value is the same as the ring counter value.	Set the values so that they are not the same.
14	A preset value or coounter value was written do the buffer memory while the ring counter command (Y13) was ON.	Turn OFF the ring counter command, cancel the ring counter function, and execute the write.
102	A write operation was attempted to addresses 0 to 3.	Delete the sequence program containing that operation.
1( )[ ]	The ON/OFF position data setting values of dogs 0 to 3 for a channel are not in ascending order.	Set the limit switch output ON/OFF position data so that the values are in ascending order for each dog.
20[ ]	A value outside the range of 0 to 4 was set in the multi-dog setting.	Set a value of 0 to 4.

* The error code is expressed as a decimal number.

( ) indicates a channel containing the first error during an operation.

[ ] indicates a dog containing the first error during an operation.

(2) When several errors occur during a single operation, only the code number of the first error detected by the A1SD61 is stored.

(3) Reset the error either by turning ON the error reset command (Y17) or by writing "0" to the data error code storage buffer memory (address 11).

After resetting the error, the RUN LED will stay lit instead of flashing.

10.2 RUN LED Flashes or OFF

(1) When the RUN LED flashes:

Check Item	Corrective Action
Does the A1SD61 contain data that cannot be written or read?	Read the error code stored in the A1SD61 buffer memory, and take measures according to the error code listed in section 11.1.

(2) When the RUN LED is OFF:

Check Item	Corrective Action
Was a fault in the hardware (watchdog timer error) detected?	• Check to make sure the power is correctly supplied. Try turning the power supply ON and OFF several times. (Also, check if noise influences the hardware.) • When the LED remains OFF after executing the above operation, the A1SD61 may be faulty.

10.3 Counter Value is Incorrect

Check Item	Corrective Action
Is the pulse input mode consistent with the pulse input setting in the buffer memory?	Input pulses consistently with the setting. (see section 5)
Is the sequence program data processed as 32-bit BIN data?	Correct the sequence program so that the data is processed as 32-bit BIN data.
Is a twisted pair wire used as the pulse input wire?	Use a twisted pair wire.
Does noise come in through the ground of the A1SD61?	• Disconnect the A1SD61 from the ground. • If the A1SD61 comes in contact with the ground, separate it from the ground.
Have adequate measures been taken against noise in the panel or noise resulting from the other equipment?	Provide CR surge suppression to magnetic switches, etc.
Is sufficient distance provided between heavy current equipment and counter input line?	Wire the pulse input line independently, and separate wire in panel 150 mm (5.91 in.) or more from power line.
Do the pulses input waveform to the specifications?	Monitor and confirm the input waveform using a synchroscope. If the waveform is not consistent with the specifications, correct the waveform.

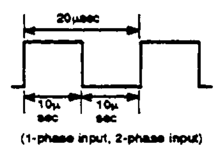
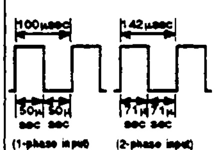
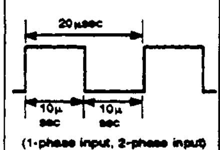
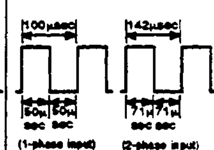
10.4 Count Cannot be Made

Check Item	Corrective Action
Is the external wiring of øA and øB correct?	Check the external wiring, and correct it.
When voltage is applied to the pulse input terminals øA and øB, do the LEDs of øA and øB go ON?	• When the LEDs went ON, check the external wiring and the pulse generator, and take appropriate measures. • When the LEDs did not go ON, the hardware may be faulty. In this case, consult your nearest Mitsubishi representative.
Is the count enable command (Y10) ON?	Turn ON the count enable command (Y10) with the sequence program.
Does the PC CPU signal that an error occurred?	When the PC CPU contains an error, see the troubleshooting section in the PC CPU manual, and verify the correct operation functions.
Is the counter function selection start command (Y14) ON; or is the voltage applied to the F.START terminal?	When the count disable function was set by the counter function selection, turn OFF Y14 or the F.START terminal.

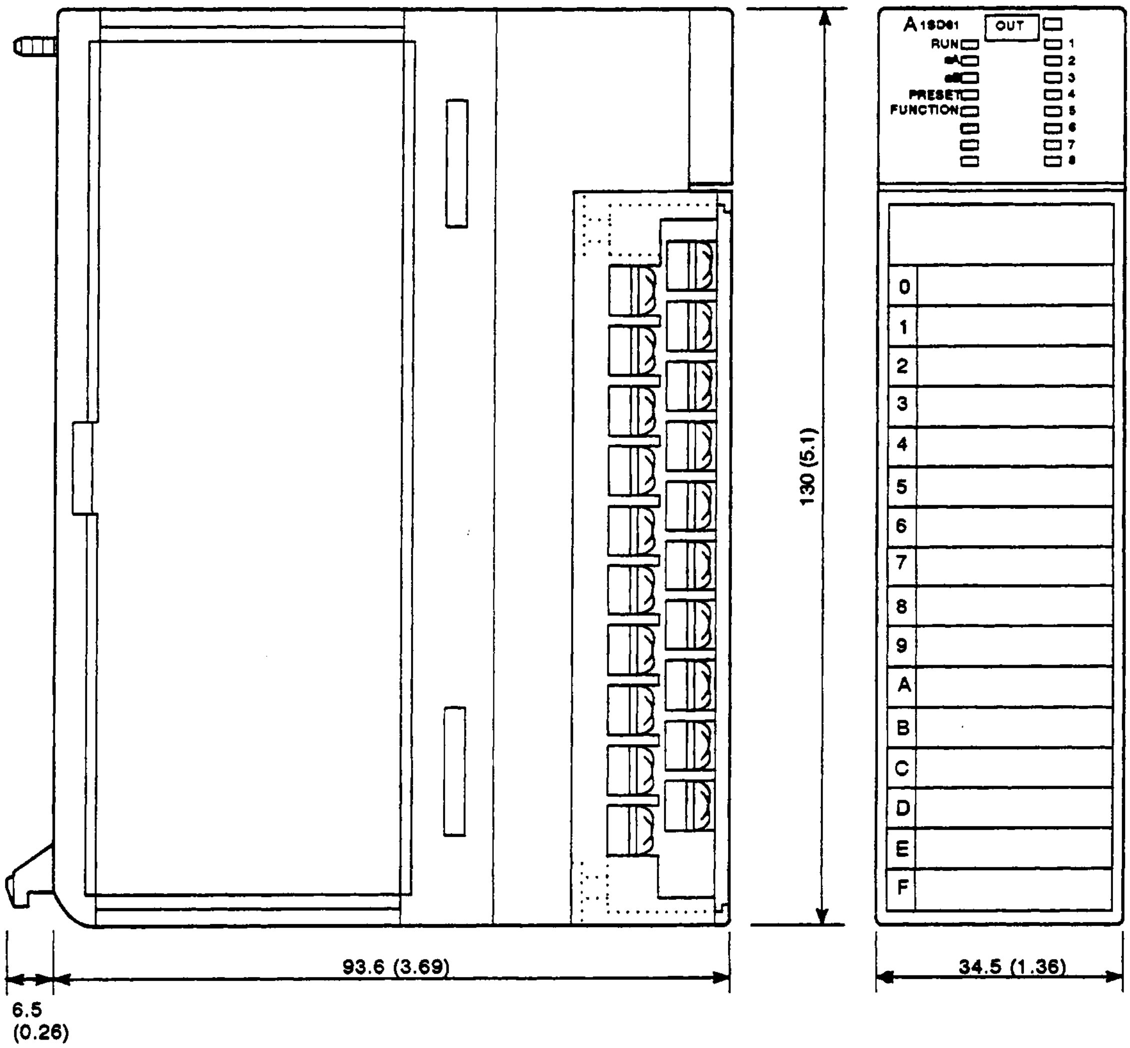
APPENDICES

Appendix 1 COMPARING THE A1SD61 AND AD61(S1)

Table 1 Performance Comparison

Item			Specifications			
			A1SD61		AD61	AD61-S1
			Counting Speed Setting Pin (50K)	Counting Speed Setting Pin (10K)		
Number of I/O occupied points			32			
Number of channels			1		2	
Count input signal	Phase		1-phase input, 2-phase input			
	Signal level (øA, øB)		5 VDC, 12 VDC, 24 VDC } 2 to 5 mA			
Counter	Counting speed	1-Phase input	50K pps	10K pps	50K pps	10K pps
		2-Phase input	50K pps	7K pps	50K pps	7K pps
	Counting Range		-2147483648 to 2147483647 (signed 32-bit binary)		0 to 16777215 (signed 32-bit binary)	
	Type		UP/DOWN preset counter + ring counter function			
	Min. Count pulse width (Input leading edge/fall time should be 5 μsec or less; duty ration is 50 %.)					
Comparison output	Comparison range		Signed 32-bit binary		Signed 24-bit binary	
	Comparison results		Limit switch output NO contact operation: Dog ON address ≤ Counter value ≤ Dog OFF address NC contact operation: Dog OFF address ≤ Counter value ≤ Dog ON address		Set value < Counter value Set value = Counter value Set value > Counter value	
External input			Preset Function start	12/24 VDC, 3/6 mA 5 VDC, 5 mA	Preset Count disable	12/24 VDC, 3/6 mA 5 VDC, 5 mA
External output			Comparison output	Transistor (open collector) output 12/24 VDC, 0.1 A/point, 0.8 A/common	Match output	Transistor (open collector) output 12/24 VDC, 5mA
Current consumption			5 VDC, 0.35 A		5 VDC, 0.3 A	

Appendix 2 EXTERNAL DIMENSIONS



Unit: mm (in)

IMPORTANT

The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.

(1) Ground human body and work bench.

(2) Do not touch the conductive areas of the printed circuit board and its electrical parts with any non-grounded tools etc.

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