MITSUBISHI

PROGRAMMABLE CONTROLLER

MELSEC-A

User's Manual

Positioning module type A1SD71-S7

JUM-424

MITSUBISHI ELECTRIC

REVISIONS

* The manual number is given on the bottom left of the back cover.

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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 explains the specifications, handling, and programming methods of the A1SD71-S7 positioning module (hereafter called the A1SD71) used with a MELSEC-A series A1SCPU.
In this manual, the term "Positioning control" includes speed/positioning control and speed control.

The following are called peripheral devices in this manual:
The AD71TU teaching unit is referred to as the AD71TU.

- A6GPP graphic programming panel
- A6PHP plasma handy graphic programmer
  } → Peripheral device
- AD71TU teaching unit ——————————→ AD71TU

Refer to the following manuals:

- SW0GP-AD71P Operating Manual
- A6GPP User's Manual
- AD71TU Operating Manual
- Manual Relevant drive unit instruction manuals
- A1SCPU User's Manual

The functions and specifications of A1SD71 are the same as those of the AD71(S1) except for the following:

Items \ Modules	A1SD71-S7	AD71(S1)
Number of I/O points	48 points (empty 16 points + 32 points)	32 points
Applicable PC CPUs	A1SCPU	All MELSEC-A series PC CPUs except the A2CCPU
Applicable installation positions in the data link system	Master station, local station	Master station, local station, remote I/O station
Output speed during inching operation	10 to 20000 PLS/sec.	20000 PLS/sec.
Internal current consumption	5 VDC, 0.8 A	5 VDC, 1.5 A
Sizes mm (inch)	130(H) × 69.5(W) × 93.6(D) (5.12 × 2.74 × 3.69)	250(H) × 37.5(W) × 121(D) (9.84 × 1.48 × 4.76)
Weights kg (lb)	0.38 (0.84)	0.63 (1.39)

Be sure that the following items are included in the package.

Item	Quantity
A1SD71-S7 positioning module	1
40 - pin connector for external wiring	1

POINT

In this manual A1SD71 I/O numbers assigned from the PC CPU assume that the A1SD71 is loaded in slots 0 and 1 of the main base.

2. SYSTEM CONFIGURATION

2.1 Overall Configuration

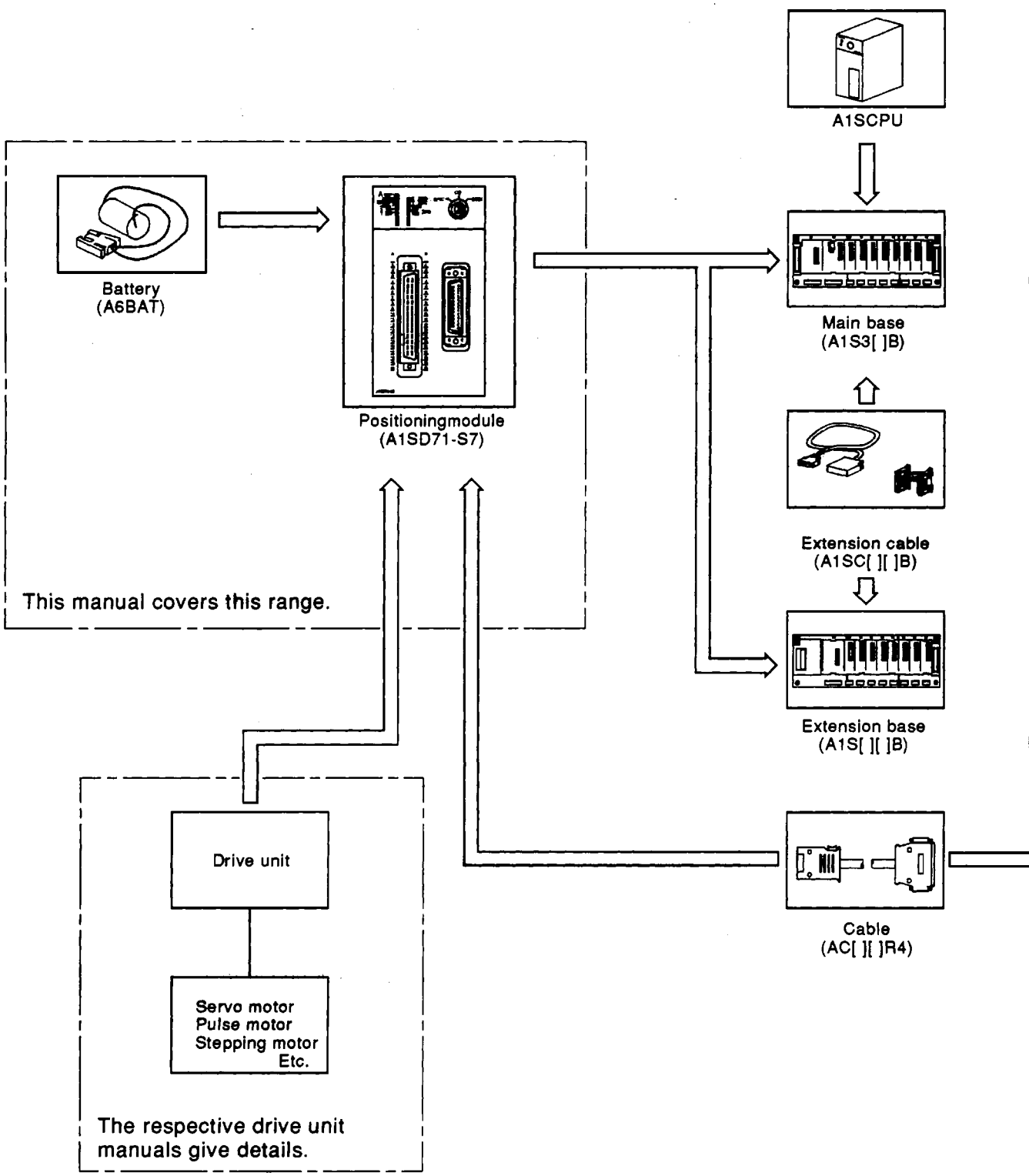
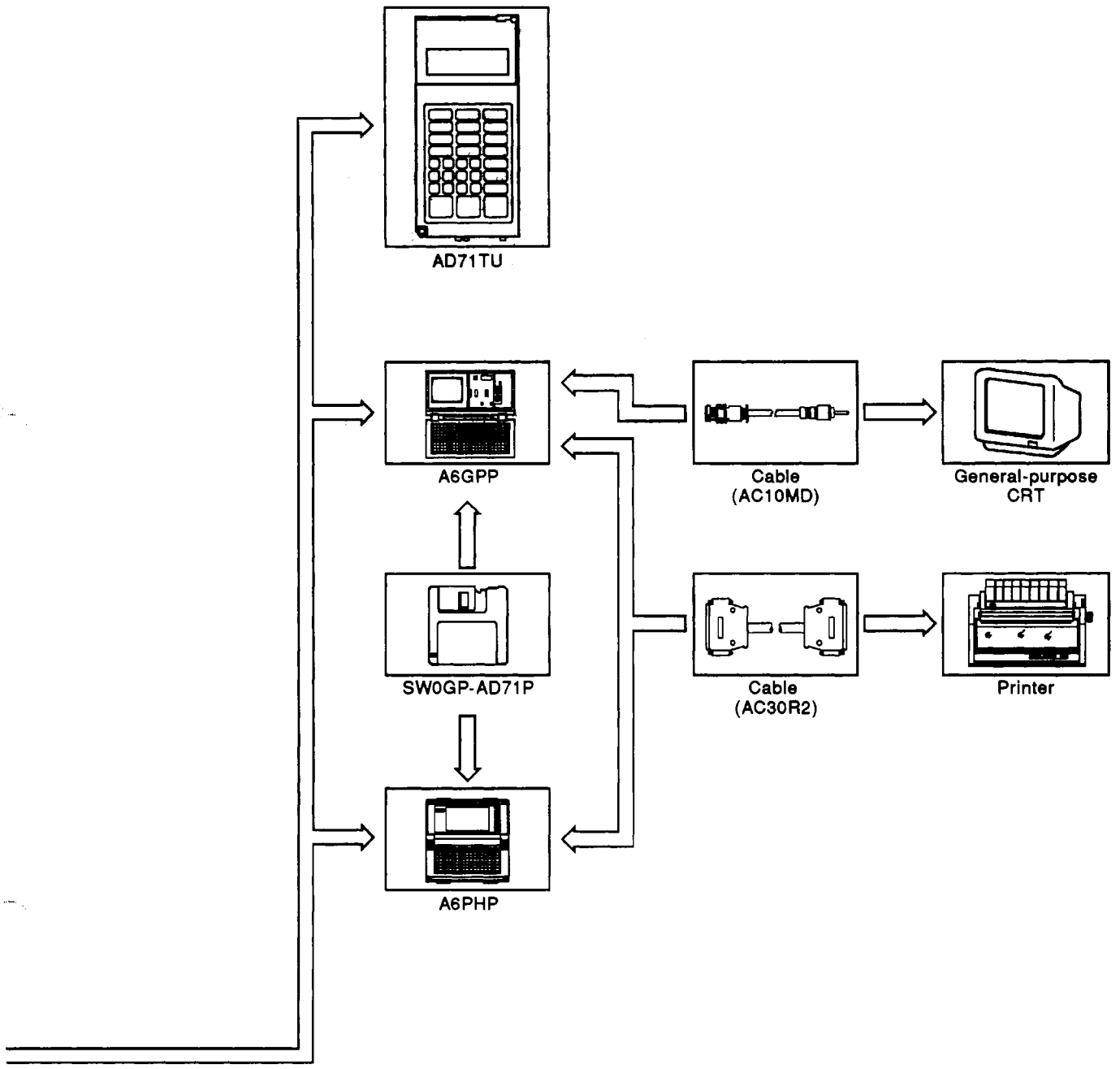


Fig. 2.1 Overall Configuration


AD71TU
A6GPP
Cable
(AC10MD)
General-purpose
CRT
SW0GP-AD71P
Cable
(AC30R2)
Printer
A6PHP

2.2 Applicable Systems

(1) The A1SD71 is only applicable to an A1SCPU module.

(2) The number of A1SD71 used with an A1SCPU module must be within the range of the number of I/O points of the A1SCPU.

(3) The A1SD71 can be installed in any two-slot area of a base unit, but the following must always be considered:

(a) If possible, avoid installing the A1SD71 in an extension base unit (A1S52B, A1S55B, A1S58B) not equipped with a power supply module, since the power supply capacity may be insufficient.

(b) If it is necessary to install the A1SD71 in an extension base unit which does not have a power supply module, select a power supply module, main and extension base units, and extension cables taking into consideration (a) the power supply capacity of the main base unit, and (b) the voltage drop across the main and extension base units and extension cables.

(See the A1SCPU User's Manual for details.)

2.3 Programming Equipment

The following table indicates the equipment available for programming the A1SD71.

Table 2.1 Programming Equipment

<table>
<tr><th>Unit Division</th><th>Description</th><th>Type</th><th>Remarks</th></tr>
<tr><td></td><td>Software package</td><td>SW0GP-AD71P</td><td>AD71(S1)/AD72/A1SD71 (S[ ]) software package</td></tr>
<tr><td rowspan="11">Programming unit</td><td>Intelligent GPP</td><td>A6GPPE-SET</td><td>• Consists of the following:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6GPPE</td><td>• Programming unit with CRT
• Equipped with ROM writer, FDD and printer interface functions.</td></tr>
<tr><td>SW[ ]GP-GPPA</td><td>A series system disk</td></tr>
<tr><td>SW[ ]GP-GPPK</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connecting A1SD71 and A6GPPE.</td></tr>
</table></td></tr>
<tr><td>Plasma handy programmer</td><td>A6PHPE-SET</td><td>• Consists of the following:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6PHPE</td><td>• Programming unit with plasma display
• Equipped with FDD, printer interface and memory cassette functions.</td></tr>
<tr><td>SW[ ]GP-GPPA</td><td>A series system disk</td></tr>
<tr><td>SW[ ]GP-GPPK</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connecting A1SD71 and A6PHPE. 3 m (9.84 ft) length.</td></tr>
</table></td></tr>
<tr><td rowspan="2">User disk</td><td>SW0-GPPU</td><td>2DD</td><td rowspan="2">Floppy disk ofr storing user programs (3.5 inch, formatted)</td></tr>
<tr><td>SW0S-USER</td><td>2HD</td></tr>
<tr><td rowspan="2">RS-422 cable</td><td>AC30R4</td><td colspan="2">Cable for connecting CPU and A6GPPE. 3 m (9.84 ft) length.</td></tr>
<tr><td>AC300R4</td><td colspan="2">Cable for connecting CPU and A6GPPE. 30 m (98.4 ft) length.</td></tr>
<tr><td>Composite video cable</td><td>AC10MD</td><td colspan="2">Cable for connecting GPP screen monitor display. 1 m (3.28 ft) length.</td></tr>
<tr><td>Cleaning disk</td><td>SW0-FDC</td><td colspan="2">Floppy disk for cleaning floppy disk drive.</td></tr>
<tr><td rowspan="8">Printer</td><td rowspan="5">Printer</td><td>K6PR(S1)</td><td colspan="2" rowspan="5">For print out of program ladder diagrams and lists.</td></tr>
<tr><td>K6PR-K</td></tr>
<tr><td>K7PR(S1)</td></tr>
<tr><td>A7PR</td></tr>
<tr><td>A7NPR</td></tr>
<tr><td>RS-232C cable</td><td>AC30R2</td><td colspan="2">Cable for connecting A6GPPE and printer (K6PR(S1), K6PR-K, K7PR(S1), A7PR, A7NPR, general-purpose printer with RS-232C interface). 3 m (9.84 ft) length.</td></tr>
<tr><td>Printer paper</td><td>K6PR-Y</td><td colspan="2">Paper for K6PR and K6PR-K printer. 9 inch. Available in units of 2000 pcs.</td></tr>
<tr><td>K6PR (K) ink ribbon</td><td>K6PR-R</td><td colspan="2">Replacement ink ribbon for K6PR and K6PR-K.</td></tr>
<tr><td>K6PR -K-SI ink ribbon</td><td>K6PR-K-SI</td><td colspan="2">Replacement ink ribbon for K6PR -K-SI</td></tr>
<tr><td></td><td>Teaching unit</td><td>AD71TU</td><td colspan="2">AD71(S1)/AD72/A1SD71 teach box.</td></tr>
</table>

3. SPECIFICATIONS

3.1 General Specifications

Table 3.1 General Specifications

<table>
<tr><th>Item</th><th colspan="5">Specifications</th></tr>
<tr><td>Operating ambient temperature</td><td colspan="5">0 to 55 °C</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="5">–20 to 75 °C</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="5">10 to 90 %RH, non-condensing</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="5">10 to 90 %RH, non-condensing</td></tr>
<tr><td rowspan="3">Vibration resistance</td><td rowspan="3">Conforms to *JISC0911</td><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep Count</td></tr>
<tr><td>10 to 55 Hz</td><td>–</td><td>0.075 mm (0.003 inch)</td><td rowspan="2">10 times **(1 octave/minute)</td></tr>
<tr><td>55 to 150 Hz</td><td>9.8 m/s^2 (1 g)</td><td>–</td></tr>
<tr><td>Shock resistance</td><td colspan="5">Conforms to *JIS C 0912 (98 m/s^2(10 g) × 3 times in 3 directions)</td></tr>
<tr><td>Noise durability</td><td colspan="5">By noise simulator of 1500 Vpp noise voltage, 1 μs noise width and 25 to 60 Hz noise frequency</td></tr>
<tr><td>Dielectric withstand voltage</td><td colspan="5">500 V AC for 1 minute across DC external terminals and ground
1500 V DC for 1 minute across AC external terminals and ground</td></tr>
<tr><td>Insulation resistance</td><td colspan="5">5 MΩ or larger by 500 V DC insulation resistance tester across AC external terminals and ground</td></tr>
<tr><td>Grounding</td><td colspan="5">Class 3 grounding : If appropriate grounding is not available, connect the grounding wire to the electric panel.</td></tr>
<tr><td>Operating ambience</td><td colspan="5">Free of corrosive gases. Dust should he minimal.</td></tr>
<tr><td>Cooling method</td><td colspan="5">Self-cooling</td></tr>
</table>

*JIS :Japanese Industrial Standard

REMARK

One octave marked ** indicates a change from the initial frequency to double or half frequency. For example, any of the changes from 10 Hz to 20 Hz, from 20 Hz to 40 Hz, from 40 Hz to 20 Hz, and 20 Hz to 10 Hz are referred to as one octave.

3.2 Performance Specifications and Functions

3.2.1 Performance specifications

Table 3.2 Performance Specifications

Item			Performances and Specifications
Number of I/O points			48 points* (number of occupied slots : 2)
Number of control axes			2 (simultaneous or independent)
Interpolation			Linear interpolation (for simultaneous 2 axes)
Positioning data		Capacity	400 points per axis
		Setting method	Input from peripheral device or sequence program
RAM memory backup			15 minutes without battery (25 °C) Lithium battery guarantees power failure backup for a total of 300 days. Battery guaranteed for five years.
Positioning	Method		Absolute and/or incremental method
	Positioning units		1 to 16,252,928 (PULSE) Max. 162 (m) (command unit: 0.1 to 10 μm/PLS) Max. 16200 (inch) (command unit: 1×10^{-5} to 0.001 inch/PLS) Max. 16200 (degree) (command unit: 1×10^{-5} to 0.001 degree/PLS)
	Positioning speed		10 to 200000 (PLS/sec) (command unit: 10 PLS/sec) 10 to 120000 (mm/min) (command unit: 10 mm/min) 1 to 12000 (inch/min) (command unit: 1 inch/min) 1 to 12000 (degree/min) (command unit: 1 degree/min)
	Acceleration and deceleration		Automatic trapezoidal acceleration and deceleration
	Acceleration and deceleration times		64 to 4999 (msec)
	Backlash compensation		0 to 65535 × position command unit (0 to 255 pulses if unit is PULSE)
	Error compensation		The A1SD71 may be calibrated to allow for mechanical errors in the positioning control mode and speed/positioning control switching mode.
Zero return			With zero address change function. Zero return direction and speed depend on setting.
Jog operation function			Jog operation by jog start signal input.
Inching function			Operation using manual pulse generator.
M function			M code output
Internal current consumption			5 V DC, 0.8 A
External supply voltage, current			4.75 to 26.4 V, max. 50 mA
Size mm (inch)			130(H) × 69.5(W) × 93.6(D) (5.12 × 2.74 × 3.69)
Weight kg (lb)			0.38(0.84)

REMARK

* I/O allocation for the 2 slots are as follows:
First half slot .....Empty slot: 16 points
Second half slot ... Special-function module: 32 points
Section 6.1.1 gives details about the first half slot.

3.2.2 Functions

The A1SD71 has functions used for positioning and positioning control during two-axis independent operations and two-axis linear interpolation operations. These functions are utilized as follows:

- By test operation of a peripheral device or teaching unit ····· A peripheral device or AD71TU is connected to an A1SD71, and positioning is executed using the peripheral device or AD71TU. This is used during program checks or test operations.
- By a sequence program ····· Positioning is executed using a program built in the PC CPU.

For use of the peripheral device, refer to the SW0GP-AD71P Operating Manual. For use of the AD71TU, refer to the AD71TU Operating Manual. Positioning control functions are shown below.

Function	Sequence Program or A6GPP	
	Two-axis independent operation	Two-axis interpolation operation
Error detection	An error code is provided by the A1SD71 if a data setting or positioning control error occurs. (For details of the error codes, refer to Chapter 8.)	
Set data read and write	A1SD71 set data (parameters, zero return data, positioning data) can be read and written.	
Present value and speed read	Present value data and speed data can be read from the A1SD71. (Present value can be read and monitored during positioning.)	
Teaching (positioning data write)	After manual positioning, present value can be written as position data. (Data is written to both axes in the case of two-axes interpolation operations.)	

The positioning functions of the A1SD71 are shown in Table 3.3.

Table 3.3 A1SD71 Positioning Functions

Functions		Method with a sequence program or method(test operation) using a peripheral device (or AD71TU)	
		Two-axes independent operation	Two-axes interpolation operation
Inching operation function		The drive for the given axis is advanced by a predefined number of pulses each time a manual pulse is received. The manual pulse is provided by the manual pulse generator.	Unavailable
JOG operation function		JOG operations can be done when a JOG operation command from the PC CPU (or peripheral device) is turned ON.	Unavailable
Zero return		Returns by a zero return start command from the PC CPU (or peripheral device). The current value is corrected to the zero address after zero return is completed.	Unavailable
Positioning	One-time positioning	Positioning is executed at a set speed from the current position to the setting position.	Positioning is executed at a speed with two axes moving in linear directions from the current position to the setting position (linear interpolation).
	n-times positioning	Changes speed in accordance with the positioning data set by a one-time start signal, and executes positioning.	Positioning by linear interpolation can be executed continuously as well as with the two-axis independent operation.
	Positioning accompanied by a change in speed (pattern change)	Changes speed in accordance with the positioning data set by a one-time start signal, and executes positioning.	Unavailable

Note)

(1) Error compensation and backlash compensation functions are valid for all the functions shown in Table 3.3.

(2) If positioning is done using a sequence program , a PC CPU can output the set M code from an A1SD71 when positioning starts or after positioning is completed. (Peripheral devices do not output M codes during positioning.)

(3) Current values in an A1SD71 can be changed (rewritten) by a sequence program or peripheral device before positioning is started.

(4) Positioning can be done continuously by setting a positioning start data number to 20 points in the buffer memory (X axis: 0 to 39, Y axis: 300 to 339) in an A1SD71 before positioning starts in the postion control mode.

3.3 General Description of Positioning System Operations

This section gives a general description of the A1SD71 and its use in a positioning system.

3.3.1 Positioning system using an A1SD71

Fig. 3.1 shows the operation of an A1SD71 in a positioning system.

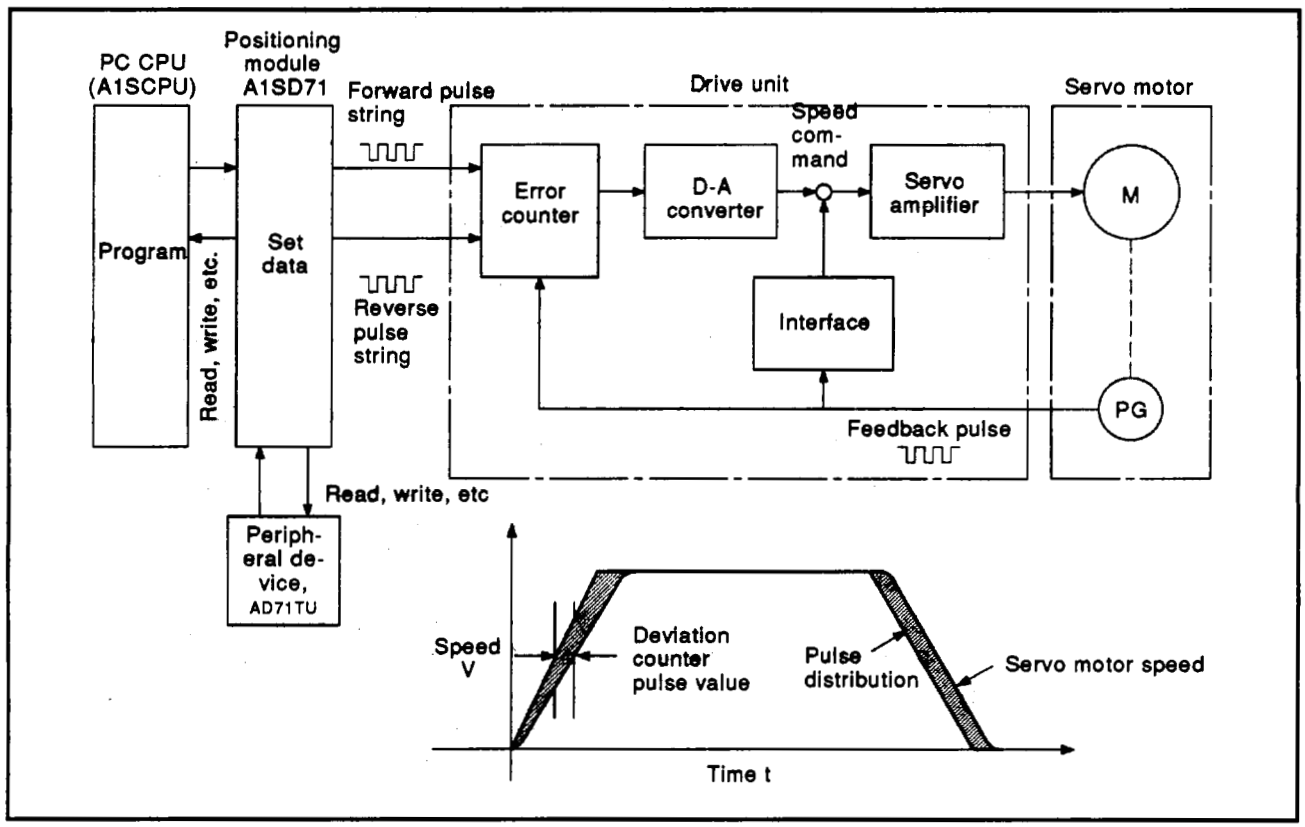
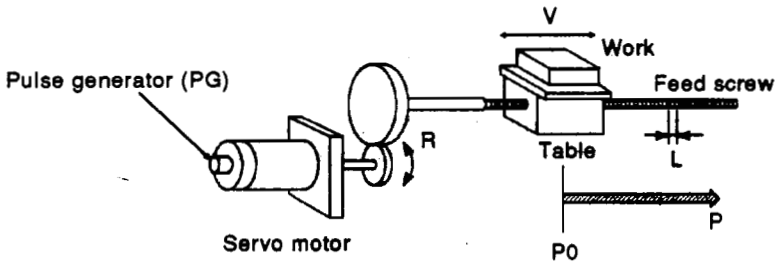


Fig. 3.1 Positioning System Operation Block Diagram

The A1SD71's output is a pulse string
When pulse strings are output, pulses are converted into error counters. Deviation counter pulse values are converted into DC analog voltages by a D-A converter, and changed into speed commands.
The drive unit gives a speed command.
The motor begins to rotate and the pulse generator PG gives feedback pulses in proportion to the revolutions of the motor to subtract accumulated pulses.
The motor rotation continues maintaining the constant deviation counter pulse value.
When the command pulse output from the A1SD71 ceases, the deviation counter pulse value decreases, and the speed slows down.
Then, when the deviation counter pulse value becomes 0, the motor stops.
Thus, the motor's rotary speed is proportional to the frequency of the command pulse, and degree of the angle of the motor's rotation is proportional to the number of command pulse output pulses.
Therefore, transmission can be done to a position that is proportional to the number of pulses of a pulse string by specifying the feedrate per pulse.
The pulse frequency is equal to the number of revolutions (transmission speed) of the motor.

General design of positioning system



A : Position detection increment (mm/p)
Vs : Command pulse frequency (p/s)
n : Number of pulse generator slits (slits/rev)
L : Feed screw lead (mm/rev)
R : Reduction ratio
V : Moving part speed (mm/s)
N : Motor speed (rpm)
K : Position loop gain (sec^{-1})
e : Deviation counter pulse value
P0 : Zero point (pulse)
P : Address (pulse)

(1) Position detection increment

$$A = \frac{L}{R \times n} (mm/p)$$

(2) Command pulse frequency

$$Vs = \frac{V}{A} (p/s)$$

(3) Deviation counter pulse value

$$\varepsilon = \frac{Vs}{K} (pulse)$$

Expression (1) indicates the travel per pulse, i.e. the number of output pulses x A. Using expression (2), calculate the command pulse frequency from the work speed and position detection increment. Expression (3) indicates the relation between the command pulse frequency and deviation counter pulse value.

Any of the four positioning units, (mm), (inch), (degree), and (PULSE), may be selected individually for the X and Y axes.

According to the target positioning address, a pulse string is output, and positioning is executed by the A1SD71 by setting data such as the travel distance and acceleration/deceleration time per pulse, the positioning speed, and the positioning address in a positioning command unit.

3.3.2 Signal communications between an A1SD71 and each unit

Fig. 3.2 shows a function block diagram for signal communications between each unit connected to an A1SD71, an A1SCPU, peripheral device, and the drive unit.

- Communication between PC CPU and A1SD71
  Control signals and data communications via base unit, they consist of:
  - Control signals.....I/O signals given in Section 3.6.
  - Data.....Written to and read from the buffer memory by the PC CPU. Detailed in Section 3.5.
- Communication between peripheral device (or AD71TU) and A1SD71
  Data write, A1SD71 test, A1SD71 monitor, etc. via the A1SD71's RS-422 connector.
- Communications between drive unit and A1SD71
  Control signal communication to and from the drive unit and pulse train output from the A1SD71. (For the I/O interface, refer to Section 3.7.)

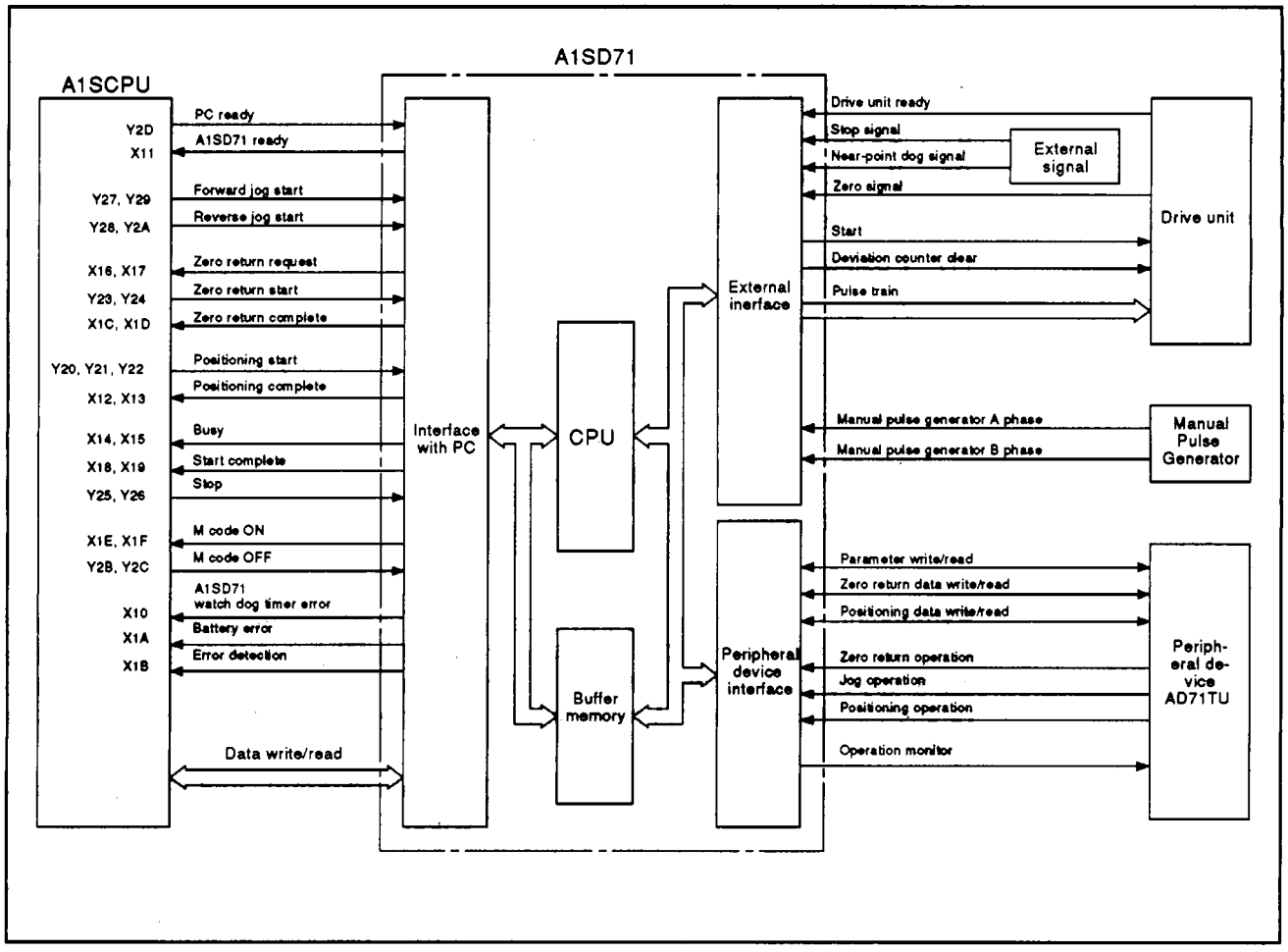
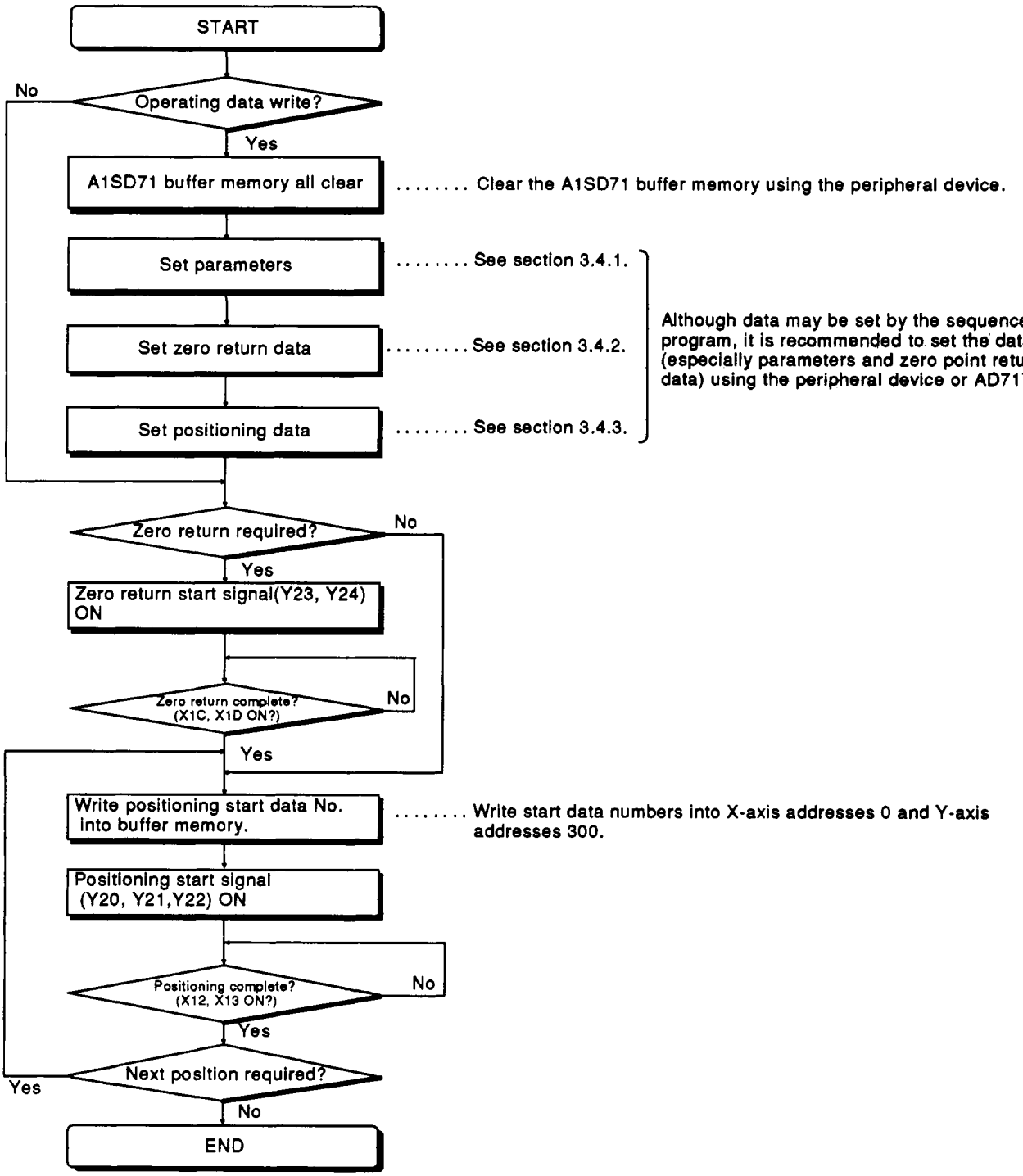


Fig. 3.2 A1SD71 Function Block Diagram

3.3.3 A1SD71 operation description

Fig. 3.2 PC Initiated Positioning Procedure



REMARKS

(1) Section 6 gives details about zero return start and positioning start conditions.

(2) Table 3.4 shows the data needed for control signals (positioning functions) from the PC CPU.

Table 3.4 Data Needed for Positioning Functions

Data \ Functions		Manual pulse generator operation	JOG operation	Zero return	Positioning control
Parameter	Unit setting	O	O	O	O
	Travel per pulse	O	O	O	O
	Speed limit value		O	O	O
	Jog speed limit value		O		
	Starting bias speed		O	O	O
	Backlash compensation	O	O		O
	Upper stroke limit				O
	Lower stroke limit				O
	Error compensation	O	O		O
	Acceleration and deceleration times		O	O	O
	Positioning complete signal output time				O
	Pulse output mode	O	O	O	O
	Rotation direction setting	O	O	O	O
	Positioning method				O
	M code ON/OFF timing				O
	Travel per manual pulse generator during inching	O			
Zero return data	Zero return direction	O	O	O	O
	Zero return method			O	
	Zero return address	O	O	O	O
	Zero return speed			O	
	Zero return creep speed			O	
	Zero return dwell time			O	
	Torque limit			O	
Positioning data	Positioning information				O
	Positioning speed				O
	Positioning address				O
	Dwell time				O
Others	Start data number area				O
	Speed change data		O*	O*	O*
	Jog speed		O		
	Inching operation enable	O			
	Inching operation speed	O			

* Indicates functions used to change the speed during A1SD71 positioning.

3.4 Types and Functions of Setting Data

- Setting data is data that is necessary for an A1SD71 to do positioning control. Setting data is the general term for the following three kinds of data:

Section 3.5 gives details about storing set data in the buffer memory.

Setting data
- Parameter
- Zero return data
- Positioning data

Setting data is written using the following two methods:

1) By a peripheral device or AD71TU ..... The Operating Manual and the AD71TU Operating Manual SW0GP-AD71P give details.

2) By a sequence program ..... Section 6 gives details.

It is necessary to set data for two (X and Y) axes.

POINTS

(1) All-clear data
Before writing setting data, use a peripheral device to do allclear processing of the memory.

(2) Data setting when using either the X or Y axis
When using either the X or Y axis, write parameter and zero return data to the axis not used.

[Writing data must be a value in the setting range given in the User's Manual. However, even if an initial value (default value) is set by a parameter, there is no problem.]

If zero return is done without writing data, an error occurs, and the error detection signal (X1B) goes ON.

3.4.1 Parameters

Parameters are the basic data which enable the A1SD71 to do positioning control. The data in Table 3.5 is contained in parameters.

- Initialization of parameters
If all parameters are not set or an error outside the setting range is detected by parameter checking, the A1SD71 will be controlled using the initial values shown in Table 3.5.
However, parameter area data remains as user-set values.

Parameters are checked when:

1) The power is turned ON;

2) Parameters are sent from a peripheral device to an A1SD71;

3) A PC CPU ready signal from the PC CPU to the A1SD71 switches from OFF to ON;

4) (1) zero return, (2) positioning, (3) jog operation, or (4) inching has been selected in the peripheral device or the AD71TU.

However, error code and error detection signals are not given for 1) above (power ON parameter check).

Table 3.5 Parameter Settings

No.	Items	mm		Inch		degree		PULS(PLS)		Initial Values	
		Setting Ranges	Units	Setting Ranges	Units	Setting Ranges	Units	Setting Ranges	Units		Units
1	Units	0	—	1	—	3	〃	3	—	3	—
2	Travel per pulse	1 to 100	$X10^{-1}$ μm/PLS	1 to 100	$X10^{-5}$ inch PLS	1 to 100	$X10^{-5}$ degree PLS	—	〃	—	—
3	Speed limit values	1 to 12000	$X10^{1}$ mm/min	1 to 12000	X1 inch/min	1 to 12000	X1 degree min	1 to 12000	$X10^{1}$ PLS/sec	20000	$X10^{1}$ PLS/sec
4	Jog speed limit values	1 to 12000	$X10^{1}$ mm/min	1 to 12000	X1 inch/min	1 to 12000	X1 degree min	1 to 20000	$X10^{1}$ PLS/sec	2000	$X10^{1}$ PLS/sec
5	Starting bias speeds	0 to 12000	$X10^{1}$ mm/min	0 to 12000	X1 inch/min	0 to 12000	X1 degree min	0 to 20000	$X10^{1}$ PLS/sec	0	$X10^{1}$ PLS/sec
6	Backlash compensation	0 to 65535	$X10^{-1}$ μm	0 to 65535	$X10^{-5}$ inch	0 to 65535	X10-5 degree	0 to 255	PLS	0	PLS
7	Upper stroke limits	0 to 162000	mm	0 to 162000	inch	0 to 162000	degree	0 to 16252928	PLS	16252928	PLS
8	Lower stroke limits	0 to 162000	mm	0 to 162000	inch	0 to 162000	degree	0 to 16252928	PLS	0	PLS
9	Error compensation	±0to100000 (per m)	$X10^{-1}$ μm	±0to100000 (per 100 inch)	$X10^{-5}$ inch	±0to100000 (per degree)	$X10^{-5}$ degree	—	〃	0	—
10	Travel per manual pulse during inching	1 to 100000	$X10^{-1}$ μm	1 to 100000	$X10^{-5}$ inch	1 to 100000	$X10^{-5}$ degree	1 to 100	PLS	1	PLS
11	Acceleration and deceleration times	64 to 4999(msec)								1000	msec
12	Positioning complete signal output time	1 to 20000(msec)								300	msec
13	Pulse output mode	0: PLS + SIGN (B type) 1: Forward PLS or reverse PLS (A-type)								Same as the previous setting *	—
14	Direction setting	0: Current value increase when forward pulse is output 1: Current value increase when reverse pulse is output								Same as the previous setting *	—
15	Positioning method	0: Absolute 1: Incremental 2: Incremental/absolute combined								0=absolute	—
16	M code ON/OFF timing	0: M code not used 1: M code used		0: WITH mode 1: AFTER mode						Same as the previous setting *	—

*:Not fixed when shipped from the factory. All clear set to 0.

The actual parameter speed limit values and JOG speed limit values in Table 3.5 are multiplied by 6.1 (PLS/sec).

For example, the value that is nearest to 200 (PLS/sec) is multiplied by 6.1 (PLS/sec), even if the speed limit value is set to 200 (PLS/sec).

200 ÷ 6.1 = 32.78688.....(Decimal point values are rounded off.)

The actual speed is 6.1 x 32 = 195.2 (PLS/sec).

POINT

Numbers 2 to 12 show the setting range when setting with a sequence program.
However, parameters whose unit is $x10^{-1}$ or $x10^{1}$ are processed automatically as $x10^{-1}$ or $x10^{1}$ in the A1SD71 when processed with a value set in the program.
(Example) If the speed limit value is set to 200, the value becomes $2000x10^{1}$ = 20000 mm/min in the A1SD71.

Parameter data is explained as follows.

(1) Unit

Selects the units (mm, inch, degree, or pulse) for positioning control. Can be set independently for X and Y axes (e.g. X axis = mm, Y axis =degree).

(2) Travel per pulse

- Specifies the travel distance per pulse as determined by the mechanics of the system.
- Controls the number of pulses contained in the pulse train from the A1SD71.

(3) Speed limit value

- Specifies the maximum speed for positioning (or zero return).
- When the positioning speed called at a given time is greater than the speed limit value, the speed is limited to the value set by the parameter.
- When a new speed is called during positioning by the sequence program and this is greater than the speed limit value, the speed is limited to the value set by the parameter.

(4) Jog speed limit value

- Specifies the maximum speed for jog operation.
- The jog speed limit value must be within the range shown in Table 3.5 and must not exceed the speed limit value.
- When the jog speed set using the peripheral device or sequence program is greater than the jog speed limit value, the jog speed is kept to the limit value.
  * For jog operation, refer to Section 6.3.4.

(5) Starting bias speed

- A minimum starting speed is required for the smooth operation of some motors (e.g. stepping motors). This may be set as a starting bias speed.
- The starting bias speed is used for positioning, jog operation, and zero return. See Fig. 3.3.

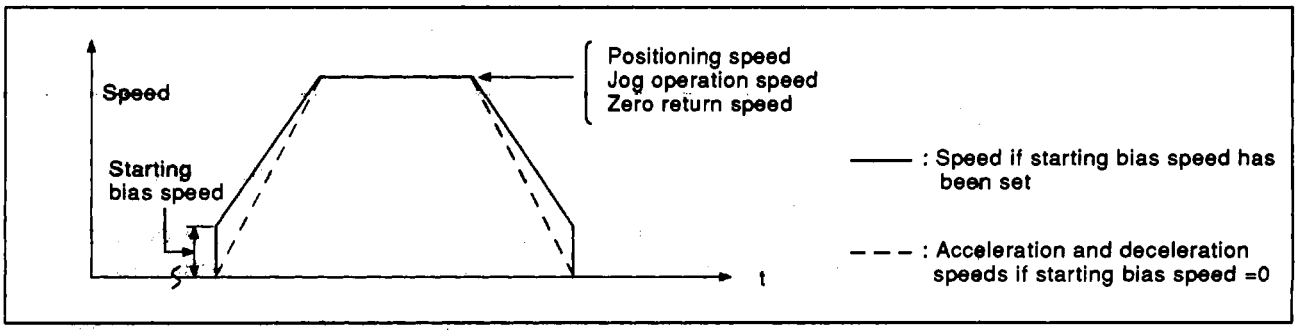


Fig. 3.3 Speed Change When Starting Bias Speed Is Set

For positioning with interpolation between axes, the starting bias speed set for the axis with the shorter distance to travel is ignored.

(6) Backlash compensation

- Allows a backlash compensation (see Fig. 3.4) to be programmed in for accurate positioning. Note that there is also an error compensation facility to allow for tolerances within the mechanical drive, see note (9).
- When backlash compensation is set, every time the travel direction changes during positioning, a feed pulse occurs which exceeds the backlash compensation amount.

  During manual pulse generator inching, the pulse output begins as soon as the number of input pulses exceeds the backlash compensation amount each time the direction of movement changes. (If the inched distance is less than the backlash compensation, feed pulses will not be generated. However, the A1SD71 does calculate the subsequent positions according to the updated data).
- The feed pulse for a backlash compensation amount is generated by at least one JOG start signal during the JOG operation. Therefore, even if the travel distance is smaller than a backlash compensation amount, the feed pulse for a backlash compensation amount occurs.

- Backlash compensation is valid after zero return. After redefining the backlash compensation, always zero the system.

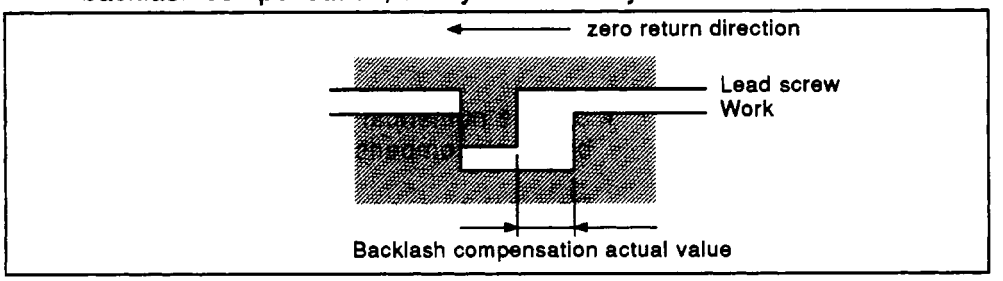


Fig. 3.4 Backlash Compensation

- For the backlash compensation amount, the range of the number of output pulses differs in accordance with the unit to be set in the parameter.

Setting Units	Number of Output Pulses
PLS	0 to 255
mm	*0 to 65535
inch	
degree	

The * symbol indicates the value when the travel distance per pulse is set to 1.

(7) Upper stroke limit

- Defines the upper limit value of machine travel.
- The stroke limit is checked before each positioning operation and if outside the allowed range, positioning is halted.
  During jog operation and manual pulser inching, the stroke limit is ignored.

(8) Lower stroke limit

- Defines the lower limit value of machine travel.
- The stroke limit is checked before each positioning operation and if outside the allowed range, positioning is halted.
  During jog operation and manual pulser inching, the stroke limit is ignored.

(9) Error compensation

When the set value and an actual feedrate differ, this is called error compensation.
When the unit is mm, an error compensation per m (per 100 inches if the unit is inches and per 100 degrees if the unit is degrees) is set to 0, and the feedrate of any set value is transmitted. (Automatic start) Then, the actual feedrate (A) is measured, and the error compensation amount and backlash compensation amount are calculated as indicated below.

- When the unit is mm

$$\text{Error compensation amount } (10^{-1}\mu m) = \left(\frac{\text{Set value(mm)}}{\text{A (mm)}} - 1\right) \times 10^7$$

- When the unit is inches

$$\text{Error compensation amount } (10^{-5}\ \text{inch}) = \left(\frac{\text{Set value(inch)}}{\text{A (inch)}} - 1\right) \times 10^7$$

- When a unit is degrees

$$\text{Error compensation amount } (10^{-5} \text{ degree}) = \left(\frac{\text{Set value(degree)}}{\text{A (degree)}} - 1\right) \times 10^7$$

- Set the numerical value calculated in the following expression as the backlash compensation amount when there is a machine error.

$$\text{Backlash compensation} = \text{Backlash compensation actual value} \times \frac{\text{Set value}}{\text{A}}$$

(10) Manual pulser inching travel increment

- Defines the distance travelled each time a manual pulser inching command is given.
- The A1SD71 counts the number of manual pulse inching command inputs and transmits the appropriate number of output pulses. (The applicable output speed range is 10 to 20000 PLS(unit = 10 PLS/sec.). See section 3.5.

(11) Acceleration and deceleration times

- Defines the period of time from the start of positioning to when the speed limit value specified in the parameter is reached. (Refer to Fig. 3.5.)

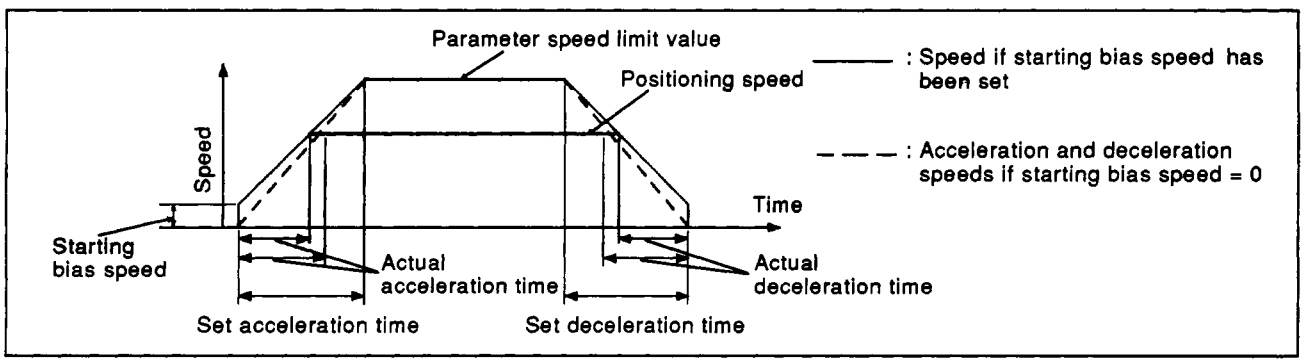


Fig. 3.5 Acceleration and Deceleration Times

- The acceleration time is the same as the deceleration time. They cannot be set differently.
- The acceleration and deceleration are controlled at a constant value.
- When the positioning speed is lower than the parameter speed limit, the acceleration and deceleration times are comparatively ahort. Therefore, the maximum positioning speed must be either equal to the parameter speed limit or an approximate value.
- The acceleration and deceleration times are valid for zero return, positioning, and jog operations.
- For interpolation positioning, the acceleration and deceleration times for a master axis are valid. (The acceleration ane deceleration times for a slave axis are ignored.)

(12) Positioning complete signal duration

Sets the duration of the "positioning complete signal" from the A1SD71. Positioning is considered to be complete after the A1SD71 terminates pulse output and the predetermined dwell time has elapsed.

(13) Pulse output mode

Defines the output mode as A type or B type.

- Forward pulse or reverse pulse, two pulse chains.

Forward feed pulse $\overline{\text{PULSE F}}$	$\overline{\text{PULSE F}}$	A type
Reverse feed pulse $\overline{\text{PULSE R}}$	$\overline{\text{PULSE R}}$	

- PLS + SIGN

Feed pulse $\overline{\text{PULSE}}$	Forward and reverse feed pulses. Travel direction is controlled by direction sign ($\overline{\text{SIGN}}$). $\overline{\text{PULSE}}$ $\overline{\text{SIGN}}$ 25 ms + direction travel - direction travel	B type
Direction sign $\overline{\text{SIGN}}$	Low in forward direction. High in reverse direction. (Present value increases in forward direction and decreases in reverse.)	

(14) Direction setting

Selects the direction for which the present value increases. (Set 0 when using forward pulse output. Set 1 when using reverse pulse output.) Positioning and zero return follow this direction of rotation.

(15) Positioning mode

- Specifies incremental, absolute, or incremental/absolute combination modes for positioning.
- In incremental mode positioning, positions are reached with reference to the previous position. (See Fig. 3.6.)

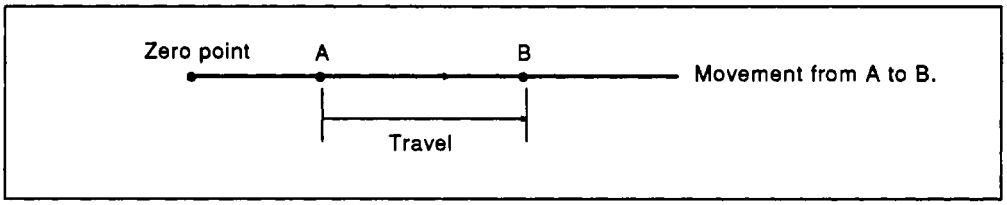


Fig. 3.6 Incremental Method

- In absolute mode positioning, positions are reached with reference to a Zero point address. (See Fig. 3.7.)

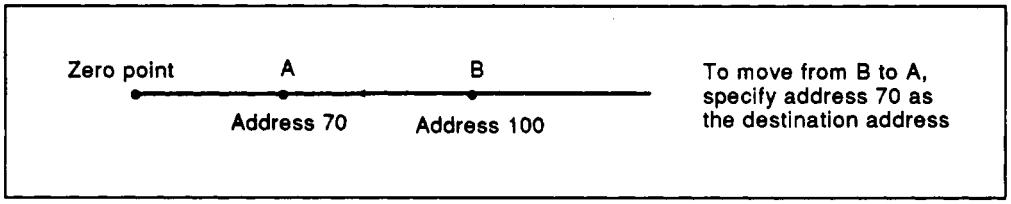


Fig. 3.7 Absolute Method

- To use both incremental and absolute modes in the same axis (e.g. X axis), set 2. In this case, the mode is controlled by the individual piece of positioning data. (Refer to Section 3.4.3.)

(16) M code ON/OFF timing

M codes are code numbers (1 to 255) assigned by the user to control auxiliary functions (for example, clamp, drill rotation, stop, and tool exchange commands, etc.) at defined points in the positioning cycle. These are used by the PC CPU to co-ordinate the operation of external equipment and processes.

- M code use/non-use must be specified as well as where in the positioning sequence they are to be used.
  When M code non-use is specified or peripheral device test mode is in operation, M code data in the buffer memory is cleared and the "M code ON" signal is not output.
- When the M code used is specified, the output timing of the M code ON signal must be specified.
- "M code ON" signal output is available in two timing modes, WITH and AFTER.

(a) WITH mode
The "M code ON" signal is given at approximately the same time as the positioning operation starts.

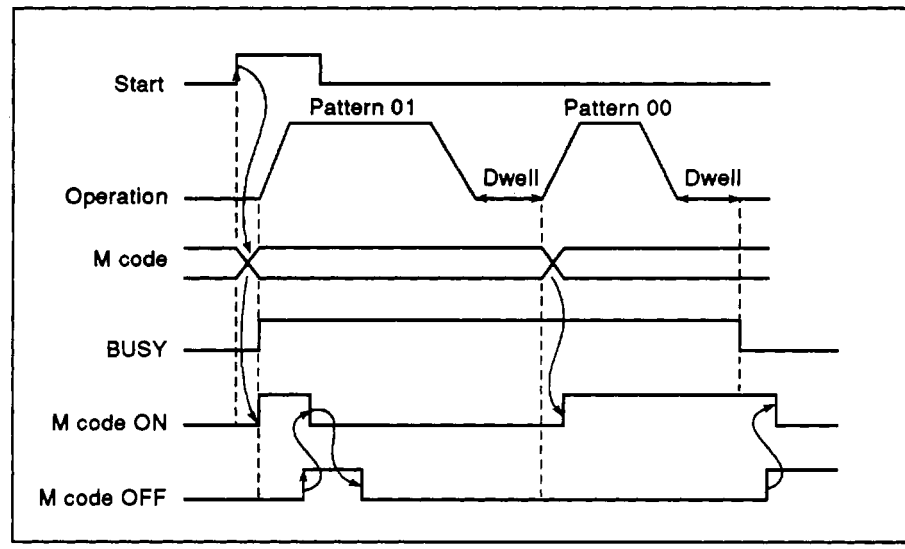


Fig. 3.8 WITH Mode Signal Timing

(b) AFTER mode

The "M code ON" signal is given after the positioning operation has finished. In this mode, if the operation is stopped before it is complete the "M code ON" signal is not given.

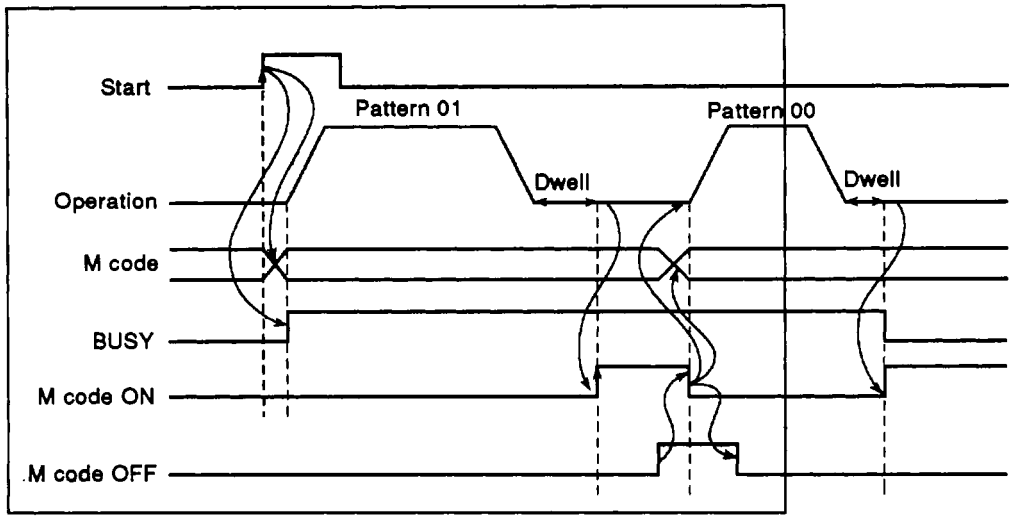


Fig. 3.9 AFTER Mode Signal Timing

POINTS

- The "M code ON" signal is not given if the M code data in the positioning data is set at 0.
- The M code is ignored if the positioning pattern is "11" and the "M code ON" signal is not given. (For details of the positioning pattern, refer to Section 3.4.3.)
  The next positioning operation is not started until the "M code ON" signal is switched off. An error condition arises if the "M code ON" signal is on at the rise of the start signal and positioning is not started.
  The "M code ON" signal is turned off when:
  1. "M code OFF" signal changes from OFF to ON;
  2. PC ready signal (Y2D) is OFF; or
  3. Zero return, positioning, jog operation, or inching mode is selected in the peripheral device or the AD71TU test mode.

When positioning processing beginning with pattern 11 is executed, the M code ON signal goes ON when positioning processing of pattern 00 or pattern 01 begins in the WITH mode or when completed in the AFTER mode.

The M code is set before pattern 11 positioning processing begins.

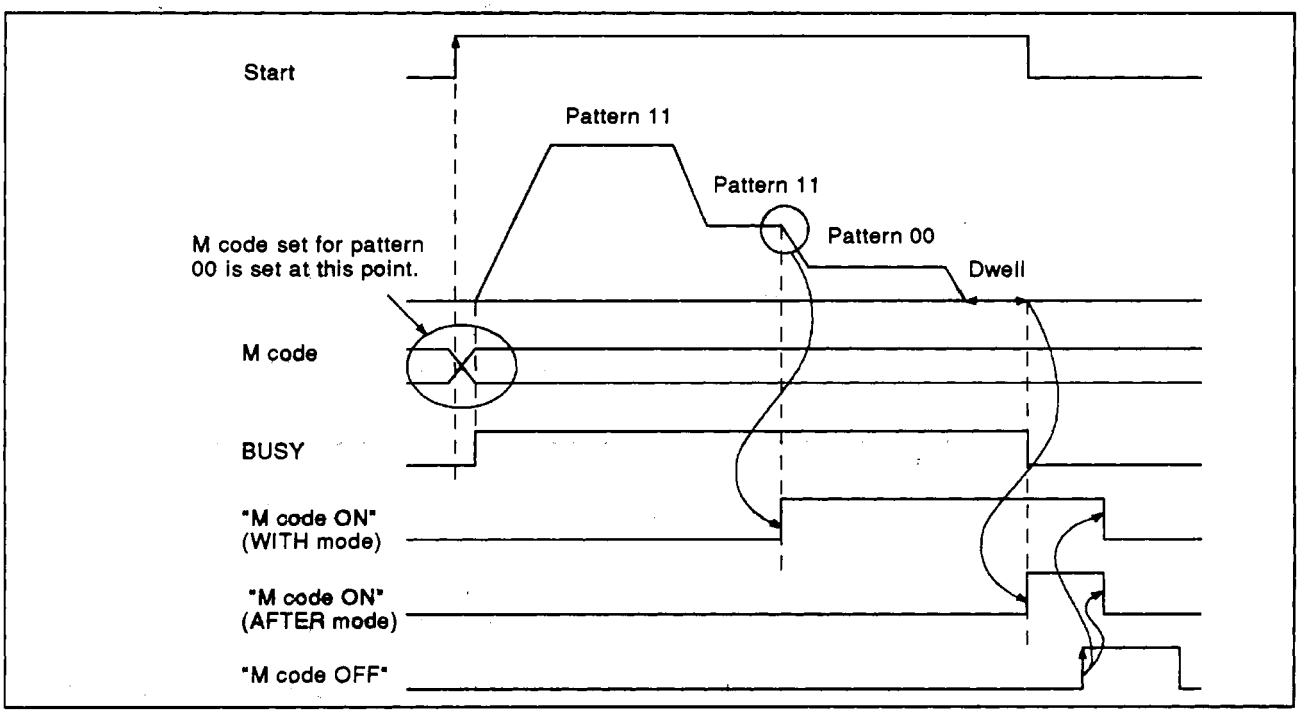


Fig. 3.10 "M Code ON" Signal Timing for Positioning Pattern "11"

REMARK

Fig. 3.10 shows the M code ON signals in the WITH mode and the AFTER mode. However, this is only to explain the M code ON signal, and either (WITH mode or AFTER mode) can actually be used.

3.4.2 Zero return data

This defines a home position or zero point for the A1SD71. Refer to Table 3.6. Zero return data is checked when:

1) Parameters or zero return data is transferred from the peripheral device to the A1SD71;
2) "PC ready signal" output from the PC CPU to the A1SD71 changes from OFF to ON; or
3) Zero return, positioning, jog operation, or manual pulser inching is selected in the peripheral device test mode.

Table 3.6 Zero Return Data

No.	Item	mm		inch		degree		PULSE	
		Setting range	Unit	Setting range	Unit	Setting range	Unit	Setting range	Unit
1	Zero return direction	0 : Forward direction (address increases) 1 : Reverse direction (address decreases)							
2	Zero return method	0 : Pulse generator(PG)zero-point signal 1 : Stopper stop (1) and dwell timer time-out 2 : Stopper stop (2) and signal from drive unit							
3	Zero return address	0 to 162×10^7	$\times 10^{-1}$ μm	0 to 162×10^7	$\times 10^{-5}$ inch	0 to 162×10^7	$\times 10^{-5}$ deg	0 to 16252928	PLS
4	Zero return speed	1 to12000	$\times 10^1$ mm/min	1 to12000	×1 inch/min	1 to12000	×1 deg/min	1 to12000	$\times 10^1$ PLS/sec
5	Creep speed	1 to12000	$\times 10^1$ mm/min	1 to12000	×1 inch/min	1 to12000	×1 deg/min	1 to12000	$\times 10^1$ PLS/sec
6	Zero return dwell time	0 to 499($\times 10^1$ msec)							
7	Torque limit	10 to 250(%)							

POINTS

(1) No. 3 to No. 7 can be set by the sequence program.

(2) Setting numbers "0 and 1" of the zero return direction and setting numbers "0, 1, and 2" of the zero return method are numbers set by a peripheral device.
When setting No. 1 and No. 2 from the sequence program, refer to Section 3.5.7.

REMARK

The zero return speed and creep speed in Table 3.6 are multiplied by 6.1 (PLS/sec).
For example, the value that is nearest to 200 (PLS/sec) is multiplied by 6.1 (PLS/sec), even if the speed limit value is set to 200 (PLS/sec). (Decimal point values are rounded off.)
200 ÷ 6.1 = 32.78688....
The actual speed is 6.1 x 32 = 195.2 (PLS/sec)

Zero return data is explained below:

(1) Zero return direction

- Specifies the direction for zero return.

IMPORTANT

Zero return is controlled according to the zero return direction and speed. Deceleration is started when an actuator is operated. Always ensure that the zero return direction is correct for the drive system used.

(2) Zero return methods

There are three kinds of zero return methods:

- The pulse generator (PG) zero-phase signal method
- Mechanical stop (1) (caused by dwell timer time)
- Mechanical stop (2) (caused by a signal from the drive unit)

(a) Method by the pulse generator (PG) zero-phase signal method
This method of stopping by a zero-phase signal from the PG is shown in Fig. 3.11.
A PG with a zero-phase signal is necessary. (Refer to Fig. 3.12.)

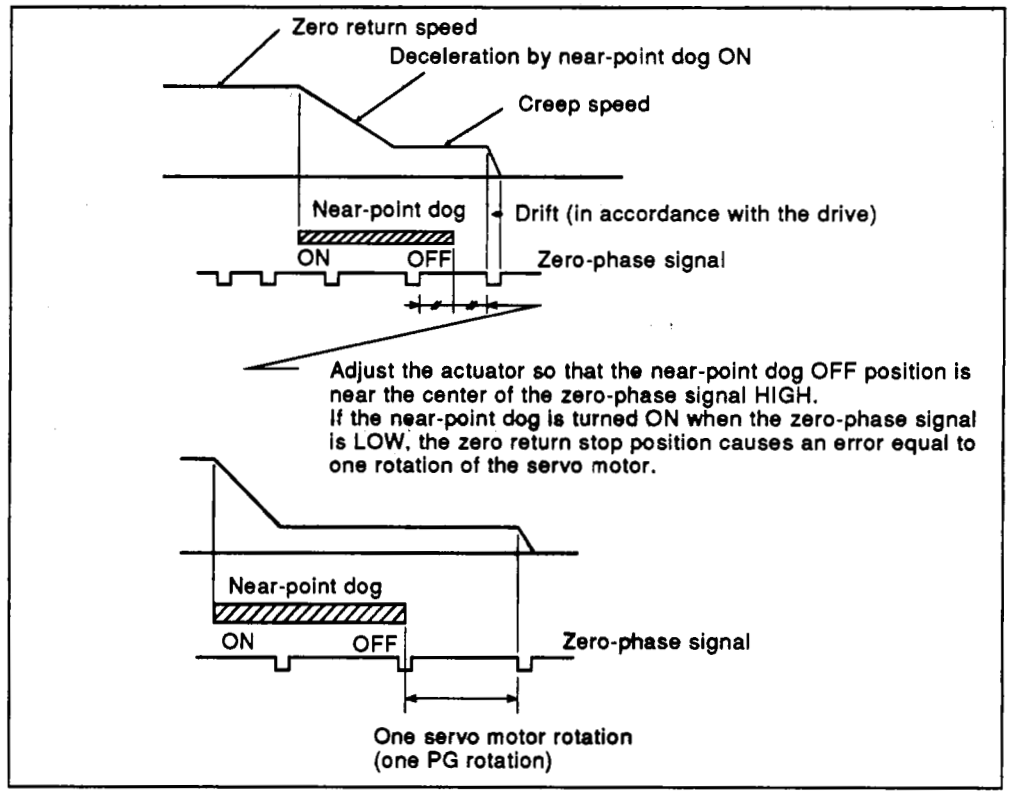


Fig. 3.11 Zero Return Using a PC CPU Zero-Phase Signal

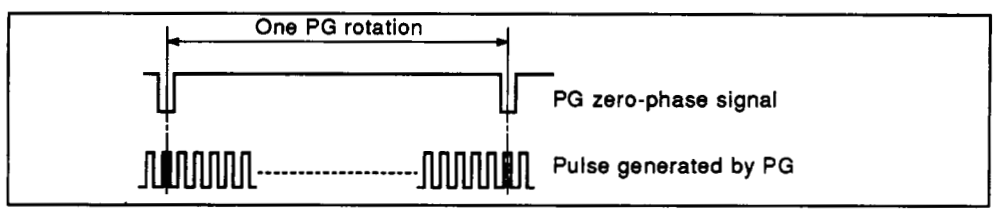


Fig. 3.12 Feedback Pulse Pattern

(b) Mechanical stop (1) (caused by a dwell time time-out)
After a near-point dog has operated and the dwell time has passed, zero return is completed. (Refer to Fig. 3.13-1.)
In this case, if the dwell time has not passed, even if the near-point dog goes OFF halfway, zero return is not completed. After reaching the creep speed, limit the servo motor torque (Section 3.4.2(7) gives details).
If the servo motor torque is not limited, the servo motor may malfunction when a stopper is hit.

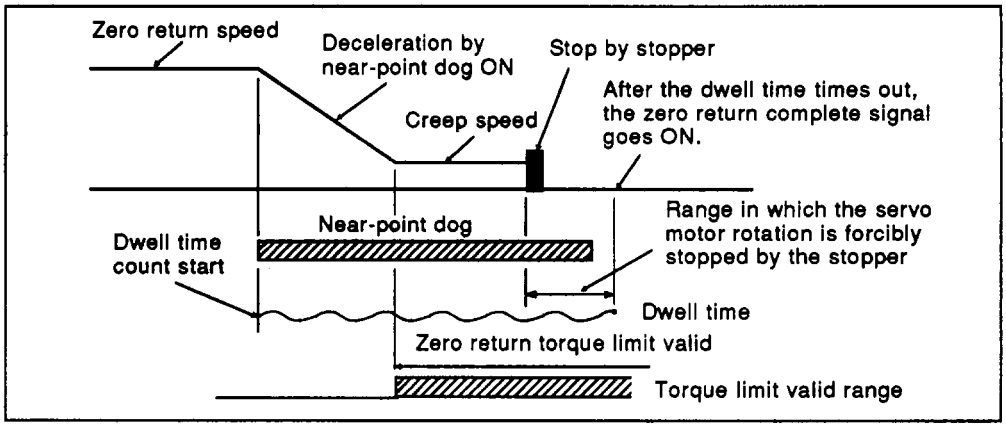


Fig. 3.13-1 Zero Return by Using Stopper Stop (1)

(c) Mechanical stop (2) (caused by an external stop command)
This is the method of stopping by inputting an external stop command when a servo motor interferes with the stopper. (Refer to Fig. 3.13-2.)
Forcibly input a zero-phase signal (stop command) to the zero-phase signal terminal by an external switch after the near-point dog goes ON.
When inputting a zero-phase signal (stop command), the ON/OFF state of the near-point dog is not a problem.
After reaching the creep speed, limit the servo motor torque (Section 3.4.2 (7) gives details).
If the servo motor torque is not limited, the servo motor may malfunction when a stopper is hit.

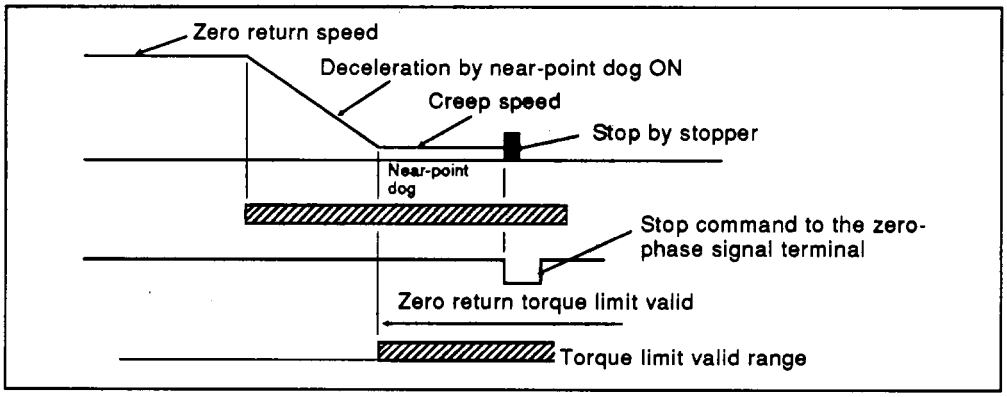


Fig. 3.13-2 Zero Return Using a Stopper

REMARK

If a stop signal is input before the speed decelerates to the creep speed, excessive power is delivered to the servo motor and machine system, causing a fault.

(3) Zero return address

- This address is set as the present value of the home position upon completion of zero return.
- Set the zero return address to either the upper or lower stroke limit set in the parameters.

(4) Zero return speed

- Sets the zero return speed. (Refer to Fig. 3.14.)

(5) Creep speed

- The creep speed is low-speed until stopped after decelerating from the zero return speed by the zero return point dog being ON during zero return. (Refer to Fig. 3.14.)
- The creep speed varies according to the detected error in the case of zero return by a zero-phase signal and to the size of an impact during collision in the case of zero return by stopper.
  Therefore, set the creep speed taking the error range and the size of an impact into consideration.

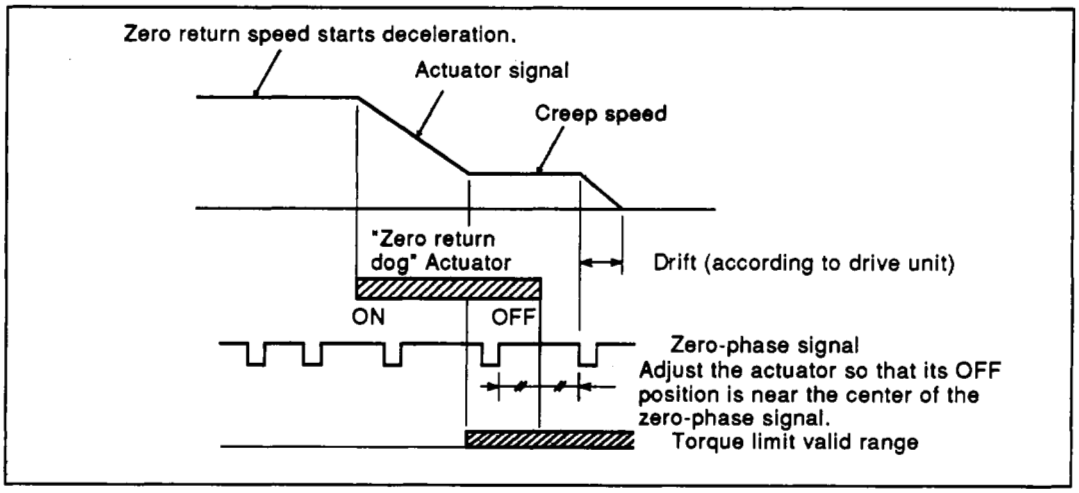


Fig. 3.14 Zero Return and Creep Speeds

(6) Zero return dwell time

- The zero return dwell time is the time until zero return is completed after the near-point dog goes ON during zero return by stopper stop (1).
- Set the time until stopping by the stopper after the zero return speed decelerates to the creep speed.
- Even if any value (in the setting range) is input at the time other than stopper stop (1), there is no problem.

(7) Torque limit

This is the set value to limit the torque of a servo motor after reaching the creep speed when doing a zero return.

POINTS

- A D-A converter is necessary for torque limit.
- Be sure to set it when doing a zero return operation by stopper stop (2).
- Even if any value (in the setting range) is input when torque is not limited, there is no problem.

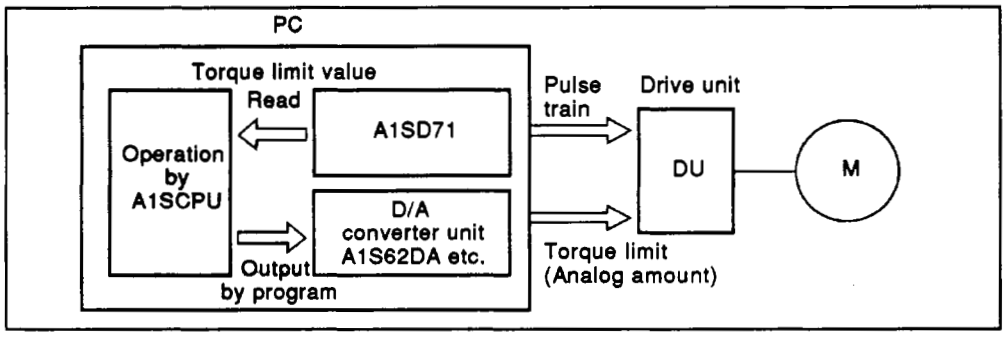
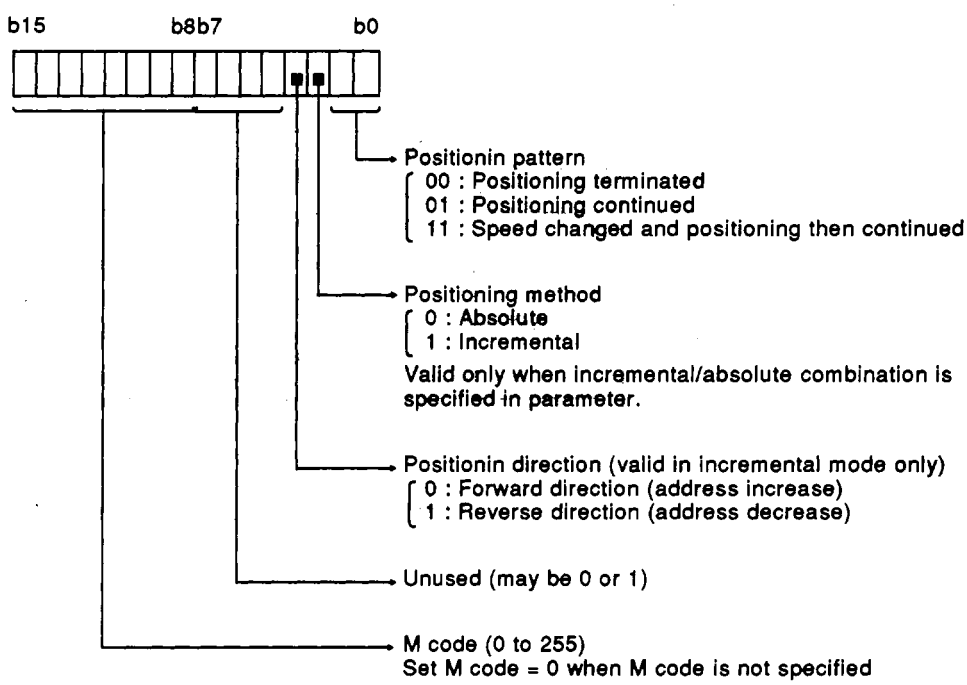


Fig. 3.15 Torque Limit Block Diagram

3.4.3 Positioning data

Positioning data is used in the A1SD71 to execute positioning control (i.e. control other than zero return, inching and jog operation). Refer to Table 3.7. Table 3.7 shows one block of positioning data. 400 blocks can be set for the X and Y axes, respectively.
The block of data used for positioning is dictated by the number set in the positioning start area of the buffer memory.
Positioning data is checked when positioning is started.

Table 3.7 Positioning Data List

<table>
<tr><th>No.</th><th>Item</th><th colspan="8">Setting Data</th></tr>
<tr><td>1</td><td>Positioning information</td><td colspan="8"> 
</td></tr>
<tr><td></td><td></td><td colspan="2">mm</td><td colspan="2">inch</td><td colspan="2">degree</td><td colspan="2">PULS</td></tr>
<tr><td></td><td></td><td>Setting range</td><td>Unit</td><td>Setting range</td><td>Unit</td><td>Setting range</td><td>Unit</td><td>Setting range</td><td>Unit</td></tr>
<tr><td>2</td><td>Positioning speed</td><td>1 to 12000</td><td>$\times10^{1}$ mm/min</td><td>1 to 12000</td><td>$\times1$ inch/min</td><td>1 to 12000</td><td>$\times1$ deg/min</td><td>1 to 20000</td><td>$\times10^{1}$ PLS/sec</td></tr>
<tr><td>3</td><td>Positioning address</td><td>0 to 162×10^{7}</td><td>$\times10^{-1}$ µm</td><td>0 to 162×10^{7}</td><td>$\times10^{-5}$ inch</td><td>0 to 162×10^{7}</td><td>$\times10^{-5}$ deg</td><td>0to 16252928</td><td>PLS</td></tr>
<tr><td>4</td><td>Dwell time</td><td colspan="8">0 to 499($\times10^{1}$ msec)</td></tr>
</table>

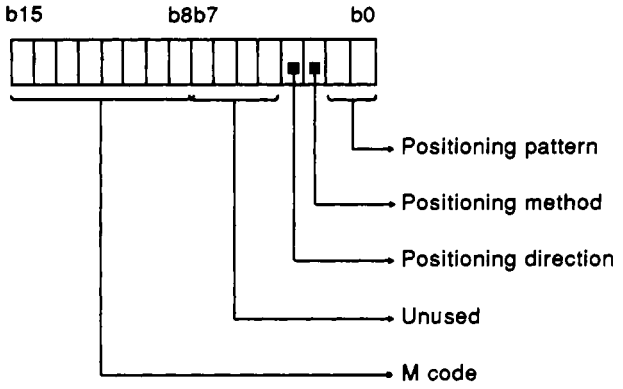
POINT

No. 2 to No. 4 can be set from the sequence program.

The data to be set as positioning data is explained below.

(1) Positioning information

- Separate the information for the X and Y axes.
- Positioning information consists of 16 bits and includes the following.



(a) Positioning pattern

Specifies positioning completion in accordance with the positioning data that corresponds to the data number or positioning continuation by the next data number by using the positioning pattern.
The positioning continuation pattern is as follows:

1) Positioning is completed in accordance with the specified address, and positioning is continued by the next data number (positioning address).
2) Positioning is continued after changing speed at the specified address.
Fig. 3.16 shows how to specify bits in the buffer memory to specify the positioning pattern.

This pattern data is specified by the first two bits of the positioning information.

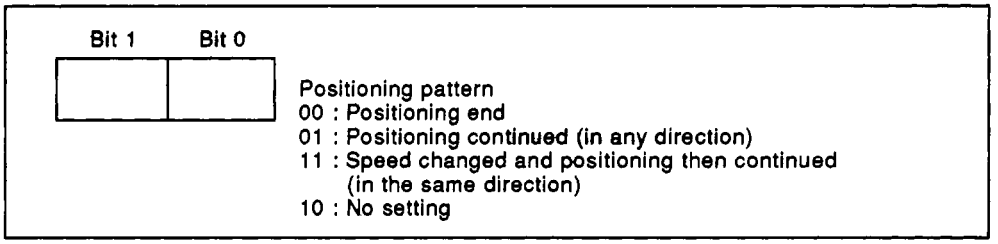


Fig. 3.16 Positioning Pattern

- Positioning end

  Drives to the specified address, positioning is complete after the dwell time has elapsed.

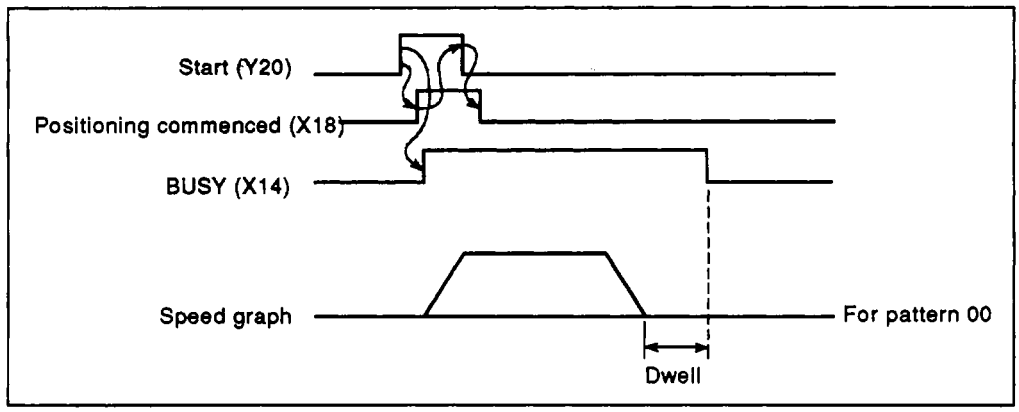


Fig. 3.17 Pattern 00

- Positioning continued

  The positions are reached consecutively in the order specified by their data numbers by a single start signal. (The BUSY signal remains on during positioning.)

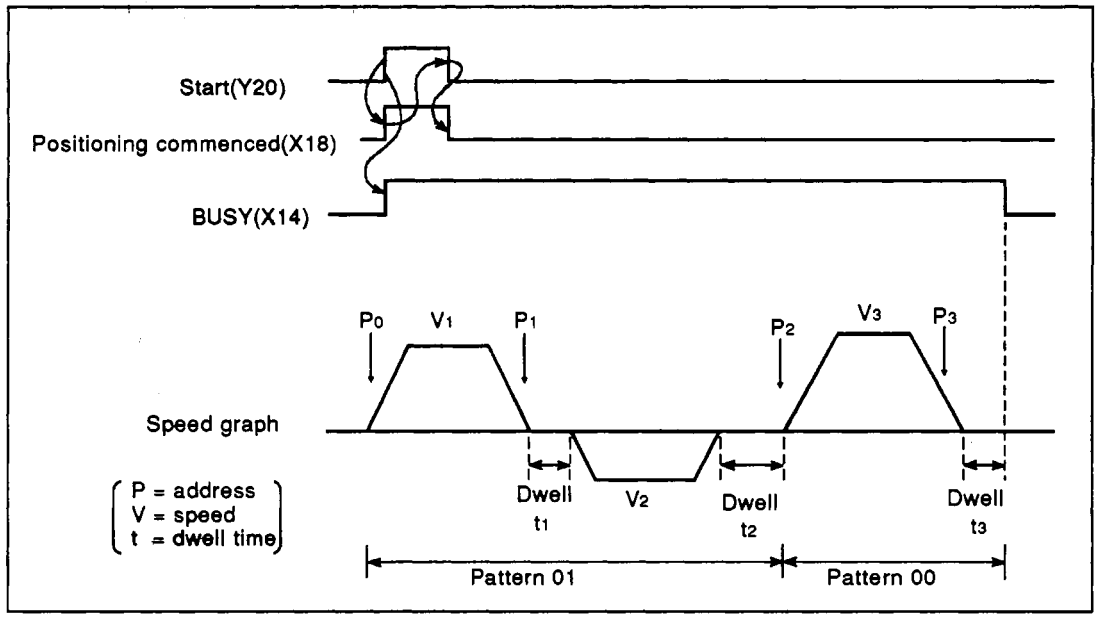


Fig. 3.18 Pattern 01

POINT

Pattern 00 should be set for the last position in a series of continuous operations.
Pattern 01 may be set for interpolation positioning. In this case, the patterns for the X and Y axes should be the same. The X and Y axis patterns are checked before operation and any error will stop positioning.

- Positioning continues with speed change

The positions are reached consecutively in the order specified by their data numbers by a single start signal. During positioning, the speed may be changed but the direction remains the same. (Refer to Fig. 3.19.)

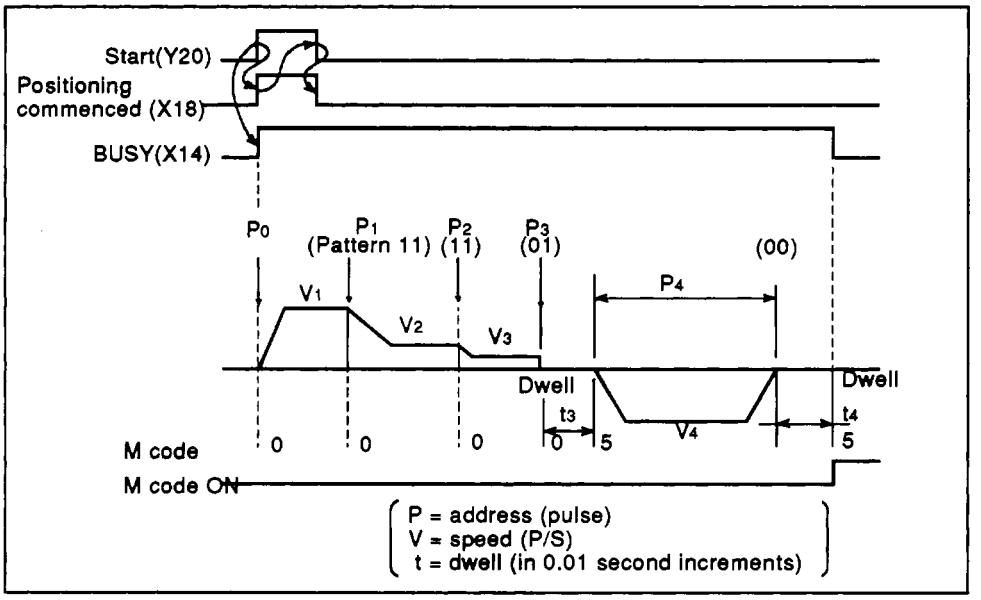


Fig. 3.19 Pattern 11

Table 3.8 shows the positioning data for Fig. 3.19. The following conditions apply:

M code ON/OFF timing : AFTER mode
Incremental/absolute method : Incremental and absolute combined

Table 3.8 Positioning Data

	Data No.	Pattern	Speed	Address	Dwell	Method	M code
X axis	100	11	V_1	P_1	–	Abs.	0
	101	11	V_2	P_2	–	Abs.	0
	102	01	V_3	P_3	t_3	Ahs.	0
	103	00	V_4	P_4	t_4	Inc.	5
	104						
	105						
	106						
	107						
	108						

In the method column, Abs. indicates absolute method and Inc. incremental method.

POINTS

(1) For continuous positioning, pattern 11 should not be used more than nine times consecutively. Where a large number of consecutive 11 patterns are being used, they must be broken down by placing 01 pattern data every nine 11 patterns. (e.g. pattern 11 = 9 times, pattern 01 = 1 time, pattern 11 = 9 times, pattern 00 = 1 time).

(2) Always set pattern 00 in the final data block.

(3) While pattern 11 is continuing, the direction of movement and the positioning method should remain unchanged, only after pattern 01 or 00 may these be changed. If the speed is changed after deceleration has started, the new speed is ignored and, if the M code has been set in WITH mode, the "M code ON" signal is not given.

(4) During positioning using pattern 11, dwell time data and M code will be ignored.

(5) Interpolation positioning cannot be specified when pattern 11 is being used.

(b) Positioning methods

The positioning method specified in positioning data becomes valid only when a parameter positioning method was specified to use both incremental and absolute mode positioning.
(If the parameter positioning method is not specified to use both incremental and absolute mode positioning, the specification of the positioning method in positioning data is ignored, and the positioning method follows the setting in the parameter.)

POINT

While pattern 11 is continuous, positioning methods cannot be changed.
When use of both incremental and absolute mode positioning is specified, positioning methods can be changed after pattern 00 or pattern 01.

(c) Positioning direction

- For incremental mode positioning, the direction of travel relative to the previous address must be specified. (0 specifies forward, increasing address numbers and 1 specifies reverse, decreasing address numbers.)
  In absolute mode, the positioning direction is ignored.

(d) M code

Specifies an "M" code relevant to that position address. (range: 0 to 255)
The code should be set to 0 if it is not required.
During interpolation positioning, M codes are given individually for the X and Y axes. (X-axis M code, buffer address = 46. Y-axis M code, buffer address = 346.)

(2) Positioning speed

Specifies the speed at which the next position is to be approached.

POINTS

(1) Before operation, the parameter speed limit is checked and if the positioning speed exceeds the speed limit value, the parameter speed limit value is used.

(2) In the case of linear interpolation, the setting speed of the axis whose travel distance is smaller is ignored.

Therefore, when the combination of travel distance and speed differs greatly between the X and Y axes, the travel speed of either X or Y may be larger than the setting speed. (The speed limit value is ignored.)

In the same case of linear interpolation, Mitsubishi recommends setting the same speed and speed limit value to both the X and Y axes.

Positioning speed for linear interpolation

During linear interpolation positioning, the speed set for the axis with the furthest to travel takes precedence and the speed of the other axis is derived as follows.

(Short travel axis speed)

$$= (\text{long travel axis speed}) \times \frac{(\text{short travel distance})}{(\text{long travel distance})}$$

An example of this is given in Fig. 3.20 which uses the following data:

	X Axis	Y Axis
Parameter set value : speed limit value	20 KPLS/sec	50 KPLS/sec
Positioning data set value : positioning speed	20 KPLS/sec	50 KPLS/sec

To move from point A (address 0, 0) to point B (100 kp, 200 kp), X-axis travel is less than Y-axis travel so Vy = 50 kp/s has precedence.

$$\text{X-axis positioning speed} = 50 \times \frac{100}{200} = 25 \text{ KPLS/sec}$$

(This speed exceeds the speed limit value which is ignored in this case.)

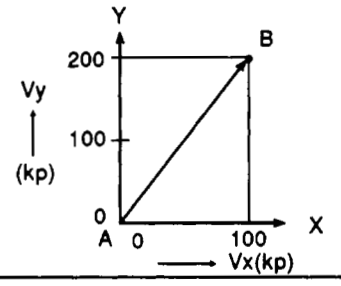


Fig. 3.20 Linear Interpolation

Note)

In case of interpolation positioning, the actual positioning speed is approx. 5% slower than the set speed.

When the set speed is too slow, the error range becomes large.

Example: When 100 PPS is set, the error range becomes approx. 10% large.

REMARK

Positioning speeds are multiplied by 6.1 (PLS/sec).
For example, when a positioning speed is 200 (PLS/sec), the maximum speed to be output from A1SD71 is as follows:
200 = 6.1 x n....n = 32.7868....
Therefore, the maximum speed is 6.1 x 32 = 195.2 (PLS/sec).

(3) Positioning address

Set the positioning address in accordance with the positioning method.

- When using the incremental method, set the travel distance. When using the absolute method, set the address value.

(4) Dwell time

The dwell time is the period of time indicated in Fig. 3.21 below.

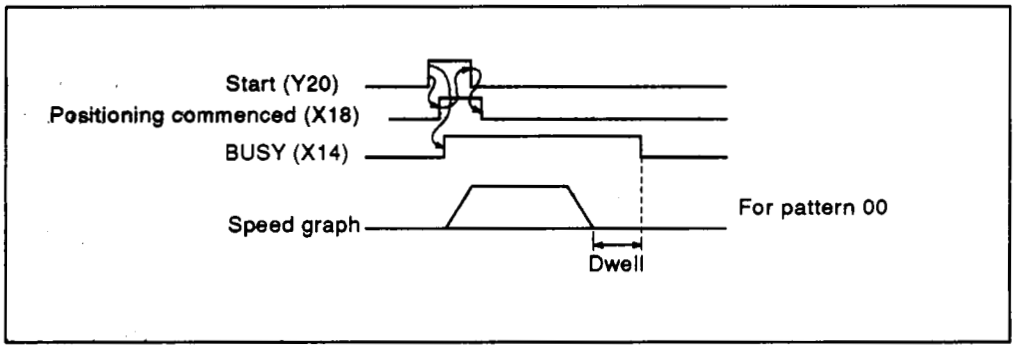


Fig. 3.21 Pattern 00

During interpolation positioning, the longer dwell time value is valid irrespective of the distance travelled (e.g. if X axis = 1 sec and Y axis= 1.5 sec, 1.5 sec is valid.)

3.5 Buffer Memory

The A1SD71 has a battery backed buffer memory for communication of data with the A1SCPU. The memory map is shown in Fig. 3.28.

Data can be read from the buffer memory as follows:

- Reading data using the sequence program

  One word (16 bit) or two word data can be read by using the buffer read application instructions.
- Reading data using the peripheral device

  Data can be read in the various modes of a peripheral device.

  For details, refer to the SW0GP-A1SD71P Operating Manual.

Data can be written to the buffer memory as follows:

(The writing of data may be restricted depending on the status of the A1SD71. General write conditions are shown in Fig. 3.28. For further details, refer to Section 3.5.1 to 3.5.5.)

- Writing data from the sequence program

  One word (16 bit) or two word data can be written by using the buffer write application instructions.
- Writing data from the peripheral device

  Data can be written by storing data to a memory area in the peripheral device and transferring data in blocks from the peripheral device to the A1SD71 buffer memory.
  One word (16 bit) or two word data can be written to the A1SD71 buffer memory by using the AD71TU .

An additional function allows individual pieces of positioning data to be written to the buffer memory if the A1SD71 is busy. For details, refer to the SW0GP-AD71P Operating Manual.

REMARK

For buffer memory access instructions, refer to Chapter 6 "Programming."

			Description	Source of data	
				Sequence program	Peripheral device or AD71TU
0 to 200	X-axis positiong start data		Area for positiong start data numbers, etc. (For X axis)	Depends on data	Write enabled when both X-axis and Y-axis BUSY signals sre off.
201	Error reset		Area for error reset	Write enabled at any time	Write enabled at any time
202	X-axis inching output speed		Area for output speed during inching operation (for X axis)	Write enabled at any time	———
			Unused	———	———
300 to 500	Y-axis position start data		Area for positiong start data numbers, etc (For Y axis)	Depends on data	Write enabled when both X-axis and Y-axis BUSY signals are off.
502	Y-axis inching output speed		Area for output speed during inching operation. (For Y-axis)	Write enabled at any time.	———
			Unused	———	———
512 to 767	For OS		OS RAM. Writng here is not allowed.	Write disabled	Write disabled
768 to 3871			Unused	———	———
3872 to 4271	Positiong information	X-axis positiong data	X axis positiong data area descibed in Seciton 3.4.3 (Maximum 400 positions) Data format as follows: Positiong information: 2 bytes (16 bits) Positong speed: 2 bytes (16 bits) Dwell time: 2 bytes (16 bits) Position address: 4 bytes (43 bits)	Write enabled at any time	Block tranfer of positiong data from peripheral drvice to A1SD71 is only enabled when PC ready dignal is off.
4272 to 4671	Positiong speed				
4672 to 5071	Dwell time				
5072 to 5871	Positiong address				
5872 to 6271	Positiong information	Y-axis positiong data	Y axis positiong data area descirbed in Section 3.4.3 (Maximum 400 positions) Data format as for X axis	Write enabled at any time	
6272 to 6671	Positong speed				
6672 to 7071	Dwell time				
7072 to 7871	Positiong address				
7872 to 7889	X-axis parameters		Paramter area explained in Sesction 3.4.1 (X axis)	Write only enabled when PC ready signal is off	Write only enabled when PC ready signal is off
7892 to 7908	Y-axis parameters		Parameter area explained in Section 3.4.1 (Y axis)		
7912 to 7918	X-axis zero return data		Zero return data area described in Section 3.4.2 (X axis)		
7922 to 7928	Y-axis zero return data		Zero return data area descirbed in Section 3.4.2 (Y axis)		

The above data may be read at any time.
Address are expresssed in decimal
(1 address = 2 bytes (16 bits).

Fig. 3.22 Buffer Memory Map

3.5.1 Positioning start data

The positioning start data area is shown in Fig. 3.23. The arrangement of the data is the same for both X and Y axes, only addresses are different.

POINT

Both the X-axis and Y-axis BUSY signals must be off to write this data into the A1SD71 from the peripheral device.

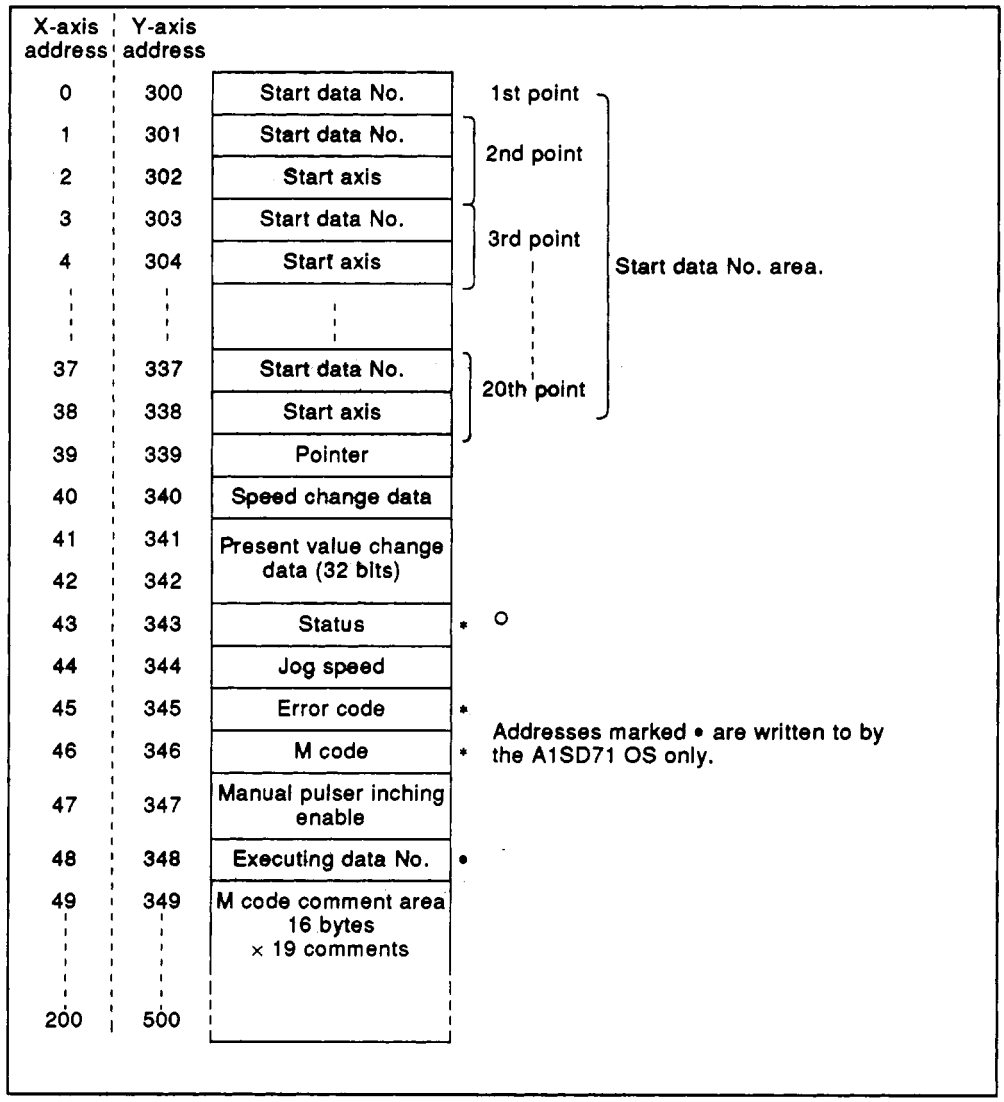


Fig. 3.23 Positioning Start Data Area

(1) Speed change area (X axis :address 40, Y axis :address 340)

To change the speed of traverse during positioning, jog operation or zero return, write the new speeds to these addresses. (To be within the range shown in Table 3.7) This data overrides the speed set in the positioning data. Speed change is illustrated in Fig. 3.24 below.

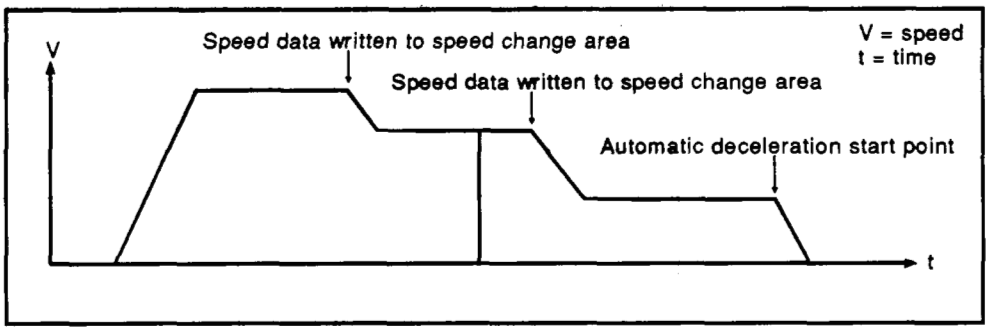


Fig. 3.24 Speed Change Example

POINT

Acceleration and deceleration cycles use the positioning data speed regardless of any forced speed change.
The speed cannot be force changed under the following circumstances:

- after a deceleration start point;
- in inching mode;
- after a stop command or after the jog signal is turned off; or.
- during interpolation positioning

(2) Present value change area
(X axis :address 41,42, Y axis :address 341,342)

To change the present value data in the A1SD71, write the new value to these addresses.

POINT

The present value cannot be changed while the A1SD71 is BUSY.
Present value data is two words long, one word data cannot be written.

(3) Jog speed area (X axis :address 44, Y axis :address 344)

Specify the jog speed by writing speed data to these addresses. This data may be written at any time.
JOG speed data set when the JOG start becomes valid.

(4) Manual pulser inching enable area (X axis:address 47, Y axis:address 347)

Enable the manual pulser inching function by writing a 1 to the least significant bit in this address. This data may be written at any time. (Refer to Fig. 3.25.)

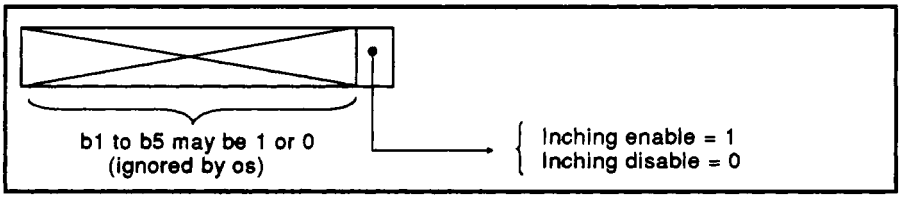


Fig. 3.25 Manual Pulser Inching Enable Area

(5) M code comment area (X axis :address 49 to 200, Y axis :349 to 500)

Up to 16 ASCII characters may be entered as M code comment data (using the peripheral device or sequence program).
Comments may be written to M code numbers 1 to 19 for both X and Y axes.

How to use:

1) Monitoring by a peripheral device
2) Reading using a sequence program, and displaying it externally.

(6) Status area (X axis :address 43, Y axis :address 343)

Is reserved for the information shown in Fig. 3.26 and is set by the A1SD71 OS.

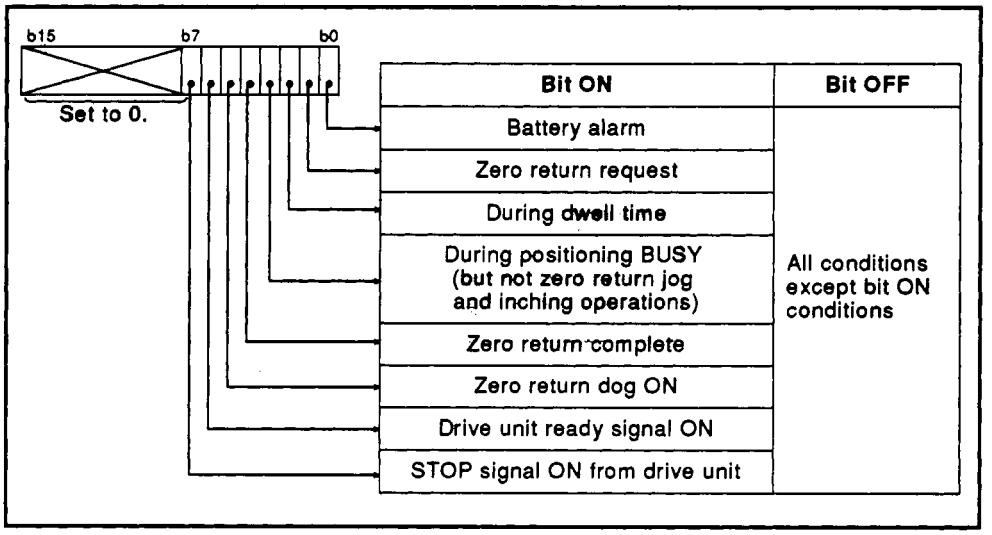


Fig. 3.26 Status Area

POINT

Do not write data to this area.

(7) Error code area (X axis :address 45, Y axis :address 345)

The code number of any error detected by the A1SD71 is written to these addresses by the OS. Use in conjunction with the error detection signal (X1B).

POINTS

- The error code area is used by the A1SD71 OS and data must not be written here.
- The most recent error code is written to this area. The absence of any error is indicated by a "0" in this address.
  It takes 20 to 30 msec to set an error code after outputting an error detection signal (X1B).
- For error codes, refer to Chapter 8.

(8) M code area (X axis :address 46, Y axis :address 346)

The "M code" specified in the positioning data for the current positioning operation is written to these addresses. The M code number can be used to co-ordinate external equipment and processes.

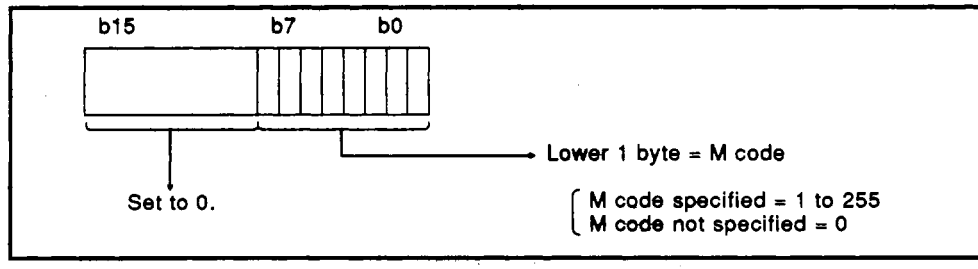


Fig. 3.27 M Code Area

POINTS

- Do not write data to these addresses.
- For M code data timing details, refer to Section 3.4.1 (16).

(9) Current data number area (X axis :address 48, Y axis :address 348)

The number of the positioning data block currently being processed is written to these addresses by the A1SD71 OS. This number is retained until the next positioning operation begins. (Refer to Fig. 3.28.)

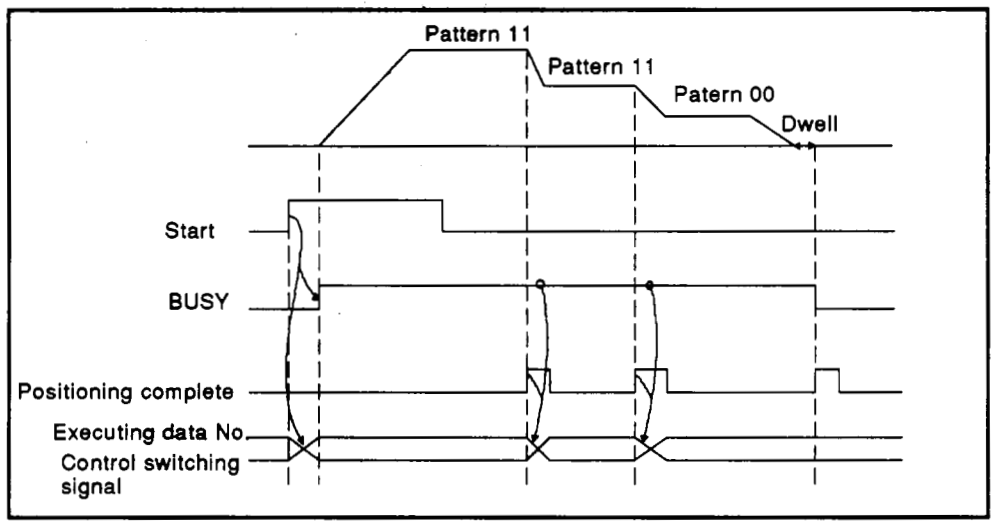


Fig. 3.28 Current Data No. Update Timing

POINT

Do not write data to these addresses.

(10) Start data number area (X axis :address 0, Y axis :address 300)

Positioning is executed sequentially by data number using a one-time start signal in the positioning control mode, and positioning operations are completed by positioning END of positioning pattern 00.
To execute the previously mentioned series of positioning operations continuously, the first data number (start data number) and the start axis of the positioning operation series are registered. This area is called a start data number area.
A start data number area with a maximum of 20 points can be set as shown in Fig. 3.29.

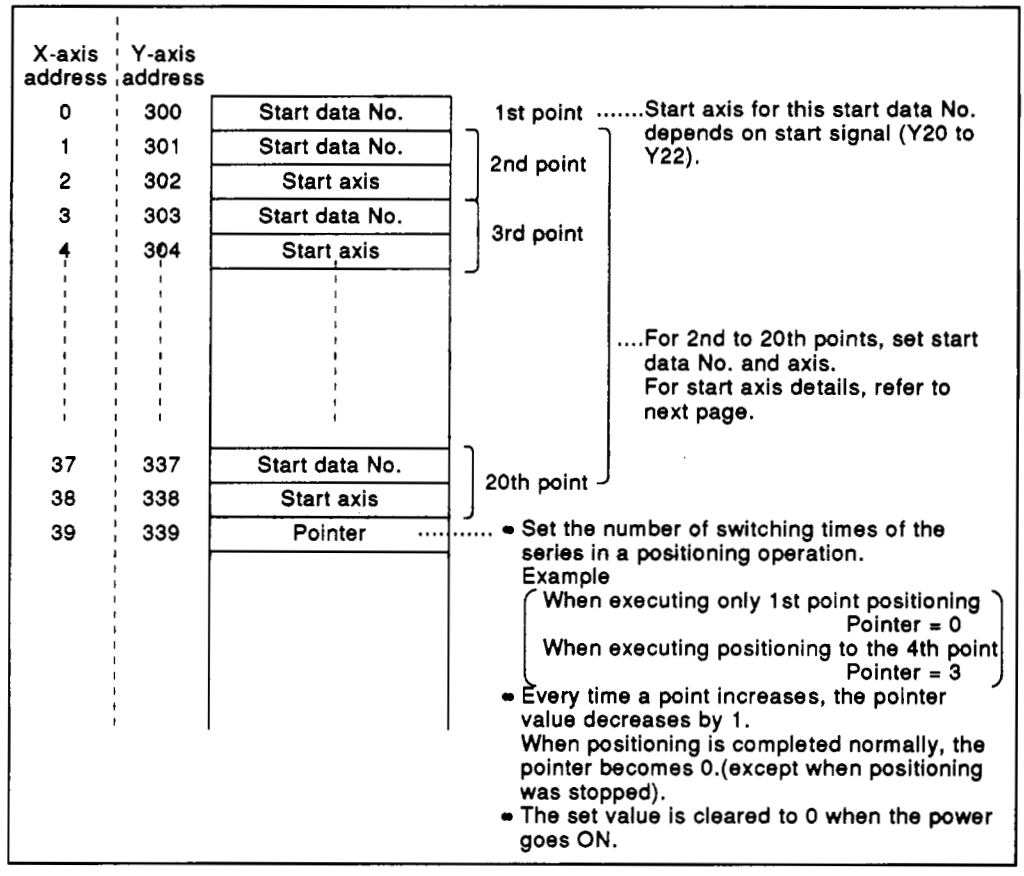


Fig. 3.29 Start Data Number Area

POINTS

- When positioning of the start data number of the 20th point is completed, positioning is completed even if the value of a pointer is not 0 (however, an error code is set).
- The BUSY signal remains ON during switching to the next point after positioning of the 1st point has been completed.

(a) Start axis area details

Use the two least significant bits of these addresses to define the start axis. (See Fig. 3.30.)

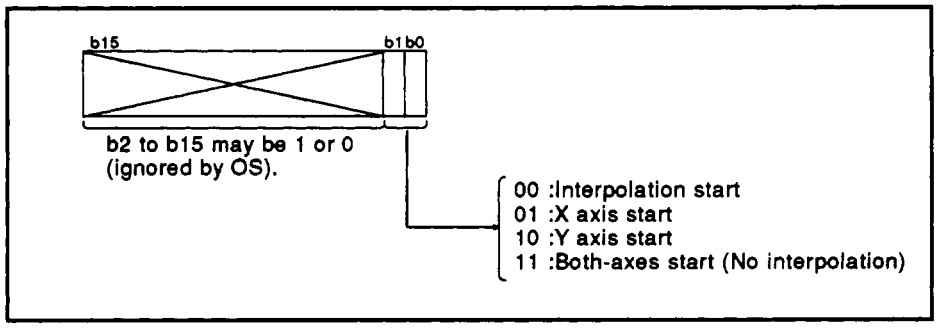


Fig. 3.30 Start Axis Area

The following occurs if both axes are started and an error is found in one:

1) Both axes stop if the error has occurred between consecutive positions.
2) Only the axis with the error stops if the error occurred after both axes have started.

(b) Data setting precautions

1) When both axes are to be started together (i.e. interpolation setting 00 or independent setting 11) ensure that the start axis data matches for both X and Y axes at that point. Processing will stop if the data does not match. Refer to Fig. 3.31.

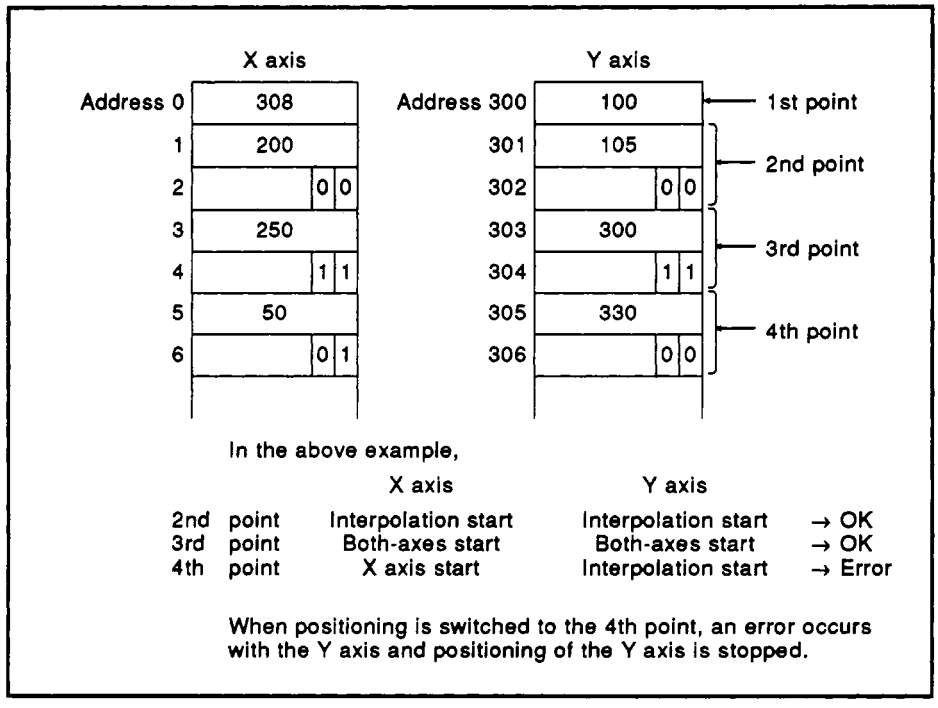


Fig. 3.31 Start Data Example 1

2) If the start axis in the X-axis start data number area is set at the Y axis (10), the point data is ignored (positioning is not executed) and the next point is processed. (Refer to Fig. 3.32.)
If the start axis in the Y-axis start data number area is set at the X axis (01), the next point is processed.

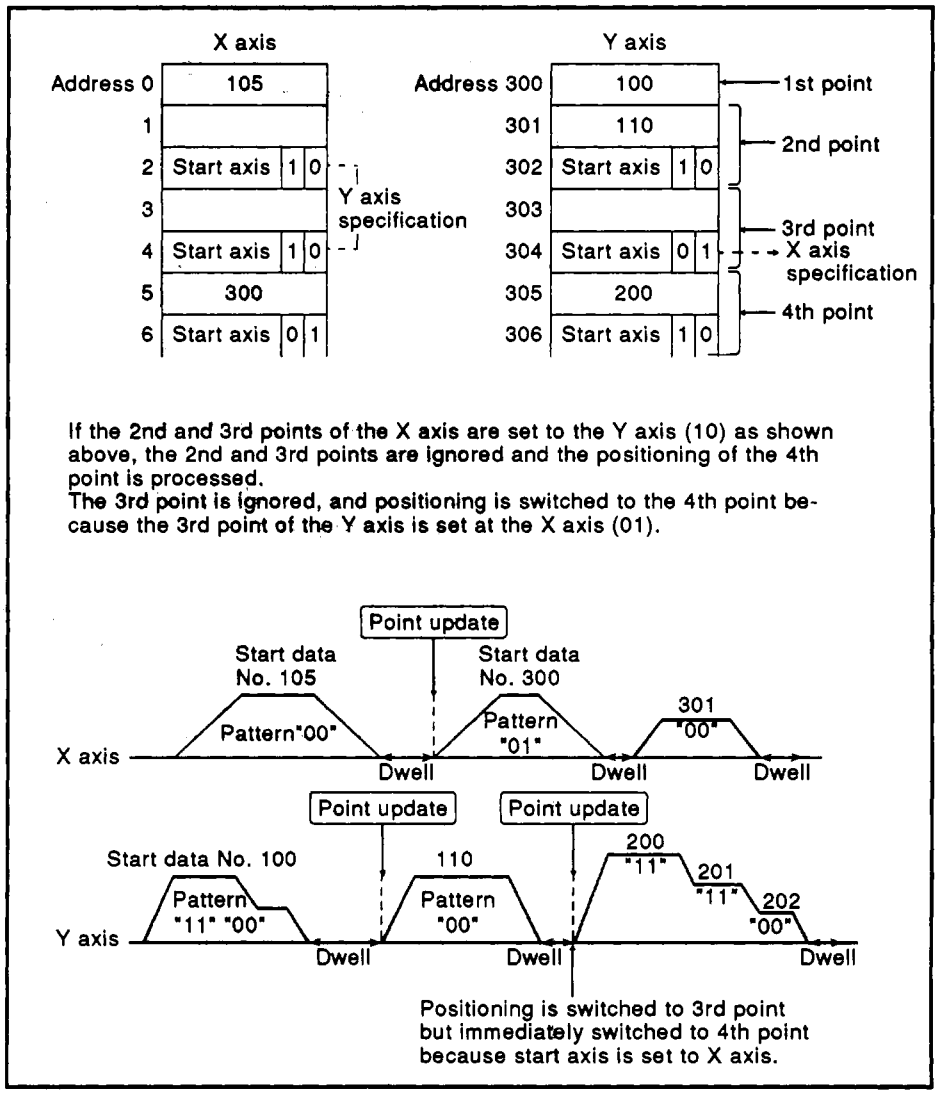


Fig. 3.32 Start Data Example 2

3) When the start axis is set to interpolation start (00) or both-axes start (11) and the other axis is not set to BUSY, the other axis starts positioning automatically using the start data number set at the point that is the same as its own axis (refer to Fig. 3.33).
If the M code ON signal of the other axis goes ON at this time, an error occurs.

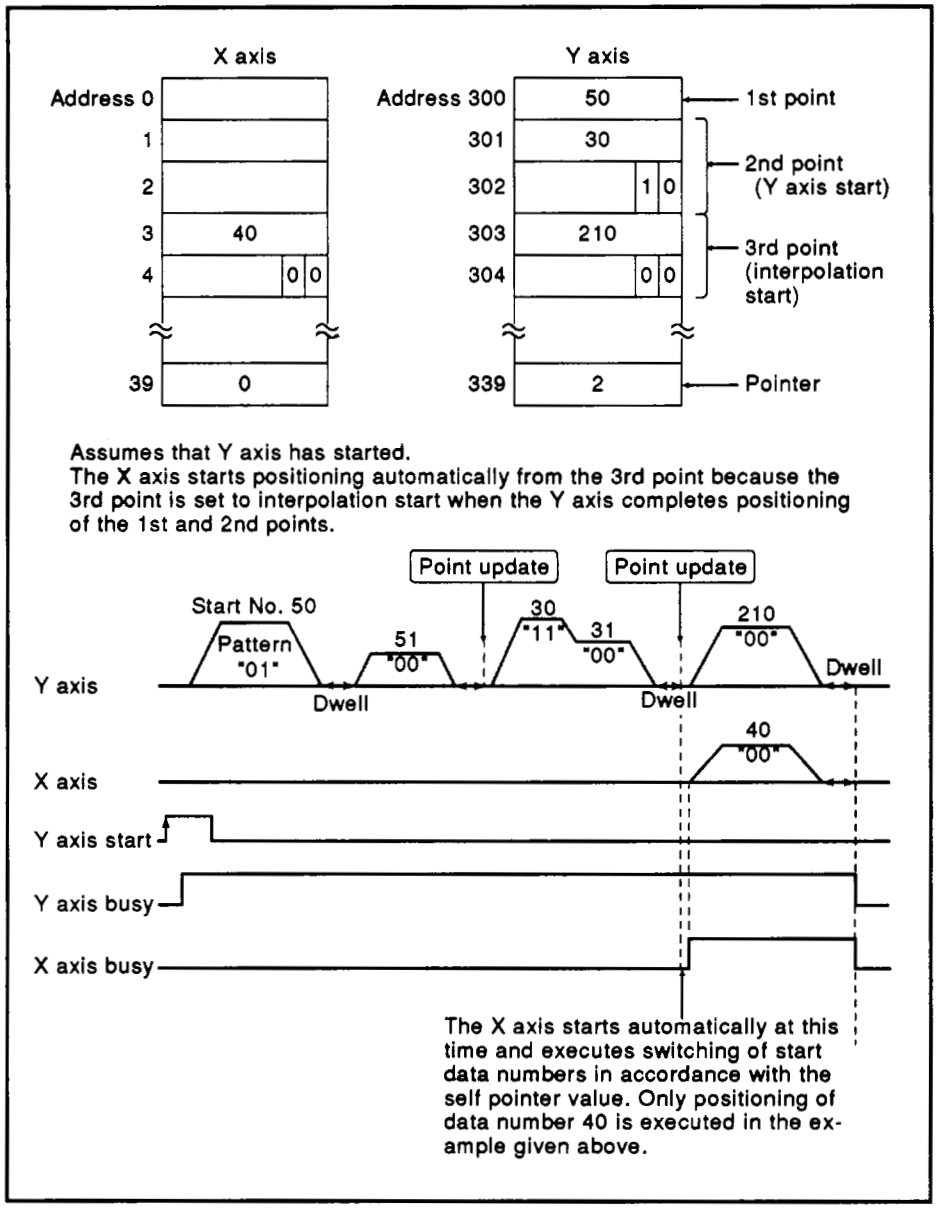


Fig. 3.33 Start Data Example 3

4) Processing will stop if interpolation (00) or independent (11) operations have been called and the other axis is under different control (e.g. zero return jog operation or inching).
(See Fig. 3.34)

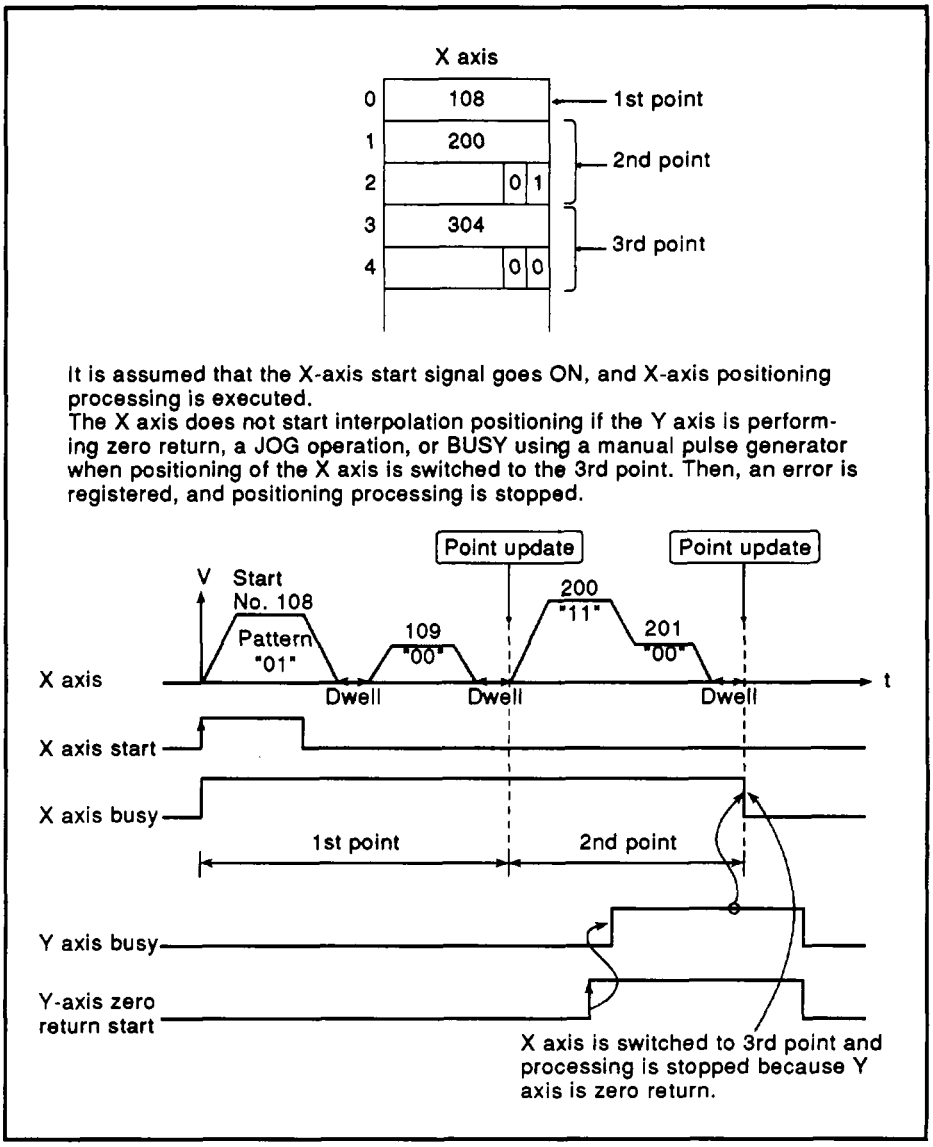
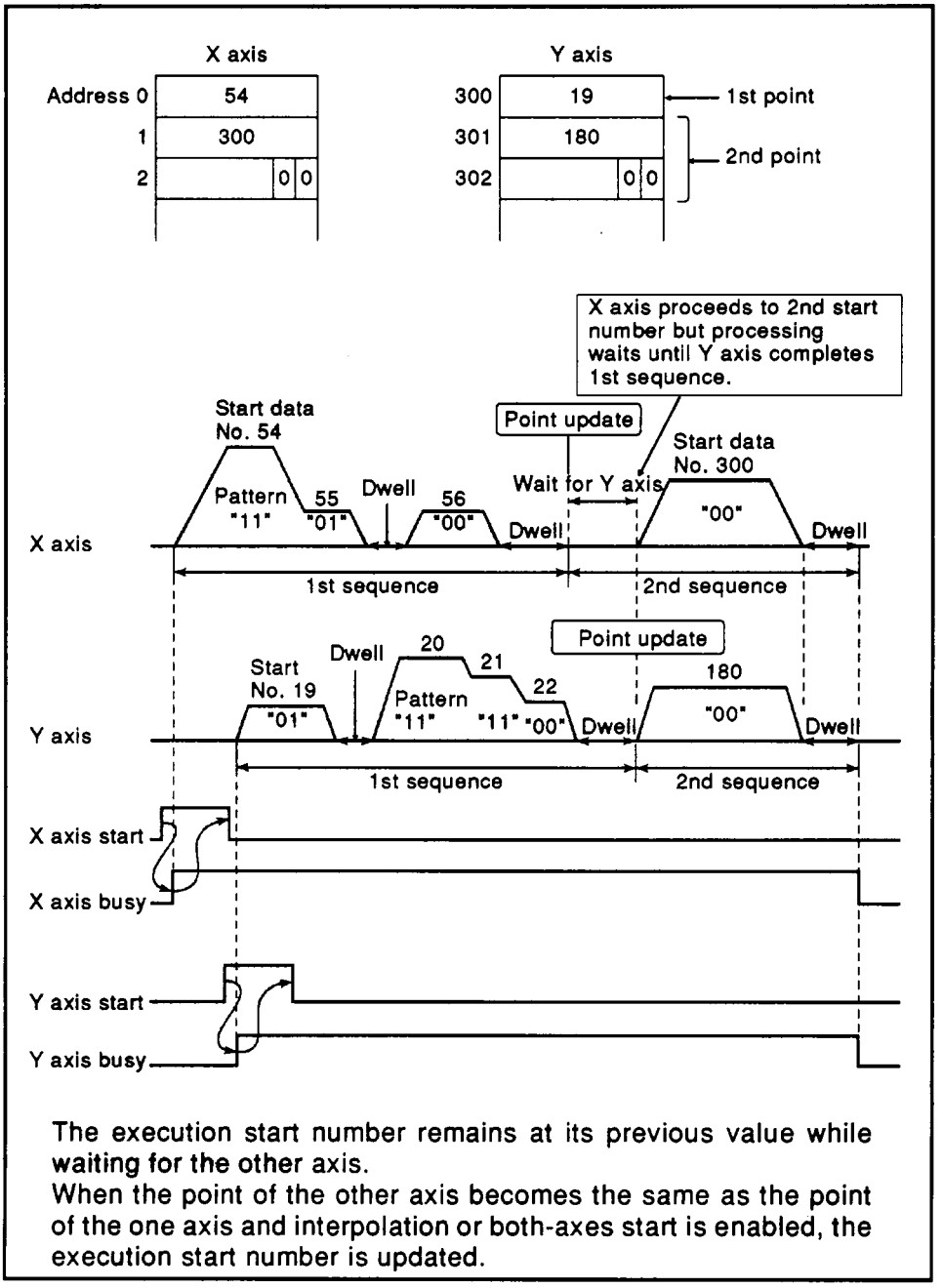


Fig. 3.34 Start Data Example 4

5) In a situation where interpolation (00) or independent (11) start has been defined at one axis and the other axis is still positioning, processing will vary as described below.

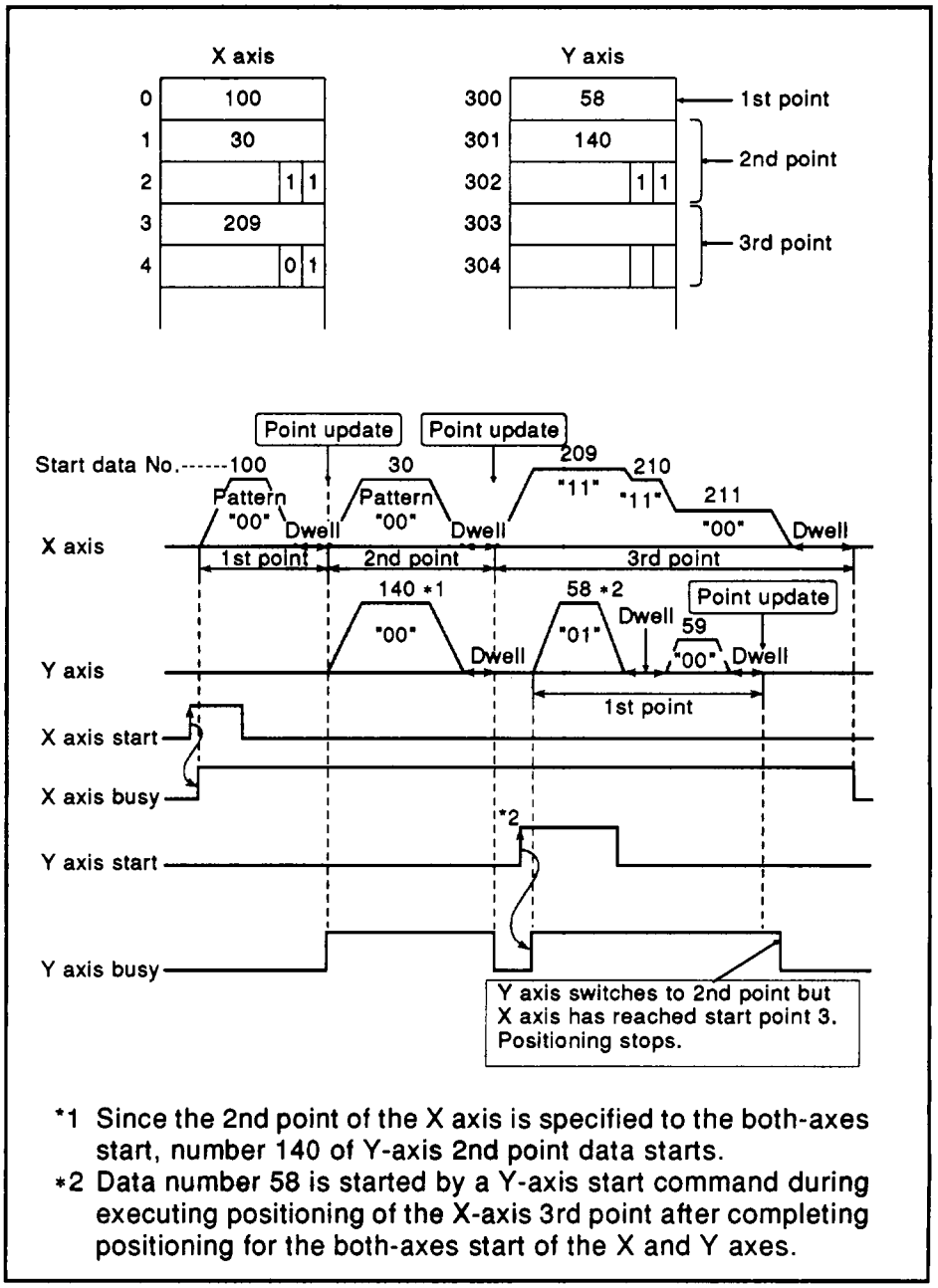
- An axis will wait for the other to finish its current process or for its busy signal to turn off. This is illustrated in Fig. 3.35 below.



The execution start number remains at its previous value while waiting for the other axis.
When the point of the other axis becomes the same as the point of the one axis and interpolation or both-axes start is enabled, the execution start number is updated.

Fig. 3.35 Start Data Example 5

- Processing will stop if one axis proceeds ahead of the other and dual axis processing is called. See Fig. 3.36.



*1 Since the 2nd point of the X axis is specified to the both-axes start, number 140 of Y-axis 2nd point data starts.

*2 Data number 58 is started by a Y-axis start command during executing positioning of the X-axis 3rd point after completing positioning for the both-axes start of the X and Y axes.

Fig. 3.36 Start Data Example 6

3.5.2 Error reset (Address 201)

The error codes for both axes can be reset by writing a 1 to the least significant bit of this address. This also resets the error detection signal X1B.
The OS then acknowledges that error signals have been reset by writing a 0 to this bit.

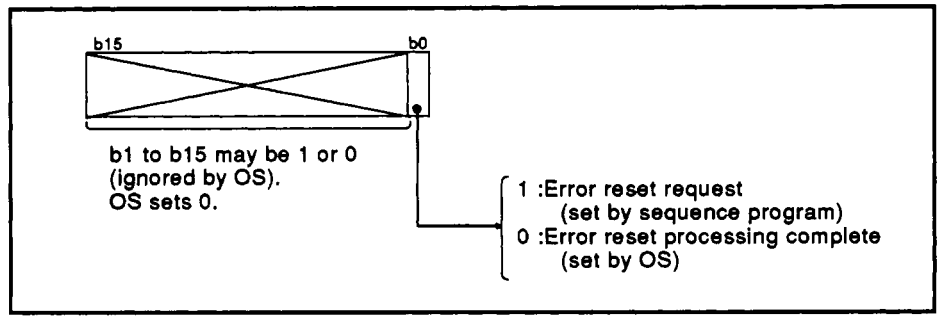


Fig. 3.37 Error Reset Area Details

3.5.3 Inching output speed area (X axis: address 202, Y axis: address 502)

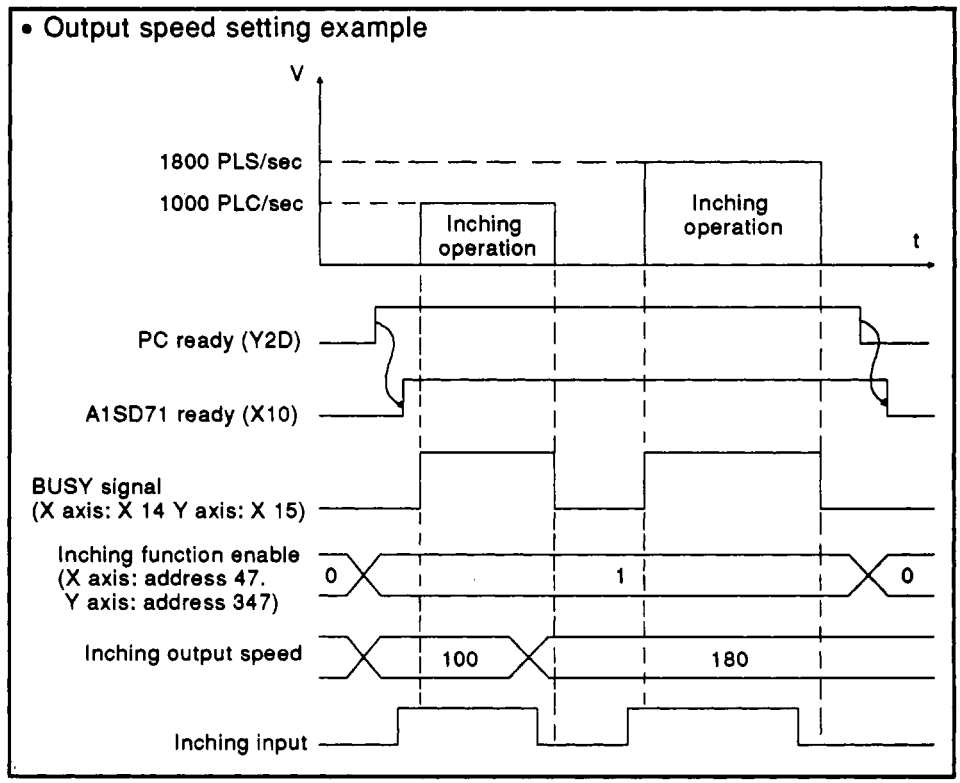
Specifies the output speed during inching operation.
The speed is specified in this area for positioning using the inching operation.

(1) The applicable output speed range is 10 to 20000 PLS (unit: 10 PLS/sec).

(2) Sets a tenth of the operation speed to be executed. Ex.) When the inching operation is to be executed at 2000 PLS/sec, set to "200".

(3) Output speed data cannot be written using the peripheral device.

(4) Output speed data is written via the user's PC program at any time. However, the data becomes available when the BUSY signal switches from OFF to ON.



3.5.4 OS data area (Addresses 512 to 767)

Addresses 512 to 767 are used by OS. The user cannot write data in this area. Data shown in Fig. 3.38 can be read and used with a sequence program. (Section 6.3.2 gives details about the reading method.)

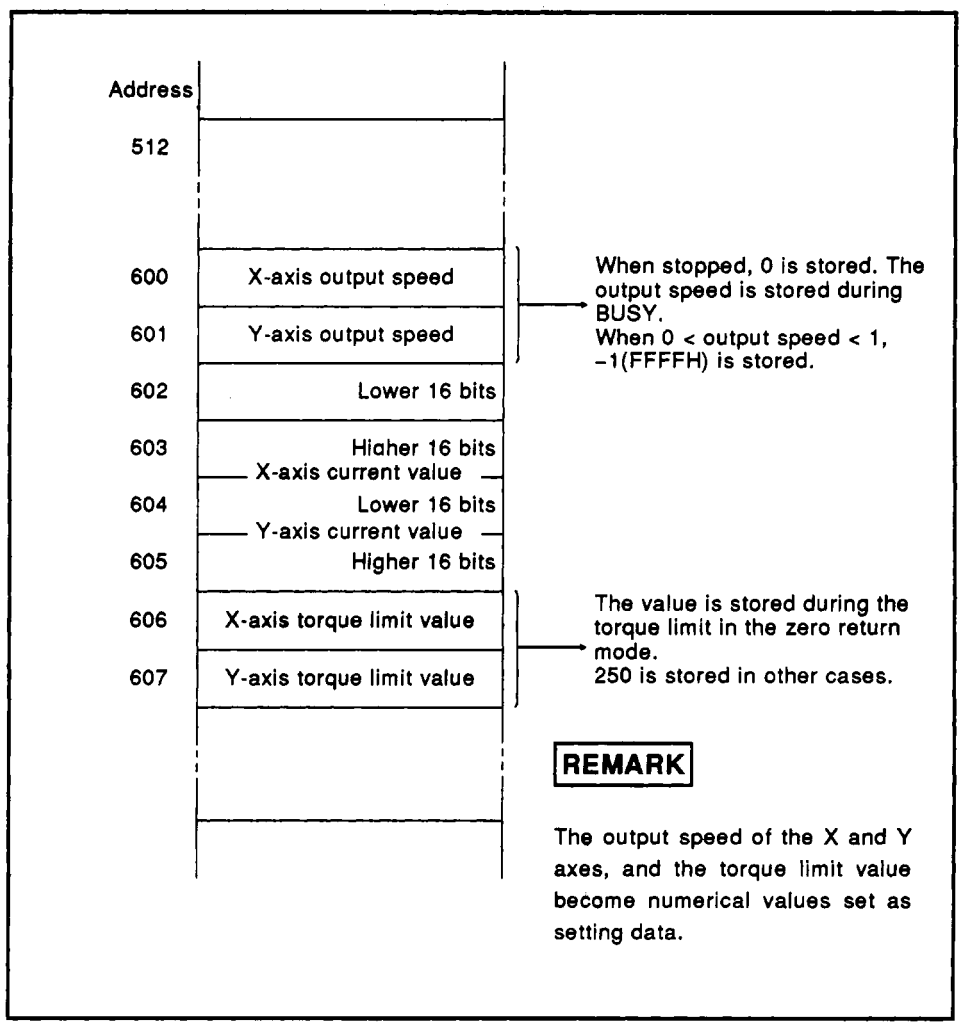


Fig. 3.38 OS Data Area

3.5.5 Positioning data area (X axis :address 3872 to 5871, Y axis :address 5872 to 7871)

This area stores the positioning data explained in Section 3.4.3. The positioning data consists of positioning information, positioning speed, dwell time, and positioning address as shown in Fig. 3.39. For the conversion of expressions from a data number to a buffer memory address, refer to the next page.
As an example, for X axis data number = 2, data is stored in the following areas:

Positioning information :Address = 3873
Positioning speed :Address = 4273
Dwell time :Address = 4673
Positioning address :Address = 5074 (lower 16 bits),
5075 (upper 16 bits)

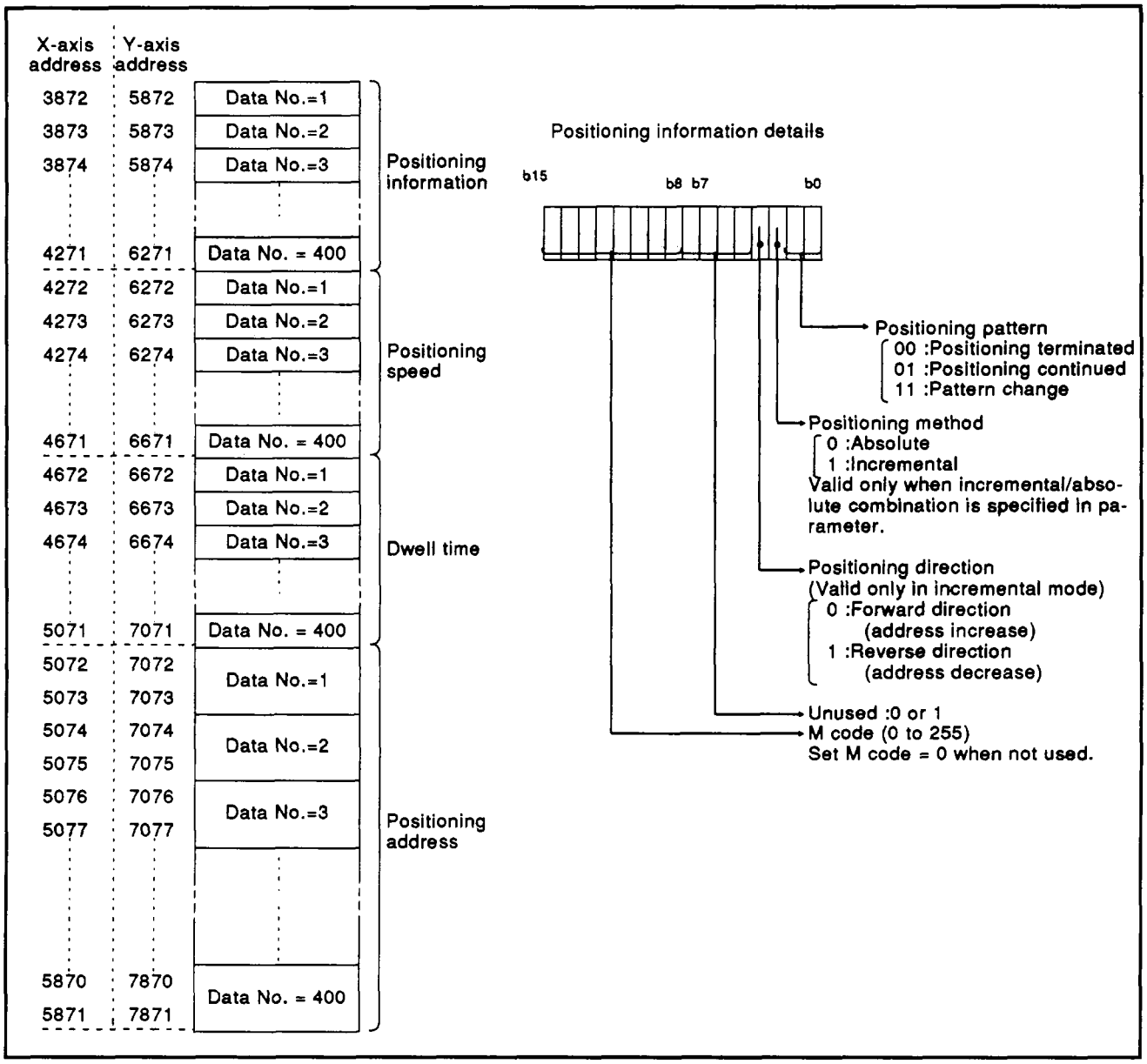


Fig. 3.39 Positioning Data Area

Method of converting from a data number to the buffer memory address

When using a sequence program to set positioning data that corresponds to data numbers, convert data numbers into a buffer memory address by the following:

	X Axis	Y Axis
Positioning information	A = 3872 + (data No. – 1) or A = 3871 + (data No.)	A = 5872 + (data No. – 1) or A = 5871 + (data No.)
Positioning speed	A = 4272 + (data No. – 1) or A = 4271 + (data No.)	A = 6272 + (data No. – 1) or A = 6271 + (data No.)
Dwell time	A = 4672 + (data No. – 1) or A = 4671 + (data No.)	A = 6672 + (data No. – 1) or A = 6671 + (data No.)
Positioning address	Lower 16 bits A_2 = 5072 + (data No. – 1) × 2 or A_2 = 5070 + (data No.) × 2	Lower 16 bits A_2 = 7072 + (data No. – 1) × 2 or A_2 = 7070 + (data No.) × 2
	Upper 16 bits $A_1 = A_2 + 1$	Upper 16 bits $A_1 = A_2 + 1$

REMARK

A conversion table is given in Appendix 5.

3.5.6 Parameter area (X axis :address 7872 to 7887, Y axis :address 7892 to 7907)

Stores the parameters described in Section 3.4.1.
See Fig. 3.40.

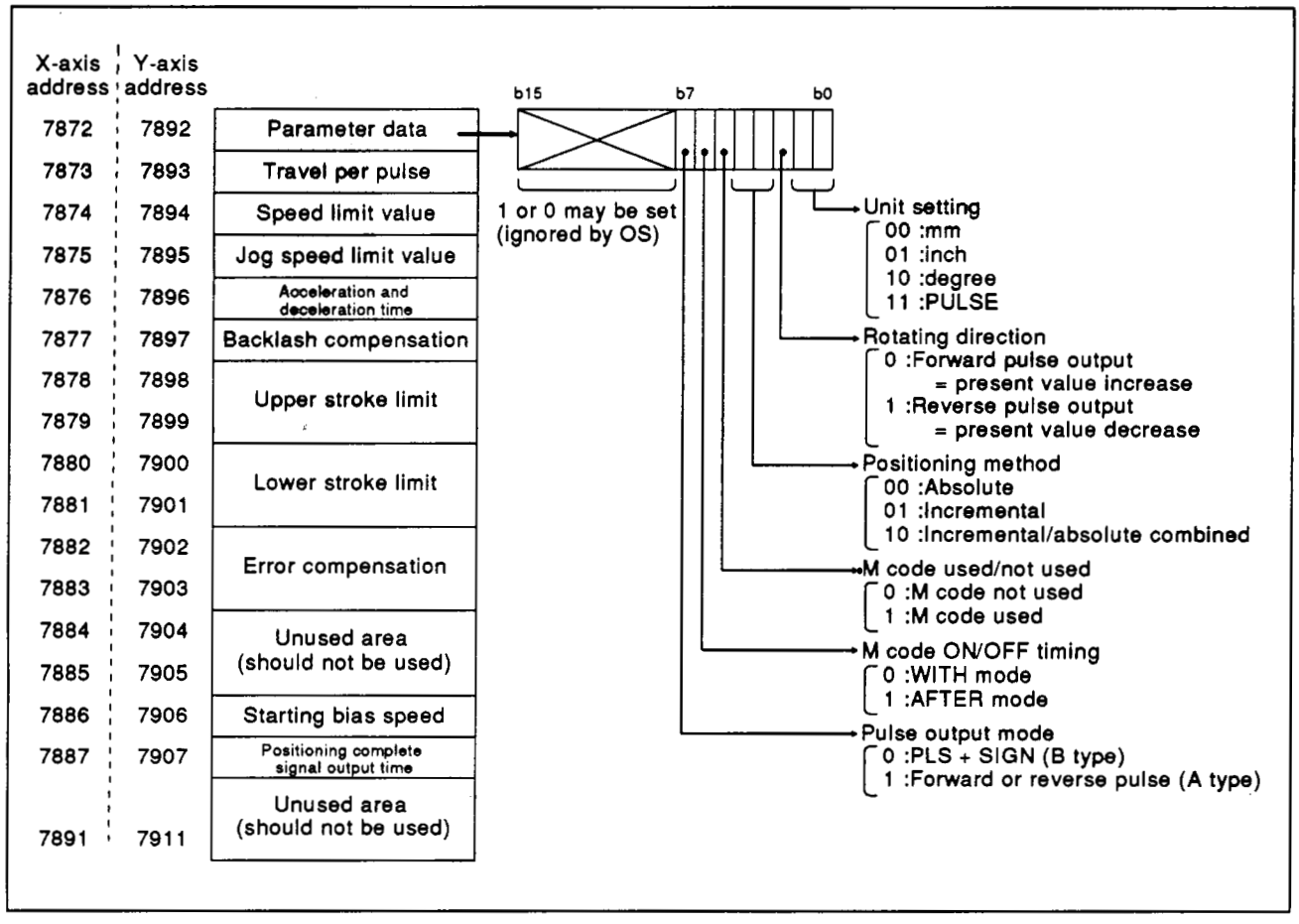


Fig. 3.40 Parameter Area

3.5.7 Zero return data area (X axis :address 7912 to 7918, Y axis :address 7922 to 7928)

Stores Zero return data described in Section 3.4.2.
See Fig. 3.41.

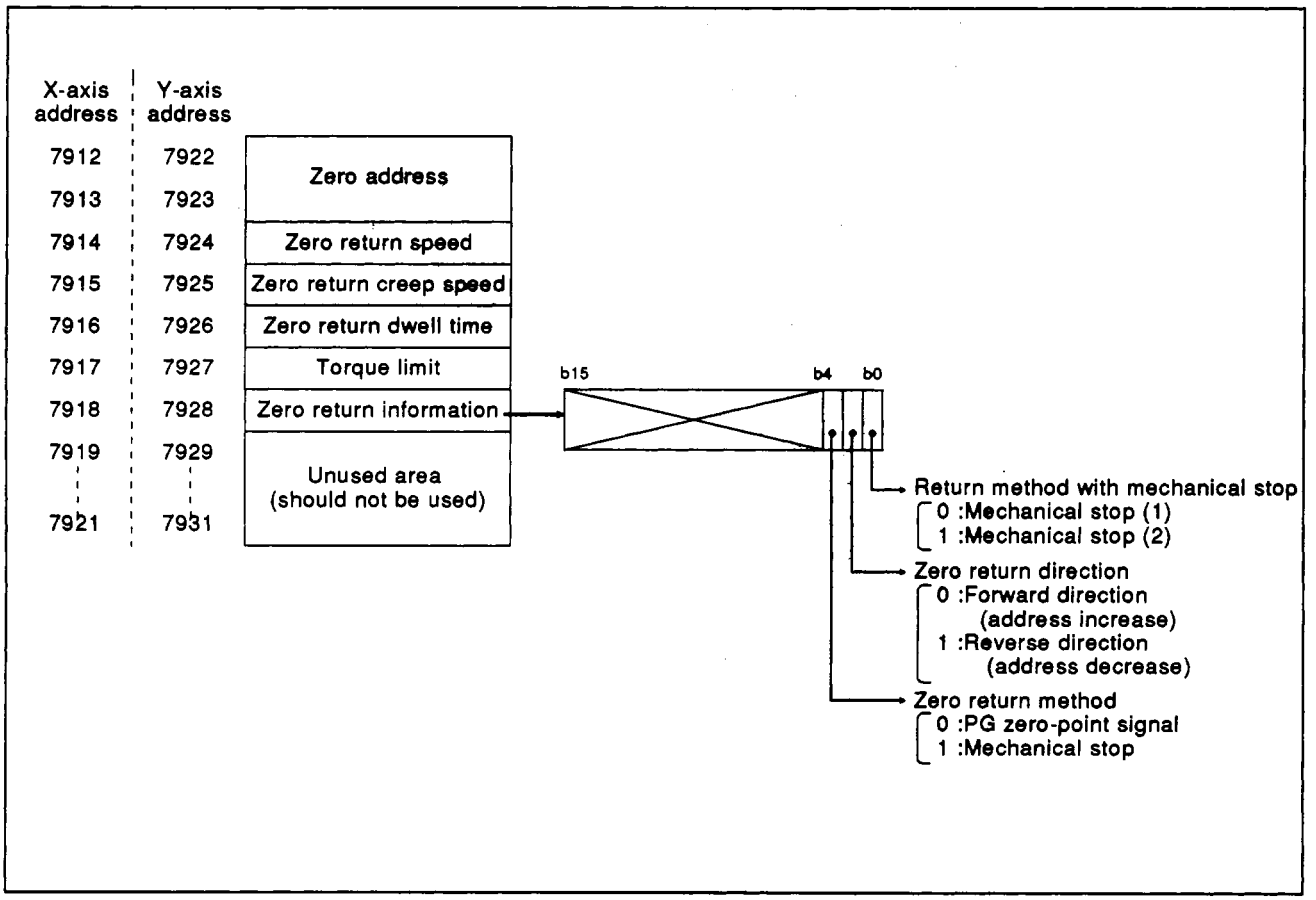


Fig. 3.41 Zero Return Data Area

3.6 I/O Signals To and From A1S CPU

The A1SD71 uses 16 inputs and 14 outputs for non-numerical com-munications with the A1SCPU. I/O signal assignment and functions are given below.

Table 3.9 shows I/O signals with the A1SD71 in slot No.0 and No.1 of the main base unit.
Device X indicates an input signal from the A1SD71 to the A1SCPU.
Device Y indicates an output signal from the A1SCPU to the A1SD71.

Table 3.9 I/O Signal List

Signal Direction: A1SD71 to A1SCPU			Signal Direction: A1SCPU to A1SD71		
Device number	Signal		Device number	Signal	
X0 to XF	Not used		Y0 to YF	Not used	
X10	Watchdog timer error (Detected by the A1SD71)		Y10 to Y1F	Used by system. Unavailable to the user.	
X11	A1SD71 ready				
X12	X axis	Positioning complete			
X13	Y axis				
X14	X axis	BUSY			
X15	Y axis				
X16	X axis	Zero return request			
X17	Y axis				
X18	X axis	Positioning commenced			
X19	Y axis				
X1A	Battery error				
X1B	Error detection				
X1C	X axis	Zero return complete			
X1D	Y axis				
X1E	X axis	M code ON			
X1F	Y axis				
X20 to X2F	Unusable		Y20	X axis	Positioning start
			Y21	Y axis	
			Y22	Interpolation	
			Y23	X axis	Zero return start
			Y24	Y axis	
			Y25	X axis	Stop
			Y26	Y axis	
			Y27	X axis Forward jog start	
			Y28	X axis Reverse jog start	
			Y29	Y axis Forward jog start	
			Y2A	Y axis Reverse jog start	
			Y2B	X axis	M code OFF
			Y2C	Y axis	
			Y2D	PC ready	
			Y2E	Used by system. Unavailable to the user.	
			Y2F		

IMPORTANT

Y2E, Y2F, X20 to X2F, and Y10 to Y1F are reserved for use by the OS or for special applications which are detailed later.
When the above devices are used (turned ON/OFF) using a sequence program, normal functioning of the A1SD71 cannot be guaranteed.

Detailed explanation of I/O signals

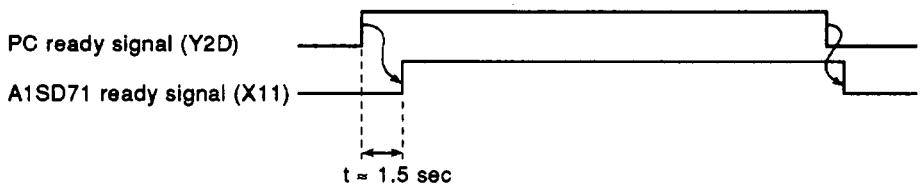
This section explains ON/OFF timing of I/O signals and I/O signal conditions. The numbers in ( ) shows the device number that corresponds to Table 3.9.
Fig 3.42 gives details about ON/OFF timing of I/O signals.

(1) Watchdog timer error signal (X10)

Switches ON when a WDT error occurs by using the A1SD71 self-diagnostic function.

(2) A1SD71 ready signal (X11)

Switches ON according to the ON/OFF state of the PC ready signal (Y2D). However, following time (t), the A1SD71 ready signal (X11) must be turned ON after checking parameter and zero return data when the PC ready signal (Y2D) goes ON.
Use this signal for the interlock in the sequence program.



(3) Positioning complete (X12, X13)

Switches on for a period set in the parameters after each position is reached. (Ignored if the positioning complete signal output time = 0.)
Switched off at positioning start, zero return start, inching start, jog start, and power on.
If positioning is stopped midway, the positioning complete signal does not switch on.
Positioning complete signals do not go on in the speed control mode.

(4) BUSY (X14, X15)

Switches on at positioning start, zero return start, inching start, and jog start. Switches off after pulse output and dwell time have elapsed. (Refer to Fig. 3.42.) (Remains on during positioning.)
Switches on while the test function is being used on the peripheral device or the AD71TU.

(5) Zero return request signals (X16, X17)

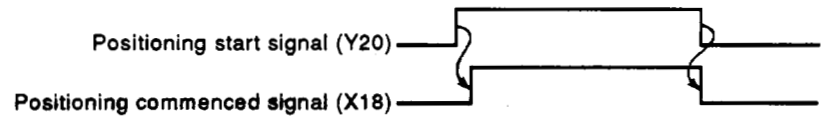
Switches ON when any of the following conditions occur, and OFF when zero return is complete.

When the power supply is turned ON to the A1SD71 module
When the drive unit READY signal ($\overline{\text{READY}}$) goes OFF during BUSY
After the PC ready signal (Y2D) goes ON, it takes about 1.5 seconds
When a parameter and a zero return data are written from the peripheral device
When zero return starts
When the following are selected in test mode of a peripheral device:

1) Zero return
2) Positioning
3) JOG operation
4) Manual pulser

(6) Positioning commenced signals (X18, X19)

When the A1SD71 starts positioning processing by positioning (zero return and the JOG operation are contained) and the start signal turns ON, these signals go ON. Then, these signals go OFF when the start signal turns OFF.



Not turned ON in the test mode by a peripheral device or AD71TU.

(7) Battery error (X1A)

Switches on when battery voltage drops.

(8) Error detection (X1B)

Switched on by any of the errors in Chapter 8. Switched off when the error is reset. For resetting, refer to Section 6.3.2 (7).

(9) Zero return complete (X1C, X1D)

Switches on to indicate the completion of zero return. Switched off at the start of the next process.

(10) M code ON signals (X1E, X1F)

These are turned ON when starting in the WITH mode.
When positioning is completed, they are turned ON in the AFTER mode.
When an M code OFF signal goes ON, the M code ON signal goes OFF.
If the M code is not designated (when M code is set to 0), the M code ON signal remains OFF .
This signal remains OFF in the test mode when using a peripheral device or AD71TU.

Remark

M code consists of the code numbers (1 to 255) allocated by a user to execute auxiliary functions (for example, clamp, drill rotation, stop, and tool exchange command) after positioning control using an A1SD71.
The PC CPU can execute specified auxiliary tasks by creating programs to go ON and OFF a relay ladder by using this M code.

(11) Positioning start (Y20, Y21, Y22)

Becomes valid at the leading edge of this signal.

(12) Zero return start (Y23, Y24)

Becomes valid at the leading edge of this signal.

(13) Stop (Y25, Y26)

One of these signals being ON stops zero return and positioning and JOG operations.
(If these signals are turned ON during BUSY, the M code ON signal goes OFF.)
After an operation stops, operations can be restarted by a positioning start signal. (Section 6.3.10 gives details about concrete examples.)

(14) JOG operation (Y27 to Y2A)

When these signals go ON, a JOG operation is executed. Operations are decelerated and stopped automatically by turning OFF this signal.

(15) M code OFF (Y2B, Y2C)

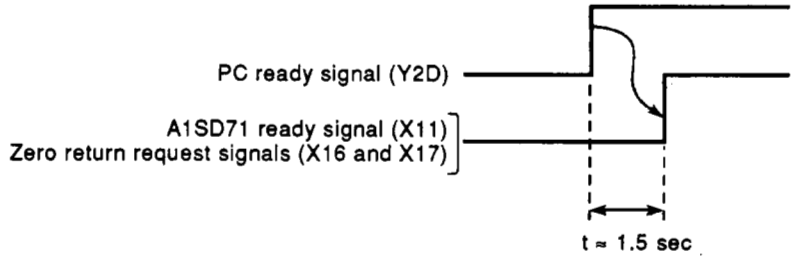
The leading edge of these signals makes the M code ON signal go OFF.

(16) PC ready signal (Y2D)

Sends the correct PC CPU operation to the A1SD71.
At the start of positioning, the zero return jog operations (other than those carried out in a peripheral device or AD71TU) signal must be ON.
However, if one axis is in BUSY in the test mode when using a peripheral device, the leading edge of the PC ready signal is ignored.
Then, when both axes are not in BUSY, execution takes place.

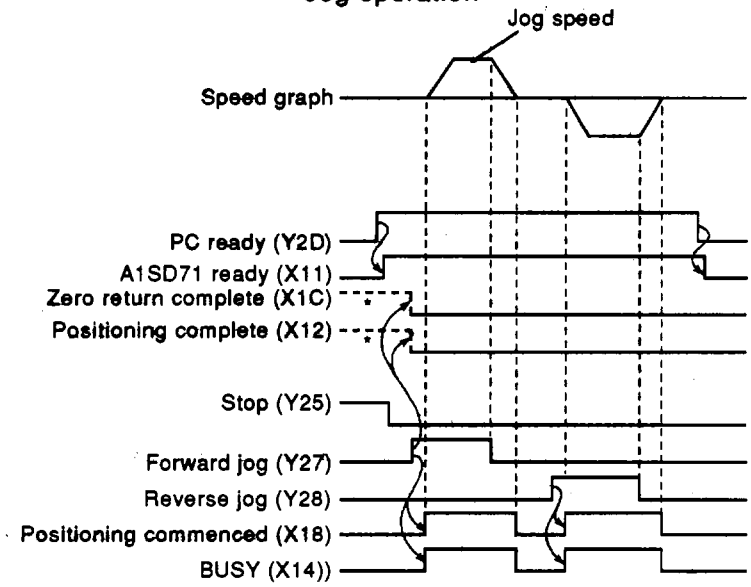
1) Parameter checking and initialization
2) Zero return data check
3) Zero return request ON, A1SD71 ready signal ON

The following time (t) the signal of 3) after a PC ready signal goes ON must go ON to process 1) and 2).

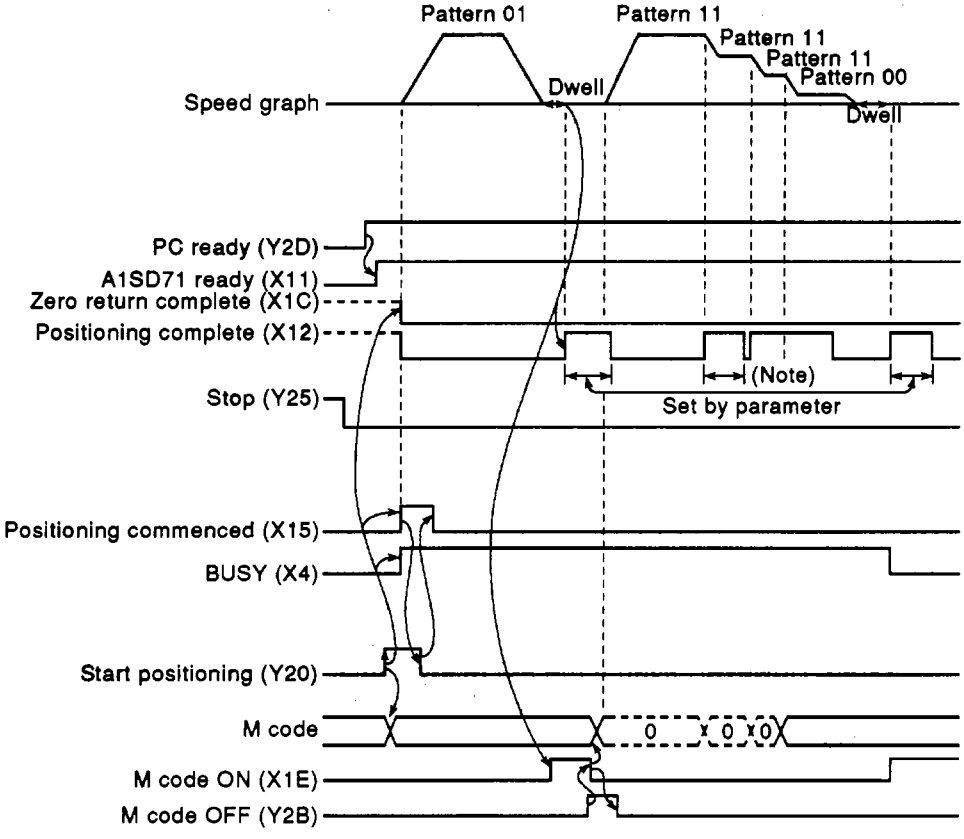


If the PC ready signal goes OFF when A1SD71 is BUSY, positioning is stopped. Then, the M code ON signal goes OFF, and the M code is cleared. However, even if the PC ready signal goes OFF in BUSY when using a peripheral device or AD71TU in the test mode, positioning does not stop.

Jog operation



Positioning operation



Note : If positioning operation is shorter than the positioning complete signal output time in the parameter, the positioning complete signal may be output continuously.

* : When a signal with a * symbol is ON before the positioning start signal goes ON, the signal with the * symbol goes OFF when the positioning start signal goes ON.

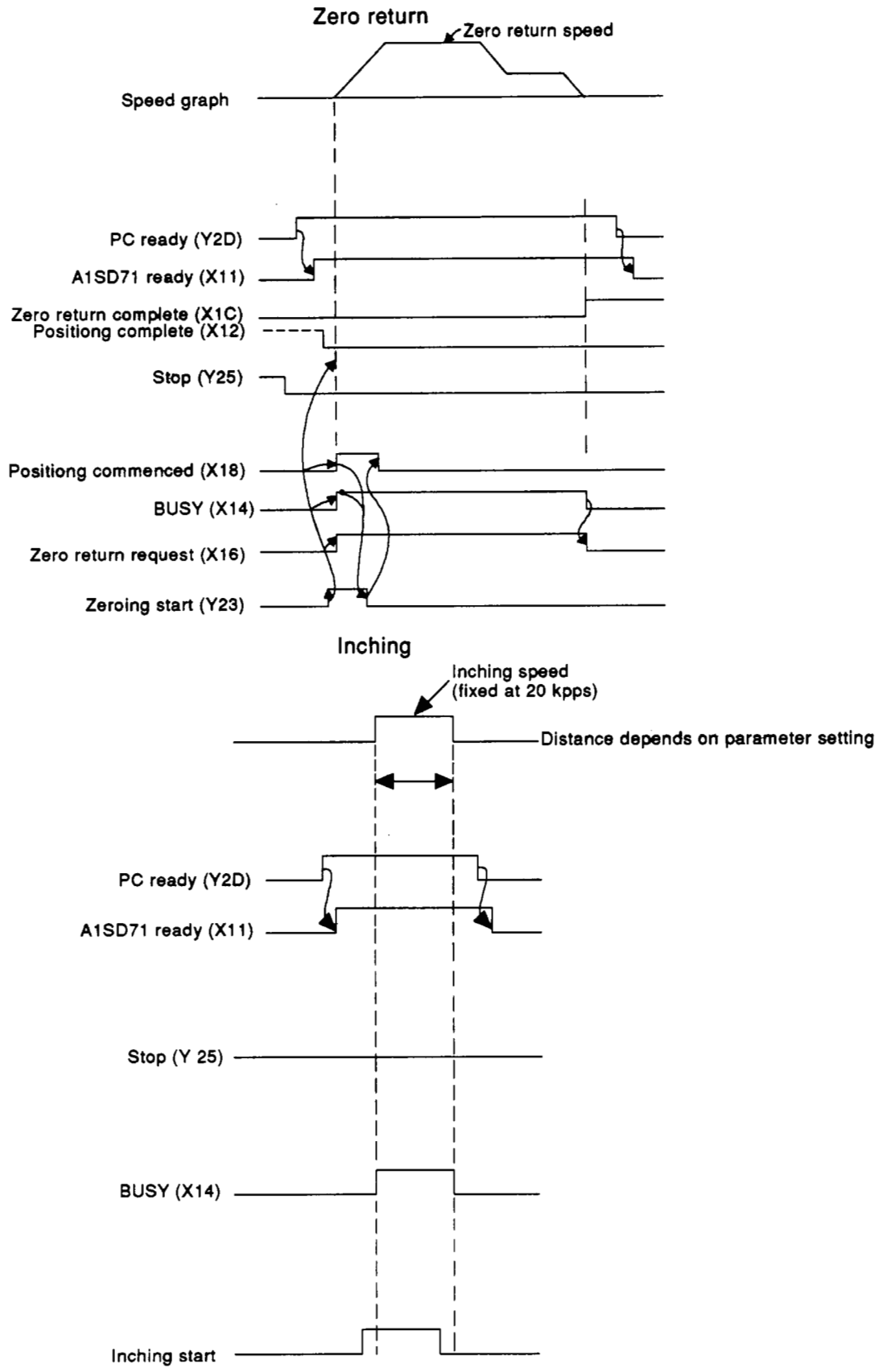
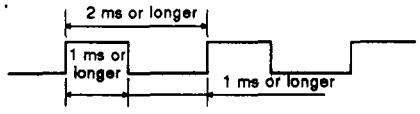
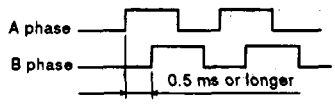


Fig. 3.42 I/O Signal ON/OFF Timing

3.7 I/O Interface with External Equipment

3.7.1 A1SD71 electrical specifications

Table 3.10 A1SD71 Electrical Specifications

I/O	Signal	Description
Input	Supply power	5 to 24V DC (Prepare a 4.75 to 26.4V stabilized power supply.) 50mA (maximum)
	Drive unit ready ($\overline{READY}$) Stop signal ($\overline{STOP}$) Near-point signal ($\overline{DOG}$)	High :(Supply power voltage - 1V) or more (Input current :0.3mA or less) Low :(Supply power voltage - 3V) or less (Input current :2.5mA or more)
	Inching A phase (PULSER A) Inching B phase (PULSER B)	Input voltage : 5 VDC $^{+20\ \%}_{-10\ \%}$ High : 4.5 V or more, 3 mA or more Low : 1.0 V or lessk, 0 mA Pulse width :  Phase difference:  [Positiong address (present value) increases if A phase leads B phase.] Input pulse rise, fall time : 500 µs max.
	Zero phase signal ($\overline{PGO}$)	High : (Supply power voltage -1 V) or more (Input current: 0.3 mA or less) Low : (Supply power voltage -3 V) or less (Input current: 3.5 mA or more) Pulse width : 50 µs or more Pulse rise time : 3 µs or less Pulse fall time : 3 µs or less
Output	Start signal ($\overline{START}$) Error detector clear ($\overline{CLEAR}$)	Output form :Open collector Load voltage :4.75 to 26.4V DC Load current :10mA (maximum) Max. drop voltage when ON :0.6V or less Leakage current when OFF :0.1mA or less
	Forward feed pulse ($\overline{PULSE\ F}$) Reverse feed pulse ($\overline{PULSE\ R}$)	Output form :Open collector Section 3.7.2 gives details about the pulse leading/trading edge time. Load voltage :4.75 to 26.4V DC Load current :50mA (maximum)

3.7.2 Pulse leading/trailing edge times of A1SD71 output signals

The pulse leading/trailing edge times of A1SD71 output signals and output ratio duty are shown below.

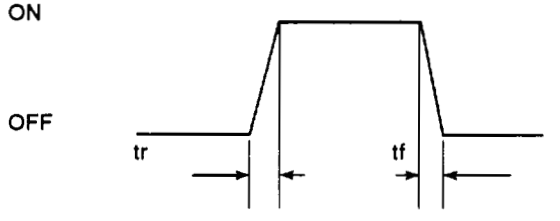
Unit tf, tr : μs Duty : %

Load voltage (V)		26.4								
Cable length (m)		1			2			3		
Load current (mA)	Pulse speed (KPPS)	tf (Leading edge)	tr (Trailing edge)	Duty	tf (Leading edge)	tr (Trailing edge)	Duty	tf (Leading edge)	tr (Trailing edge)	Duty
2	200	< 0.1	1.7	32	< 0.1	1.8	30	< 0.1	1.8	28
	100		3.0	40		3.4	36		3.6	32
	10		3.2	49		6.0	48		9.0	48
10	200	< 0.1	0.7	42	< 0.1	1.0	40	< 0.1	1.6	38
	100		0.7	46		1.1	45		1.6	44
	10		0.7	50		1.1	50		1.6	50
50	200	< 0.1	0.4	46	< 0.1	0.5	46	< 0.1	0.5	45
	100		0.4	48		0.5	48		0.5	48
	10		0.4	50		0.5	50		0.5	50

Unit tf, tr : μs Duty : %

Load voltage (V)		4.75								
Cable length (m)		1			2			3		
Load current (mA)	Pulse speed (KPPS)	tf (Leading edge)	tr (Trailing edge)	Duty	tf (Leading edge)	tr (Trailing edge)	Duty	tf (Leading edge)	tr (Trailing edge)	Duty
2	200	< 0.1	0.6	46	< 0.1	1.0	44	< 0.1	1.3	42
	100		0.6	49		1.0	47		1.3	46
	10		0.6	50		1.0	50		1.5	50
10	200	< 0.1	0.3	50	< 0.1	0.4	50	< 0.1	0.4	50
	100		0.3	50		0.4	50		0.4	50
	10		0.3	50		0.4	50		0.4	50
50	200	0.1	0.3	52	0.1	0.3	52	0.1	0.3	52
	100		0.3	52		0.3	52		0.3	52
	10		0.3	50		0.3	50		0.3	50

Pulse leading/trailing edge



3.7.3 Input/output interface specifications of the A1SD71 and an external device

The input/output interface specifications of the A1SD71 and an external device are given in Table 3.11.

Table 3.11 A1SD71 I/O Interfaces

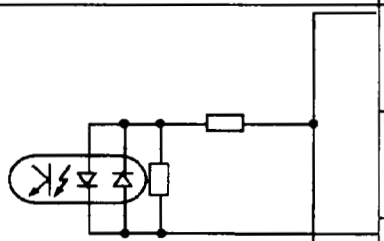
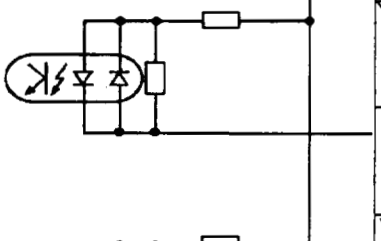
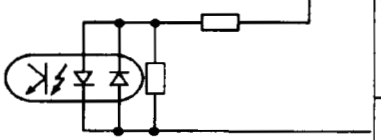
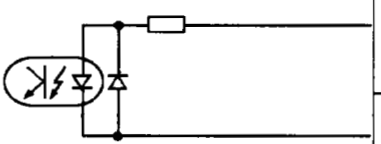
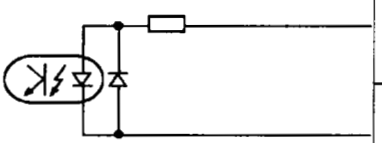
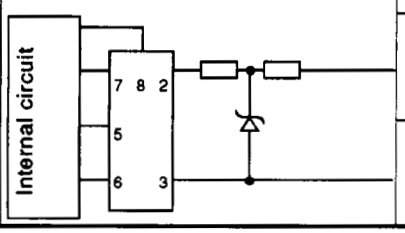
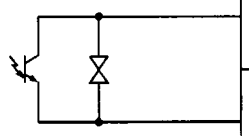
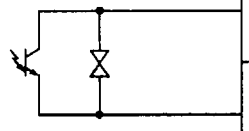
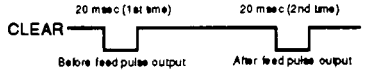
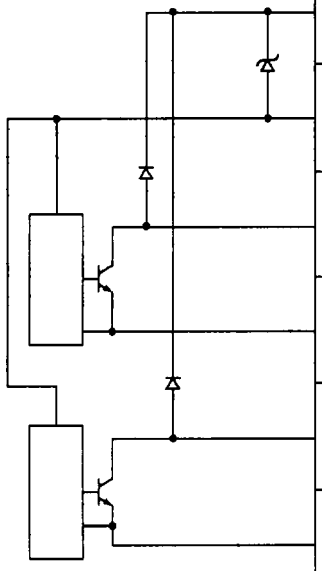
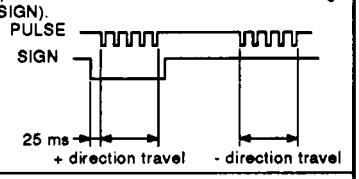
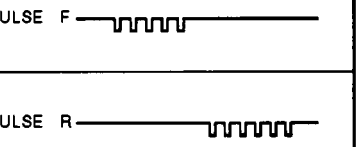
I/O	Internal circuit	Pin Number X axis	Pin Number Y axis	Signal	Description
Input		5A	7A	Common	5 to 24 VDC (external supply)
				Drive unit ready (READY)	(1) LOW indicates the servo drive unit is serviceable and the feed pulse is acceptable. (2) The A1SD71 checks the drive unit ready signal prior to start. If not ready, the A1SD71 outputs a zero return request. (3) Arrange for drive unit errors, e.g. a control power error, to set this signal HIGH. (4) Switching the signal to HIGH during positioning stops the operation. Resetting the signal will not restart the operation.
		5B	7B		
				Stop signal (STOP)	(1) LOW to stop positioning. Signal duration 20 msec or more. (2) A1SD71 stops positioning by using this signal and switches the start signal OFF (HIGH). When switching from HIGH to LOW, positioning is not started.
		6A	8A		
				Zero-point signal (DOG)	(1) Used to detect near-point during zero return. Switched to LOW by using the near-point actuator. The grid point is resolver phase angle 0. (2) When zero return by using the zero-phase signal, the zero point is away from the dog and becomes the first grid point after detecting the near-point dog.
		6B	8B		
		1A	3A	Inching A phase Pulser A	Refer to table 3.10.
		1B	3B		
		2A	4A	Inching B phase Pulser B	Refer to table 3.10.
		2B	4B		
		9A	10A	Zero-phase signal (PGO)	(1) Used as the zero signal at zero return. The zero-phase grid signal of the pulse encoder is normally used. LOW at zero. (2) Used when the zero return method uses stopper stop and zero return complete is externally input.
		9B	10B		

Table 3.11 A1SD71 I/O Interfaces (Continued)

I/O	Internal circuit	Pin Number X axis	Pin Number Y axis	Signal			Description
Output		11A	13A	Start (START)			(1) LOW while positioning. (2) ON (LOW) during feed pulse output and dwell. Used as a brake release signal for servos with mechanical brakes. Feed pulse is output after this signal goes ON.
		11B	13B				
		12A	14A	Error counter clear (CLEAR)			Given before and after zero return. Resets deviations in the servo error counter. 
		12B	14B				
		17A	20A	(+) 24 V power (+) 5 to 15 V power			5 to 24 VDC (external supply) 17B and 20B for 5 to 12 VDC. 17A and 20A for 24 VDC.
		17B	20B				
		15A	18A	A type Forward feed pulse	B type Feed pulse	B type	Forward and reverse feed pulses The operation direction follows the direction sign (SIGN). 
		15B	18B	PULSE F	PULSE		
		16A	19A	Reverse feed pulse	Direction sign	A type	
		16B	19B	PULSE R	SIGN		

Select the A or B type by parameter setting. (For details, refer to Section 3.4.1.)

3.8 Battery Specifications

Table 3.12 gives the specifications of a battery used for an A1SD71.

Table 3.12 Battery Specifications

Items \ Type	A6BAT
Nominal voltage	3.6 VDC
Guarantee period	5 years
Total power failure time	300 days (7200 hours)
Application	Back-up for setting data
Size (mm)	ϕ 16 (dia) × 30

4. HANDLING

This section explains the handling (installation preparations) and nomenclature of the A1SD71.

4.1 Handling Instructions

(1) Since the body case is made of plastic, protect the A1SD71 from dropping and sudden impacts.

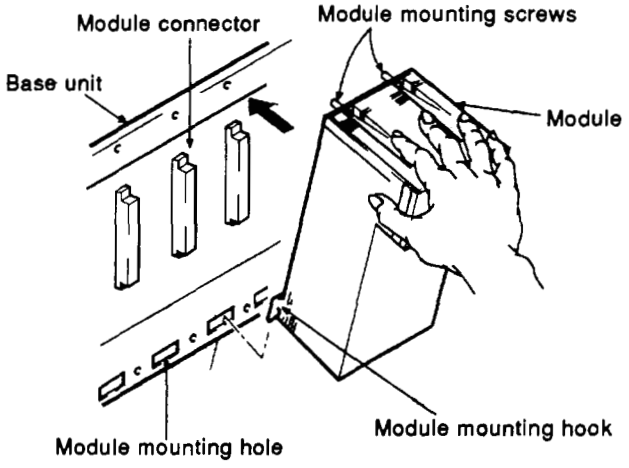
(2) Keep conductive debris out of the unit.

(3) Turn the PC CPU power supply OFF before installing or removing the unit to or from the base.

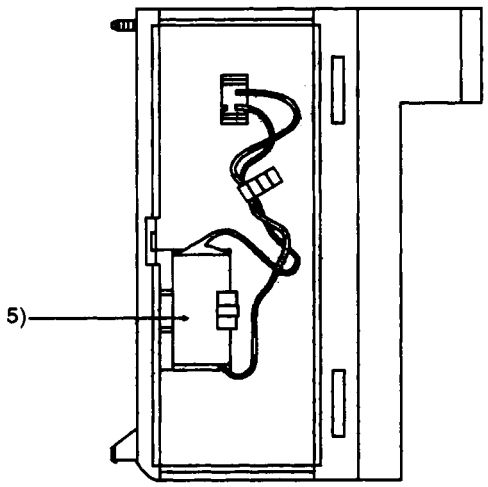
(4) Turn the PC CPU and drive module power supply OFF before connecting or disconnecting the drive unit connector.
After confirming the correct insertion direction, insert the connector directly from the front. Then, tighten the two fixing screws.
When the drive unit is not connected, keep the connector area cover closed.

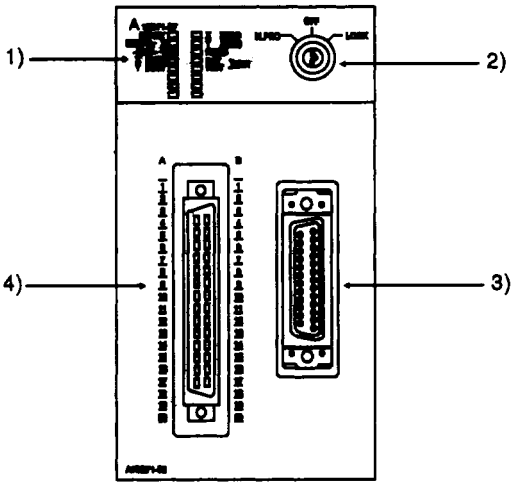
(5) When the A1SD71 is not BUSY, connect a peripheral device or AD71TU to the A1SD71.
After confirming the correct insertion direction, insert the connector directly from the front. Then, tighten the two fixing screws.
When a peripheral device or AD71TU is not connected, keep the connector area cover closed.

(6) To install the module to a base unit, first put the module mounting hook in the module mounting hole, and then tighten the two module mounting screws to secure the module.
To remove the module, loosen and remove the two module mounting screws first, and then disengage the module mounting hook from the module mounting hole.



4.2 Nomenclature





Number	Name	Explanation
1)	LED indicator	Indicates operating states and error occurrences.

LED	Contents
READY	Lights when the A1SD71 ready signal (X11) goes ON.
SERVO - ERR [X, Y]	Lights when the $\overline{\text{READY}}$ signal from the servo unit for the X or Y axis goes OFF.
X BUSY	Lights when the X-axis BUSY signal (X14) goes ON.
Y BUSY	Lights when the Y-axis BUSY signal (X15) goes ON.
X ZERO	Lights when the X-axis zero return request signal (X16) goes ON.
Y ZERO	Lights when the Y-axis zero return request signal (X17) goes ON.
HOLD	Lights when there is an A1SD71 hardware fault.
BAT, WDT ERR	Lights when the battery error signal (X1A) or WDT error signal (X10) goes ON.

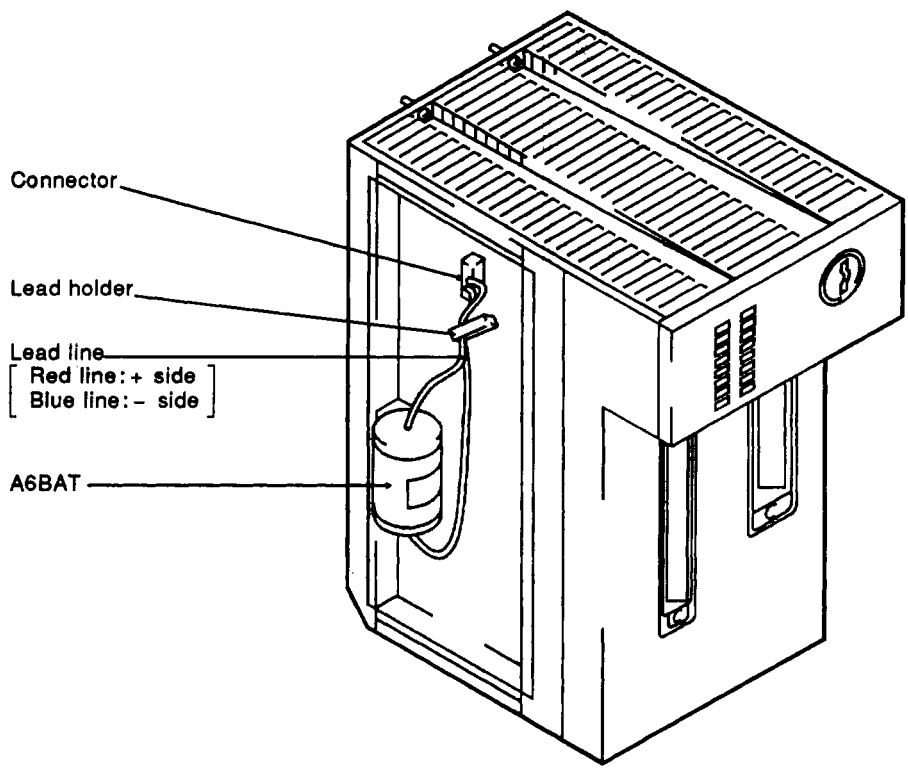
2)	Keyswitches	M.PRO ..... Sets memory protect for the setting data and positioning data areas. OFF ..... Cancels memory protect for the setting data and positioning data areas. LOCK..... Prohibits a pulse chain output from the A1SD71. (Refer to Section 7 about how of use.)
3)	RS-422 connector	Used for connections with a peripheral device such as an A6GPP, A6PHP, and AD71TU.
4)	40 pin connector	Used for connections with a drive unit.
5)	Battery (A6BAT)	For backup of positioning data

4.3 Settings

Internal setting of the A1SD71 is as shown below.

4.3.1 Battery connection

The battery backs up the IC-RAM during power failures. The leads are disconnected before shipment to prevent battery drainage.
Always connect the battery leads before using the A1SD71.
(Refer to Section 9 for details about batteries.)



IMPORTANT

The components on the printed circuit board may be damaged by static electricity. When handling the printed circuit board:

1) Ground all tools, the work bench, etc.
2) Do not touch conductive areas or electrical components.

5. LOADING AND INSTALLATION

This section explains the methods for loading and installation and the precautions to take to increase system reliability and to use the functions most efficiently.

5.1 Unit Wiring Precautions

When the A1SD71 is connected to the base (main base unit and extension base), heed the following:

(1) Do not connect it to the extension base without a power supply module (A1S5□ extension base).
(This is because the 5 VDC current consumption is very high.)

(2) If the board temperature exceeds 55 °C, consider forcible ventilation of the PC CPU board.

5.2 Wiring

The following describes (a) precautions when doing wiring between the A1SD71 and external devices, and (b) how to use the external wiring connector.

5.2.1 Wiring precautions

Precautions when doing wiring between the A1SD71 and external devices (including a drive unit) are described below. A connection examples is given in Appendix 3.

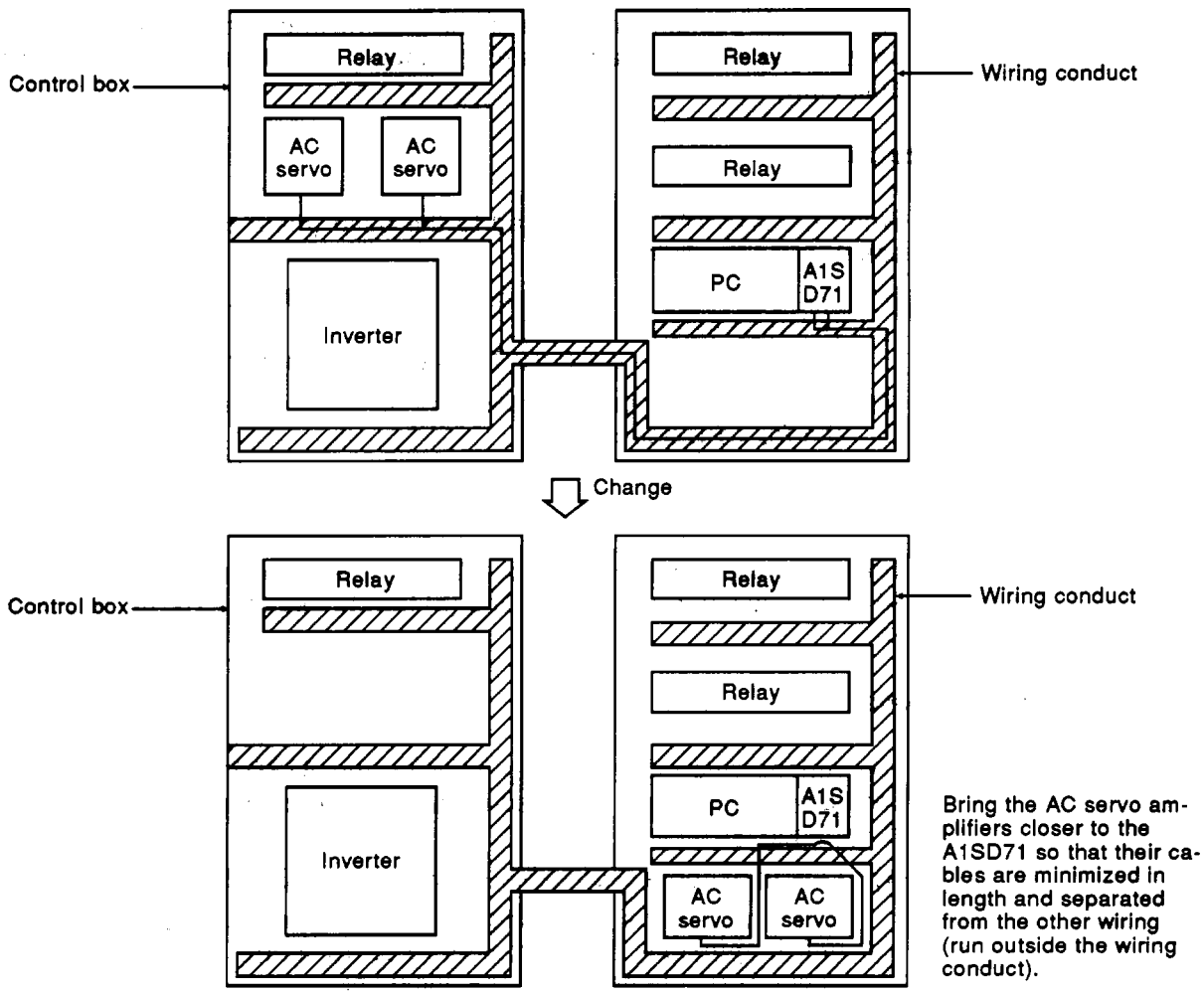
(1) Length of connection cable between the A1SD71 and drive unit

The length of the connection cable between the A1SD71 and the drive unit is generally 1 to 3 meters (3 to 10 feet). However, the distance depends on the drive unit specifications.
Make sure to confirm the correct specifications.

(2) I/O signal wiring

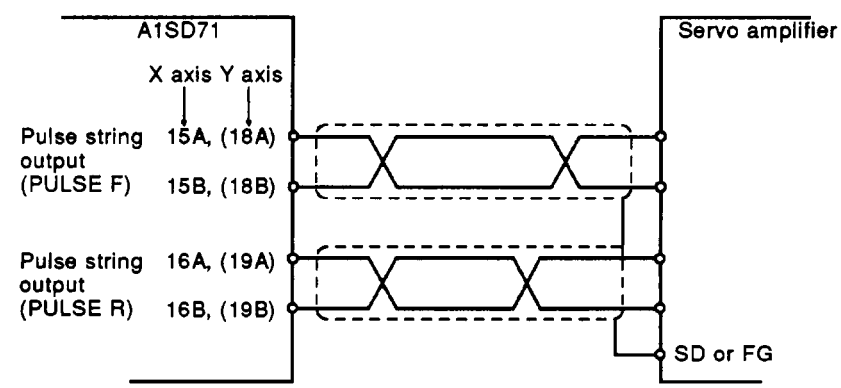
- Do not put the connection cable next to the power or main circuit cable.
- If the connection cable has to be brought close to them, either separate the ducts or use a conduit.
- If the cables must be bundled together, use a batch-sealed cable and ground them on the PC CPU side.
- If the cables are wired with conduit, make sure to ground the conduit.
- Keep A1SD71 wiring and other electric wires at least 10 cm apart.
- If the connection cable is too long, and is too close to a main circuit cable, noise may cause a malfunction.

Examples (bad example at top, good example at bottom)



REMARK

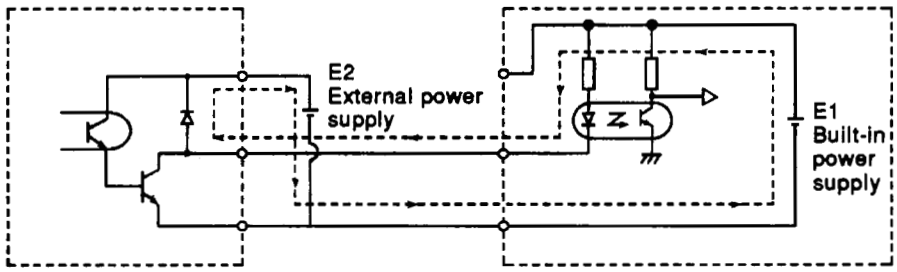
When there is a lot of noise between the A1SD71 and servo amplifier, provide wiring from the pulse string output terminal from the A1SD71 using shielded twisted-pair cable that is different from other shielded cables.



(3) 24 VDC wiring notes

When a servo drive unit has a built-in power supply of 24 VDC, a wraparound circuit is made by the state of a power supply. A malfunction will occur if a separate power supply is supplied externally. Therefore, do not use the built-in power supply and external power supply together.

[Wraparound circuit]



E1 > E2
Even if the pulse output of A1SD71 is OFF, the power supply flows in a servo unit pulse input line.

5.2.2 External wiring connector specifications

Model Name	
Connector	FCN-361J040-AU
Connector cover	FCN-360C040-B

* Consult your nearest Mitsubishi representative about the connector.

5.2.3 Connecting external wiring

The A1SD71 has the following connectors:
When connecting an electric wire, disassemble as shown in Fig. 5.1.
The disassembly and assembly procedures are as follows:

1) Loosen the four screws, and remove them.
2) Open the cover from the connector side.
3) Connect the electric wire (refer to Section 5.2.3(1) to (3)).
4) Put connectors into the cover.
5) Pull open the fixed screws.
6) Put the covers together.
7) Fasten the four screws. Use longer screws for cable clamping.
   Always keep track of small screws and nuts when disassembling.

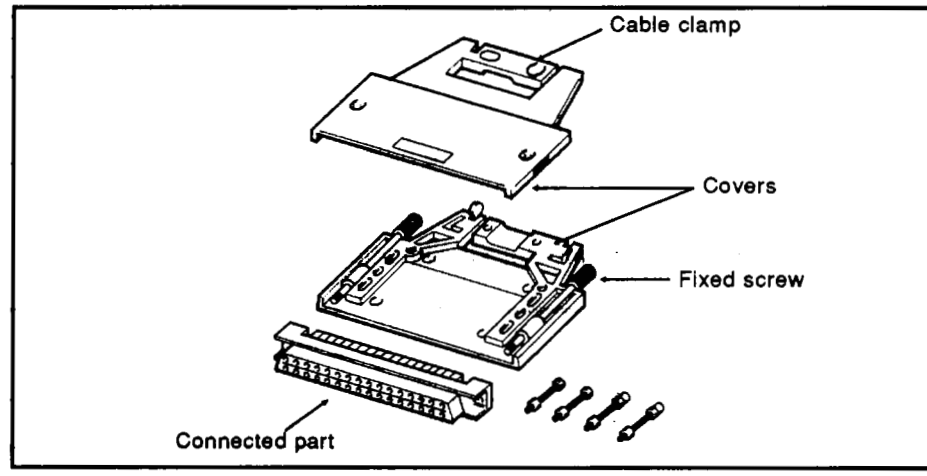


Fig. 5.1 Connector

5.2.4 Connecting electric wiring

Connector pin wiring is shown in Fig. 5.2. Connect in accordance with the I/O numbers (refer to Section 3.7.2).

(1) Use 0.3 mm^2 or less wires. Thicker wires cannot pass through the cable clamps.

(2) Solder the wires to the pins. Remove electric wire insulation carefully. Be careful not to cause a short circuit.
Wires should be threaded through an insulating tube.

(3) Secure the electric wire in the cable clamp of a cover.
When there are several connecting electric wires, wrap them together with tape.

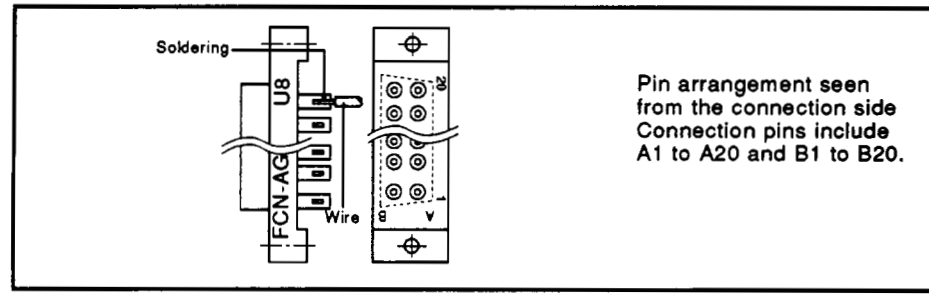


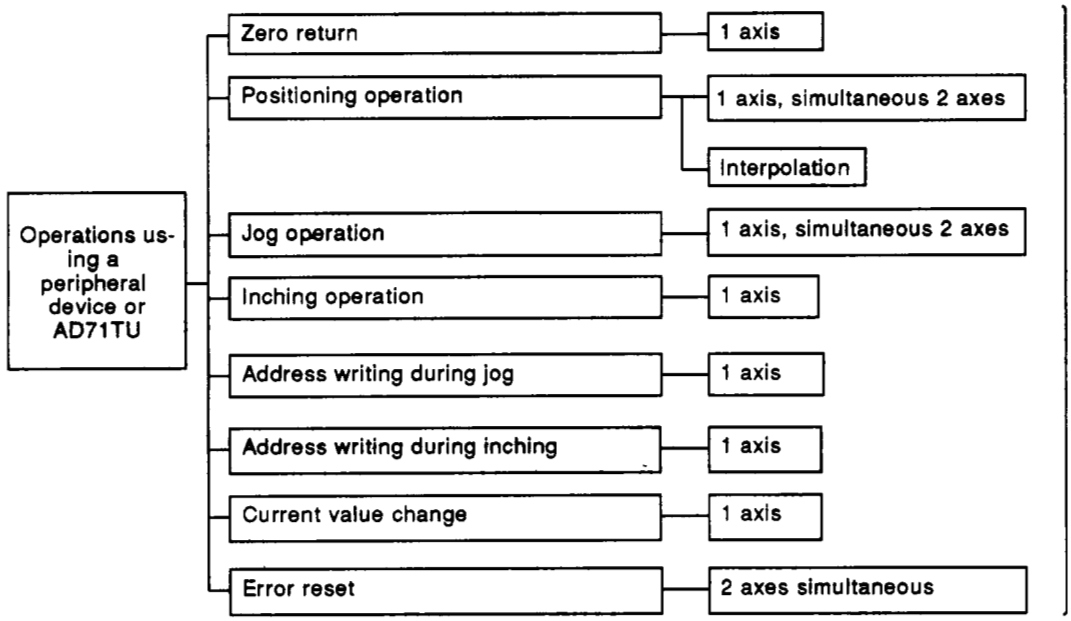
Fig. 5.2 Connection

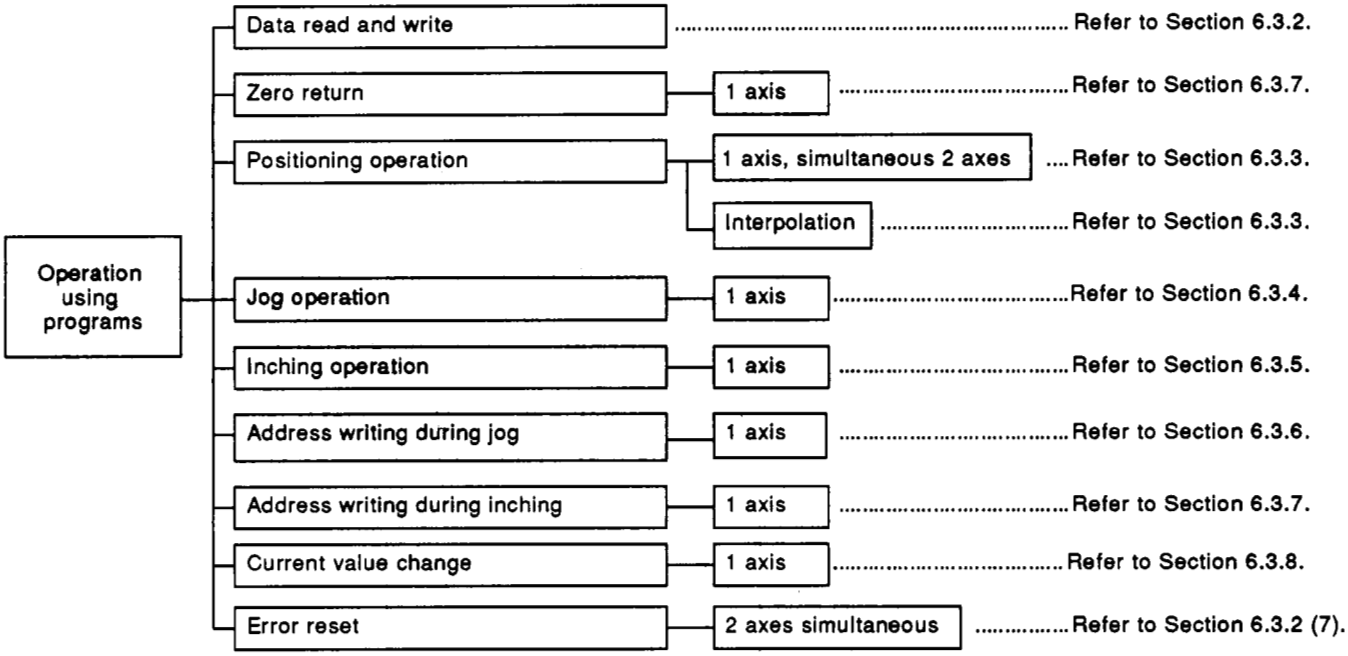
6. PROGRAMMING

6.1 Program Creation

6.1.1 Program composition

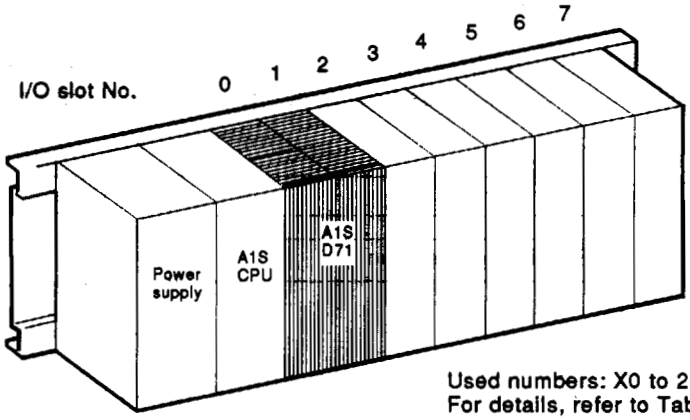
A1SD71 programs are usually incorporated in an overall program. Programs are classified as follows, and a program example is shown.





REMARK

Unless otherwise specified, I/O numbers used in thes manual assume that the A1SD71 is located at slot 0 and 1 of the main base.



Used numbers: X0 to 2F, Y0 to 2F
For details, refer to Table 3.9.

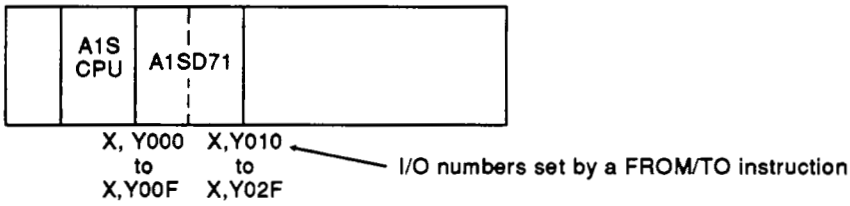
The number of devices (M, D, T, etc.) used in the program example can be changed freely.

POINTS

(1) There are 48 A1SD71 input/output points and the module occupies two slots. Therefore, execute I/O allocations using the GPP function as follows:

First half slot..... Empty slot :16 points
Second half slot.....Special-function module :32 points

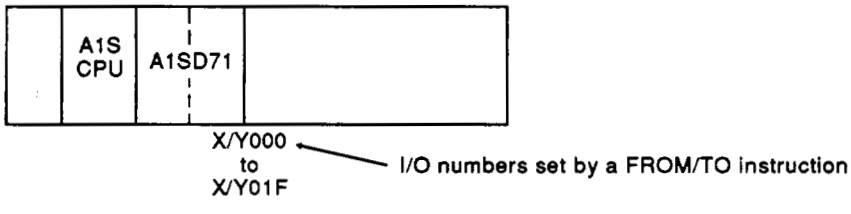
(2) When executing an A1SD71 FROM/TO instruction, the head I/O number of the second half slot of A1SD71 is used.



Therefore, the number to be set by the FROM/TO instruction becomes the head I/O number allocated to the A1SD71 + 010_H.

(3) If the first half A1SD71 slot is set to empty slot 0 in the I/O allocation by the GPP function, 16 first half slot points are saved.

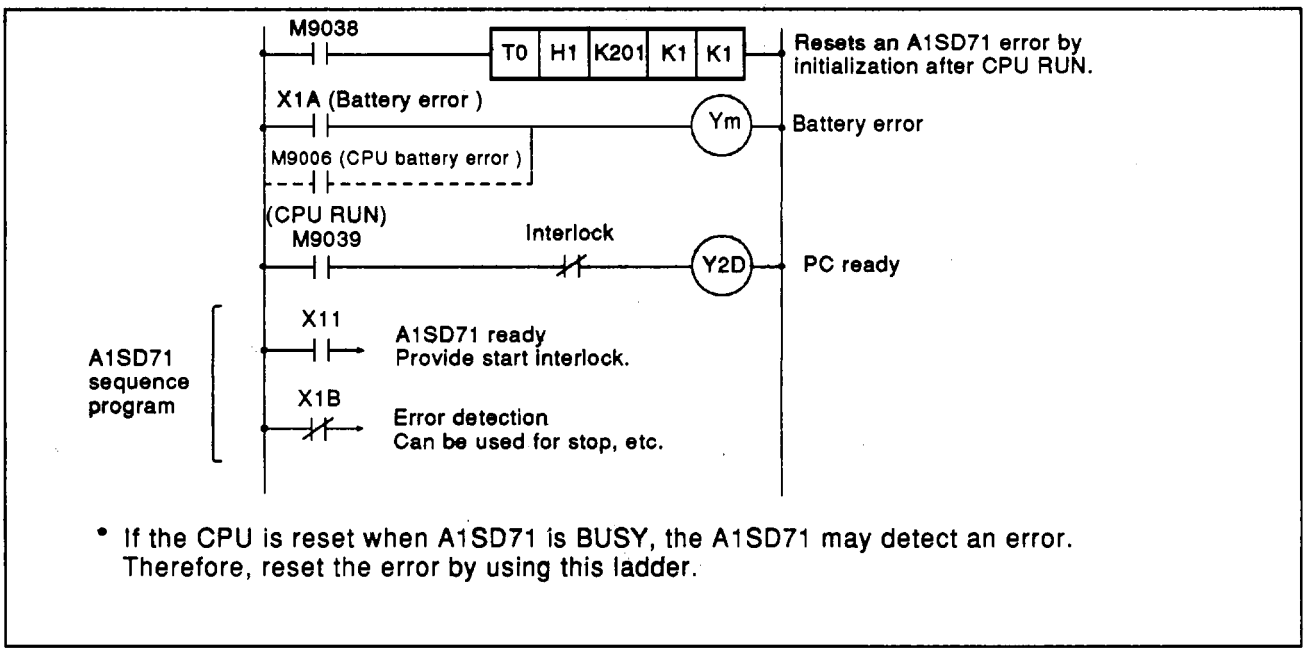
The I/O number to be set in the FROM/TO instruction becomes the same number as the first I/O number allocated to the A1SD71.



6.1.2 Precautions when creating programs

(1) Sequence program conditions

Use the A1SD71 to provide the program shown in Fig. 6.2 to the system.



• If the CPU is reset when A1SD71 is BUSY, the A1SD71 may detect an error. Therefore, reset the error by using this ladder.

Fig. 6.2 Necessary Program

(2) PC ready reset

When an error is detected in the sequence program, create a program so that the PC ready signal (Y2D) is reset by detecting the error.

(3) Zero return

Be sure to execute zero return when turning the power ON.
(The current values of the positioning module cannot be guaranteed when turning the power ON.)

(4) Limit switch for near-point dog

Use a limit switch with high contact reliability. If the near-point dog signal is not input during zero return, the movement continues at the zero return speed.

(5) Overrun processing

Overrun is prevented in the upper/lower strokes by limit setting. However, this applies when the A1SD71 is operating normally. For safety, Mitsubishi recommends setting a marginal limit switch and external circuit that turns OFF power to the motor power when the limit switch goes ON.

(6) Emergency stop

The STOP input signal is a positioning deceleration stop signal which cannot be used for an emergency stop. Stop the drive unit by external contact in the case of an emergency stop.

(7) Upper/lower stroke limit values

Confirm whether correct upper/lower stroke limit values have been set.

(8) Speed limit value

Confirm whether a proper speed limit has been set to a parameter.

(9) Do not set the high speed at the JOG speed.

Execute operations at the low JOG speed.

(10) Speed during interpolation operations

The speed during interpolation operations is decided with the X and Y axes. Therefore, set the speed of both axes correctly so that either axis operates at the setting speed or lower.

(11) Refer to section 5.1 for details about unit wiring precautions.

6.2 Operations Using a Peripheral Device or AD71TU

A1SD71 positioning operations can be executed in the test mode using a peripheral device or AD71TU. Operating conditions are as follows:

(1) Install a peripheral device or AD71TU in the A1SD71.

(2) Operations are enabled independently of the ON/OFF state of the PC ready signal (Y2D) and A1SD71 ready signal (X11).

(3) Data cannot be read and written from/to the peripheral device or AD71TU during BUSY when operating a peripheral device or AD71TU in the test mode.

(4) ON/OFF of the M code will be ignored. (Buffer memory M code area (X axis: 46, Y axis: 346) is cleared.)

6.3 ACPU Programming

6.3.1 Data read and write precautions

(1) Data read from and written to the sequence program should be kept to a minimum for optimum program scan time. The majority of the A1SD71 data must therefore be written to the buffer memory by the peripheral device or the AD71TU.

(2) The parameters and zero return data is checked at power on and when the PC ready signal (Y2D) changes from OFF to ON.

(3) Positioning data is checked immediately before it is processed. Any error will cause the error signal (X1B) to switch on and, in most cases, positioning to stop.

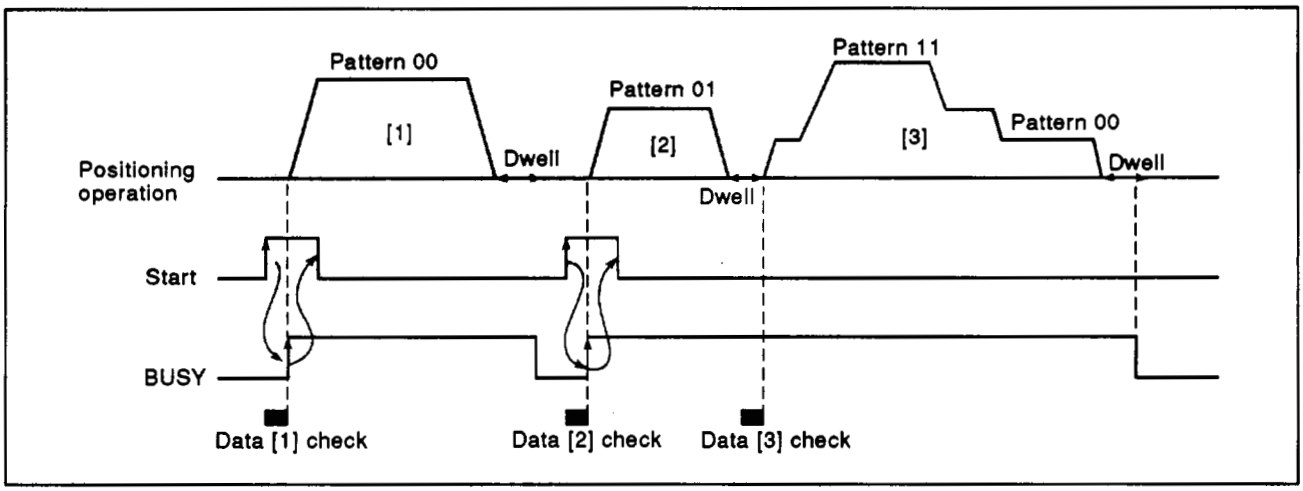


Fig. 6.3 Positioning Data Check

An error is flagged if the total distance requested exceeds the upper (or lower) stroke limit when incremental position addressing is used.

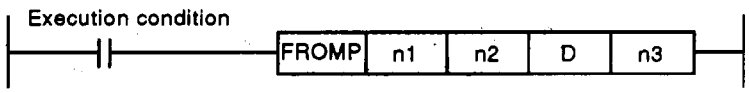
6.3.2 Data communication with PC program

(1) Read and write instructions

(a) Read from A1SD71

FROM instruction: Also FROMP, DFRO, and DFROP.

[Format]



Symbol	Description	Device
n1	Upper 2 digits of the 3-digit head I/O number to which the A1SD71 has been assigned (e.g. 4 when the head I/O number is X,Y040)	K, H
n2	Buffer head address of stored data	K, H
D	Head number of devices to which data will be written	T, C, D, W, R
n3	Number of words to be read	K, H

Fig. 6.4 Read Instruction FROM

Example: To read one word from buffer memory address 600 (X axis output speed) to D2 with the A1SD71 assigned to X130 to X13F and Y140 to Y14F.

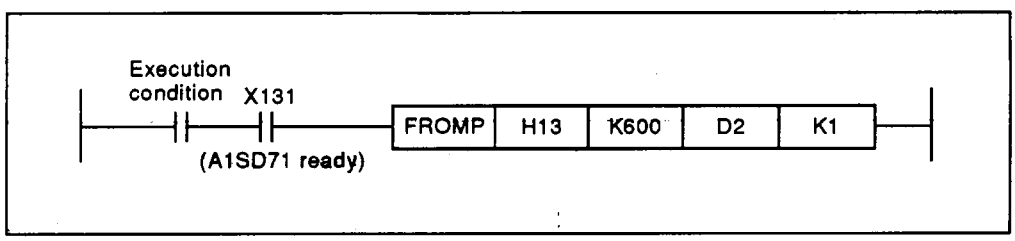
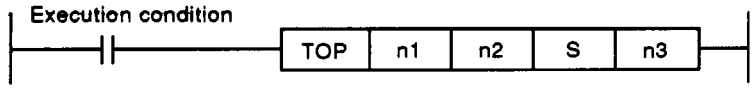


Fig. 6.5 Read Example

(b) Write to A1SD71

TO instruction: Also TOP, DTO, and DTOP.

[Format]



Symbol	Description	Available Device
n1	Upper 2 digits of the 3-digit head I/O number to which the A1SD71 has been assigned (e.g. 4 when the head I/O number is X,Y040)	K, H
n2	Buffer head address for written data	K, H
S	Head number of devices from which data will be written (may also be a constant)	T, C, D, W, R, K, H
n3	Number of words to be written	K, H

Fig. 6.6 Write Instruction TO

Example: To write positioning information to buffer memory address 3872, with the A1SD71 assigned to X20 to X2F and Y30 to 3F.

X-axis data No. 1 positioning information example

Item	Setting	Data
Positioning pattern	Continue with speed change	11
Positioning method	Incremental	1
Positioning direction (Only incremental method)	Forward	0
M code	13	13

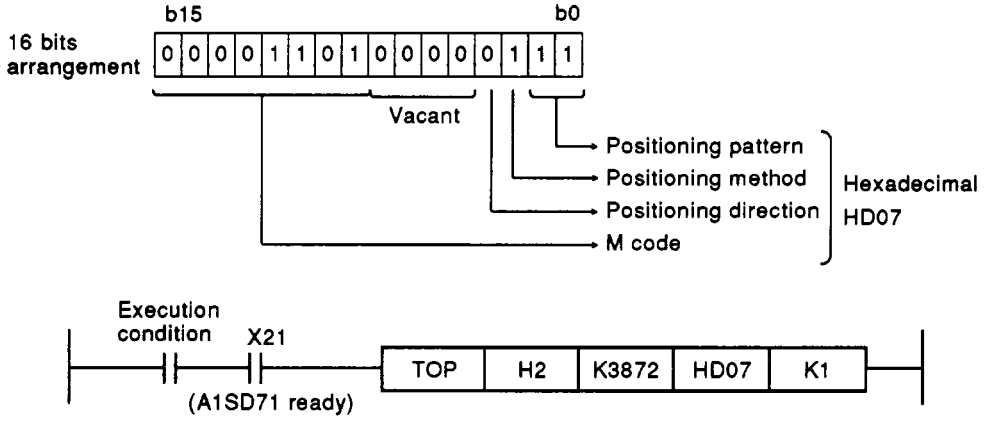


Fig. 6.7 Write Example

POINT

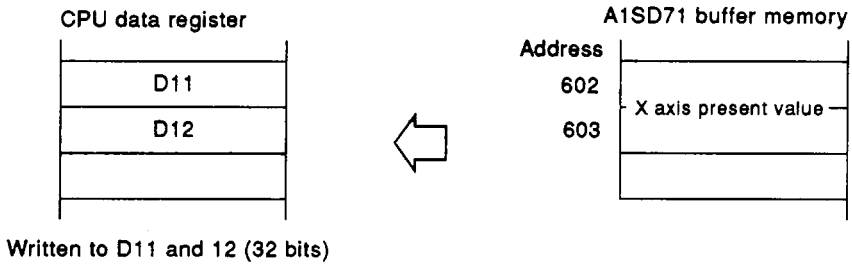
A maximum of 2,000 words may be read or written using one instruction. Note however that in this case the watch dog timer (WDT) may need to be reset.

(2) Present value read program example

[Example] Indication of X axis present value

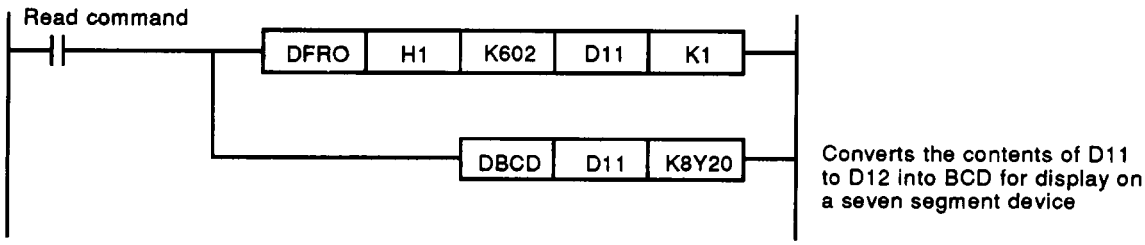
[Notes] (1) During positioning, the present value as stored in the A1SD71 buffer memory lags behind the actual value by about 0.1 seconds.
(2) The present value is two words long.

[Data transfer]



Written to D11 and 12 (32 bits)

[Program]



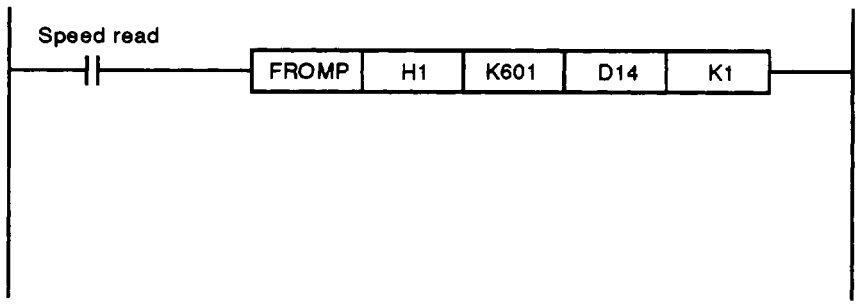
(3) Speed read program example while BUSY

[Example] Y axis speed read

[Note] None

[Data transfer]

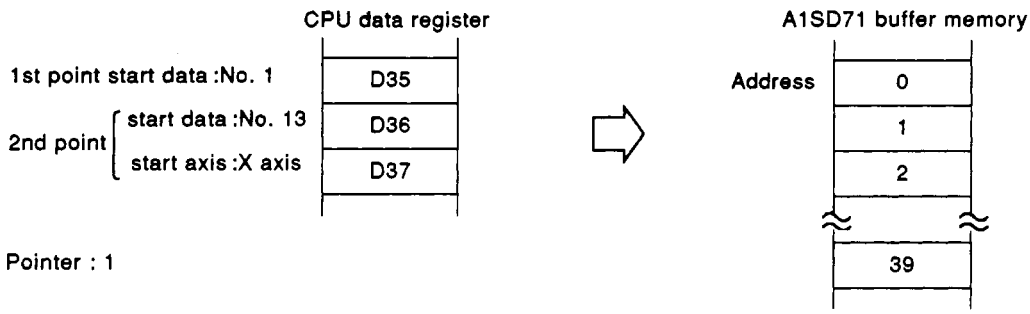
[Program]



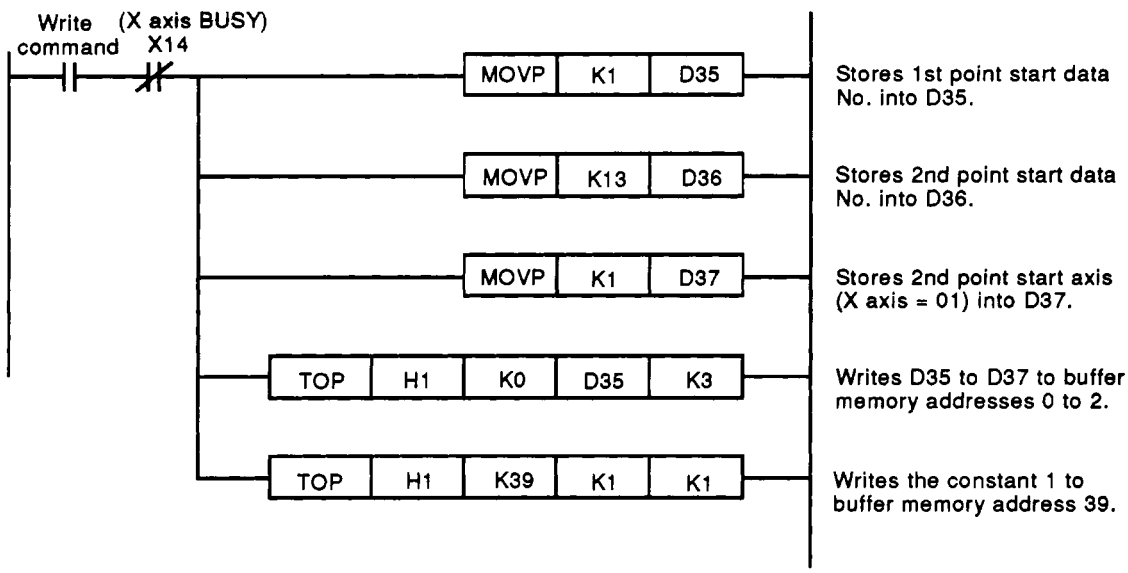
(4) Data number and pointer write program example

[Example]	X axis data number and pointer write
[Note]	The relevant axis must not be BUSY.

[Data transfer]



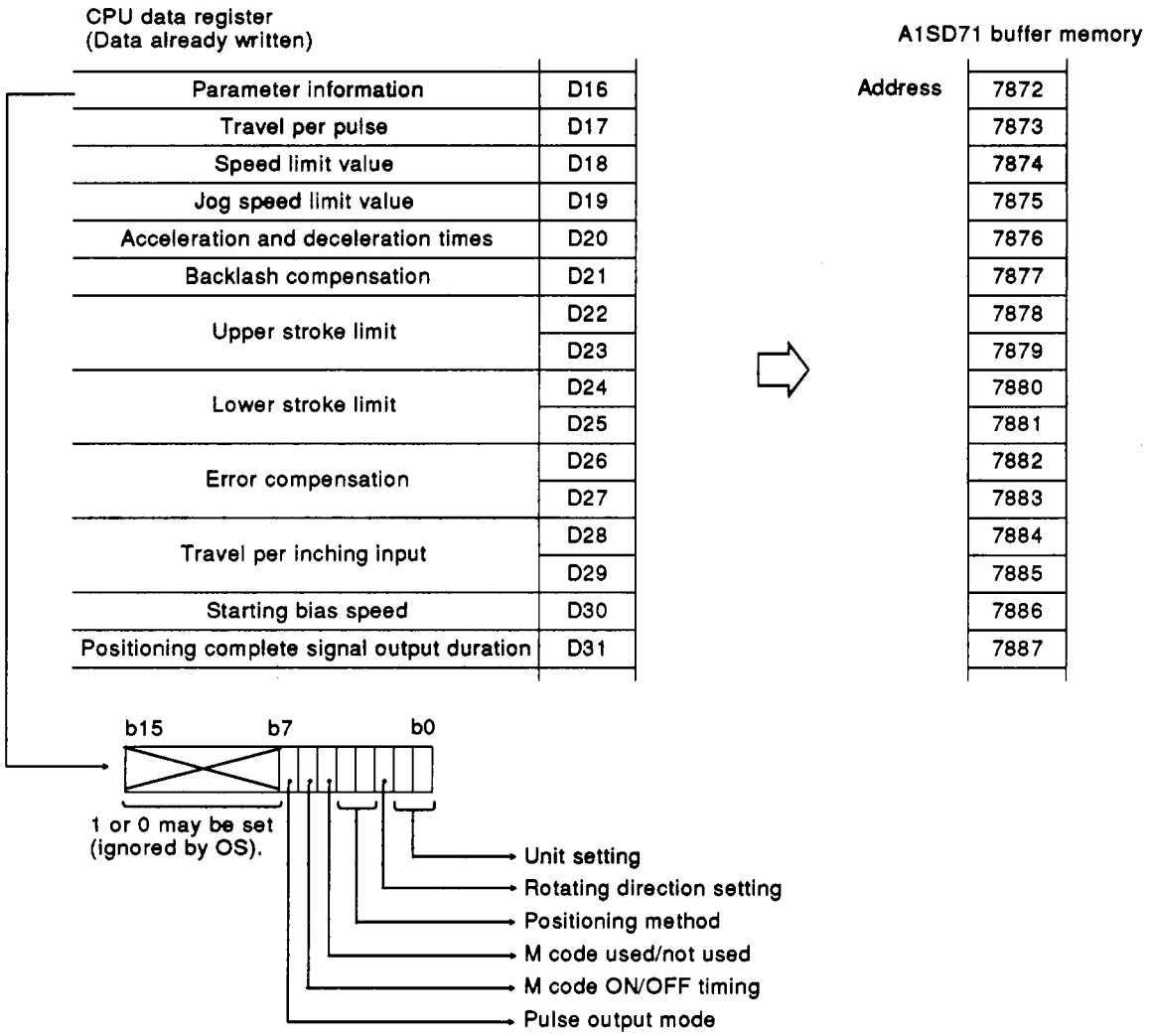
[Program]



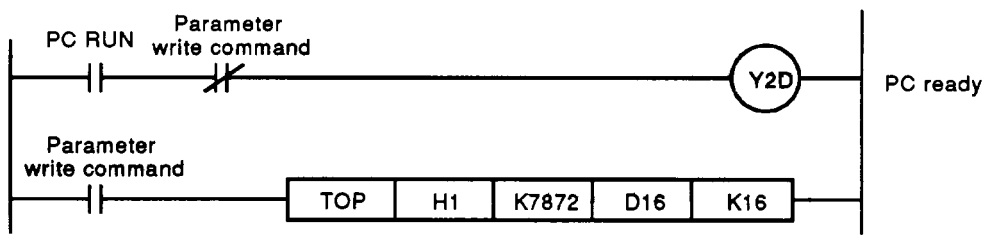
(5) Parameter and zero return data write program example

[Example]	X axis parameter write - Assume that the parameters are already in D16 to 31
[Note]	When writing parameters and zero return data, the PC ready signal (Y2D) should be off.

[Data transfer]



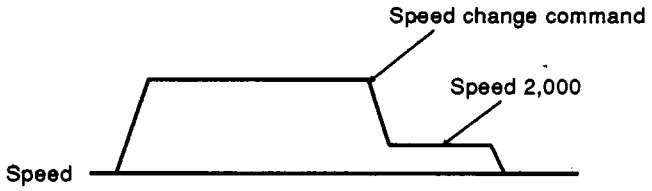
[Program]



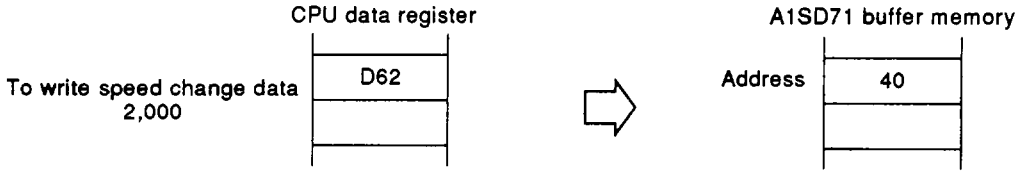
(6) Speed change program example while BUSY

[Example] To change X axis positioning speed to 2,000 (20,000 mm/min).

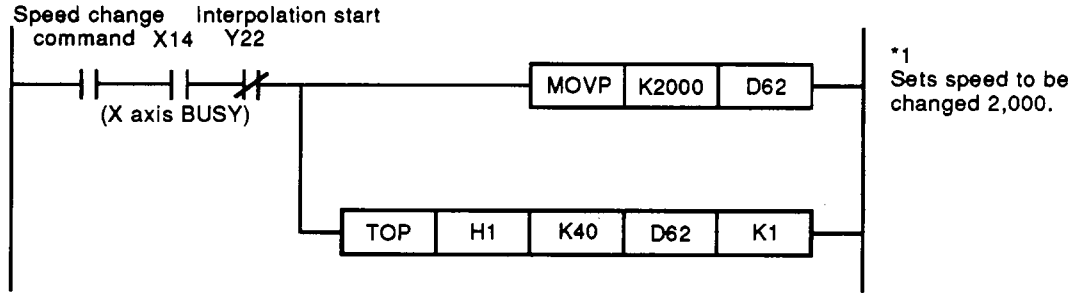
[Note] Speed cannot be changed during interpolation.

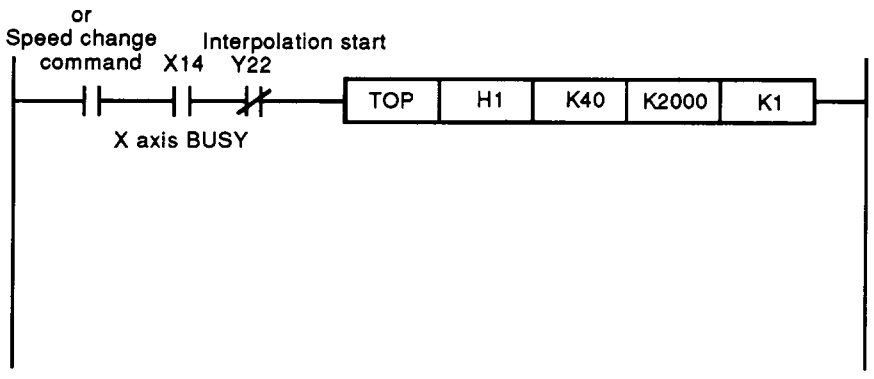


[Data transfer]



[Program]





POINT

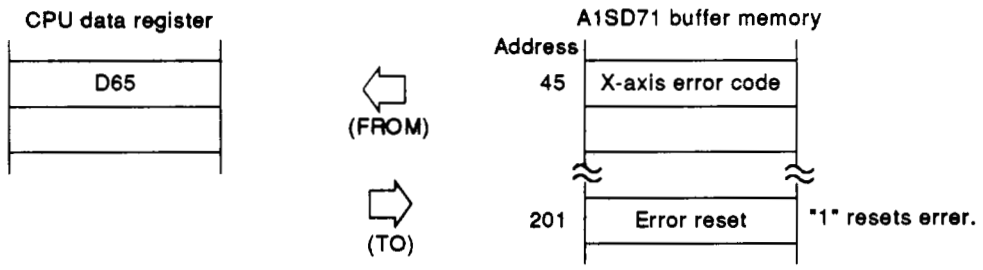
*1 When the speed is changed to 2000 in a program, it is internally processed as 2000 × 10. Therefore, the actual speed becomes 20,000 mm/min.

(7) Error reset program example

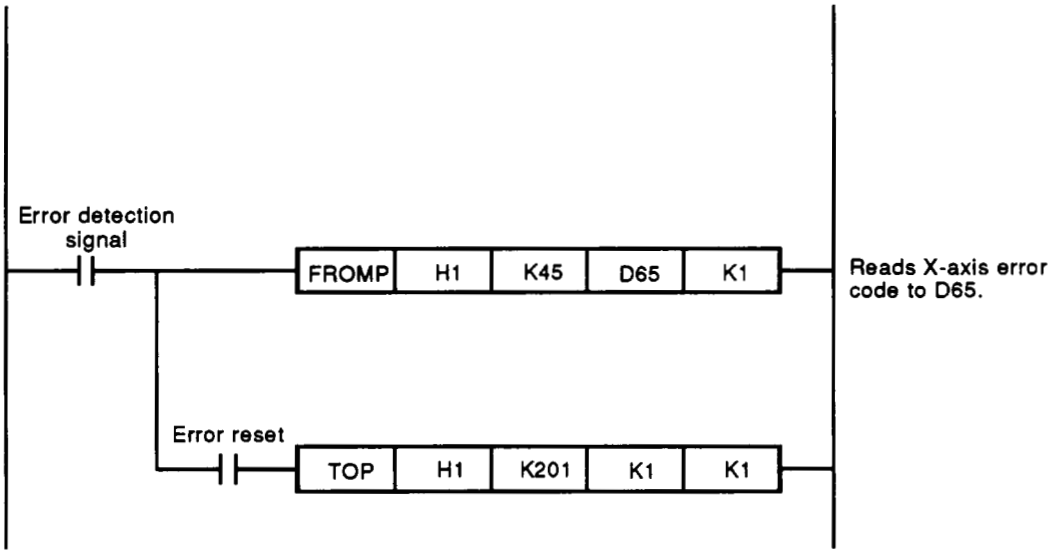
[Example] To read a X axis error code and then reset it.

[Notes] (1) The error detection (X1B) signal should be used.
(2) The buffer memory error reset (address 201) is used for both the X and Y axes. Writing a 1 to this address clears the error.

[Data transfer]



[Program]



REMARK

Writing "1" to the buffer memory error reset address resets the error code and X1B.
The error reset address is then automatically changed to "0".

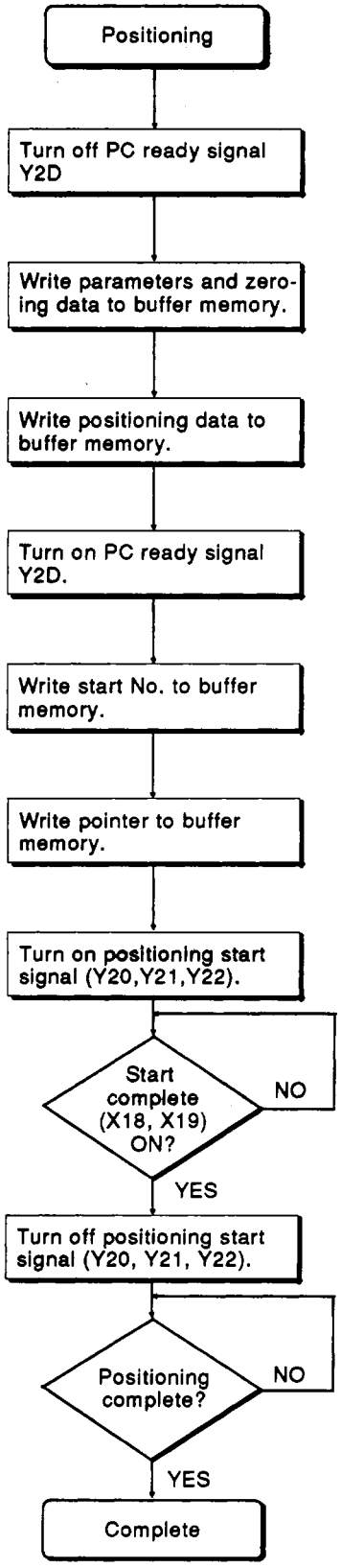
6.3.3 Positioning start program

There are two start programs (a) and (b) below.

(a) When setting data is written by using a peripheral device or AD71TU
The program is simple because it is not necessary to communicate setting data between a CPU and A1SD71.
This method is recommended when the positioning data is within 400 points and there are few setting data changes.

(b) When setting data is externally set
When there are a great many positioning data changes, communications between the CPU and A1SD71 and a program for the writing/reading to/from the buffer memory are necessary.
Many data registers and programs must be utilized and the operations takes a long time. Therefore, simplify operations without using unnecessary programs.

(1) Flow chart



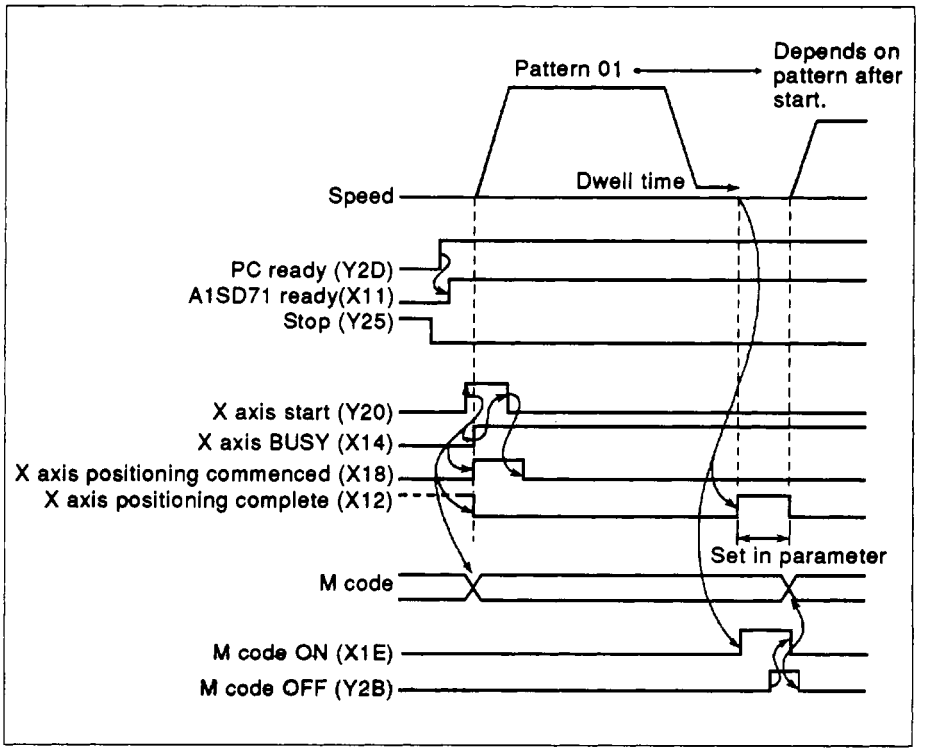
(2) Conditions Signal State Remarks

Table 6.1 Start Conditions

	Signal	State	Remarks
External signal	Drive unit READY	ON	
	Stop signal STOP	OFF	
Interface signal	A1SD71 ready (X11)	ON	*
	Relevant axis busy (X14, X15)	OFF	
	Relevant axis positioning commenced (X18, X19)	OFF	•
	Relevant axis M code ON (X1E, X1F)	OFF	•
	Relevant axis stop (Y25,Y26)	OFF	
	PC ready (Y2D)	ON	*
Other	Positioning data	Within setting range	If positioning speed is higher than the speed limit value, positioning is executed at the speed limit value.
	Start data number		
	Start axis		
	Pointer		
	Zero address		
	Monitor present value	0 ≤ present value ≤ 16,252,928	
	After BREAK signal from the peripheral device or STOP signal from the AD71TU, neither axis should be busy.		

• In peripheral device or AD71TU test mode, X11, X18, X19, X1E, X1F, and Y2D should not be checked.

(3) Timing



(4) Program

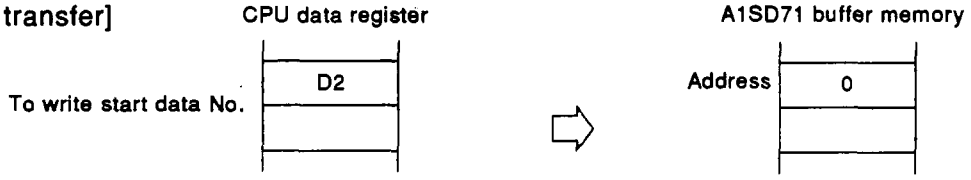
(a) Operating data already written from the peripheral device.

The following program assumes that parameters, zero return data, and positioning data have already been written to the A1SD71 buffer memory using the peripheral device.

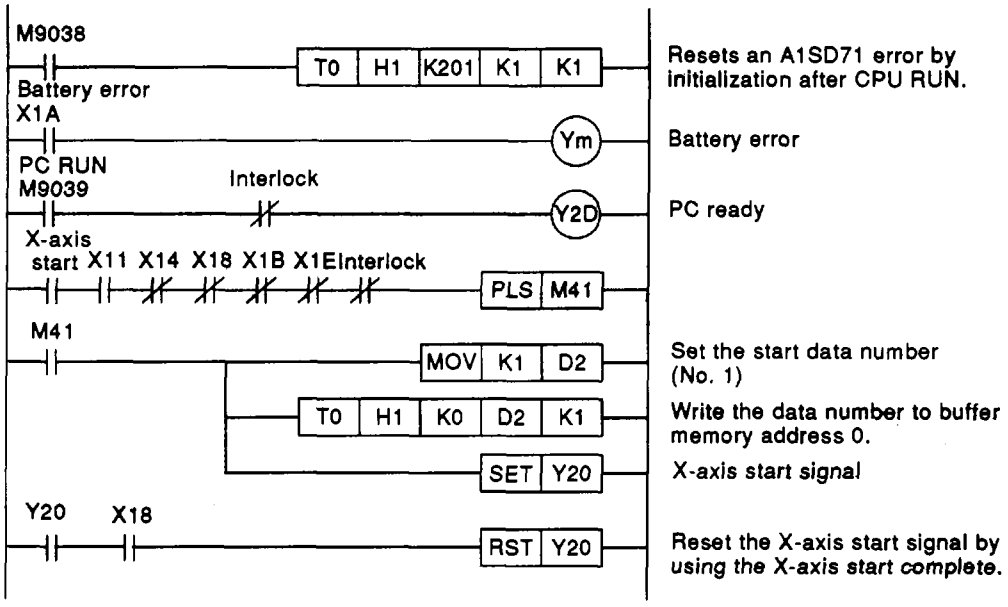
[Example] To start at X axis data number 1.

[Notes]
(1) For start conditions, see Table 6.1.
Provide necessary interlock in accordance with its use.
(2) Actual positioning operation depends on data No. 1 pattern setting.
(3) For stop during positioning, refer to Section 6.3.9.

[Data transfer]



[Program]



(b) Setting data specified using sequence program

Assumes data is stored in registers as shown in Table 6.2.

[Notes] (1) For start conditions, see Table 6.1.
Provide necessary interlock in accordance with its use.
(2) For stop during positioning, refer to Section 6.3.9.
(3) To write parameters and zero return data, turn off PC ready signal (Y2D).

[Data transfer]

		CPU data register (Data already written)	A1SD71 buffer memory
(X axis)			
1st point	start data No.	D0	0
2nd point	start data No.	D1	1
	start axis	D2	2
3rd point	start data No.	D3	3
	start axis	D4	4
X axis pointer		D5	39
(Y axis)			
1st point start data No.		D10	300
2nd point	start data No.	D11	301
	start axis	D12	302
3rd point	start data No.	D13	303
	start axis	D14	304
Y axis pointer		D15	339
(X axis)			
Positioning information data	No.1	D20	3872
	No.2	D21	3873
	No.3	D22	3874
	No.4	D23	3875
	No.5	D24	3876
	No.6	D25	3877
	No.7	D26	3878
	No.8	D27	3879
	No.9	D28	3880
	No.10	D29	3881
(X axis)			
Positioning speed data	No.1	D30	4272
	No.2	D31	4273
	No.3	D32	4274
	No.4	D33	4275
	No.5	D34	4276
	No.6	D35	4277
	No.7	D36	4278
	No.8	D37	4279
	No.9	D38	4280
	No.10	D39	4281

(X axis)			
Dwell time data	No.1	D40	4672
	No.2	D41	4673
	No.3	D42	4674
	No.4	D43	4675
	No.5	D44	4676
	No.6	D45	4677
	No.7	D46	4678
	No.8	D47	4679
	No.9	D48	4680
	No.10	D49	4681
(X axis)			
Positioning address data	No.1	D50	5072
		D51	5073
	No.2	D52	5074
		D53	5075
	No.3	D54	5076
		D55	5077
	No 4	D56	5078
		D57	5079
	No 5	D58	5080
		D59	5081
	No.6	D60	5082
		D61	5083
	No 7	D62	5084
		D63	5085
	No.8	D64	5086
		D65	5087
	No.9	D66	5088
		D67	5089
	No.10	D68	5090
		D69	5091

(Y axis positioning data omitted)
Refer to Appendix 5.

(X axis parameters)		
Parameter information	D120	7872
Travel per pulse	D121	7873
Speed limit value	D122	7874
Jog speed limit value	D123	7875
Acceleration and deceleration times	D124	7876
Backlash compensation	D125	7877
Upper stroke limit	D126	7878
	D127	7879
Lower stroke limit	D128	7880
	D129	7881
Error compensation	D130	7882
	D131	7883
Travel per manual pulse during inching	D132	7884
	D133	7885
Starting bias speed	D134	7886
Positioning complete signal output duration	D135	7887
(Y axis parameters)		
Parameter information	D140	7892
Travel per pulse	D141	7893
Speed limit value	D142	7894
Jog speed limit value	D143	7899
Acceleration and deceleration times	D144	7899
Backlash compensation	D145	7897
Upper stroke limit	D146	7898
	D147	7899
Lower stroke limit	D148	7900
	D149	7901
Error compensation	D150	7902
	D151	7903
Travel per manual pulse during inching	D152	7904
	D153	7905
Starting bias speed	D154	7906
Positioning complete signal output duration	D155	7907
(X axis zero return data)		
Zero address	D160	7912
	D161	7913
Zero return speed	D162	7914
Zero return creep speed	D163	7915
Zero return dwell time	D164	7916
Torque limit	D165	7917
Zero return information	D166	7918
(Y axis zero return data)		
Zero address	D170	7922
	D171	7923
Zero return speed	D172	7924
Zero return creep speed	D173	7925
Zero return dwell time	D174	7926
Torque limit	D175	7927
Zero return information	D176	7928

Table 6.2 Data Register Contents

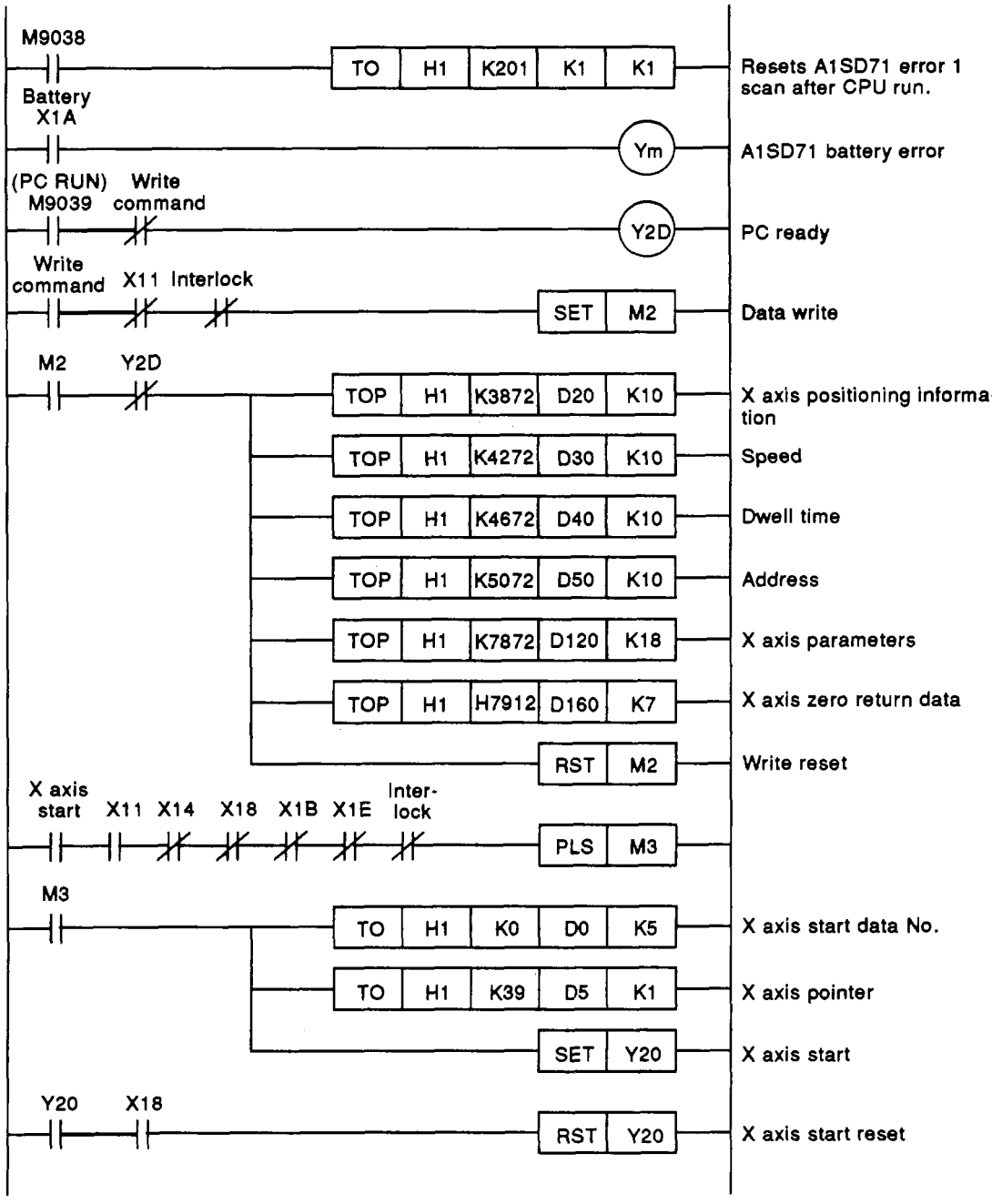
Item			Data Register
X axis start data number (3 points)			D0 to 4
X axis pointer (2)			D5
Y axis start data number (3 points)			D10 to 14
Y axis pointer(2)			D15
Positioning data	X axis	Positioning information (No. 1 to 10)	D20 to 29
		Positioning speed (No. 1 to 10)	D30 to 39
		Dwell time (No. 1 to 10)	D40 to 49
		Positioning address (No. 1 to 10)	D50 to 69
	Y axis	Positioning information (No. 1 to 10)	D70 to 79
		Positioning speed (No. 1 to 10)	D80 to 89
		Dwell time (No. 1 to 10)	D90 to 99
		Positioning address (No. 1 to 10)	D100 to119
X axis parameters			D120 to 135
Y axis parameters			D140 to 155
X axis zero return data			D160 to 166
Y axis zero return data			D170 to 176

REMARKS

1) Set the data register number to any desired value.

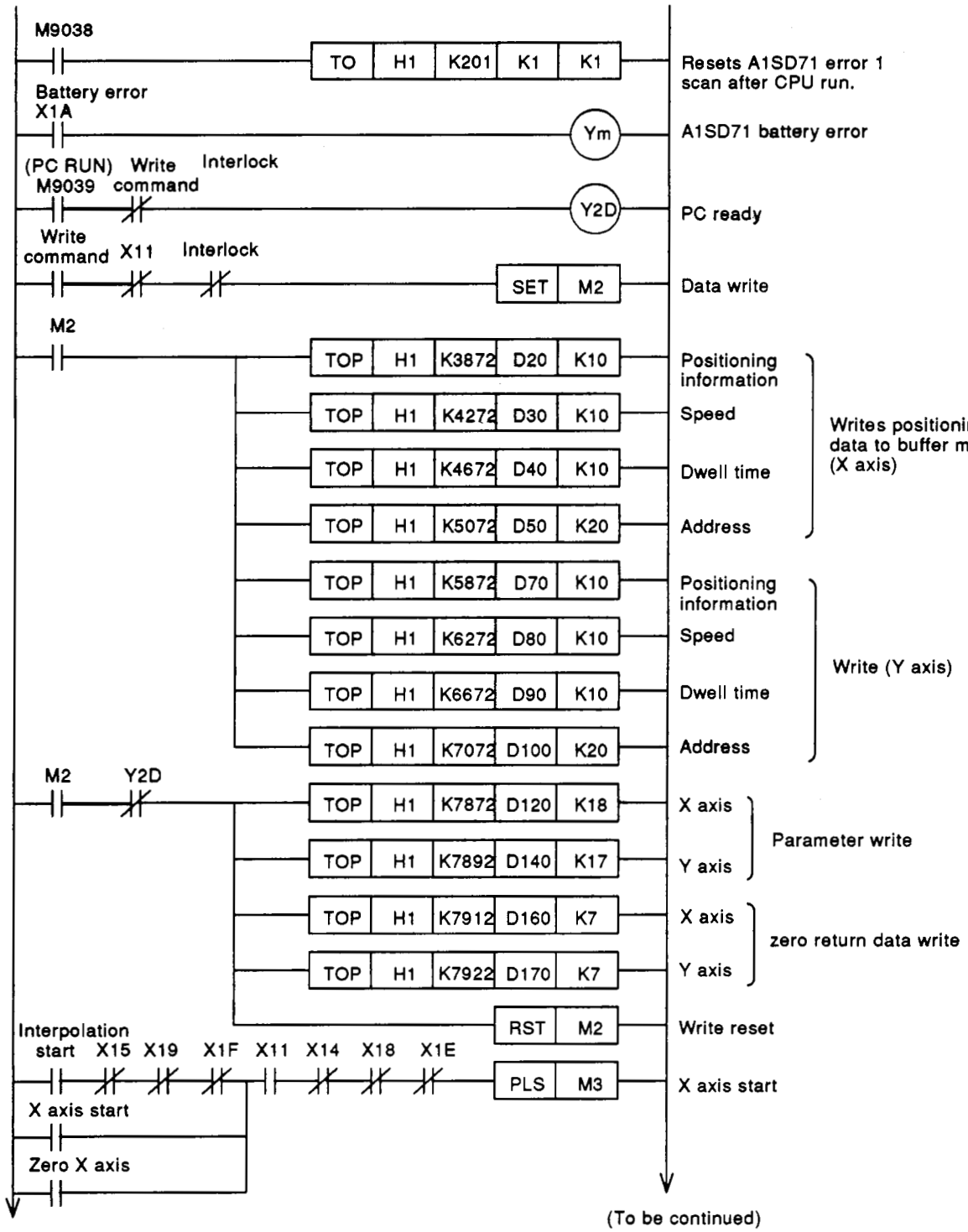
2) The buffer memory address is fixed.

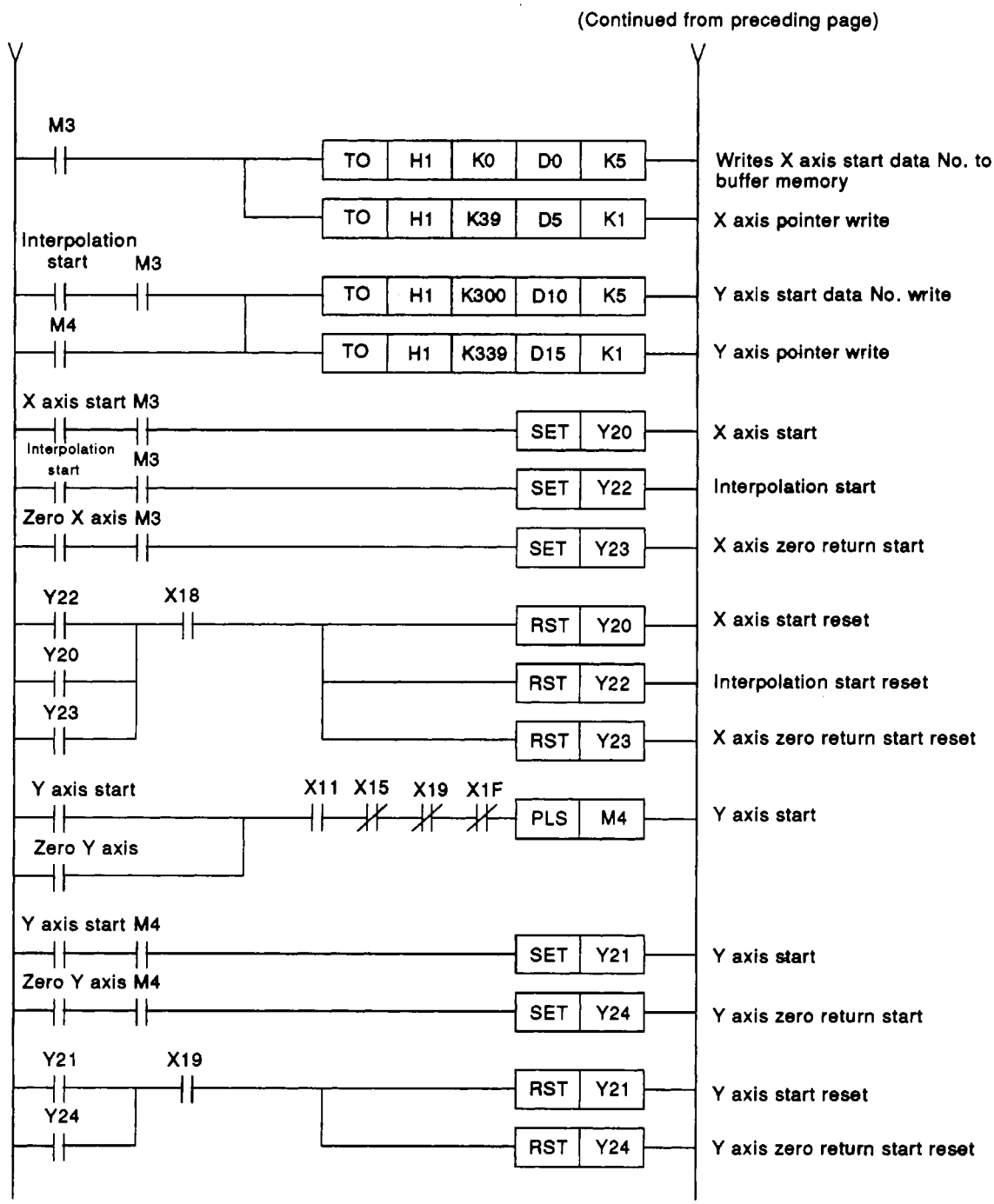
[Example 1] X axis start



Timing is same as on page 6-16.

[Example 2] Start programs
Program to start the X and Y axes, interpolation starts, and zero return are possible.

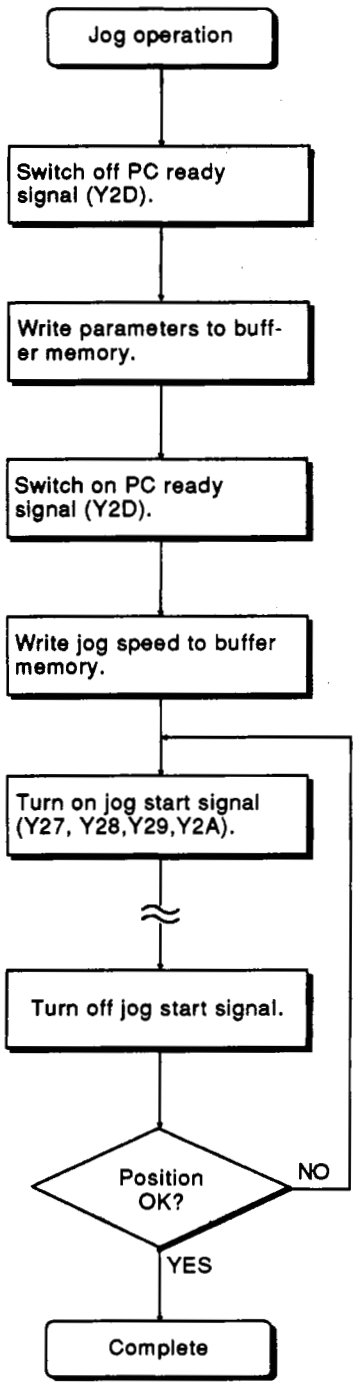




Note : For time schedule, refer to Fig. 3.42

6.3.4 Jog operation program

(1) Flow chart



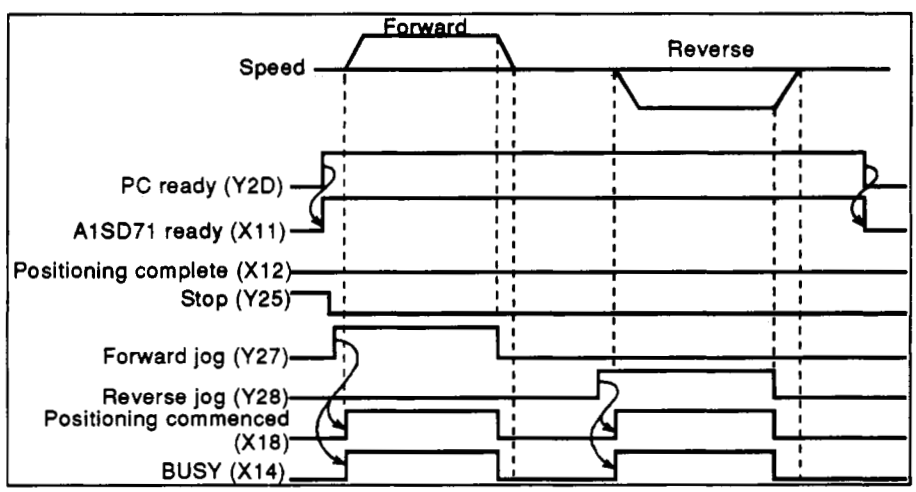
(2) Conditions

Table 6.3 Jog Operation Start Conditions

	Signal	State	Remarks
External signal	Drive unit READY	ON	
	Stop signal STOP	OFF	
Interface signal	A1SD71 ready (X11)	ON	*
	Relevant axis busy (X14, X15)	OFF	
	Relevant axis positioning commenced (X18, X19)	OFF	*
	Relevant axis M code ON (X1E, X1F)	OFF	*
	Relevant axis stop (Y25, Y26)	OFF	
	PC ready (Y2D)	ON	*
Others	Jog speed	Starting bias speed or higher	If jog speed specified is higher than the jog speed limit value, operation is performed at the jog speed limit value.
	Neither axis should be BUSY after a BREAK signal has been received from the peripheral device and both axes have stopped.		
	Neither axis should be BUSY after a STOP signal has been received from the AD71TU and both axes have stopped.		

*In peripheral device or AD71TU test mode, X11 and Y2D should not be checked.

(3) Timing



POINTS

(1) During jog operation the upper and lower stroke limits are ignored.

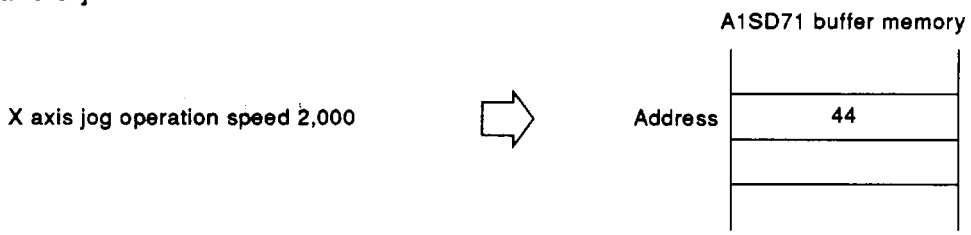
(2) When backlash compensation has been specified, the minimum movement allowed will be the backlash specified.

(4) Program

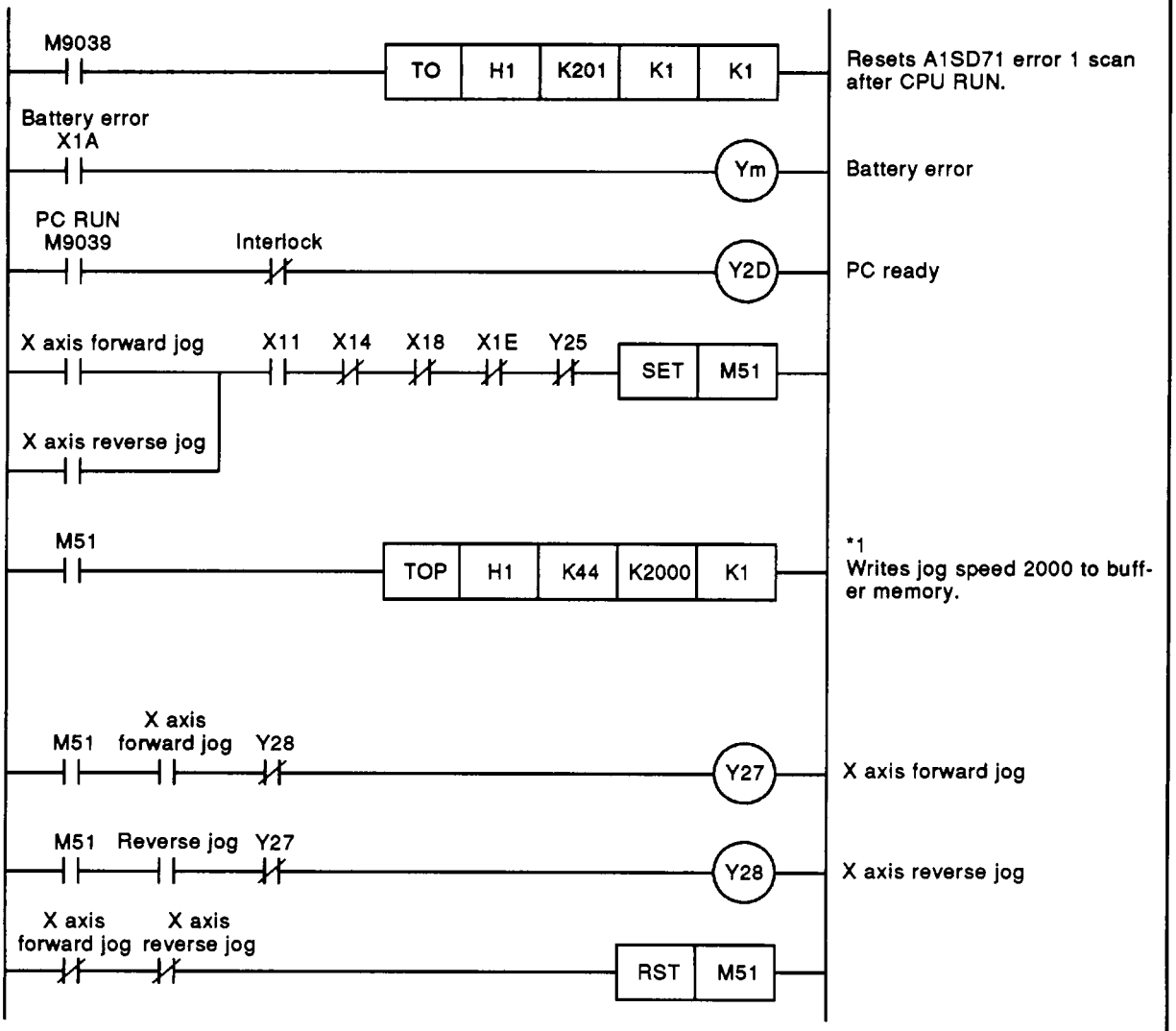
The drive is enabled for as long as the jog switch is pressed.

[Example]	X axis jog at speed 2,000 (20,000 mm/min)
[Notes]	Start conditions are shown in Table 6.3. The jog speed must be written to the buffer memory.

[Data transfer]



[Program]



REMARKS

1. The A1SD71 will wait until the output speed is zero before giving a second jog output.

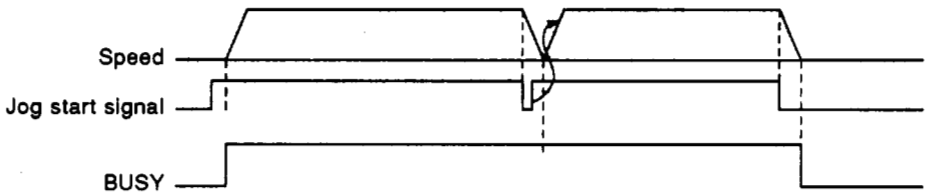


Fig. 6.8 Jog Repetition

2. Interpolation is not enabled during jog operation.
3. The A1SD71 defaults to forward jog if both forward and reverse jog commands are given simultaneously.

POINT

*1 When the speed is changed to 2000 in a program, it is internally processed as 2000×10^1. Therefore, the actual speed becomes 20,000 mm/min.

6.3.5 Manual pulse generator operation program

Manual pulse generator operation executes positioning according to the following principle.

(1) Pulse is output to an A1SD71 by operating manual pulse generator.

(2) Input pulse is converted to output pulse inside an A1SD71.
A1SD71 takes several tens of mm seconds for the internal processing such as output pulse conversion.

Conversion formula:

$$\text{Number of output pulse of A1SD71} = \frac{R \times Q}{P} \quad \text{..... (formula, 1)}$$

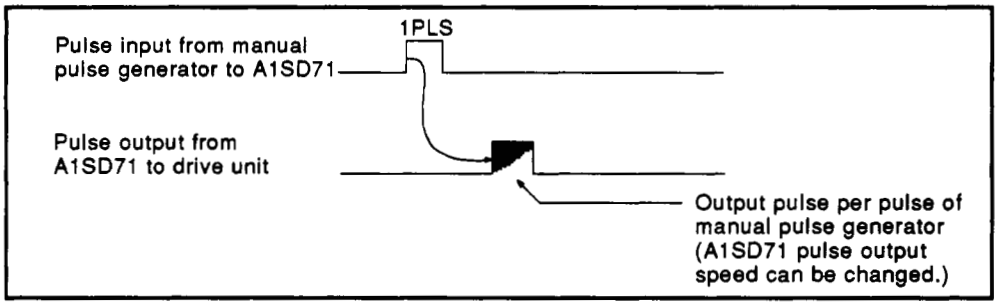
P: Travel distance per pulse set at parameter

Q: Travel distance per pulse of manual pulse generator set at parameter

R: Number of input pulses of manual pulse generator

(3) Number of output pulses calculated by formula 1 above is output to a drive unit from an A1SD71.
The method of outputting pulse of A1SD71 is as follows.

(a) A1SD71's output pulse per pulse input from a manual pulse generator to an A1SD71 is output to a drive module from the A1SD71 by each input pulse from a manual pulse generator.



(b) The time obtained by the following formula is until pulse output per manual pulse generator's pulse is completed.

[Pulse output speed is determined by the manual pulse generator output speed st at buffer memory (address 202 or 502).
When the manual pulse generator output speed is too fast, drive unit cannot follow.
In this case, set slower manual pulse generator output speed.]

Pulse output time of A1SD71 =
(A1SD71 internal processing time) (1) + (pulse output time) (2) [msec]
..... (formula, 2)

1) A1SD71 internal processing time: 20 to 99 msec

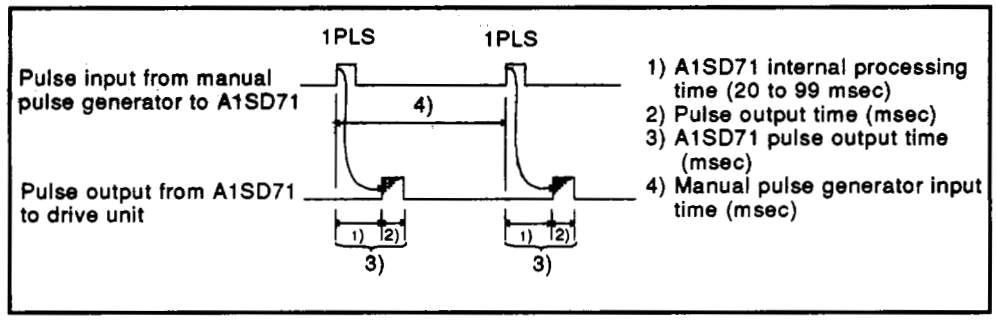
2) Pulse output time:

$$\frac{\text{(Travel distance per pulse of manual pulse generator)} \times \text{(Number of pulses counted by A1SD71)}}{\text{(A1SD71 pulse output speed)}^*} \text{ [msec]}$$

..... (formula, 3)

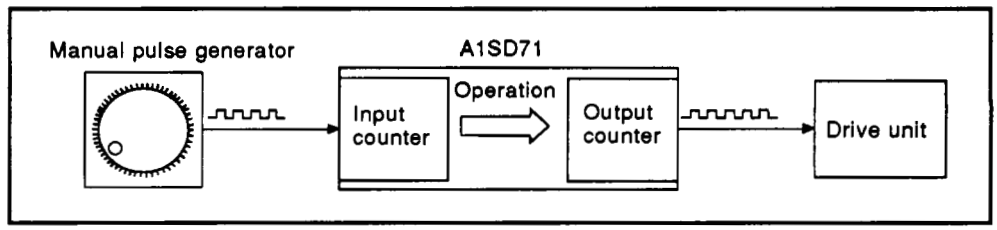
*: A1SD71 pulse output speed: 10 to 20000 PPS (10 PPS unit)

After outputting pulse from A1SD71 is completed, output pulses which correspond to the number of pulses input from a manual pulse generator is output from an A1SD71 taking the time shown in formula 2.



Therefore, smooth operation is impossible even if pulse is input from a manual pulse generaotr sequentially. Pulse is output intermittently. When the manual pulse generator input time (msec) is less than the value calculated by formula 2, output pulse is accumulated in A1SD71.
Output pulse accumulated in A1SD71 is output sequentially after A1SD71 internal processing time (20 to 99 msec).

(4) During outputting pulse to drive unit, BUSY signal of corresponding axis is ON.



POINTS

(1) When manual pulse generator operation is completed, set manual pulse generator enable to 0.
If touching a general pulse generator in the condition that manual pulse generator enable is set to "1".

(2) Input pulse of manual pulse generator is counted only when the following two conditions are established.
- Manual pulse generator enable area of buffer memory is set to "1".
- Corresponding axis is not during BUSY, or during BUSY in manual pulse generator mode.

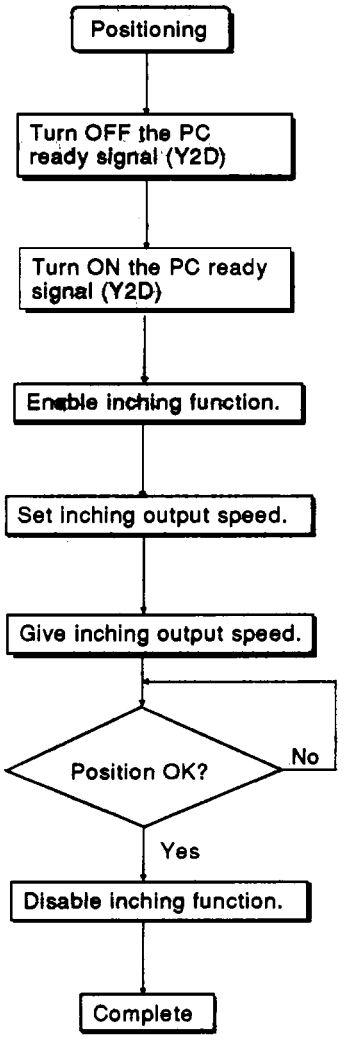
(3) When the manual pulse generator enable area is set to "0", pulse input and pulse input counters are cleared after about 0.2 seconds.
When stop signal (Y25, 26) is turned ON, pulse input and pulse output counters are cleared after about 0.2 seconds.

(4) When moved to the direction which has backlash, operation is not started if the number of output pulses is less than the backlash set value.

(5) If operation cannot be started due to an error at the time of starting manual pulse generator, pulse input counter is not cleared.
When pulse is continued to be input to A1SD71 from manual pulse generator after a error occurs, pulse input counter causes size error, and the number of input pulses cannot be stored normally.
Therefore, stop the operation of manual pulse generator after an error occurs, and clear tahe pulse input counter by writing 0 to manual pulse generator enable area.

(6) Max. 16777215 pulses can be accumulated in the output counter.
When the number of output pulses exceeds 16777215, output counter causes size error and the exceeded number of pulses is ignored.
Output counter can be recovered from size error by restricting generator output speed.

(i) Flow chart



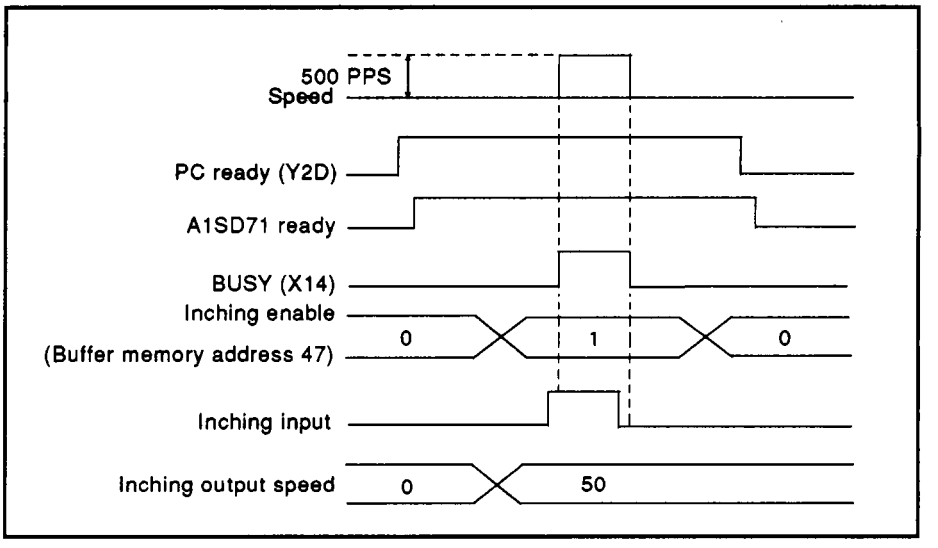
(ii) Conditions

Table 6.4 Start Conditions

	Signal	State	Remarks
External signal	Drive unit READY	ON	
	STOP	OFF	
Interface signal	A1SD71 ready (X11)	ON	*
	Relevant axis BUSY (X14, X15)	OFF	On during inching pulse generation
	Relevant axis positioning commenced (X18, X19)	OFF	
	Relevant axis M code ON (X1E, X1F)	OFF	
	Relevant axis stop (Y25, Y26)	OFF	
	PC ready (Y2D)	ON	*
Others	"Inching enable" in buffer memory (X axis 47 Y axis 347)	Bit = 1	Inching input is ignored in the case of the zero bit. This is not an error.
	Parameters	Withiin setting range	
	Inching output speed in buffer memory (202, 502)		
	Neither axis should be busy if a [BREAK] (GPP, PHP) or [STOP] (AD71TU) signal has been received and positioning has stopped.		

*: In peripheral device test mode, the signals may be off.

(iii) Timing



IMPORTANT

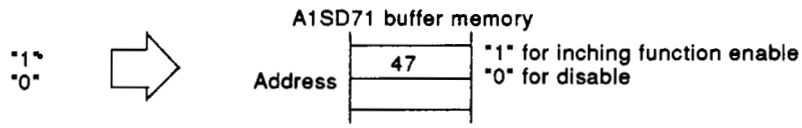
When the manual pulse generator is operated in the manual pulse generator enable state during BUSY in positioning, zero return, or JOG operation mode, an error (code 73) occurs. Therefore, set the manual pulse generator enable area to 0 (disable) other than in manual pulse generator mode.

(iv) Program

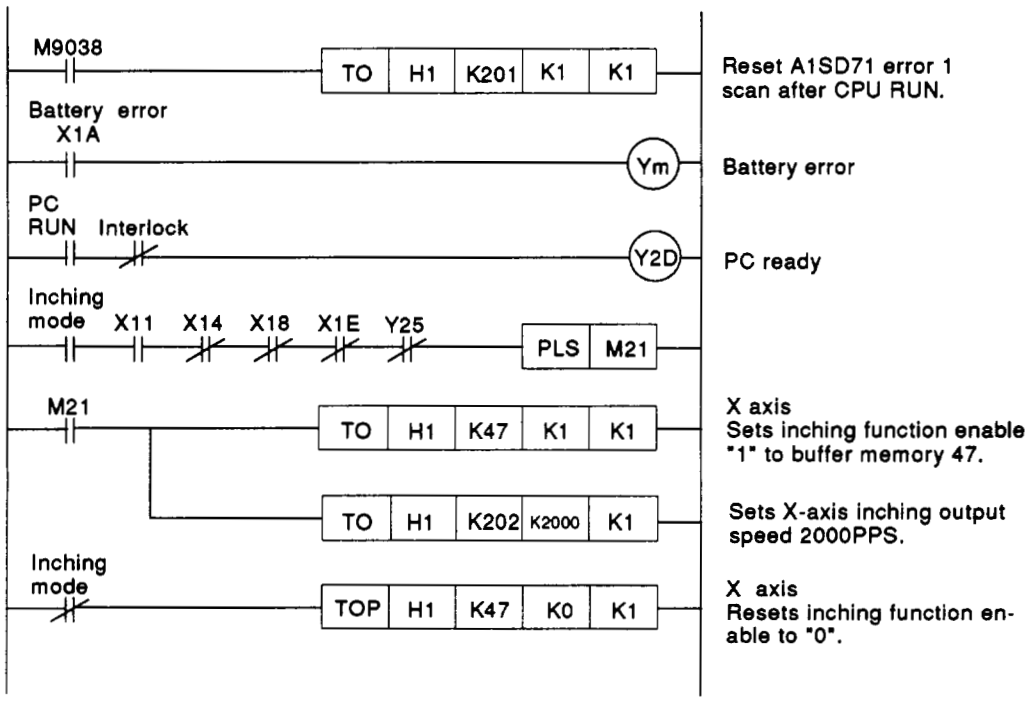
[Example] X axis inching

[Note] Start conditions are shown in Table 6.4.

[Data transfer]



[Program]



6.3.6 Positioning address teaching program

Positioning addresses can be written using devices.

(1) Using the jog operation

Addresses set by using the jog operation are written to the target data number of the A1SD71 buffer memory.

(2) Using the inching operation

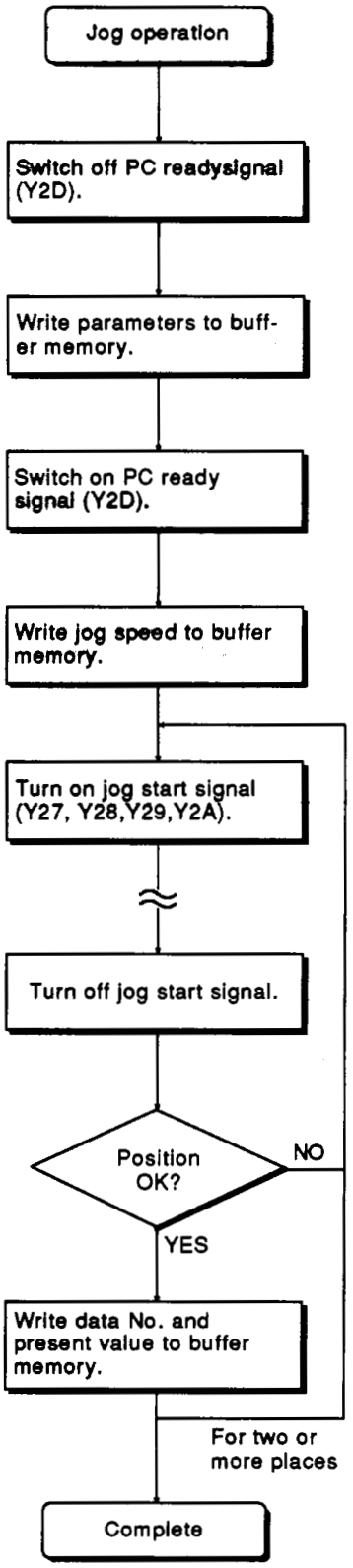
Move the system to the required position using the manual pulse generator and write that address into the A1SD71 buffer memory.

(3) Jog then inching combined

Coarse position using the jog operation then fine position with the manual pulse generator. Write the address to the A1SD71 buffer memory.

[1] Jog to position and teach

(1) Flow chart



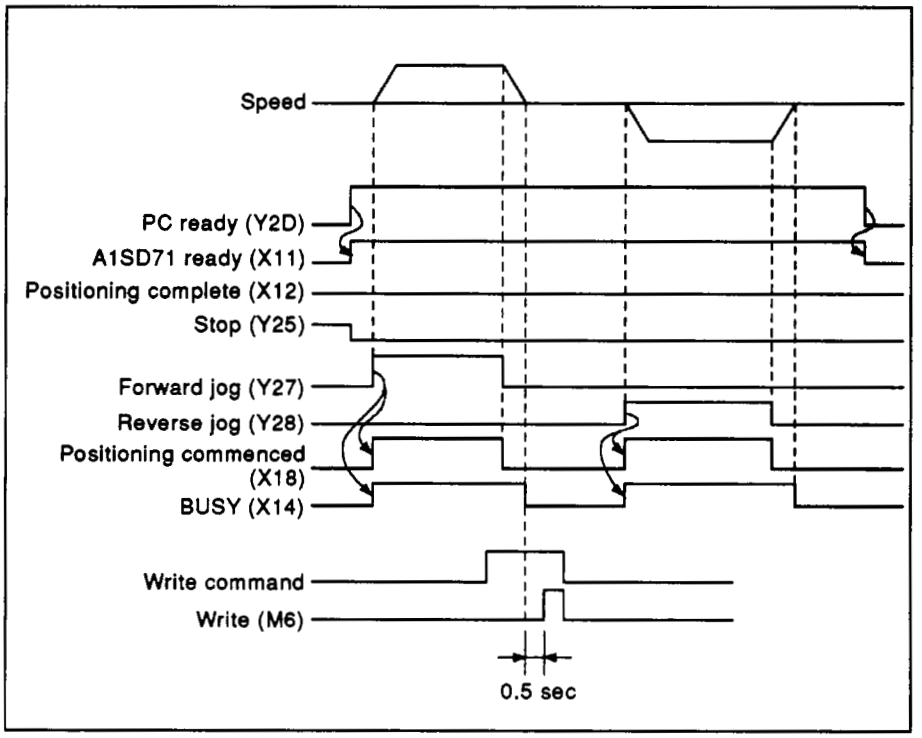
(2) Conditions

Table 6.5 Address Write Conditions Using Jog Operation

	Signal	State	Remarks
External signal	Drive unit READY	ON	
	Stop signal STOP	OFF	
Interface signal	A1SD71 ready (X11)	ON	*
	Relevant axis busy (X14, X15)	OFF	
	Relevant axis positioning commenced (X18, X19)	OFF	
	Relevant axis M code ON (X1E, X1F)	OFF	
	Relevant axis stop (Y25,Y26)	OFF	
	PC ready (Y2D)	ON	*
Others	Jog speed	Starting bias speed or higher	If jog speed specified is higher than the jog speed limit value, operation is performed at the jog speed limit value.
	Neither axis should be BUSY after a BREAK signal has been received from the peripheral device and both axes have stopped.		
	Neither axis should be BUSY after a STOP signal has been received from the AD71TU and both axes have stopped.		

*In peripheral device or AD71TU test mode, X11 and Y2D should not be checked.

(3) Timing

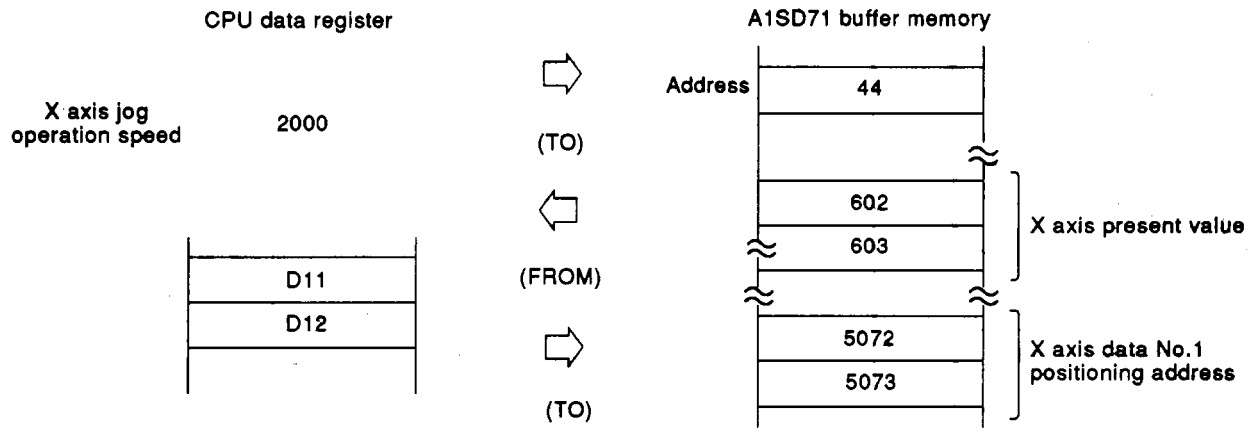


(4) Program

System is positioned in jog mode and resulting address written to buffer memory.

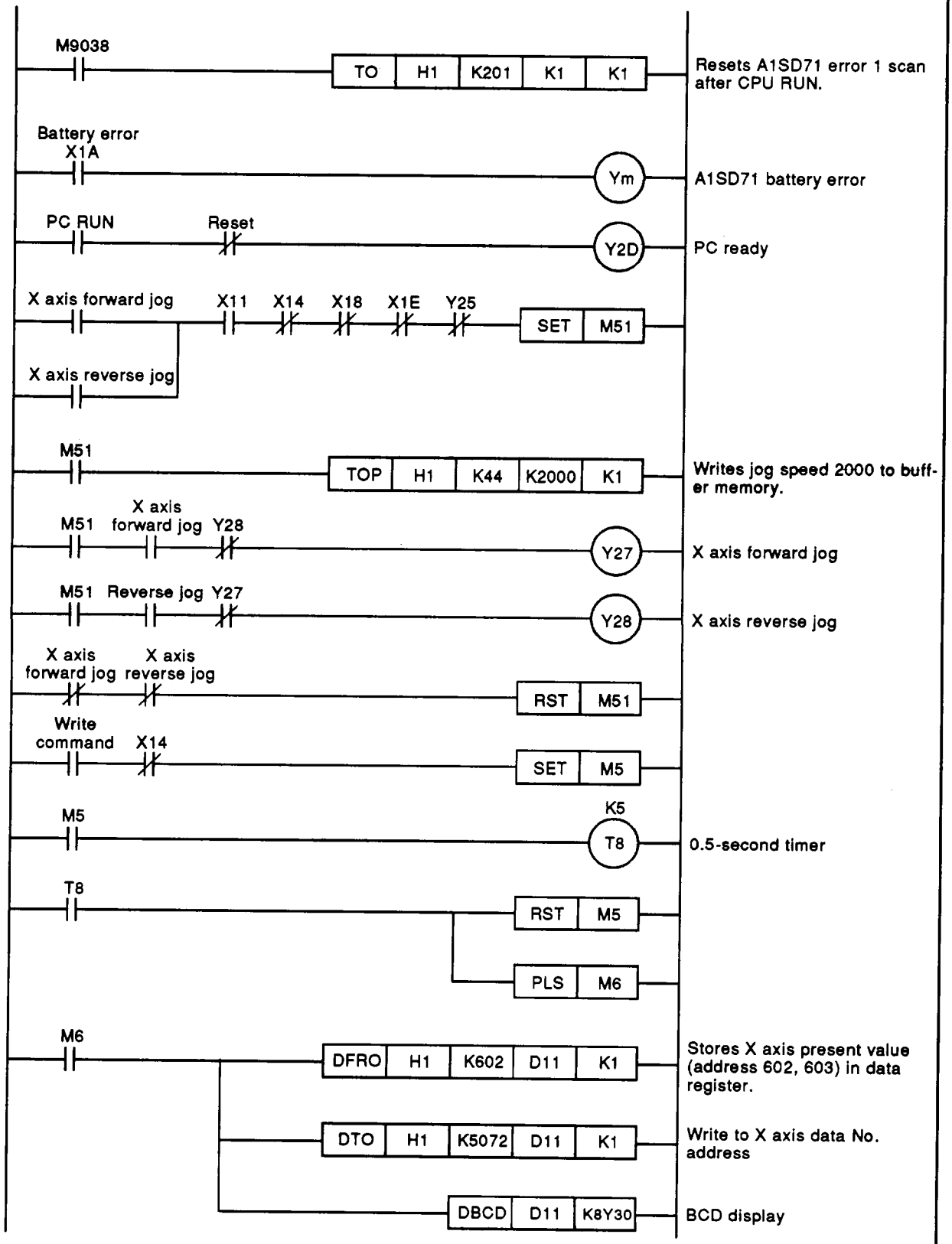
[Example]	X axis jog and address written as data No. 1 (jog speed = 2,000 (20,000 mm/min))
[Notes]	(1) Start conditions are shown in Table 6.5. (2) A delay of approx. 0.5 seconds occurs after positioning stops to allow the current value of the buffer memory to be updated.

[Data transfer]



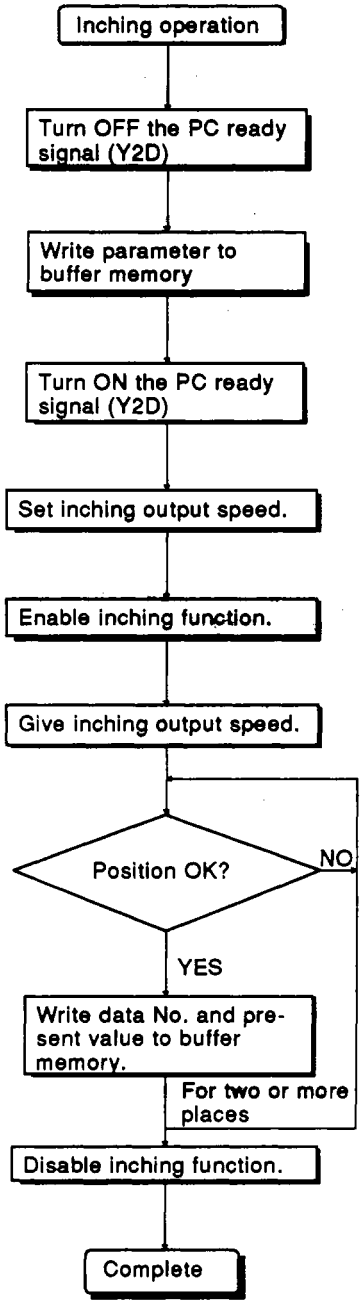
[Program]

To write address to data No.1



[2] Pulser inching to positioin address writing

(1) Flow chart



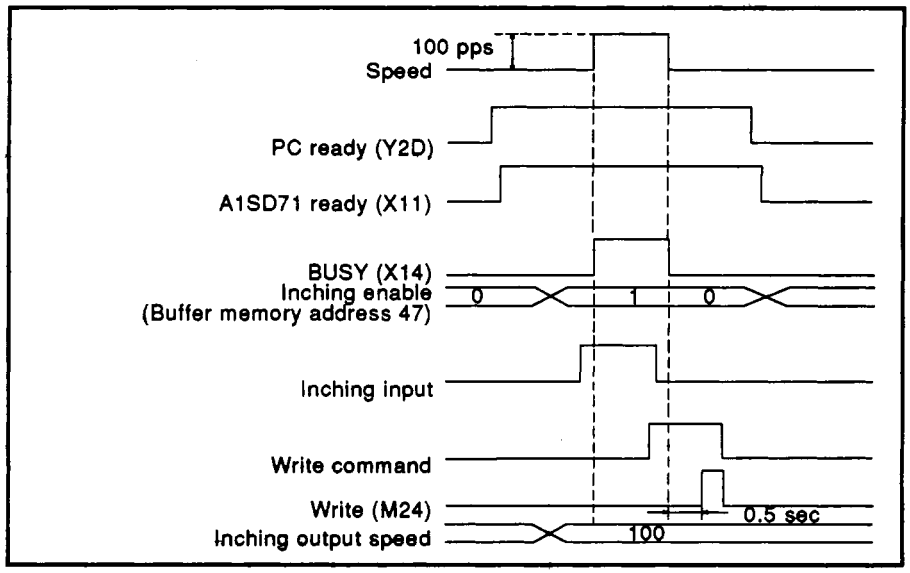
(2) Conditions

Table 6.6 Address Write Conditioin Using Inching Operation

	Signal	State	Remarks
External signal	Drive unit READY	ON	
	STOP	OFF	
Interface signal	A1SD71 ready (X11)	ON	*
	Relevant axis BUSY (X14, X15)	OFF	
	Relevant axis positioning commenced (X18, X19)	OFF	
	Relevant axis M code ON (X1E, X1F)	OFF	
	Relevant axis stop (Y25, Y26)	OFF	
	PC ready (Y2D)	ON	*
Others	"Inching enable" in buffer memory (X axis 47 axis 347)	Bit=1	Inching linut is ignored in the case of the zero bit. This is not an error.
	Parameters	Within setting range	
	Inching output speed in buffer memory (202, 502)		
	Neither axis should be busy if a [BREAK] (GPP, PHP) or [STOP] (AD71TU) signal has been received and positioning has stopped.		

*: In peripheral device test mode, the signals may be off.

(3) Timing



IMPORTANT

When the manual pulse generator is operated in the manual pulse generator enable state during BUSY in positioning, zero return, or JOG operation mode, an error (code 73) occurs. Therefore, set the manual pulse generator enable area to 0 (disable) other than in manual pulse generator mode.

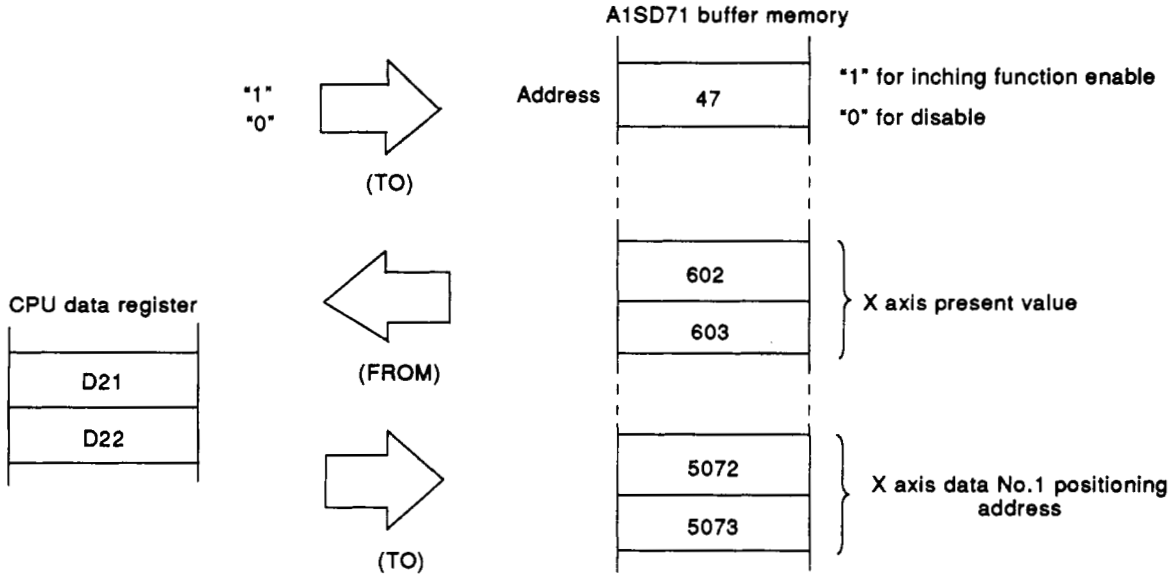
(4) Program

System is inched to required position and resulting adress written to buffer memory.

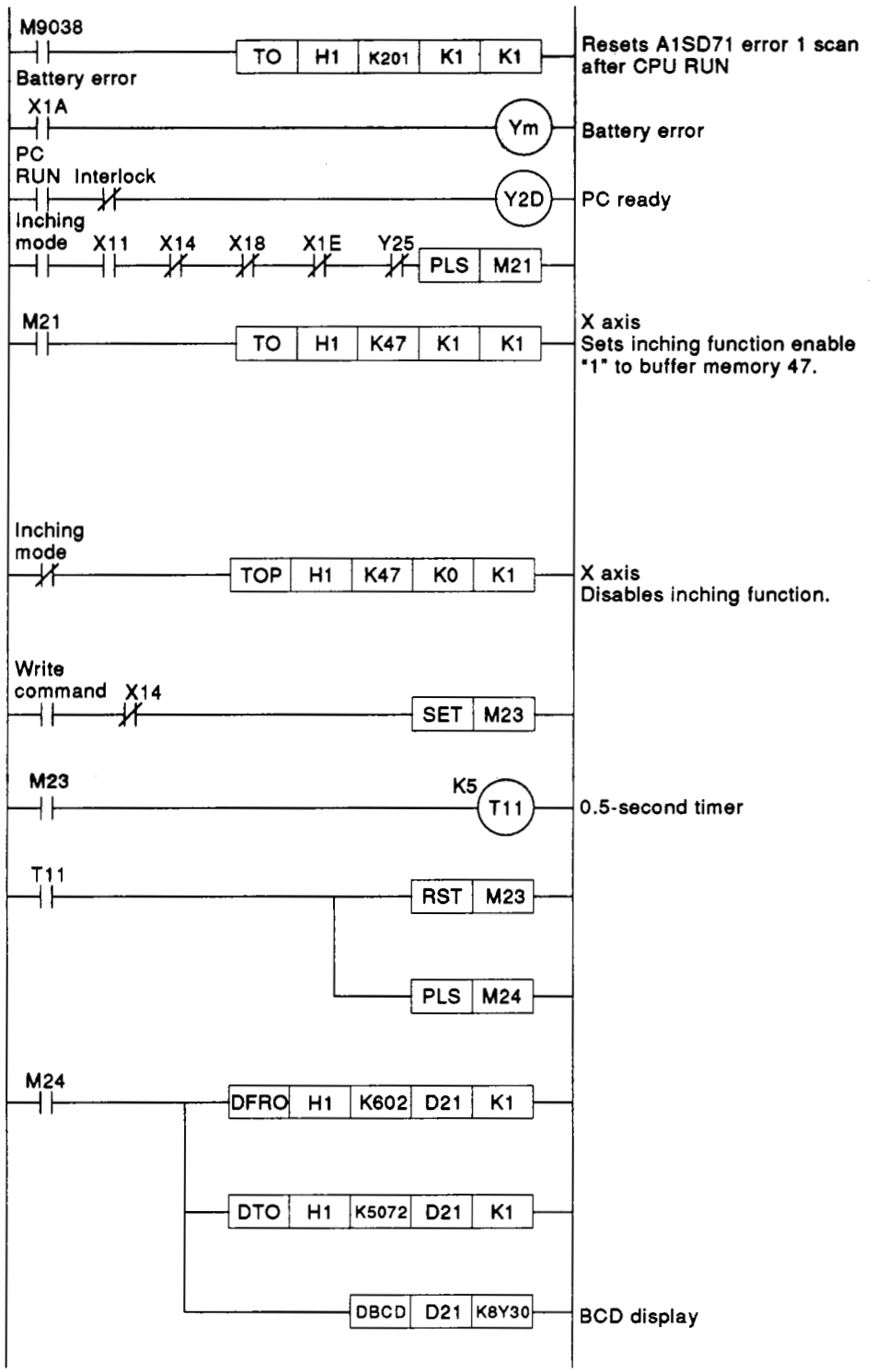
[Example] Inch X axis and address written as data No.1.

[Notes] (1) Start conditions are shown in Table 6.6.
(2) A delay of approx.0.5 seconds occurs after positioning stops to allow the urrent value of the buffer memory tobe updated.

[Data transfer]



[Program]

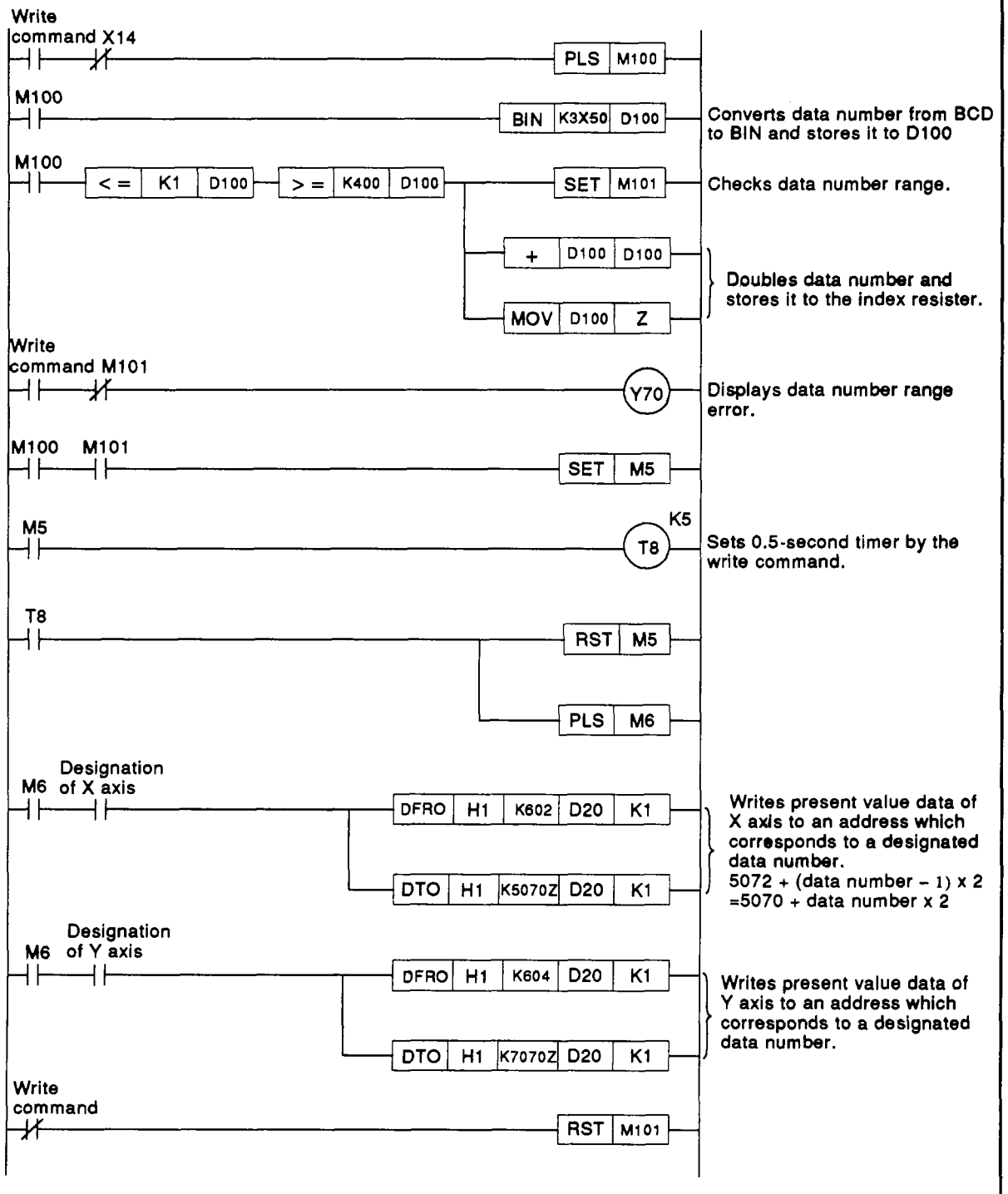

M9038
TO H1 K201 K1 K1
Resets A1SD71 error 1 scan after CPU RUN
Battery error
X1A
Ym
Battery error
PC RUN
Interlock
Y2D
PC ready
Inching mode
X11 X14 X18 X1E Y25
PLS M21
M21
TO H1 K47 K1 K1
X axis
Sets inching function enable "1" to buffer memory 47.
Inching mode
TOP H1 K47 K0 K1
X axis
Disables inching function.
Write command
X14
SET M23
M23
K5
T11
0.5-second timer
T11
RST M23
PLS M24
M24
DFRO H1 K602 D21 K1
DTO H1 K5072 D21 K1
DBCD D21 K8Y30
BCD display

[3] Writing positioning address according to the data number from the digital swich.

program example

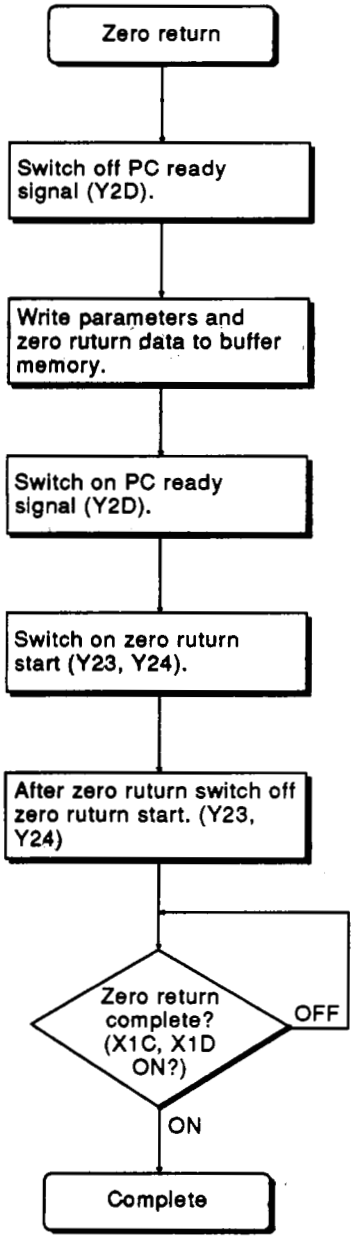
Program example which is written as a address in the condition at fixed buffer memory after executes positioning according manual pulse generator operation or JOG generator operation is as follows.
Data number assume to be at BCD-3-digit of X50 to X5B.

[Program]



6.3.7 Zero return

(1) Flow chart



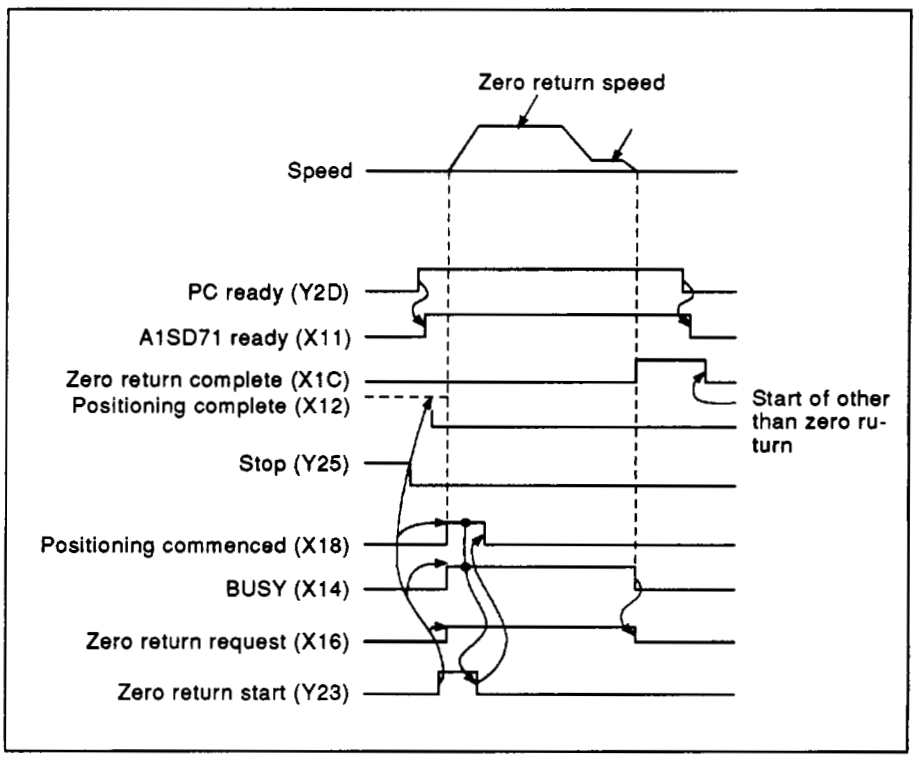
(2) Conditions

Table 6.7 Zero Return Conditions

	Signal	State	Remarks
External signal	Drive unit READY	ON	
	Stop signal STOP	OFF	
Interface signal	A1SD71 ready (X11)	ON	*
	Relevant axis busy (X14, X15)	OFF	
	Relevant axis positioning commenced (X18,X19)	OFF	
	Relevant axis zero ruturn complete (X1C,X1D)	OFF	
	Relevant axis M code ON (X1E, X1F)	OFF	
	Relevant axis stop (Y25, Y26)	ON	
	PC ready (Y2D)	ON	*
Others	Zero return data	No error	
	Repetition of zero ruturn start	Max. twice consecutively.	
	Neither axis should be BUSY after BREAK (peripheral device) or STOP (AD71TU) has been received and positioning has stopped.		

*In peripheral device or AD71TU test mode, Y2D should not be checked.

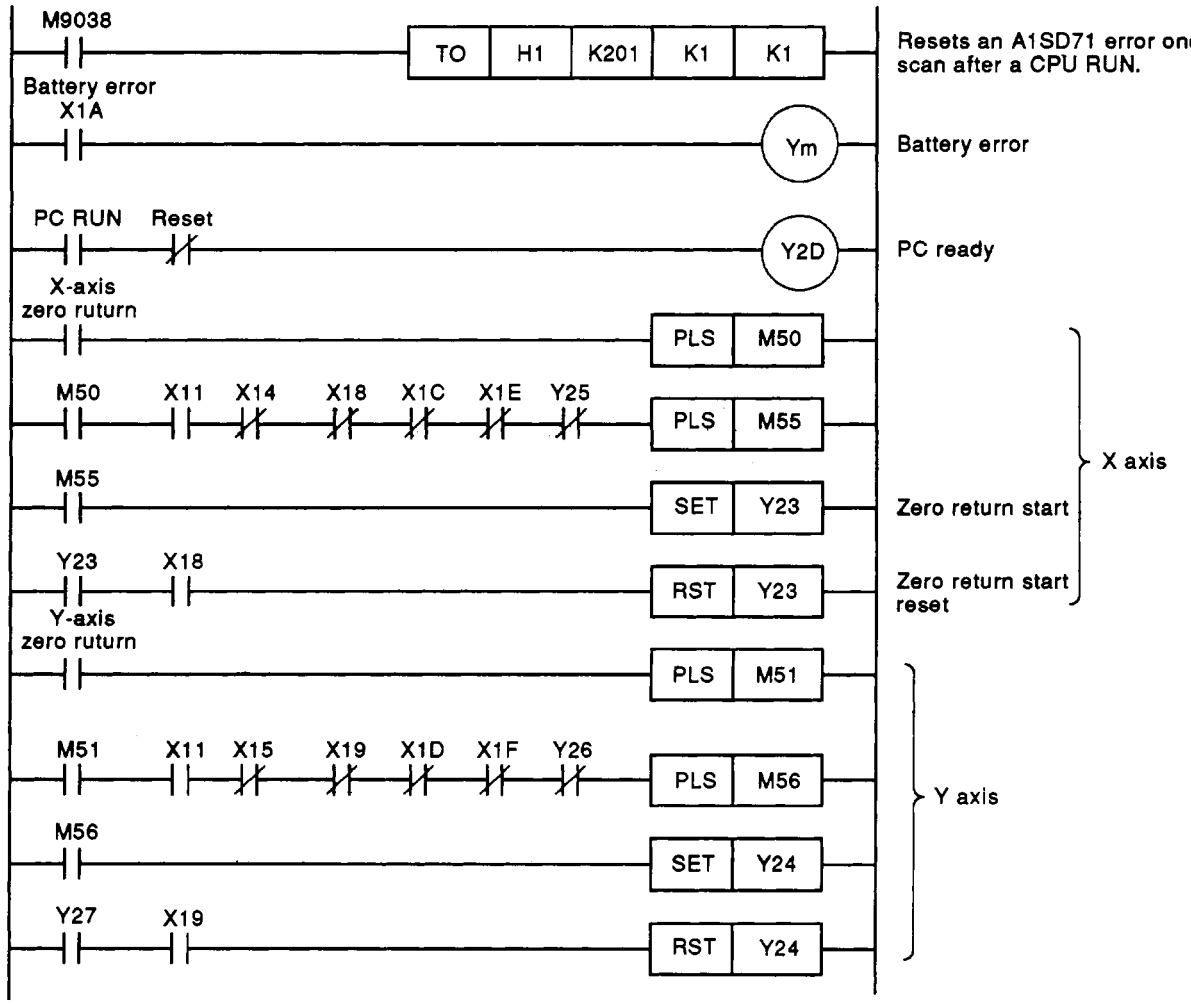
(3) Timing



(4) Program

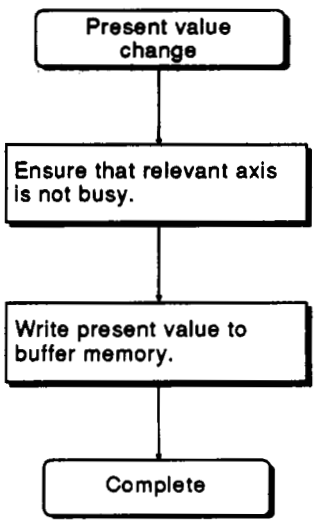
[Example]	Zero return using a zero ruturn command.
[Data transfer]	(1) Start conditions are shown in Table 6.7. (2) Interpolation operations are disabled during zero ruturn. A delay of approx. 50 msec occurs at one axis when zero ruturn is started at the X and Y axes simultaneously. (3) Zero return cannot be repeated. When zero ruturn is stopped, restart zero ruturn after a jog operation or positioning operation.

[Program]



6.3.8 Present value change

(1) Flow chart



(2) Conditions

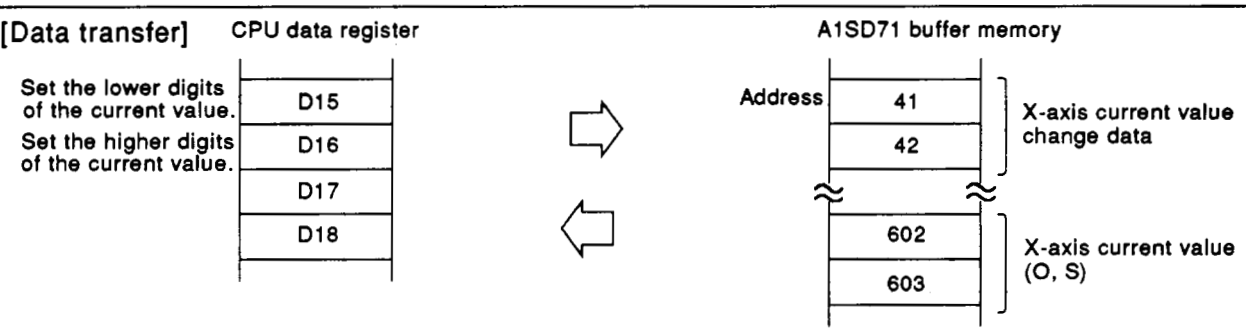
Table 6.8 Present Value Change Condition

Signal	State
Relevant axis BUSY	OFF

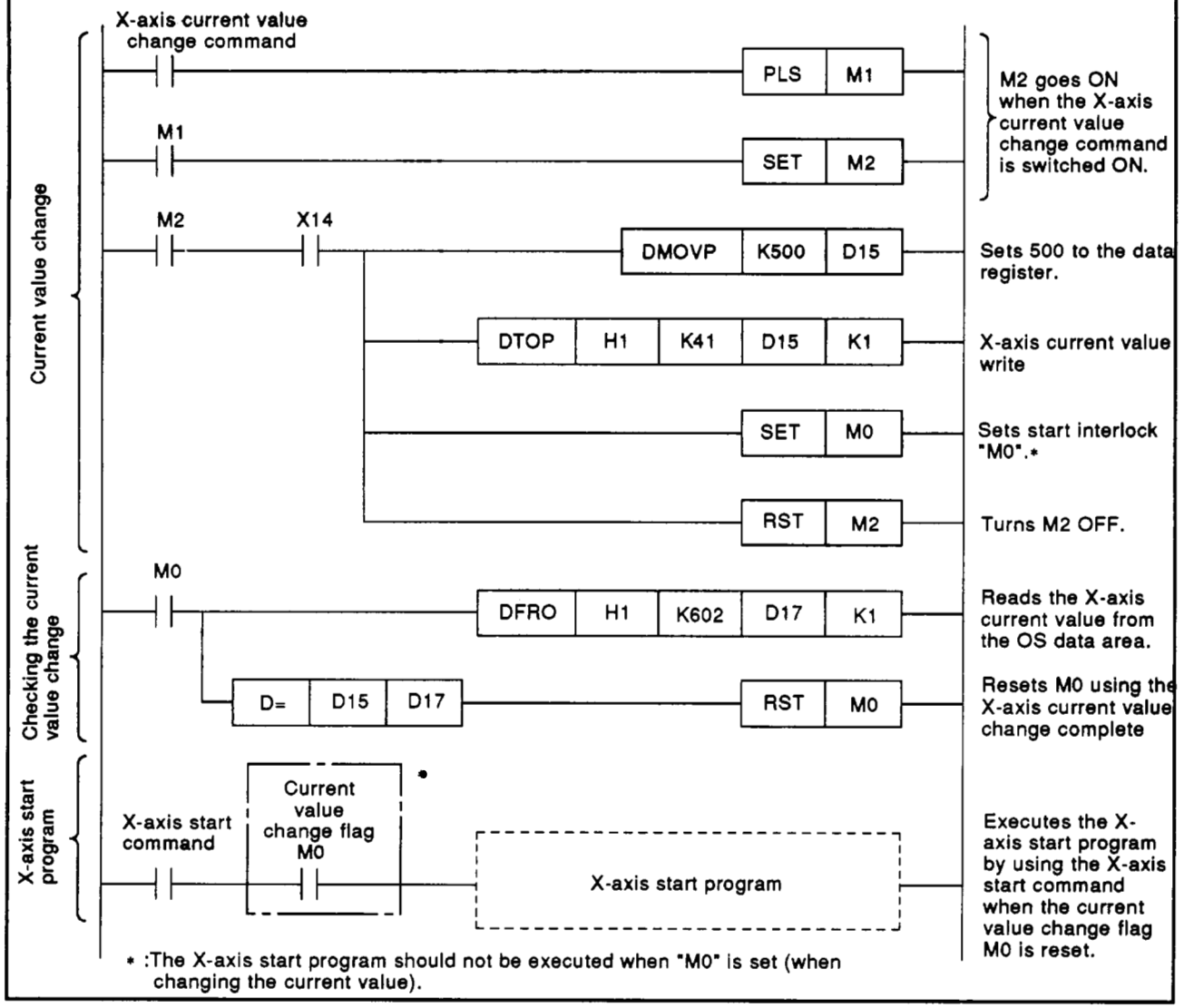
(3) Program

[Example] To change the current value to 500 when the X-axis current value change command is switched form OFF to ON.

[Data transfer]



[Program]



* :The X-axis start program should not be executed when "M0" is set (when changing the current value).

REMARKS

1. Data should be written to two words of the upper and lower digits in the current value change area. Writing to only one word causes an error, and the current value is not changed.
2. The current value is modified to a zero address by zero return after changing the current value. However, parameter and zero return data must be written before zero return.

6.3.9 Positioning stop

The positioning process may be stopped while the A1SD71 is busy as follows:

Table 6.9 Stop Signals

Item	Valid Signal	Independent operation		Inter-polation Operation
		Relevant axis	Other axis	
STOP signal from drive unit ON		O		O
PC ready signal (Y2D) OFF*		O	O	O
Stop signal from PC (Y25, Y26) ON		O		O
BREAK key input from peripheral device or STOP key input from AD71TU		O	O	O

O indicates that the signal is valid.
* :In peripheral device or AD71TU test mode, positioning is not stopped if Y1D is ON or OFF.

(1) Note on use of stop signal

(a) Deceleration is valid after stop signal is received

On receiving any of the stop commands given in Table 6.9, the system is decelerated to a stop. All emergency stops and limits must be hard-wired.

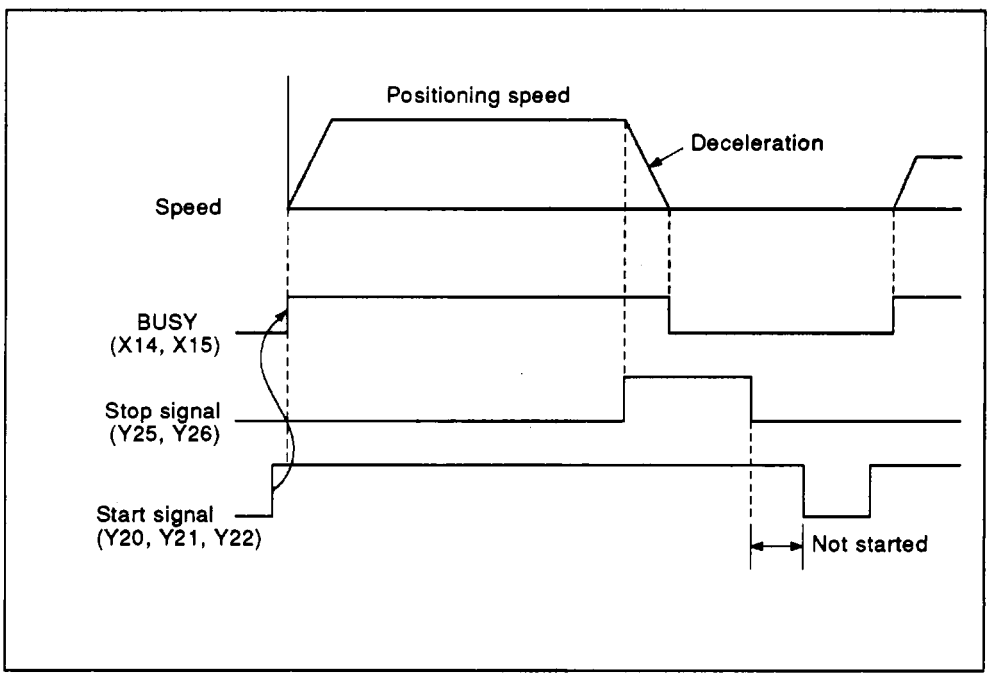


Fig. 6.9 Stop Signal

(b) Stop signal during deceleration

The operation decelerates and stops at that speed except in the following cases.

When zero return is executed, only the stop signal during deceleration is stopped.

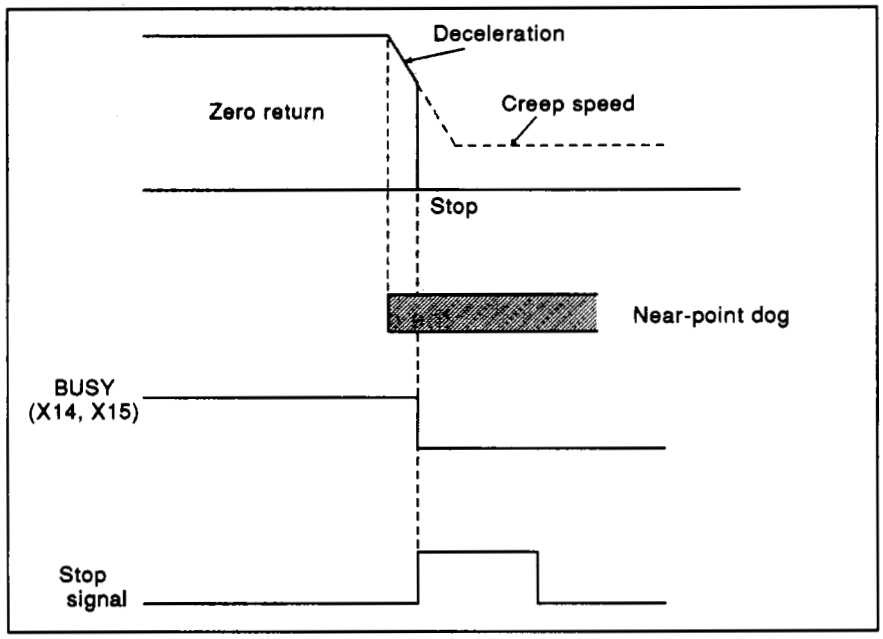


Fig. 6.10 Stop Command Received During Zero Return Deceleration

REMARK

In the case of a stop when the stop signal is turned ON after the near-point dog for zero return, return to the position prior to the zero-point dog by jog operation, and retry. Otherwise, the A1SD71 can malfunction.

(c) Stop signal reset

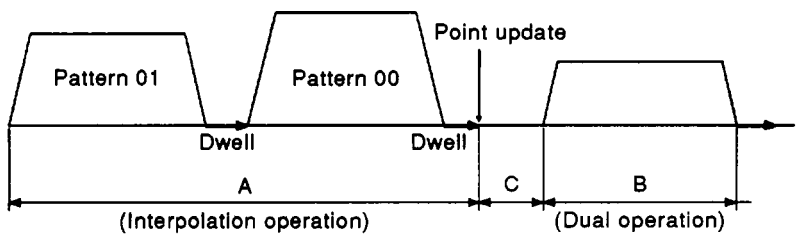
A start signal (Y10, Y11, Y12) is only valid at its leading edge, therefore, if it is already on when the stop signal is reset the process will not restart.

(d) M code

The conditions shown in Table 6.10 turn off the M code ON signal at the relevant axis. When the PC ready signal is turned off, the M code is set to "0".

(e) Stop during interpolation operations

During interpolation operations, both axes can be stopped by either the X- or the Y-axis stop signal. However, when interpolation and independent operations are combined in the start data number automatic switching (pointer setting), the axis stops as shown below at the point update. Therefore, after going to independent positioning, the stop signal is only valid for the self axis.



Stop signal ON during A	Stop signal ON during C	Conditions
Both axes are stopped.	The self axis is stopped.	The other axis is not BUSY. Or the other axis is executing independent positioning of B.
	Both axes are stopped.	The other axis has not executed positioning of B.

Fig. 6.11 Stop During Interpolation

(2) Other stop signals

In addition to the four stop signals in Table 6.9, the following in Table 6.10 also stops processing while the A1SD71 is BUSY. For all the following, positioning is decelerated to a stop and the peripheral device displays an error message.

Table 6.10 Stop Signals

Item	Valid Signal	Independent operation		Inter-polation Operation
		Relevant axis	Other axis	
Ready signal from drive unit OFF	⌐	O		O
Operation error (8231 error)		O	O	O
A1SD71 bus error		O	O	O

(3) Restarting after a stop

(a) Proceed to the next address

The table below shows when data number automatic switching is used and not used.

	Absolute method	Incremental method
	Two axes independent operation/ two axes interpolation operation	Two axes independent operation/ two axes interpolation operation
Data number automatic switching is used.	Available	Unavailable
Data number automatic switching is not used.	Unavailable	Unavailable

REMARK

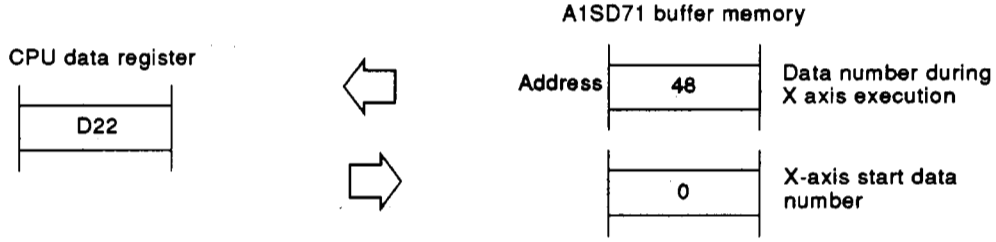
Apply the following processes for the unavailable mode:

- Restart after zero return.
- Restart after resetting the positioning data.
- When setting the data number to the 1st point (X-axis address: 0, Y-axis address: 300) in the A1SD71 positioning start data area, data number automatic switching is not used.
- When setting several data numbers to the A1SD71 positioning start data area (X-axis addresses: 0 to 39, Y-axis addresses: 300 to 339), data number automatic switching is used.

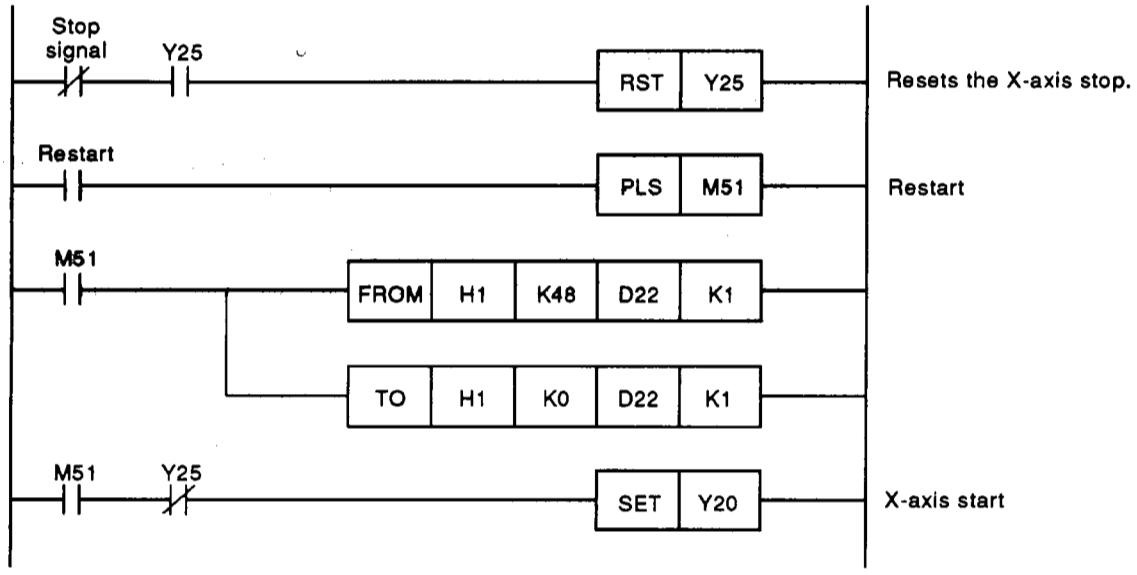
1) When data number automatic switching is not used in the absolute method.

The executing data number is stored to buffer memory addresses 48 (X axis) and 348 (Y axis) during positioning and kept until the next start. This applies to the restart after stop.

[Data transfer]



[Program]



(b) Zero return method

Refer to Section 6.3.7.

(c) Restarting after a stop during zero return

When zero return starts cannot be repeated. Execute zero return after the following operations:

1) Execute positioning from the correct data number.

2) Execute positioning using a jog operation when positioning is stopped near the zero point.

(d) Positioning is stopped by using the BREAK key on the peripheral device.

BREAK key is valid for the X and Y axes. Positioning can be restarted when both axes are not BUSY. If one axis is BUSY, starting is disabled.

7. CHECK LISTS

The check lists given in associated equipment manuals should also be referred to. For the A1SCPU, refer to the A1SCPU User's Manual.

7.1 General Check List

Before testing the A1SD71, check the following:

Table 7.1 General Check List

	Check Point	Description	Check
1	Battery	• Check that battery leads are connected to the printed circuit board.	
2	Parameter setting	• Check that parameters have been set. • Check that values are correct.	
3	Zero return data setting	• Check that zero return data has been set. • Check that values are correct.	
4	Positioning data	• Check that positioning data has been set. • Check that values are correct.	

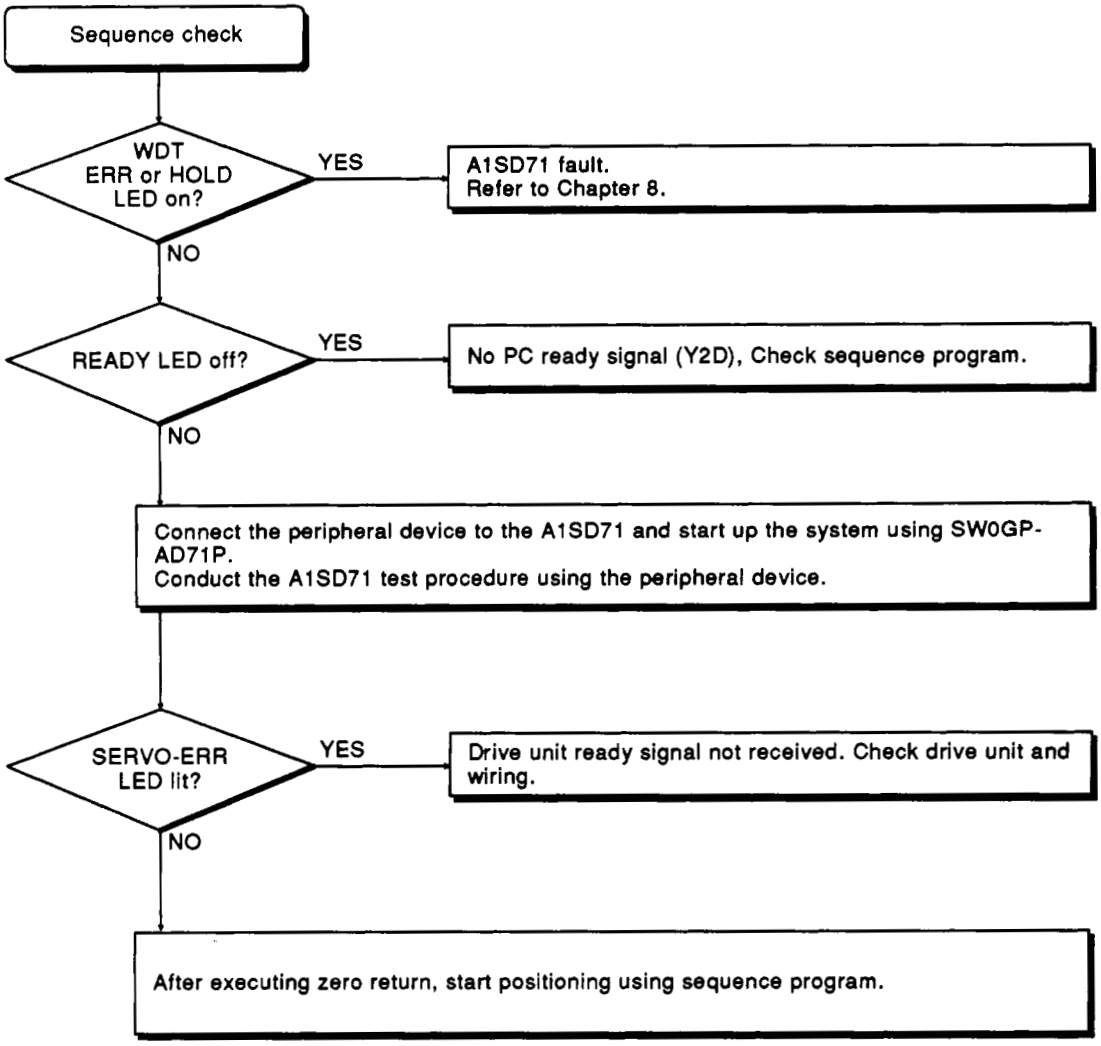
POINT

If only one axis (X or Y axis) is used, parameters and zero return data must be written to the unused axis. Otherwise zero return will result in error and switch on the X1B (error detection) signal.
(Data written must be within the range given in the User's Manual. Parameters may be default values.)

7.2 Tests and Adjustments Procedure

7.2.1 Sequence check

Use the following procedure to check the system.
Set the key switch on the A1SD71 front panel to "LOCK." This only changes the present value and allows checking of the positioning functions with the feed pulse output stopped.



7.2.2 Positioning operation check

After completing the check given in Section 7.2.1, turn the key switch on the front of the A1SD71 to OFF or M.PRO.
Check the operation after setting the parameter speed limit value at slow speed and preparing for an emergency stop if a dangerous state occurs.
The positioning operation should be checked after executing zero return.
The peripheral device (SW0GP-AD71P) has a handy monitor function and is valid when the operation is faulty. Take corrective action after reading the error code and finding the cause of the error.

8. TROUBLESHOOTING

Errors may be detected by:

1) The A1SD71 CPU; or
2) The peripheral device during program development and debugging.

This section describes errors detected by the A1SD71 CPU, for other errors see the SW0GP-AD71P Operating Manual.

8.1 Errors Detected by A1SD71

The A1SD71 has various error check functions. When an error occurs, an error code is written to address 45 (X axis) and 345 (Y axis) in the buffer memory.

(1) A new error will overwrite the previous one in the buffer memory. The code is displayed on the lower left hand side of the peripheral device's screen.

(2) Error code "0" indicates no error.

(3) Error reset

Errors are reset by writing a "1" to buffer address 201. (See Section 6.3.2 (7))
For resetting of errors using the peripheral device, refer to the SW0GP-AD71P Operating Manual.

(4) Error detection

X1B is the error detection flag. Resetting the error also resets X1B.

Error codes are classified as shown in Table 8.1.

Table 8.1 Error Code Classification

Error Code	Error Classification	Remarks
1 to 49	Data range error	Refer to Section 8.1.1.
50 to 59	A1SD71 HOLD error	Refer to Section 8.1.2.
60 to 69	Buffer memory write disable error	Refer to Section 8.1.3.
70 to 79	A1SD71 start and operation error	Refer to Section 8.1.4.
90 to 99	Other error	Refer to Section 8.1.5.

8.1.1 Data range errors

Any of the operations shown in Table 8.2 will prompt a data range check by the A1SD71 as shown below.

Table 8.2 Data Range Check

Data	Operation
Parameters	• At power on* • When parameters have been transferred from the peripheral device to the A1SD71. • When PC ready signal (Y2D) changes from OFF to ON. • When positioning, zero return, jog, or inching has been selected in peripheral device test mode.
Zero return data	• When parameters or zero return data has been transferred from the peripheral device to the A1SD71. • When PC ready signal (Y2D) changes from OFF to ON. • When positioning, zero return, jog, or inching has been selected in peripheral device test mode.
Positioning data	• At the start of positioning (Refer to the figure in Section 6.3.)

• : The power on check will not give an error code or an error detection signal (X1B).

A list of error codes is shown in Table 8.3.

Table 8.3 Data Range Error Codes

Error code	Data Type	Check Point	Check Range (Errors occur outside the following ranges.)	Remarks
0			Normal	
1	Parameter	Travel per pulse	1 to 100	
2		Speed limit value	1 to 12,000 in mm, inch, or degree (If travel per pulse is "a" (unit/PLS), speed V range is restricted as given below: $\frac{V\ (unit/PLS)}{[a\ (unit/PLS)] \times 60} \leq 200{,}000$ PLS/sec) 1 to 20,000 in PLS	
3		Jog speed limit value	1 to parameter speed limit value	
4		Starting bias speed	0 to parameter speed limit value	
5		Acceleration and deceleration times	64 to 50,000	
6		Backlash	0 to 255 in PLS 0 to 65535 in mm, inch or degree	*3
7		Upper stroke limit	0 to 162,000 in mm 0 to 16,200 in inch or degree 0 to 16,252,928 in PLS	*2
8		Lower stroke limit	0 to upper stroke limit	
9		Error compensation	0 to 100,000 in mm, inch, or degree	
10		Travel per manual pulse during inching	1 to 100,000 in mm, inch, or degree 1 to 100 in PLS	
11		Positioning method	00, 01, or 10 in bits b4 and b3	
12		Positioning complete signal duration	0 to 20,000	
20	Zero return data	Zero address	0 to 1,620,000,000 in mm, inch, or degree 0 to 16,252,928 in PLS	*2
21		Zero return speed	Starting bias speed to parameter speed limit. (Not 0)	*1
22		Creep speed	Starting bias speed to parameter zero point return. (Not 0)	
23		Dwell time	0 to 499	
24		Torque limit	10 to 250	
30	Positioning data	Positioning speed	Starting bias speed to parameter speed limit. (Not 0)	*1
31		Positioning address	Within stroke limits	
32		Dwell time	0 to 499	
33		Positioning pattern	00, 01, or 11 in bits 0 and 1 (00 only if start data No. is 400)	
34			Pattern 11 may be used a max. of 9 times consecutively.	
35			Travel for consecutive 11 patterns must be in the same direction.	
36			The addressing method must be the same for consecutive 11 patterns.	
37			Interpolation start setting for both axes must be the same (00 or 01).	

Table 8.3 Data Range Error Codes (continue)

Error Code	Data Type	Check Point	Check Range (Errors occur outside the following ranges.)	Remarks
40	Positioning start data	Start number	1 to 400	
41		Pointer	0 to 19	
42		Speed change	Starting bias speed to parameter speed limit (Not 0)	*1
43		Present value change	0 to 1,620,000,000 in mm, inch, or degree 0 to 16,252,928 in PLS	*2
44		Jog speed	Starting bias speed to parameter jog speed limit (Not 0)	*1
45		Start axis	When two axes are to be started at the same time, both must be set for interpolation start (00) or for dual axis start (11).	
46		Start axis	The second axis must not be busy or must be behind the start point when an interpolation start (00) or a dual axis start (11) is called.	
140		Inching operation speed	1 to 20,000	

*1: If the set speed exceeds the parameter speed limit value, positioning is controlled at the parameter speed limit value.

*2: If the units are mm, inch, or degree and travel per pulse is "a" (unit/PLS), the address S range is restricted as given below:

$$\frac{S\,(\text{unit})}{a\,(\text{unit/PLS})} \leq 16{,}252{,}928(\text{PLS})$$

*3: When the travel distance per pulse is set to 1.

8.1.2 A1SD71 "HOLD" errors

The errors shown in Table 8.4 are indicated by the A1SD71 "HOLD" LED. Errors 50 or 51 indicate a hardware failure.
An A1SD71 bus error may be due to an A1SD71 failure or to the sequence program accessing too much of the buffer memory too frequently. In the later case, the sequence program must be changed in accordance with Section 8.2.

Table 8.4 A1SD71 Hold Error Codes

Error Code	Check Point	Error Definition
50	Operation element (8231)	Operation time-out error (hardware fault)
51		Operation error (overflow, underflow, etc...)
	A1SD71 bus error	The PC has priority for accessing the buffer memory. If accessing is too frequent the A1SD71 may not be able to access the data.

In the event of any of the above errors occurring 1) turn off the A1SD71 ready (X11) and 2) force BUSY processing to stop. The start signal is then not accepted.

8.1.3 Buffer memory write errors

Writing data from the sequence program to prohibited buffer addresses or writing when the buffer cannot accept the data prompts the error codes shown in Table 8.5. The sequence program must be checked and corrected.

Table 8.5 Buffer Memory Write Error Codes

Error Code	Shared Memory Address	Error Definition
60	39,339	Pointer value is not 0 though 20th point has been reached. Data has been written to pointer address while BUSY.
61	40,340	"Speed change" during interpolation.
62	41,42,341,342	"Present value change" while BUSY.
63	7872 to 7928	Data written from PC while Y2D is on.
64	Monitoring present value area Speed area	Data written from PC to a write prohibit address.

8.1.4 A1SD71 start and operation errors

The following errors are detected when A1SD71 cannot start operations after receiving a PC CPU command due to A1SD71 internal condition errors or A1SD71 operating errors. Error codes are shown in Table 8.6 below.

Table 8.6 A1SD71 Start and Operation Error Codes

Error Code	Cause	Corrective Action(s)
70	READY signal is OFF at the start	Set the drive unit READY.
71	External stop signals (6A and 8A) are ON at the start.	Turn OFF the stop signals (6A and 8A).
72	The A1SD71 ready signal (X11) and PC CPU ready signal (Y2D) are OFF at the start.	Turn ON the PC CPU power and set the PC CPU to RUN. Check the hardware.
73	The relevant axis is BUSY at the start.	Do not start when BUSY.
74	The relevant axis positioning complete signal is ON at the start.	Restart after turning OFF the start signal.
75	The M code ON signal is ON at the start.	Turn OFF the "M code ON" signal using the "M code OFF" signal.
76	• The stop signals (Y25, Y26) are ON at the start. • Inputting the BREAK key from a peripheral device stops operations.	• Turn OFF the stop signals (Y25, Y26). • Release the stop processing from the peripheral device or AD71TU.
77	Zero return is repeated more than twice consecutively.	Zero return cannot be repeated.
78	The zero return complete signal is ON when zero return is started.	Zero return has been already completed. Transfer positioning or the jog operation.
79	Outside the range from 0 to 16252928 pulses.	• Return inside the stroke limit range using jog. • Change the current value.

Note 1: Start includes;
- Zero return start
- Jog operation
- Inching operation

2: For interpolation starts, error codes are always given for both axes even if one axis has an error.

8.1.5 A1SD71 positioning start errors during BUSY

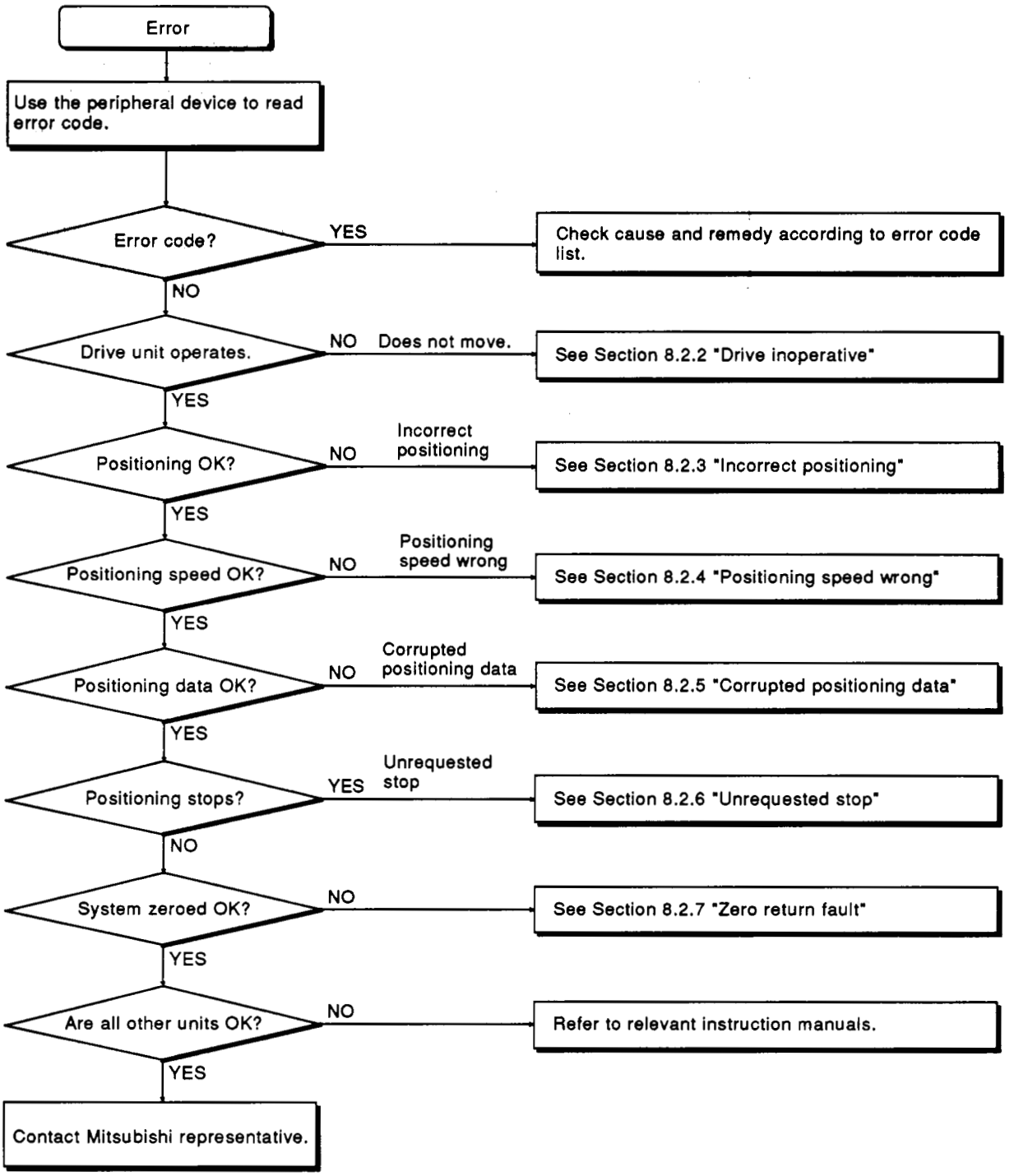
The following errors are detected when the drive unit ready signal is turned OFF while A1SD71 is BUSY or when positioning is stopped during zero return.

Table 8.7 BUSY Error Codes

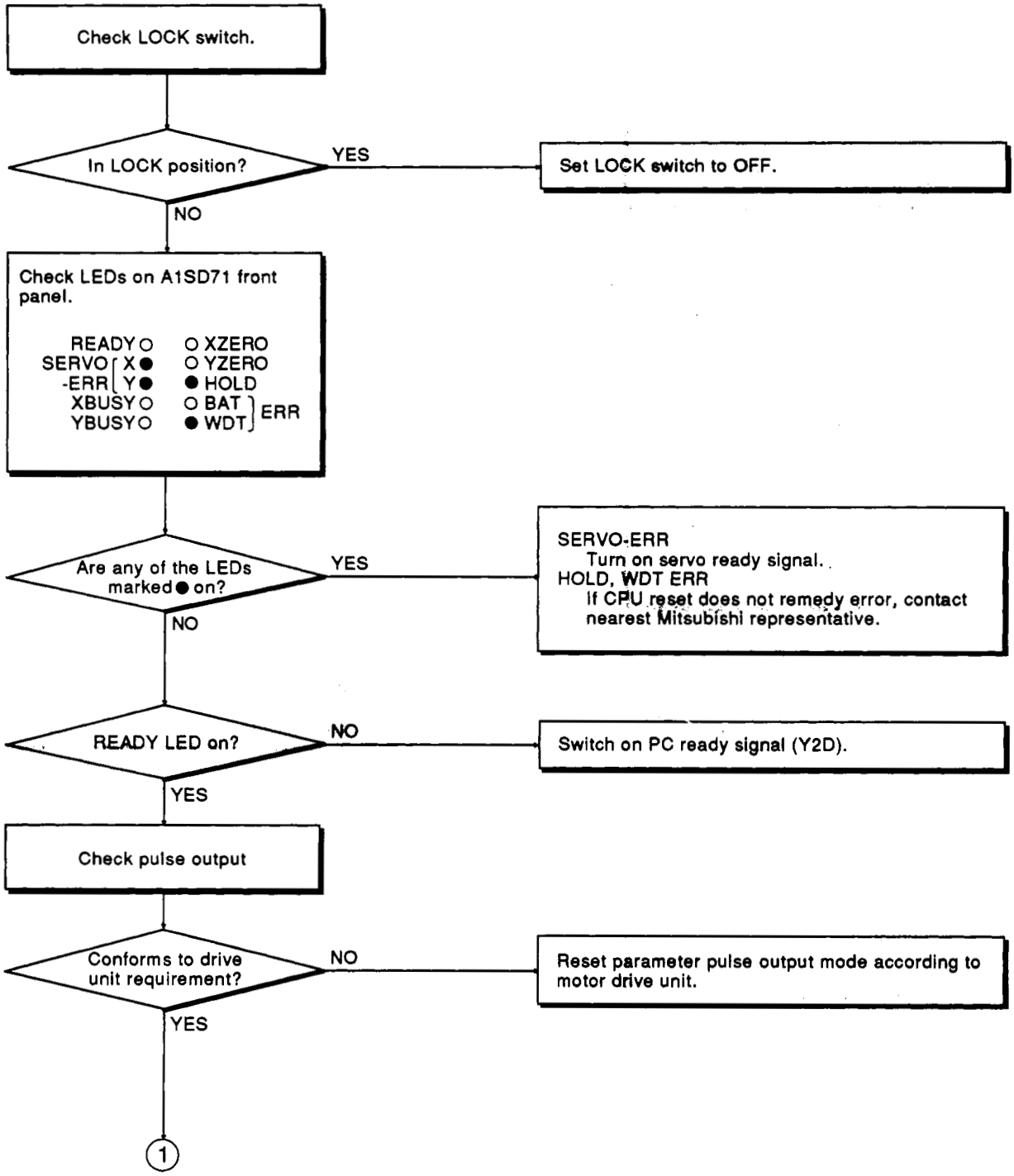
Error Code	Cause	Corrective Action(s)
80	The READY signal is OFF during BUSY.	Check the drive unit and turn ON the ready signal.
81	Zero return is stopped.	Zero return is not allowed more than twice consecutively. If necessary, return to the position before near-point dog using a jog operation or positioning by specifying the data number, and restart zero return.

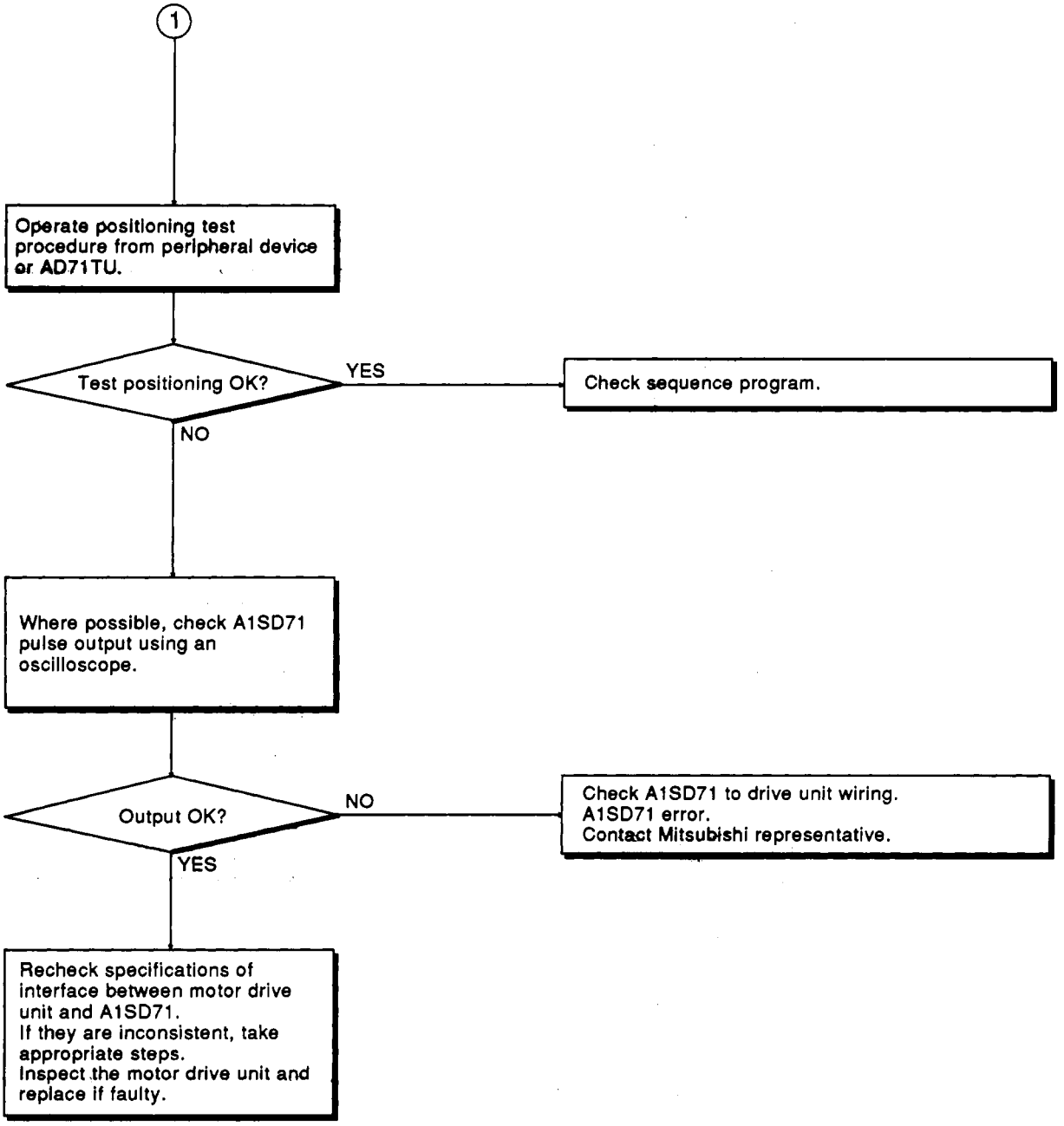
8.2 Troubleshooting

8.2.1 General troubleshooting

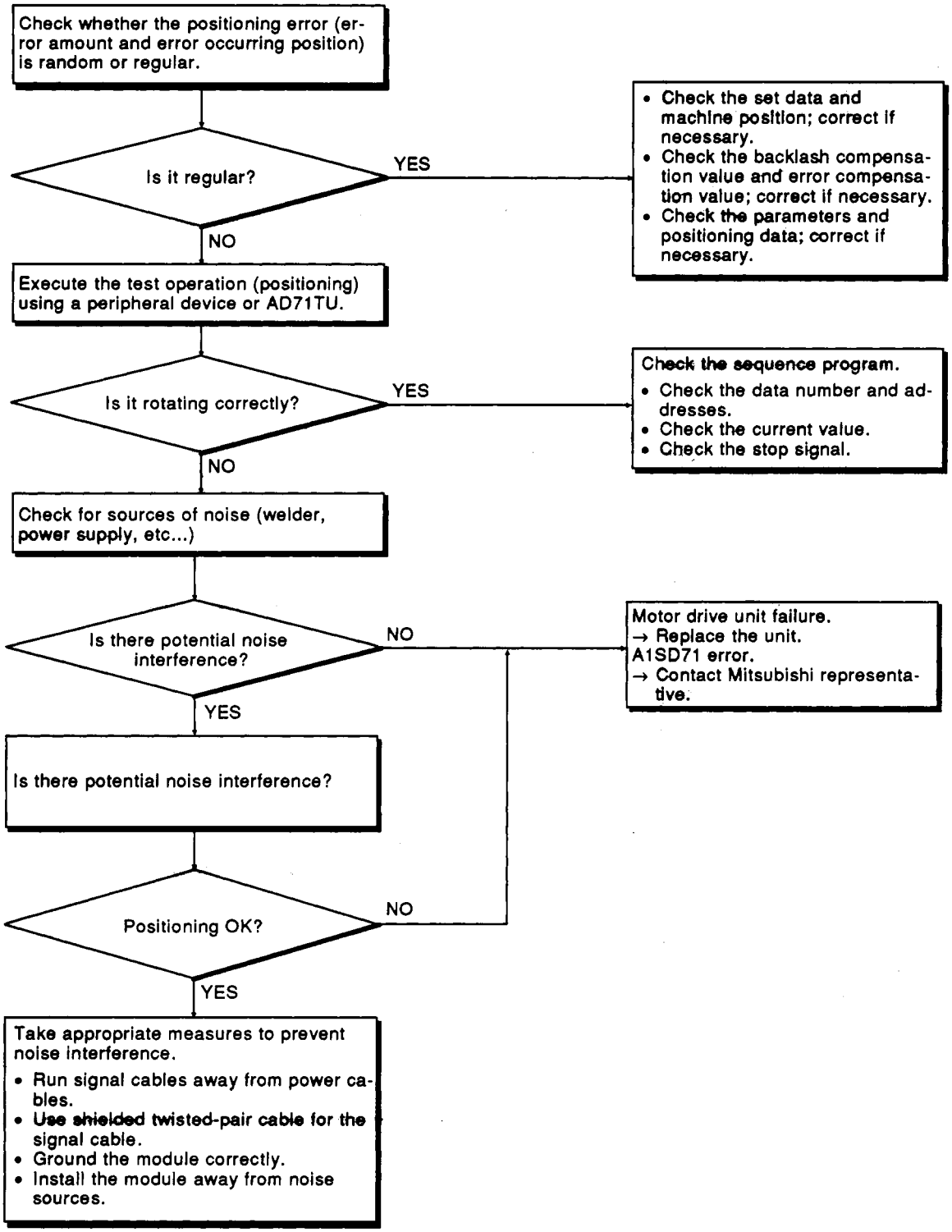


8.2.2 Drive inoperative

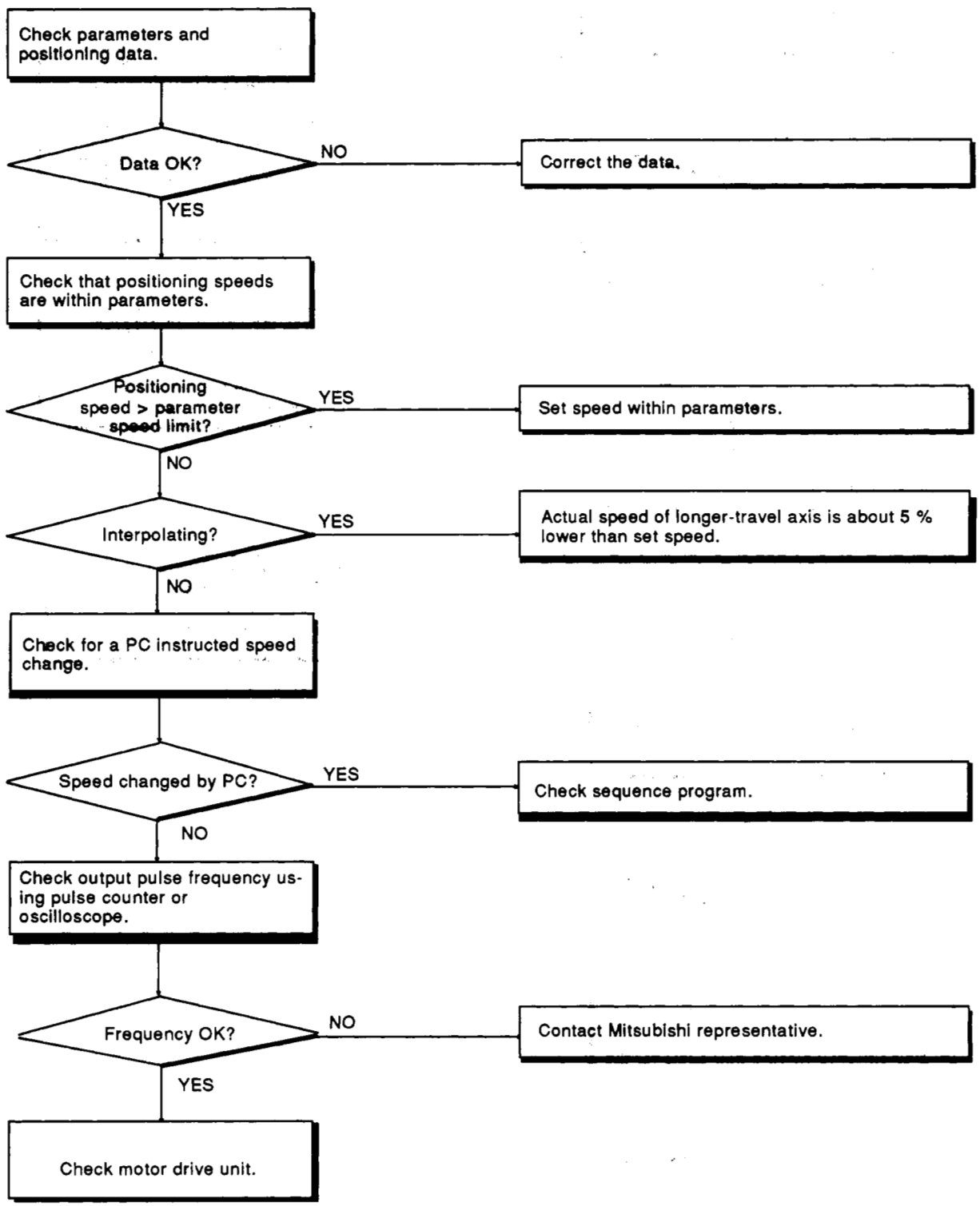



1
Operate positioning test procedure from peripheral device or AD71TU.
Test positioning OK?
YES
Check sequence program.
NO
Where possible, check A1SD71 pulse output using an oscilloscope.
Output OK?
NO
Check A1SD71 to drive unit wiring.
A1SD71 error.
Contact Mitsubishi representative.
YES
Recheck specifications of interface between motor drive unit and A1SD71.
If they are inconsistent, take appropriate steps.
Inspect the motor drive unit and replace if faulty.

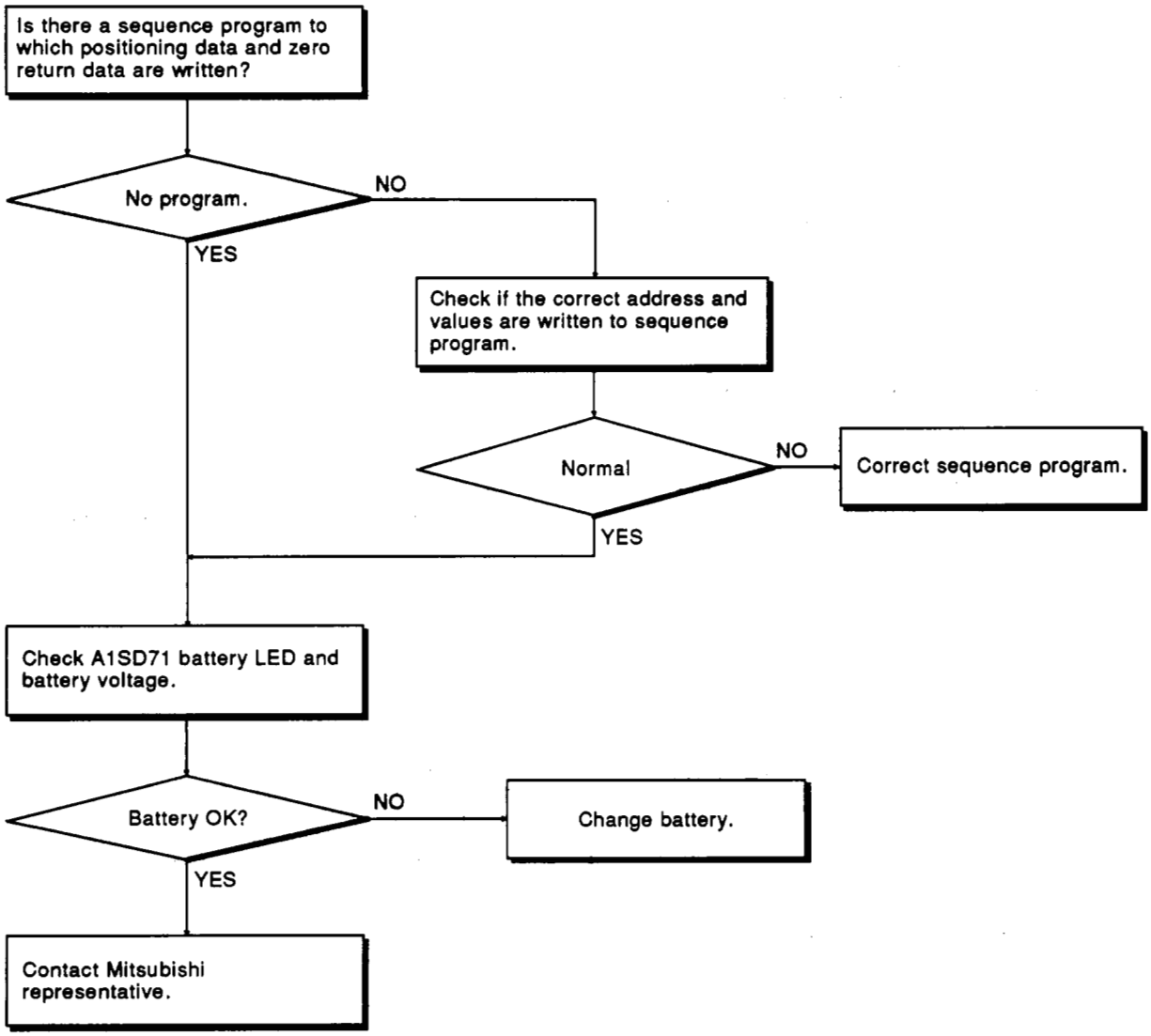
8.2.3 Incorrect positioning



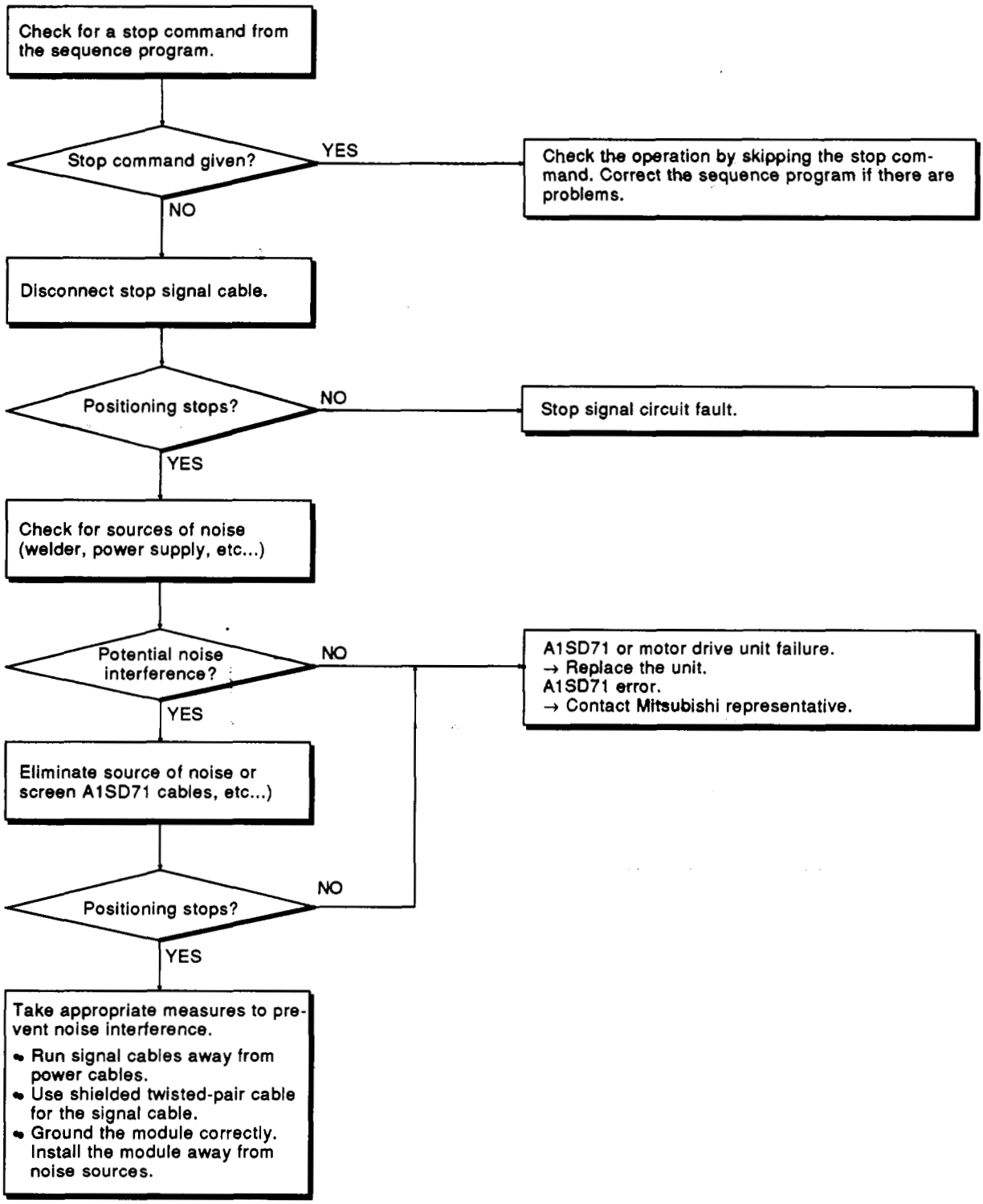
8.2.4 Positioning speed wrong



8.2.5 Corrupted positioning data

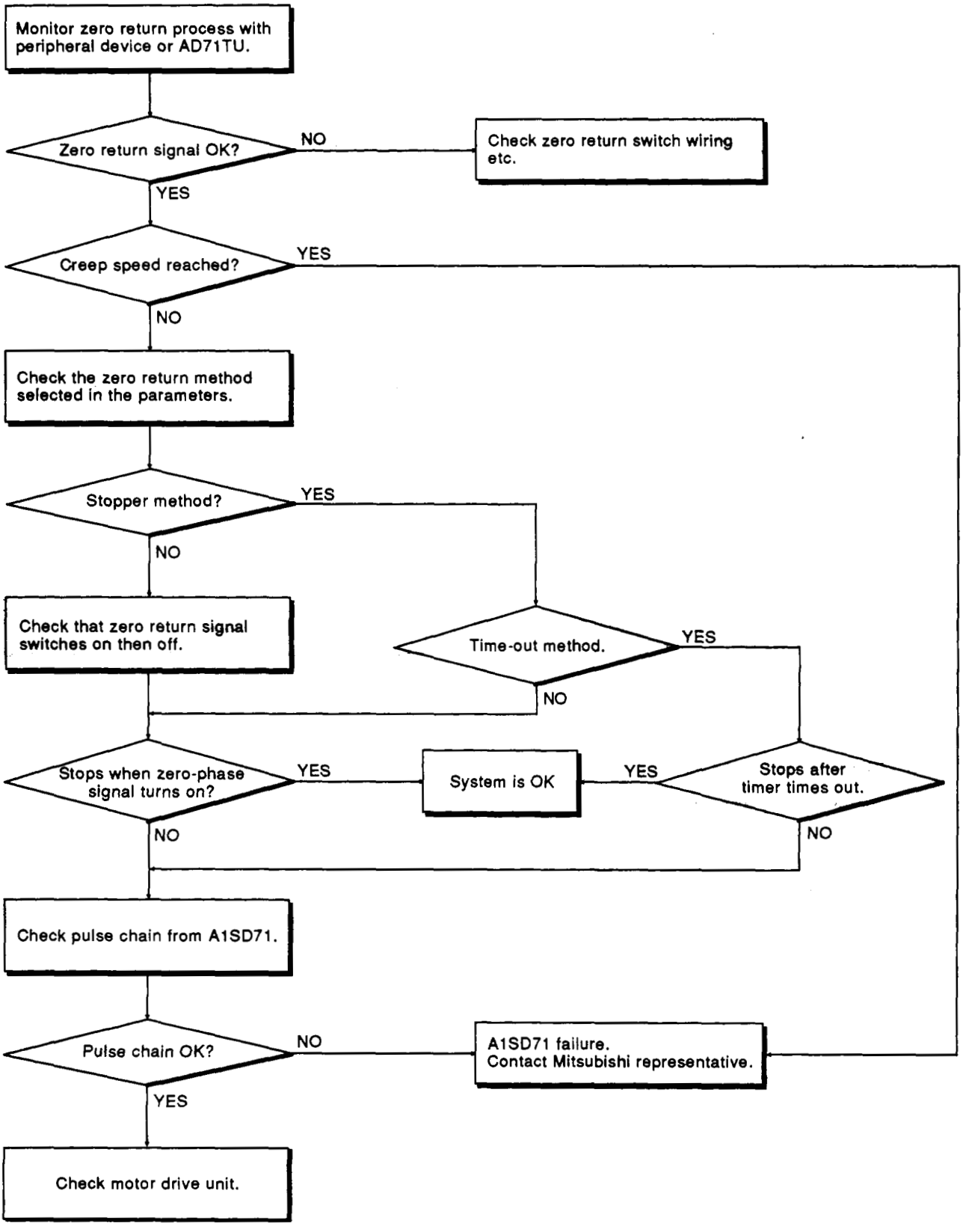


8.2.6 Unrequested stop

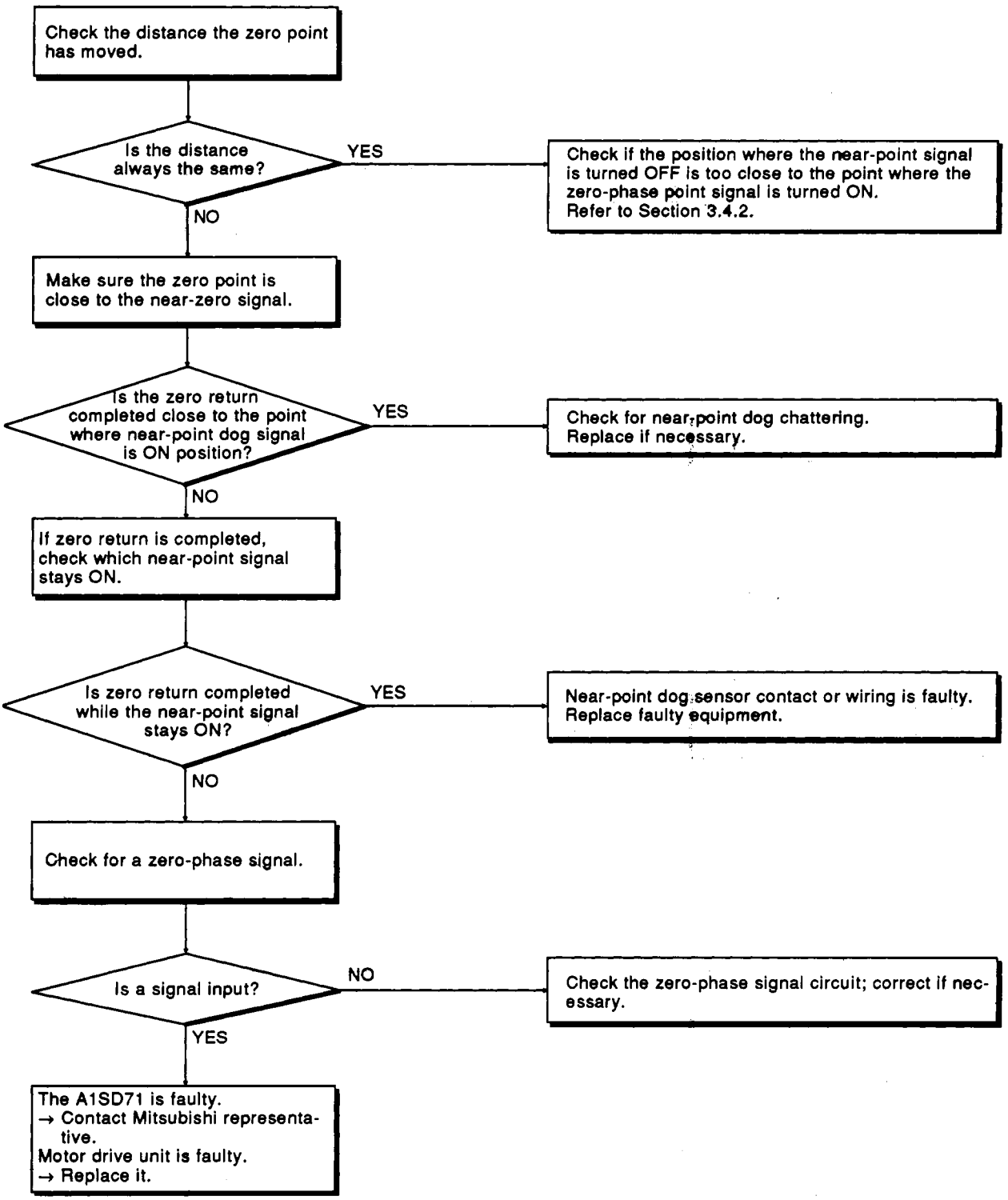


8.2.7 Zero return fault

(1) Partial zero return



(2) Zero point position has shifted (using zero-phase signal)



Note : When using the stopper method, make sure that the stop signal is input or timer setting is correct. If so, theA1SD71 or motor drive unit is faulty. Replace the faulty A1SD71 or motor drive unit.

9. MAINTENANCE

This section describes how to maintain the A1SD71 (unit storage and battery replacement).

For other modules (i.e., the power module, PC CPU module, I/O module, special modules, etc.), refer to the appropriate User's Manual.

9.1 Unit Storage

The A1SD71 should be stored in the following environments:

(1) Ambient temperature 0 to 75 °C.

(2) Ambient humidity 10 to 90 % RH.

(3) No condensation (e.g. due to sudden temperature changes).

(4) No direct exposure to sunlight.

(5) Free from excessive amounts of conductive powder such as dust, iron filings, oil mist, salt, or organic solvent.

A two hour "warming up" period should be allowed if the A1SD71 has not been powered up for over 12 months. (This is to allow the electrolyte in electrolytic capacitor to stabilize.) The battery should be replaced every 10 months if the unit is not powered up to maintain buffer memory data. (If the A1SD71 has not been used for 10 months or more, the data in the A1SD71 could be lost. In this case, it is necessary to check the set data.)

9.2 Battery Change

9.2.1 Battery change frequency

When the data backup battery voltage drops, the LED on the A1SD71 front panel is lit and an input signal (battery error) to the PC CPU is enabled. The battery is live for about one month more and, if it is not replaced, data will then be lost or corrupted.

Guide for preventive maintenance

1) The battery should be replaced every 4 to 5 years if it is only used for memory back up for a maximum of 300 days in that period.

2) Battery changing frequency for memory backup duty exceeding 300 days can be calculated as follows.

Example

Assume that there are five operation days (10-hour operation and 14-hour power-off during a day) and two power-off days in a week. Under these conditions, power-off period during one week is:

14 (hours) × 5 (days) = 70 hours
24 (hours) × 2 (days) = 48 hours

7200 (hours) / (70 + 48) (hours) = 61 (weeks)

61 (weeks) × 7 (days) = 427 (days)

Regarding one month as 30 days,

427 (days) / 30 (days) = 14.2 months

Hence,

it is necessary to change the battery every 14 months.

REMARK

The same battery is used for all MELSEC-A series modules.
The battery can be stored for five years. The battery is guaranteed to work for 300 days in total.
The following battery is used. When replacing the battery, order from a Mitsubishi representative.

Product : Lithium battery
Model : A6BAT (with 3.6 V lead wire)

Precautions when handling the battery

(1) Do not short circuit the battery.
(2) Do not take the battery apart.
(3) Keep the battery away from fire.
(4) Do not heat the battery.
(5) Do not solder the electric poles.
(6) Do not measure the voltage using a tester. Otherwise, the capacity will be greatly lowered.

9.2.2 Battery replacement procedure

Fig. 9.1 shows how to replace the battery.

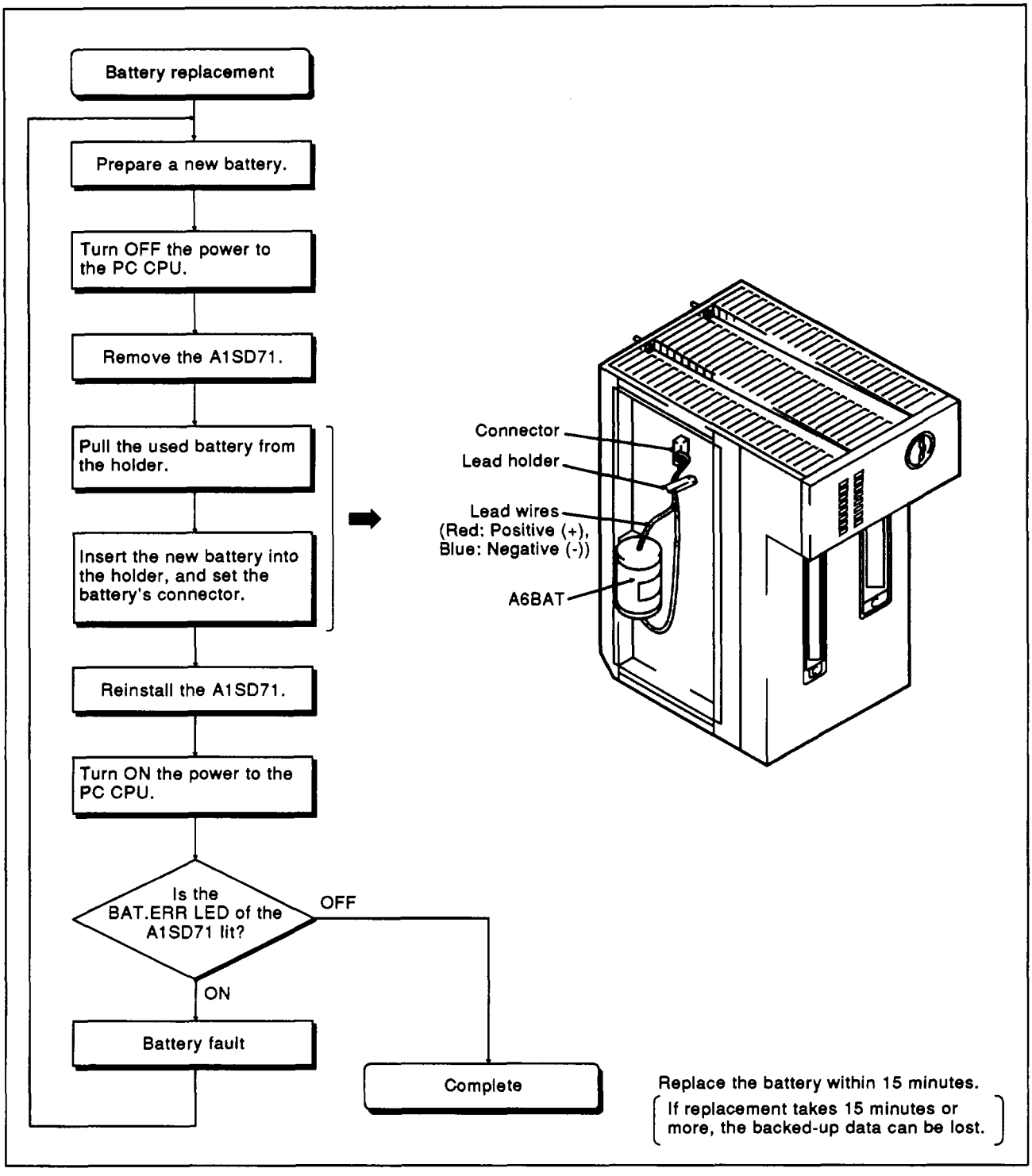


Fig. 9.1 Battery Replacement Procedure

IMPORTANT

The components on the printed circuit board may be damaged by static electricity. When handling the printed circuit board:

1) Ground all tools, work bench, etc.

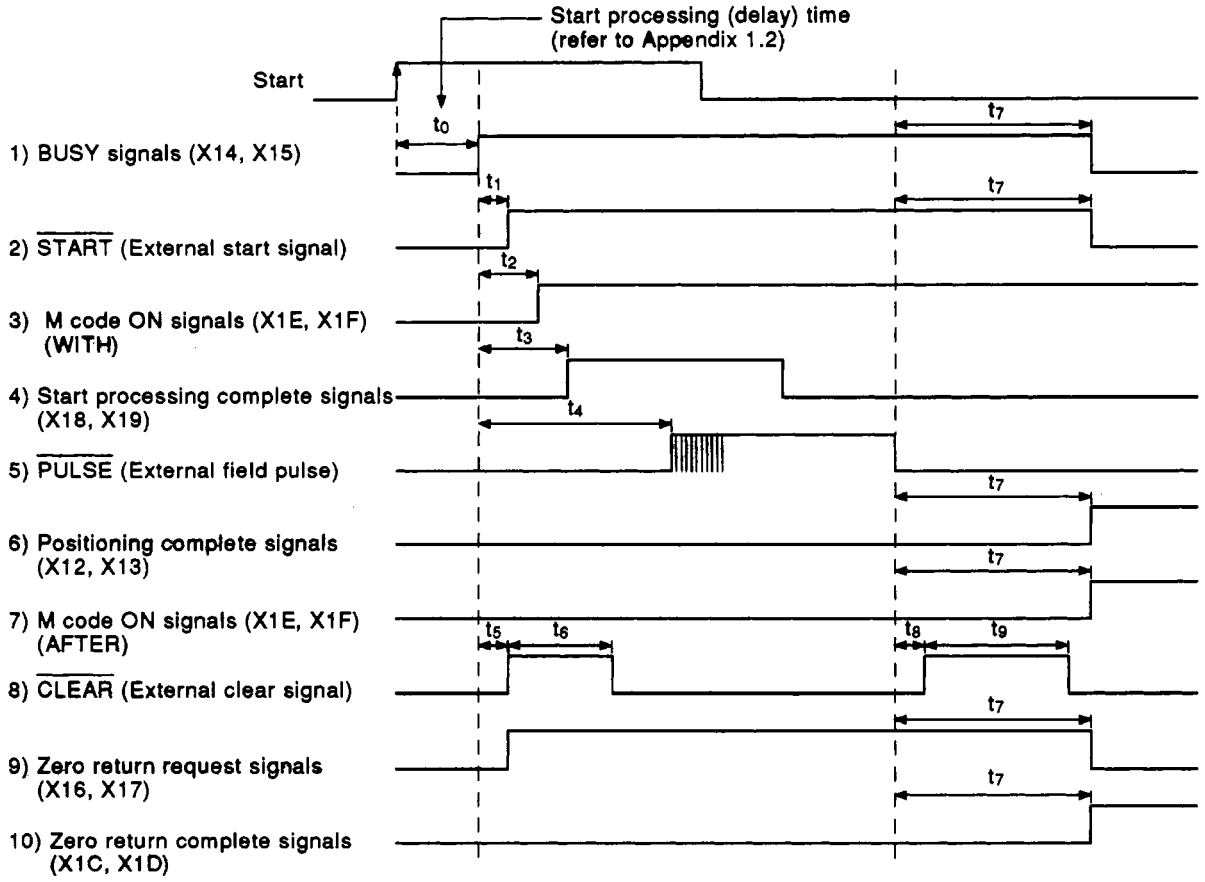
2) Do not touch the conductive areas or electrical components.

APPENDICES

APPENDIX 1 SIGNAL TIMING FROM THE A1SD71

1.1 Output Signal Timing

This section gives the output signal timing chart for positioning, operating in the speed control module, and zero return.

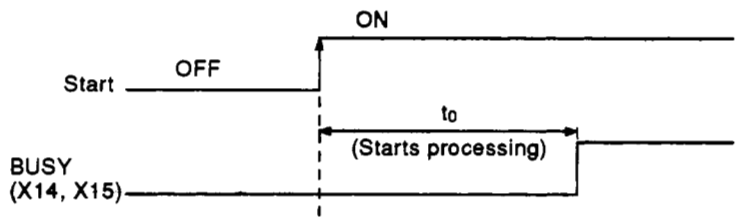


	Positioning in the positioning control mode			Positioning in the switching mode		Positioning in the speed mode		Zero return	
	X axis	Y axis	Interpolation	X axis	Y axis	X axis	Y axis	X axis	Y axis
t_1 (msec)	0.2	0.2	0.3	0.2	0.2	0.3	0.3	49.1	49.1
t_2 (msec)	0.3	0.3	0.6	0.3	0.3	—	—	—	—
t_3 (msec)	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.4	0.4
t_4 (msec)	18.4	18.4	18.4	18.4	18.4	18.4	18.4	58.3	58.3
t_5 (msec)	—	—	—	—	—	—	—	0.1	0.1
t_6 (msec)	—	—	—	—	—	—	—	49.5	49.5
t_7 (msec)	1.4	1.4	1.4	1.8	1.8	27.5	27.5	17.7	17.7
t_8 (msec)	—	—	—	—	—	—	—	0.7	0.7
t_9 (msec)	—	—	—	—	—	—	—	16.5	16.5

Note 1: Indicates the timing in the case of pattern (00) and pointer (0) for positioning in the positioning control mode.
Note 2: The timing when executing the zero return is given in 8) to 10) above.
Note 3: The dwell time when executing positioning is measured as "0".

1.2 Start Delay Time

This section explains the time (t_0) required after turning ON the start signal until the A1SD71 BUSY signals (X14 and X15) go ON .
The following chart gives the timings for the start signal and BUSY signals.



(1) Variations in start processing times

Start processing times until a BUSY signal is turned on vary according to the following conditions:

1) Execution of the FROM/TO instruction during start processing
   - If the FROM/TO instruction is executed, a delay up to several seconds could occur because the FROM/TO instruction takes priority.
   - If a FROM/TO instruction is not executed, no delay will occur.
2) Operating state of the other axis
   - If start processing is executed during the operation of the other axis, a delay of less than 100 msec will occur.
   - If the other axis is not in use, no delay will occur.
3) Intervention by a peripheral device during start processing
   - If a peripheral device intervenes, a delay of several msec will occur.
   - When no peripheral device is connected, no delay will occur.
4) The number of speed change points in the positioning pattern in (11)
   - As the number of speed change points in the positioning pattern in (11) increases, the delay is increased. (Approx. 10 msec per point)

(2) Start processing time (t_0)

Table 1.1 gives the measurement processing time under the following conditions with no delay resulting from the above items:

1) A FROM/TO instruction is not executed during the start processing.
2) The other axis is not in use.
3) No peripheral device intervenes.

Table 1.1 Start Processing Times

	Operating Mode		Min. Value of t_0 (msec) *1	Max. Value of t_0 (msec) *2
1	Zero return start		5.5 ± 5	14 ± 12
2	JOG start		4.5 ± 5	33 ± 12
3	Positioning control	Independent positioning start	15 ± 5	58 ± 12
		Interpolation positioning start	61 ± 5	94 ± 12
4	Positioning pattern (11) Speed change positioning continuation	Number of speed change points: 4	61 ± 5	94 ± 12

*1: t_0 becomes minimum when the X or Y axis starts under any of the following conditions:

1. After zero return has been completed.
2. After positioning has been completed.
3. After a current value has been changed.

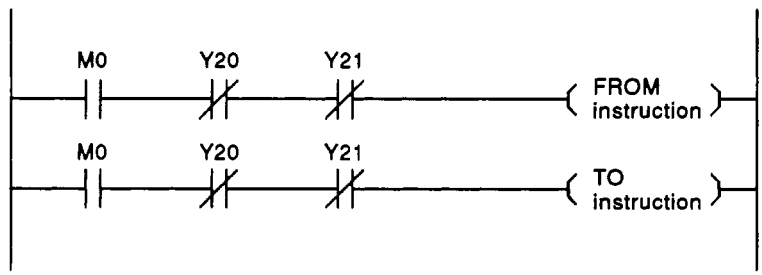
*2: t_0 becomes maximum when X or Y axis starts under any of the following conditions:

1. After zero return has been canceled.
2. After positioning has been canceled.
3. After an operation in the speed control mode.
4. After a JOG operation has been stopped.

Note (1): Feed pulses are output after the BUSY signals (X14 and X15) have been turned ON and t_0 (msec) has passed (refer to Appendix 1.1).

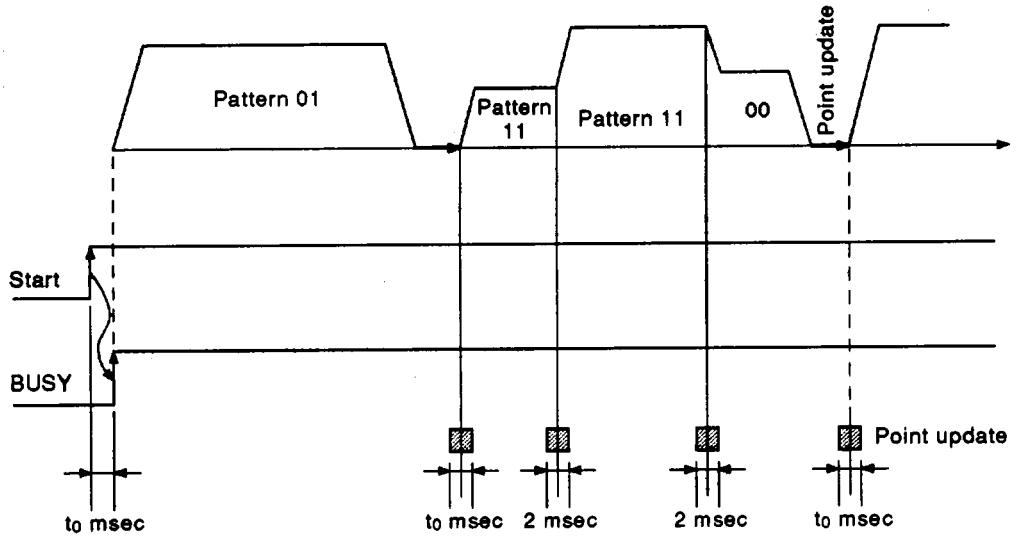
POINT

To not execute FROM/TO instructions during start processing, use the start signals (Y20 and Y21) for providing interlock to FROM/TO instructions.



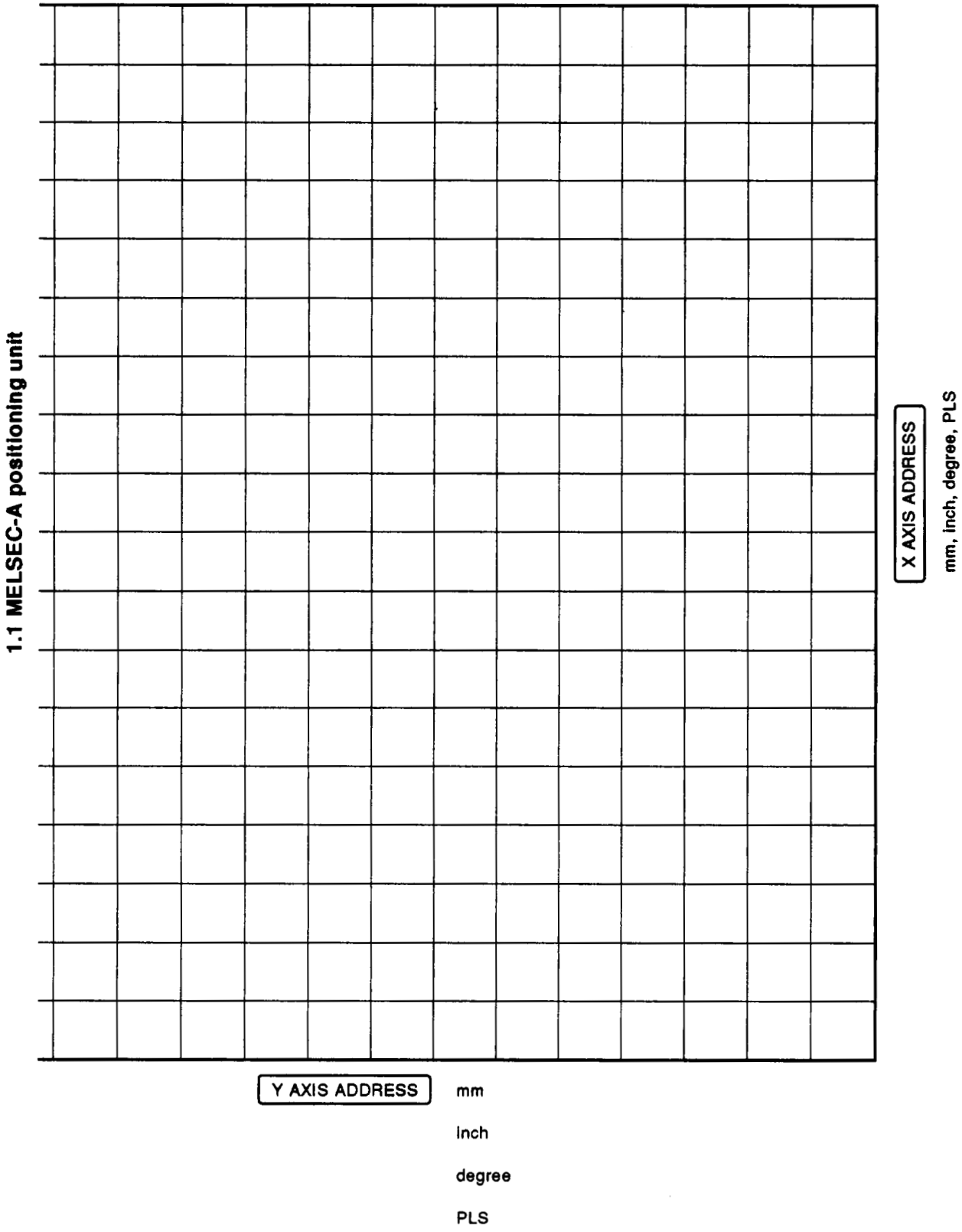
1.3 A1SD71 Processing Times

The processing times for each pattern operation are as follows:



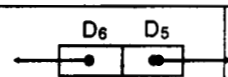
The above times do not include the processing time of the PC CPU, representing the estimated processing time of the A1SD71.

APPENDIX 2 FORMAT SHEETS



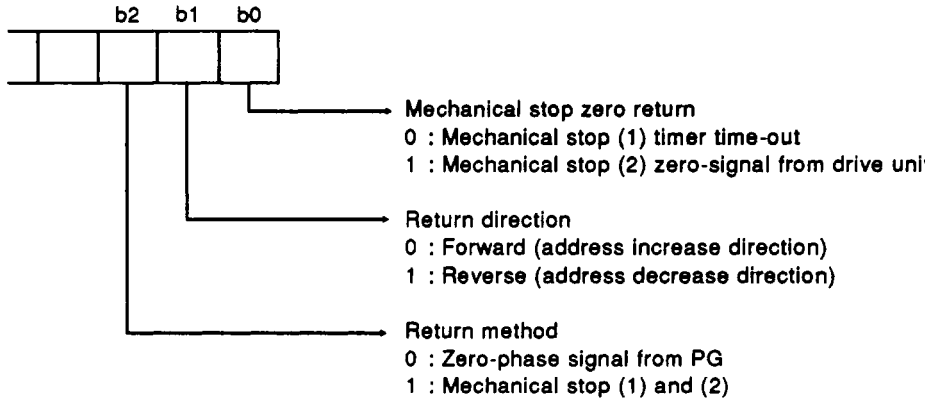
2.1 Format Sheets

(1) Parameters

	Item	Initial value	X Axis	Y Axis	mm		inch		degree		PULSE (PLS)	
					Setting range	Unit	Setting range	Unit	Setting range	Unit	Setting range	Unit
1	Unit setting	3			0	–	1	–	2	–	3	–
2	Travel per pulse	Set value			1 to 100	$\times10^{-1}$ μm/ PLS	1 to 100	$\times10^{-5}$ inch/ PLS	1 to 100	$\times10^{-5}$ deg/ PLS	–	
3	Speed limit value	20,000			1 to 12,000	×10 mm/ min	1 to 12,000	×1 inch/ min	1 to 12,000	×1 deg/ min	1 to 20,000	×10 PLS/ sec
4	Jog speed limit value	2,000			1 to 12,000	×10 mm/ min	1 to 12,000	×1 inch/ min	1 to 12,000	×1 deg/ min	1 to 20,000	×10 PLS/ sec
5	Starting bias speed	0			1 to 12,000	×10 mm/ min	1 to 12,000	×1 inch/ min	1 to 12,000	×1 deg/ min	1 to 20,000	×10 PLS/ sec
6	Backlash	0			0 to 65,535	$\times10^{-1}$ μm	0 to 65,535	$\times10^{-5}$ inch	0 to 65,535	$\times10^{-5}$ deg	0 to255	PLS
7	Upper stroke limit	16,252,928			0 to 162,000	mm	0 to 16,200	inch	0 to 16,200	deg	0 to 16,252,928	PLS
8	Lower stroke limit	0			0 to 162,000	mm	0 to 16,200	inch	0 to 16,200	deg	0 to 16,252,928	PLS
9	Error compensation	0			±0 to 100,000 (per 1 m)	$\times10^{-1}$ μm	±0 to 100,000 (per 100 inch)	$\times10^{-5}$ inch	±0 to 100,000 (per 100 deg)	$\times10^{-5}$ deg	–	
10	Travel per manual pulse during inching	1			0 to 100,000	$\times10^{-1}$ μm	0 to 100,000	$\times10^{-5}$ inch	0 to 100,000	$\times10^{-5}$ deg	0 to 100	PLS
11	Acceleration and deceleration times	1,000			64 to 4,999 msec							
12	Positioning complete signal output time	300			0 to 20,000 msec							
13	Pulse output mode	Set value			0 : PLS + SIGN 1 : forward pulse, reverse pulse							
14	Rotating direction setting	Set value			0 : present value increase with forward pulse output 1 : present value increase with reverse pulse output							
15	Absolute/ incremental setting	0			0 : absolute 1 : incremental 2 : absolute/incremental combined							
16	M code ON/OFF timing	Set value			0 : WITH mode 1 : AFTER mode				0 : not used 1 : used			

(2) Zero return data

	Item	X Axis	Y Axis	mm		inch		degree		PULSE (PLS)	
				Setting range	Unit	Setting range	Unit	Setting range	Unit	Setting range	Unit
1	Zero return direction			0 : forward direction (address increase) 1 : reverse direction (address decrease)							
2	Zero return method			See below.							
3	Zero return address			0 to 1,620,000,000	$\times 10^{-1}$ μm	0 to 1,620,000,000	$\times 10^{-5}$ inch	0 to 1,620,000,000	$\times 10^{-5}$ deg	0 to 16,252,928	PLS
4	Zero return speed			1 to 12, 000	×10 mm/ min	1 to 12, 000	×1 inch/ min	1 to 12, 000	×1 deg/ min	1 to 20,000	×10 PLS/ sec
5	Creep speed			1 to 12000	×10 mm/ min	1 to 12, 000	×1 inch/ min	1 to 12, 000	×1 deg/ min	1 to 20,000	×10 PLS/ sec
6	Dwell			0 to 499 × 10 msec							
7	Trque limit			10 to 250 %							



2.2 Positioning Data (Data No. to)

X AXIS

Data No.	Pattern	Abs./Inc.	Direction	Speed	Address	Dwell	M code
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							

00 :END
01 :Continue
11 :Change

0 :Abs.
1 :Inc.

For Inc.
0 :Address increase direction
1 :Address decrease direction

0 to255
0 :Without M code
1 to 19 :With comment

Y AXIS

Data No.	Pattern	Abs./Inc.	Direction	Speed	Address	Dwell	M code
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							

00 :END
01 :Continue
11 :Change

0 :Abs.
1 :Inc.

For Inc.
0 :Address increase direction
1 :Address decrease direction

0 to255
0 :Without M code
1 to 19 :With comment

2.3 M Code Comments

M CODE	X AXIS	M CODE	Y AXIS
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
11		11	
12		12	
13		13	
14		14	
15		15	
16		16	
17		17	
18		18	
19		19	

Maximum 16 characters per comment

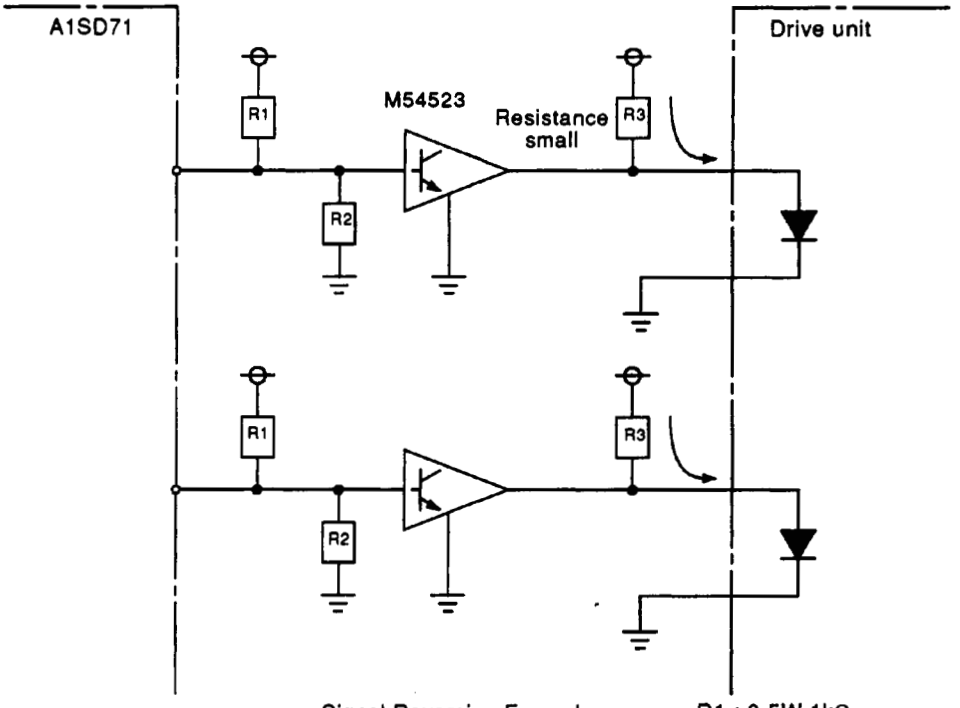
APPENDIX 3 CONNECTION WITH SERVO MOTORS

There are several drive unit models and motors that can be used with the A1SD71. Examples of connections as of July 1986 are given. These examples shall be used only for reference because the driver's specifications are subject to change. Other drive units than described here can also be used.

[CAUTION]

(1) The A1SD71 output is a sink output pulse chain.
The drive unit should be sink input.

(2) For use with source input drive units, use the interface shown below.



Signal Reversing Example

R1 : 0.5W 1kΩ
R2 : 0.5W 47kΩ
R3 : by each drive units

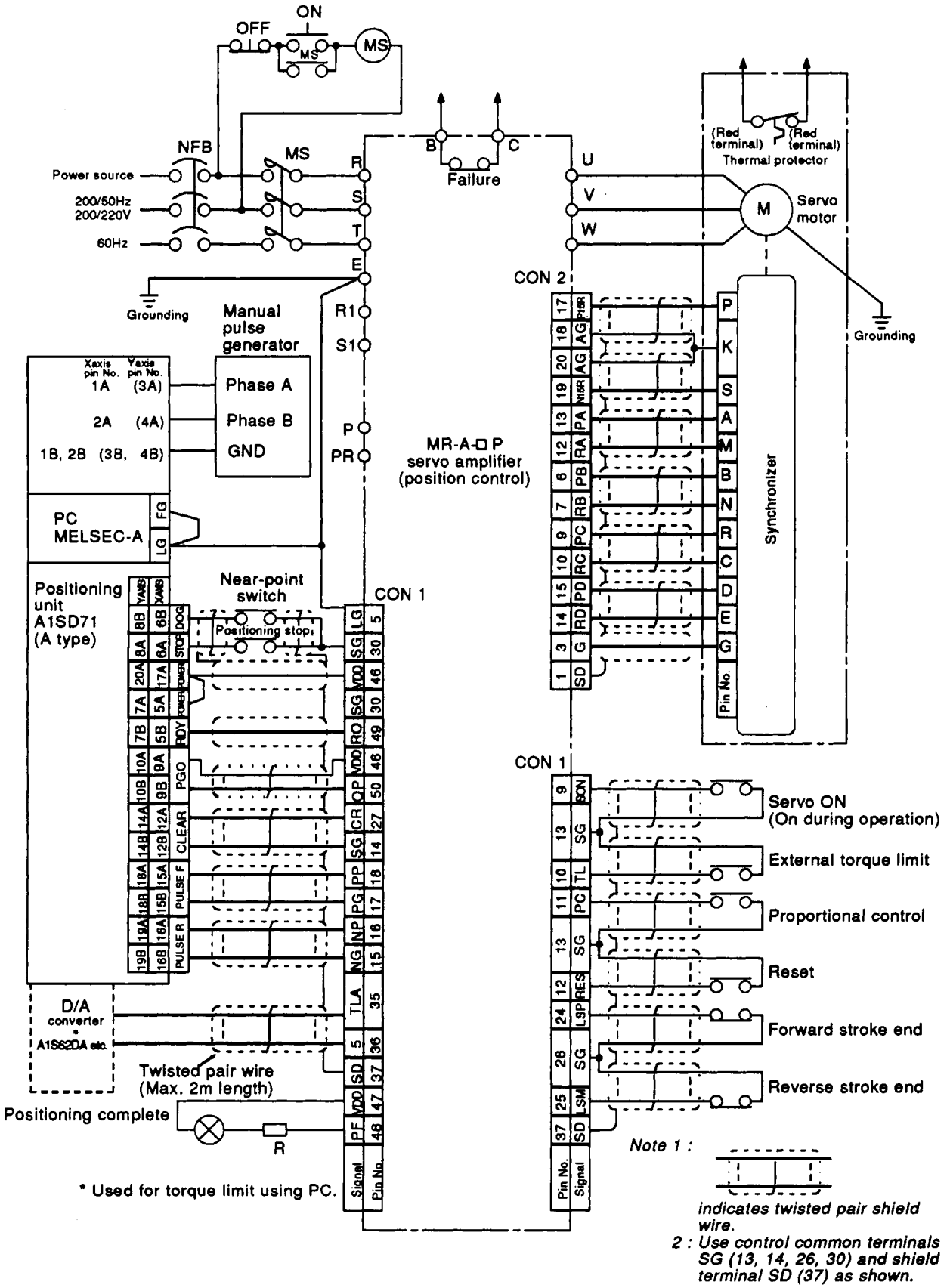
(3) The A1SD71 pin numbers in parentheses are for the Y axis.

(4) For other signal wires of the drive unit. Refer to the instruction manual for the corresponding drive unit.

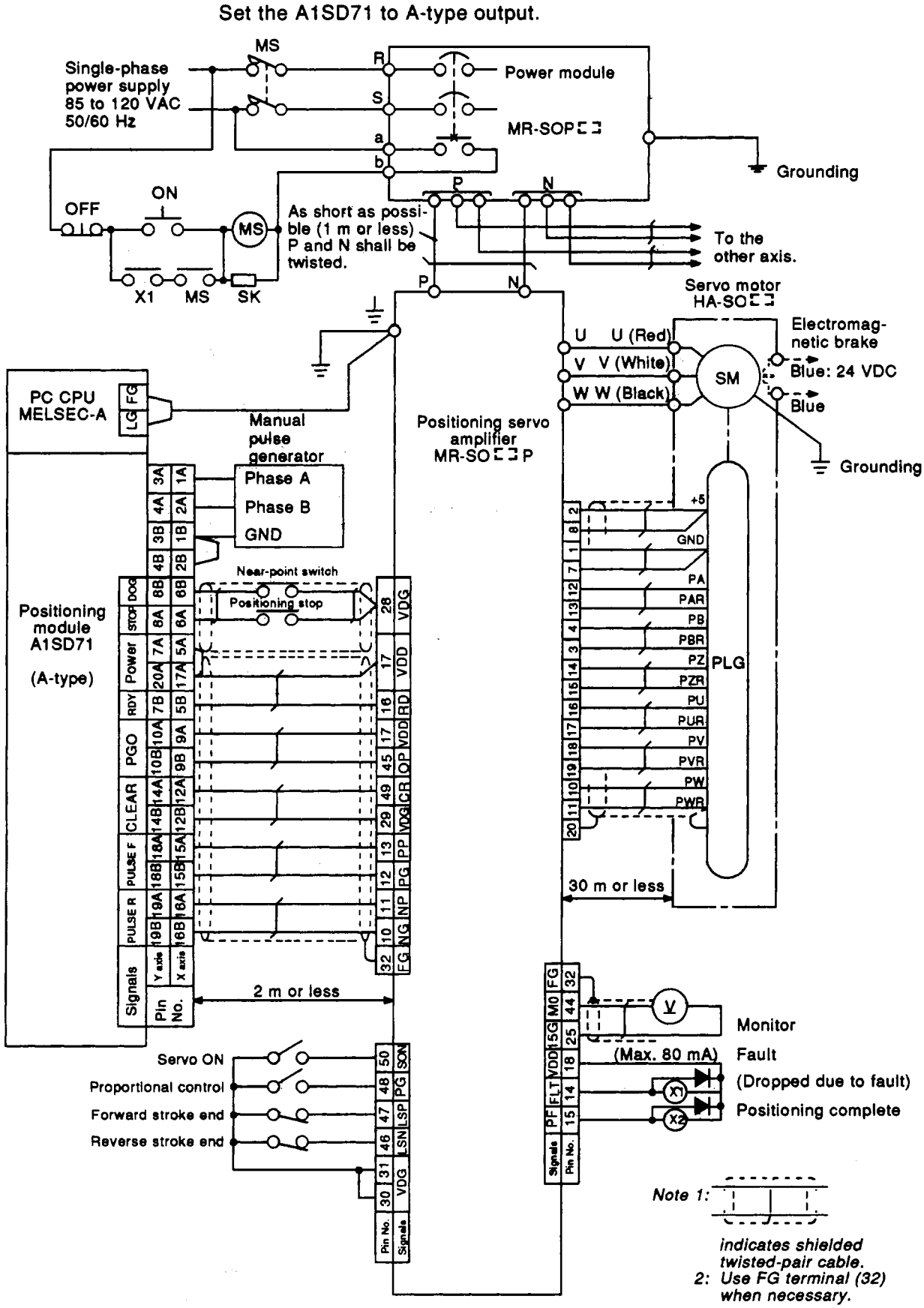
(5) For connections to the A1SD71, use shielded twisted-pair cable.

3.1 Connection with Mitsubishi MELSERVO-A

A type output.

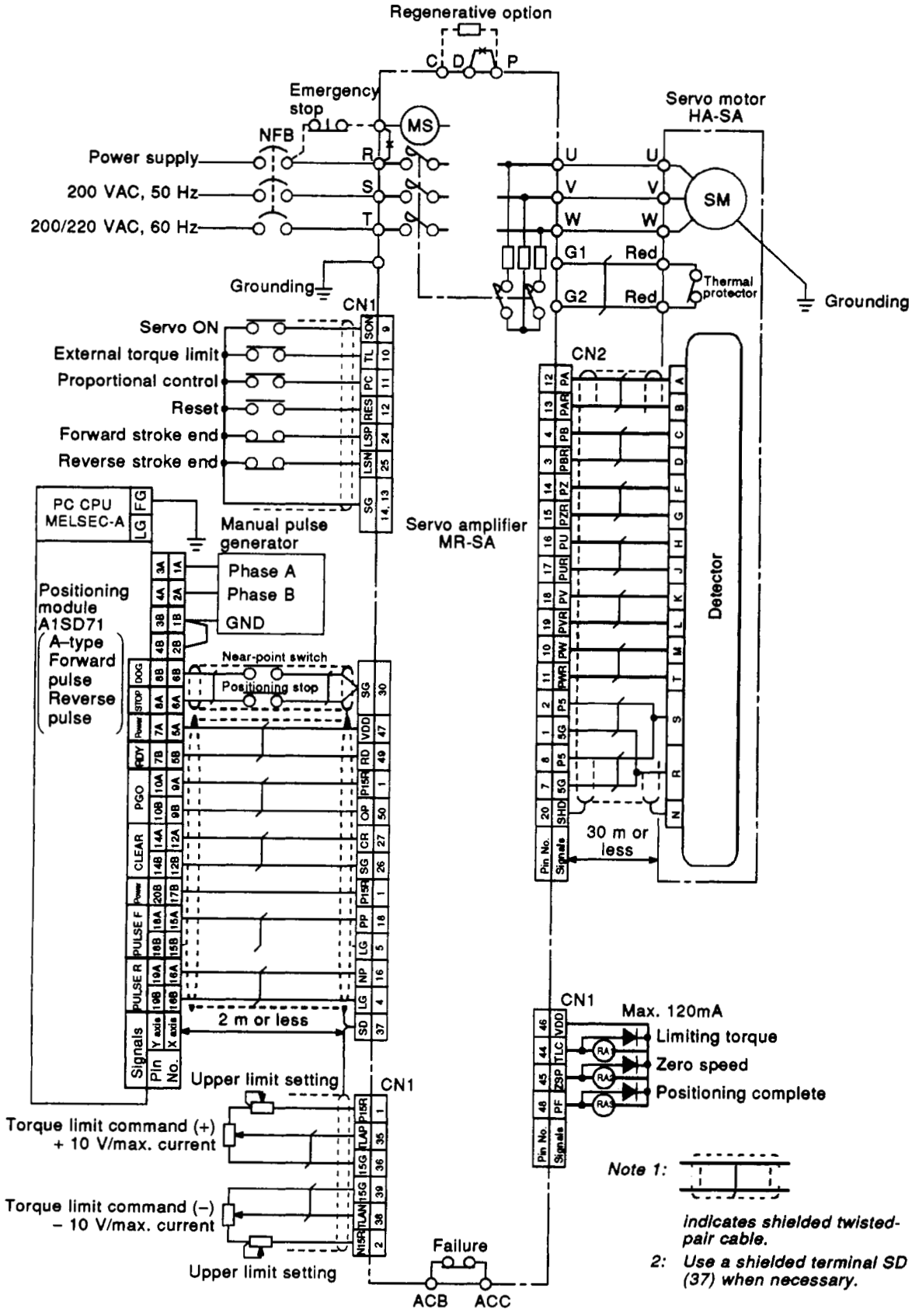


3.2 Connection with Mitsubishi MELSERVO-SO



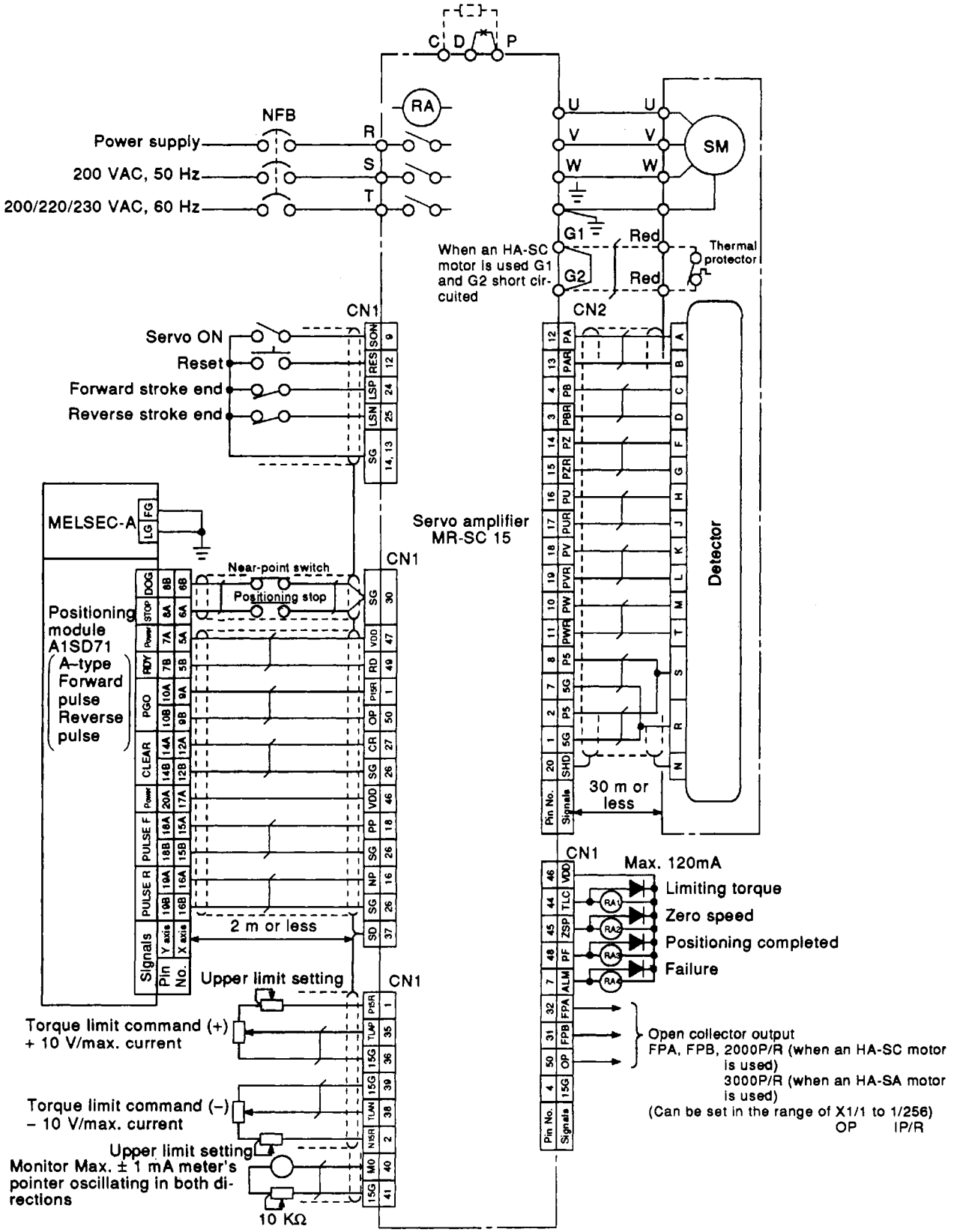
3.3 Connection with Mitsubishi MELSERVO-SA

Set the A1SD71 to A-type output.



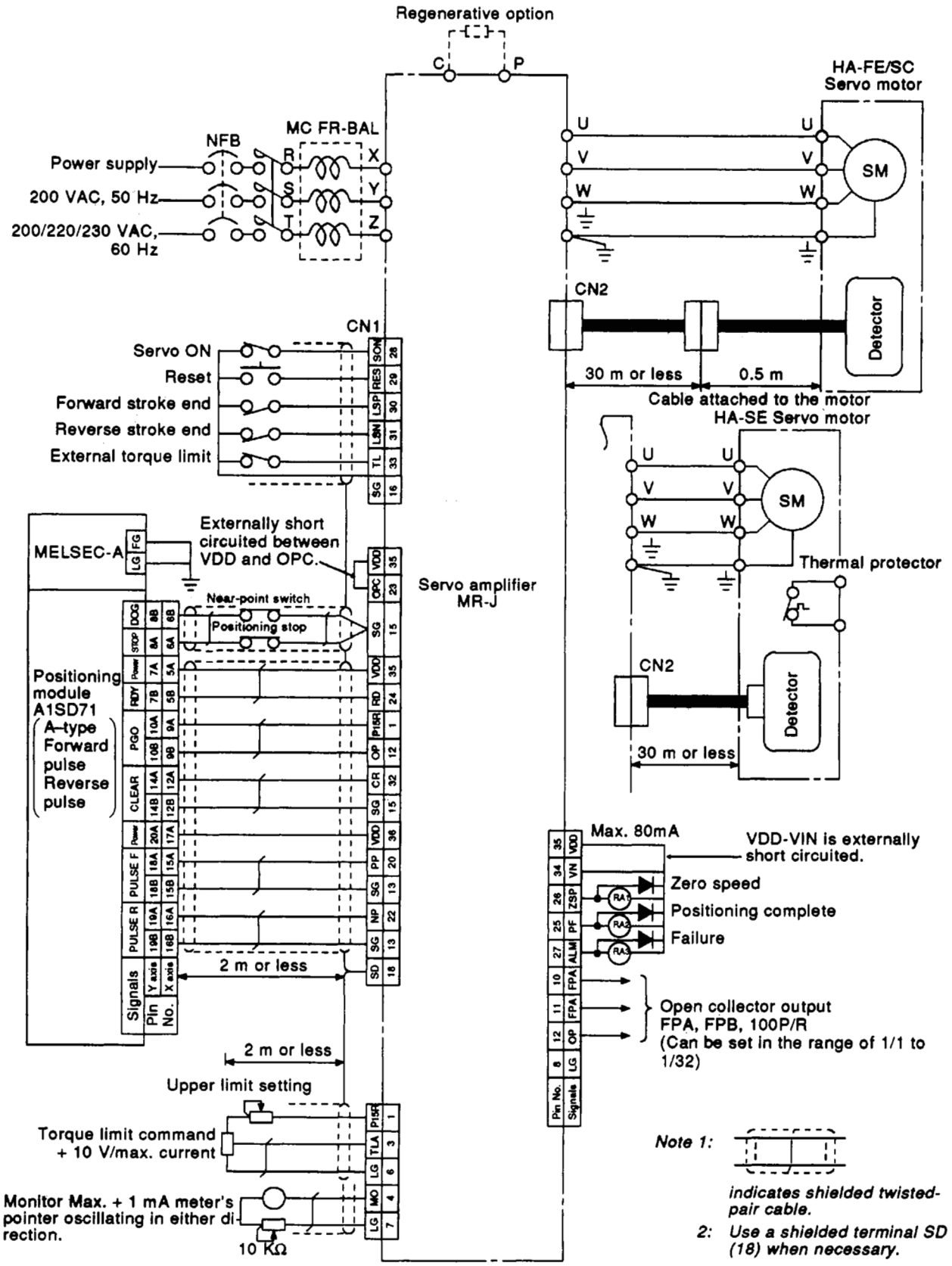
3.4 Connection with Mitsubishi MELSERVO-SC

Set the A1SD71 to A-type output.



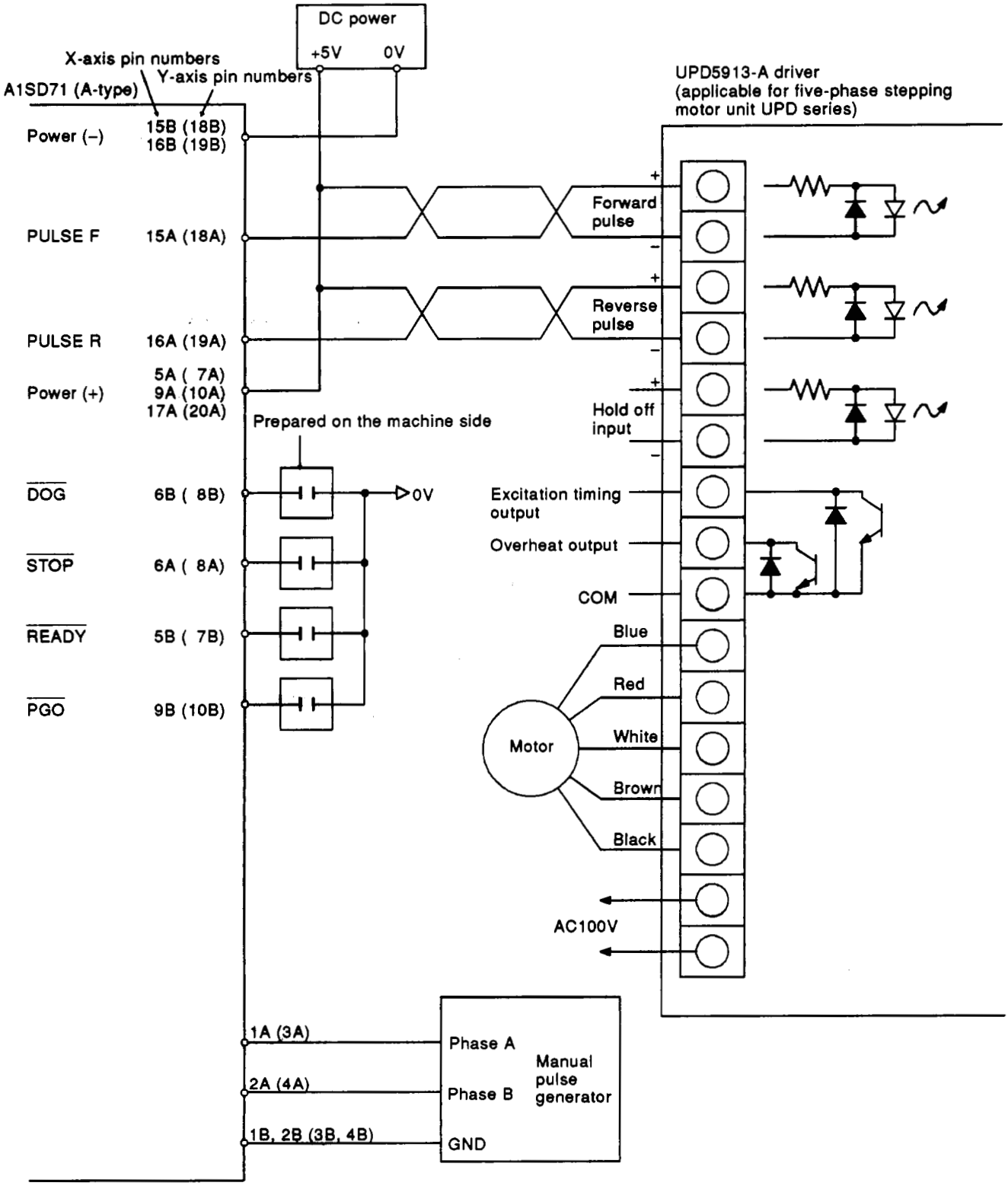
3.5 Connection with Mitsubishi MELSERVO-J

Set the A1SD71 to A-type output.



3.6 Connection with Oriental's stepping motor

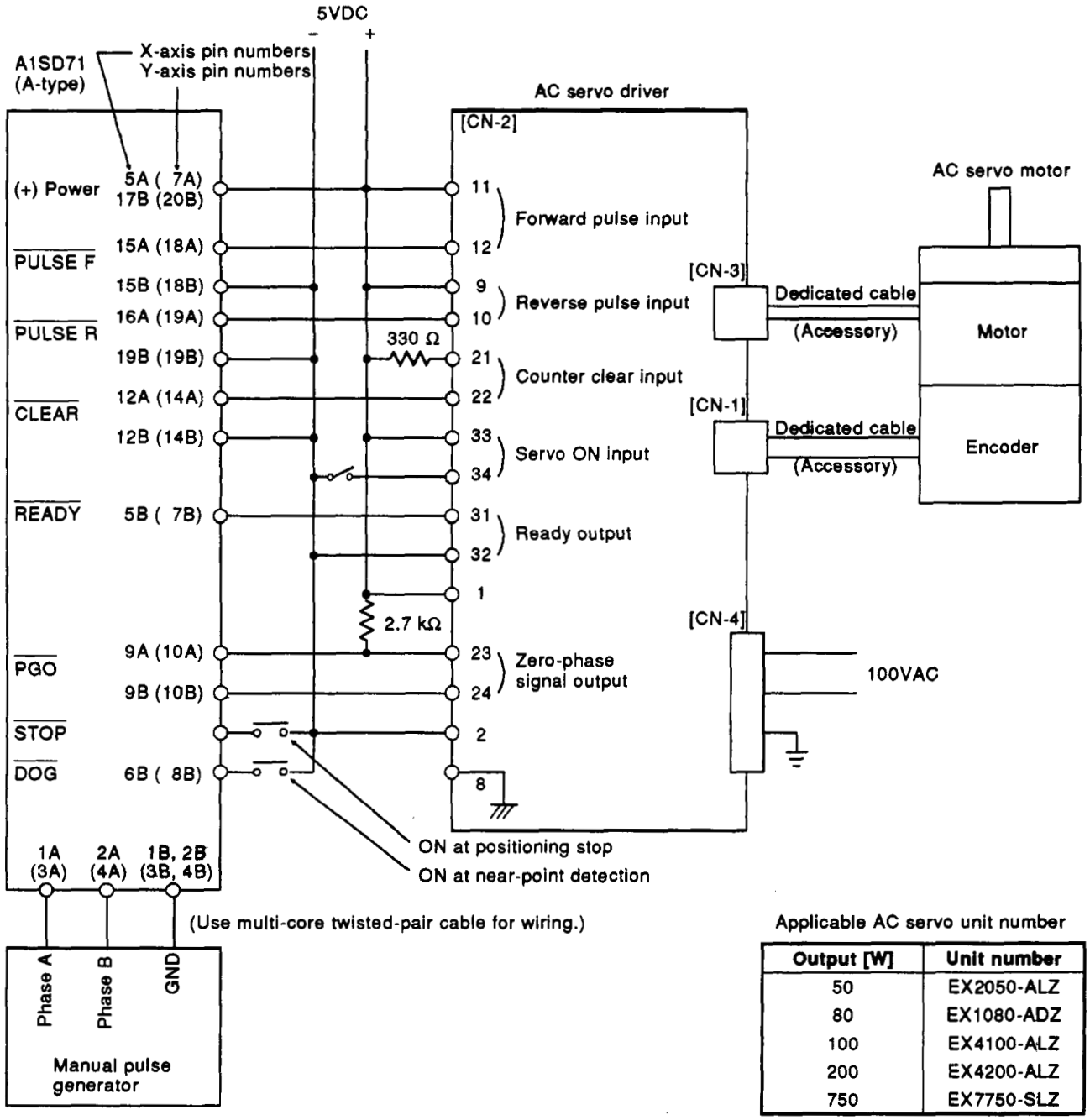
Set the A1SD71 with a motor to A-type output.



Note 1: Use shielded twisted-pair cable for wiring to the A1SD71.

3.7 Connection with Oriental's AC servo motor

Set the A1SD71 with a motor to A-type output.

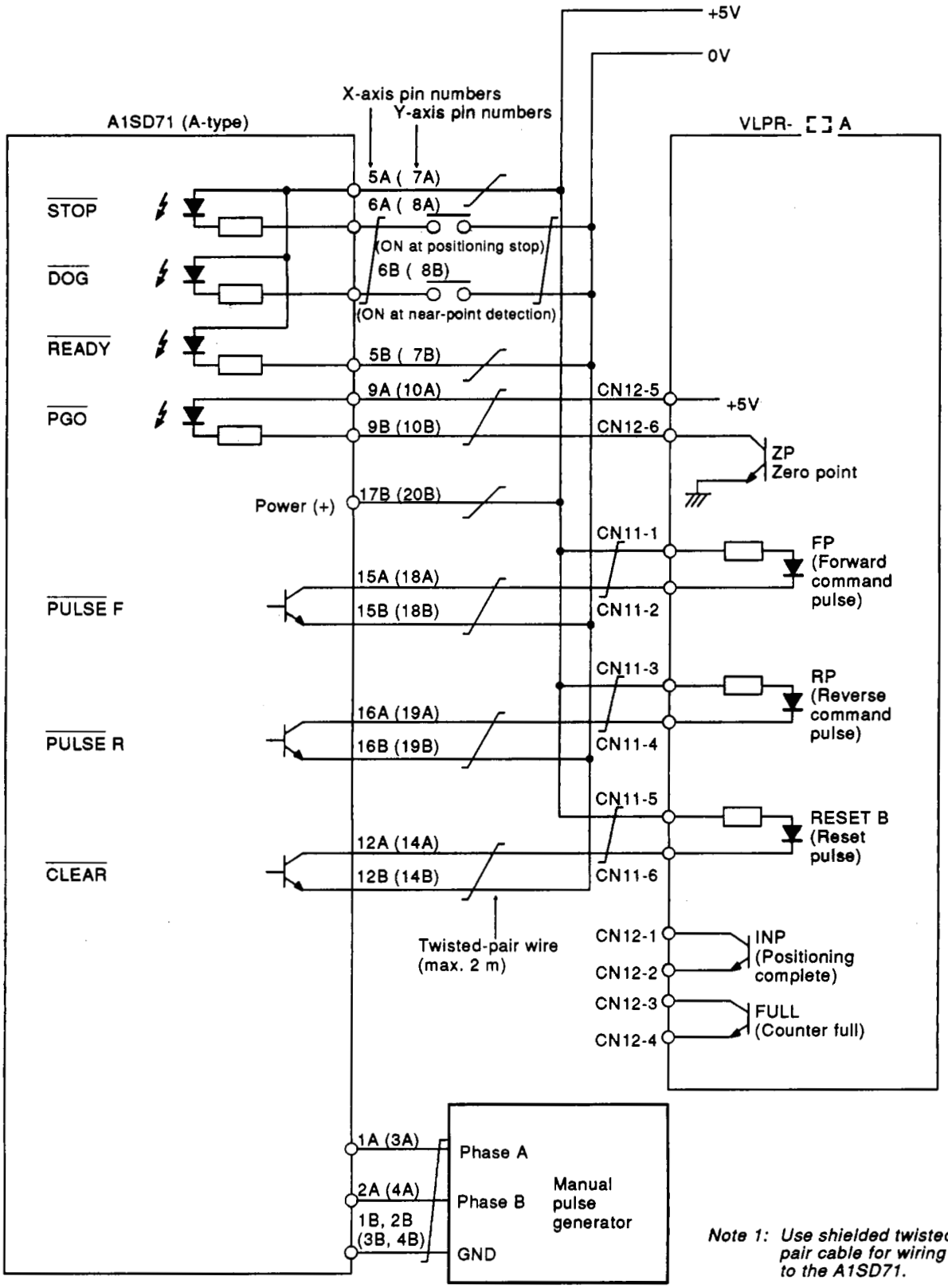


Applicable AC servo unit number

Output [W]	Unit number
50	EX2050-ALZ
80	EX1080-ADZ
100	EX4100-ALZ
200	EX4200-ALZ
750	EX7750-SLZ

3.8 Connection with Toei Electric's VELCONI-C

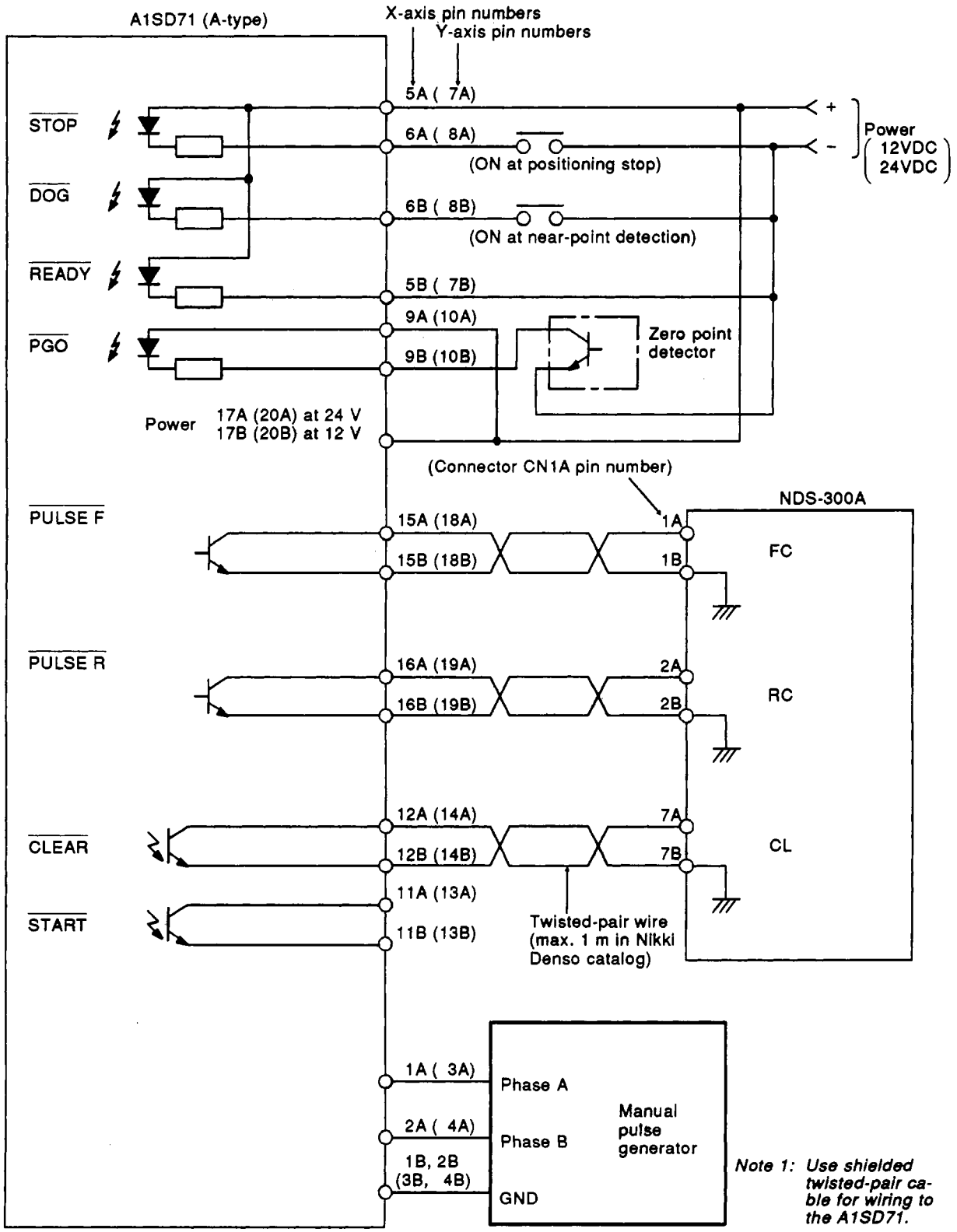
The connecting method to Toei Electric's VELCONI-C resolver-type positioning module LPR-ZA is shown below.
Set the A1SD71 to A-type output.



Note 1: Use shielded twisted-pair cable for wiring to the A1SD71.

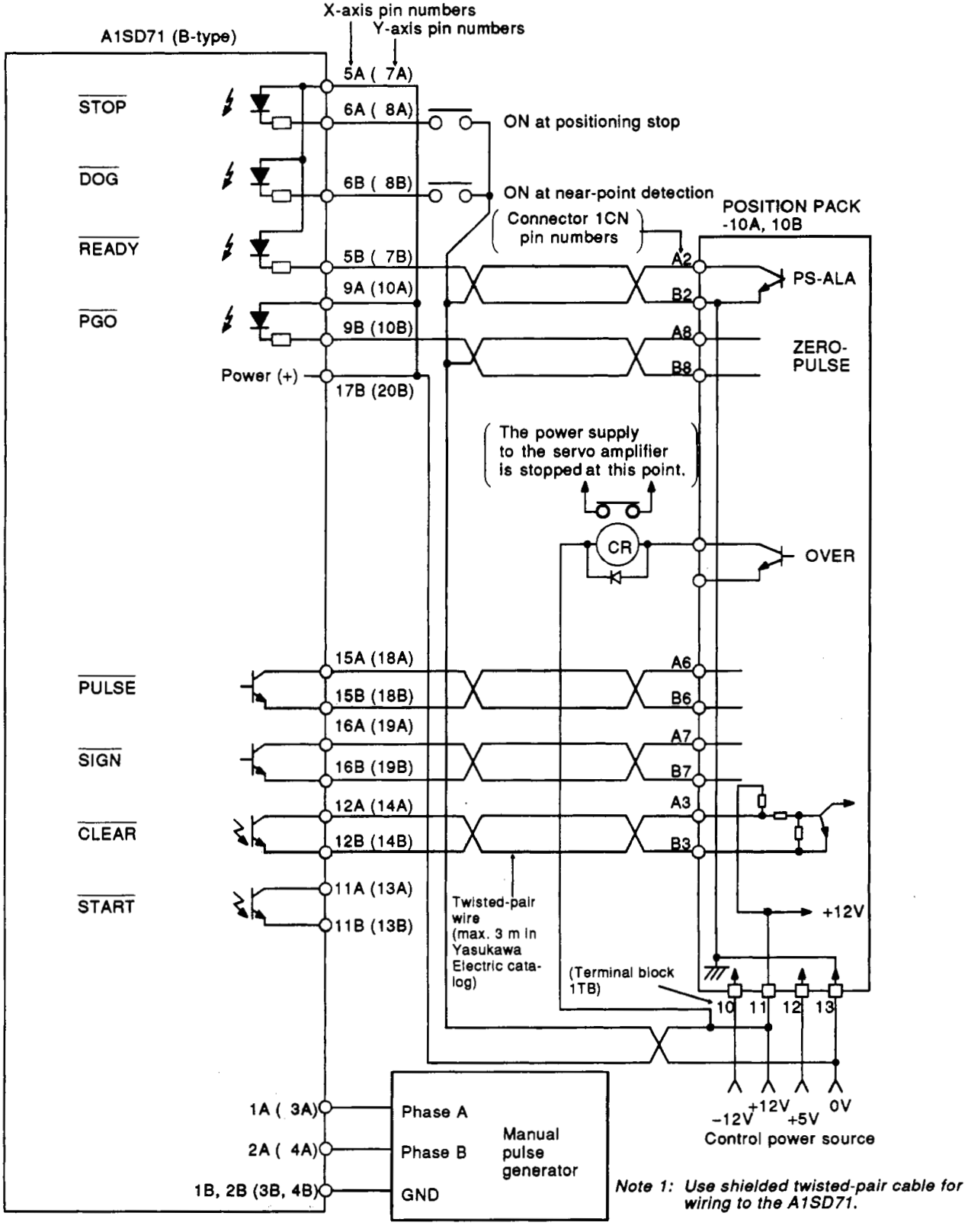
3.9 Connection with Nikki Denso's DIGITAL S-PACK

The connecting method to Nikki Denso's DIGITAL S-PACK NDS-300 is shown below.
Set the A1SD71 to A-type output.



3.10 Connection with Yasukawa Electric's PACK-10A and 10B

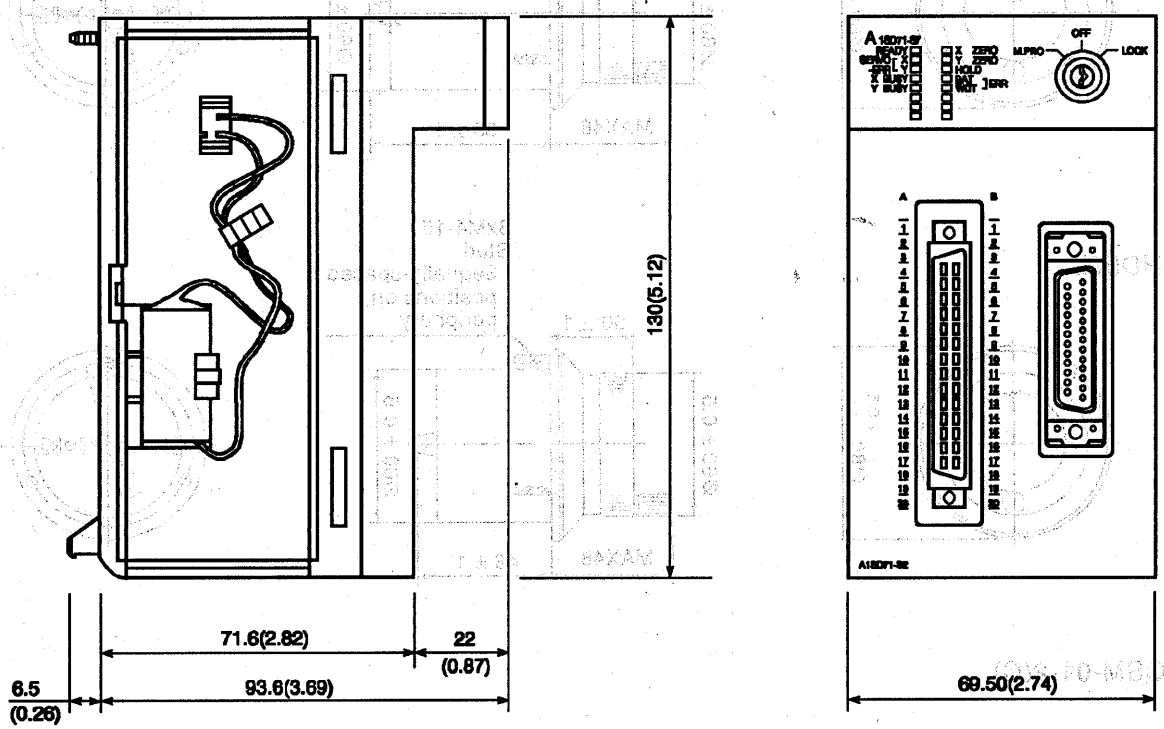
The connecting method to PACK-10A and 10B is shown below. Set the A1SD71 to B-type output.
Set the $\overline{\text{PULSE}}$ and $\overline{\text{SIGN}}$ to 5V inside POSITION PACK.



Note 1: Use shielded twisted-pair cable for wiring to the A1SD71.

APPENDIX 4 OUTSIDE DIMENSIONS

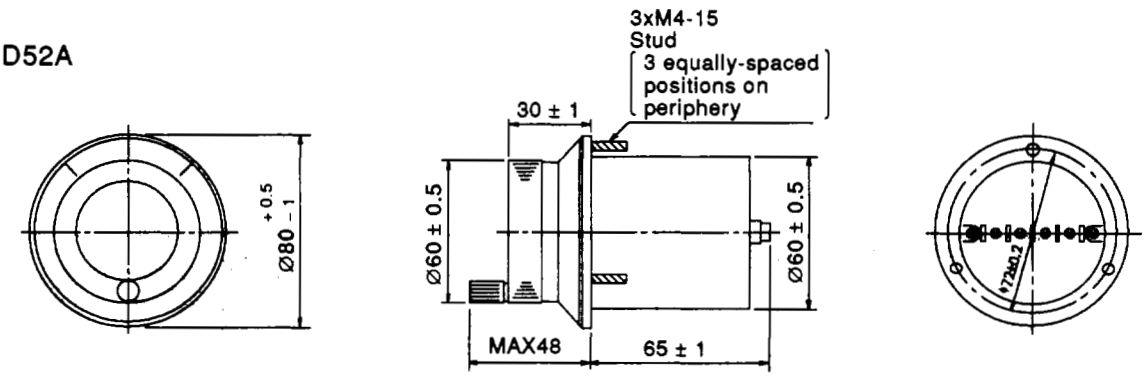
(1) A1SD71-S7



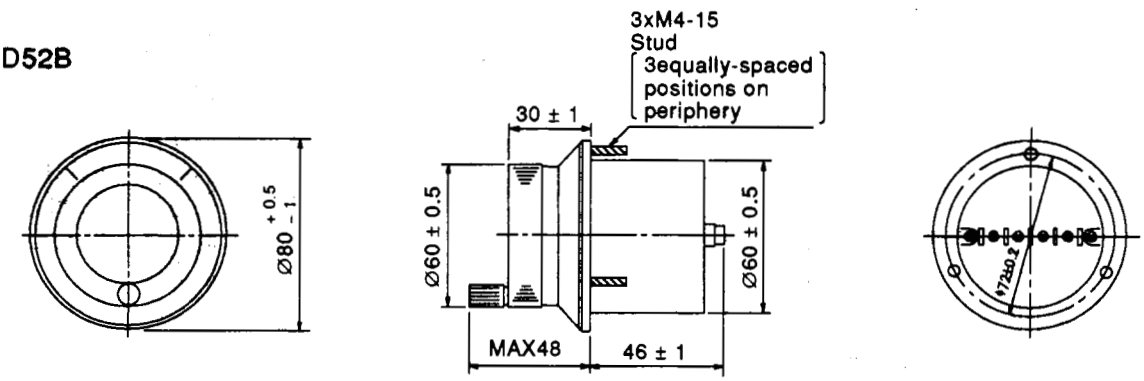
Unit : mm (inch)

(2) Manual pulse generator

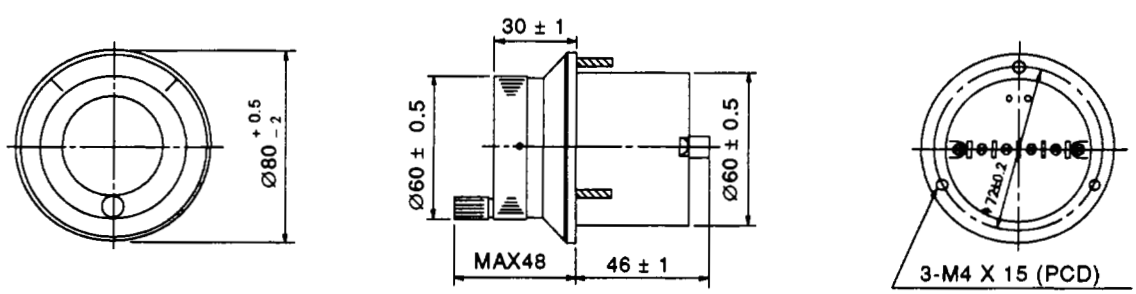
(a)HD52A



(b)HD52B



(c)OSM-01-2(C)



APPENDIX 5 POSITIONING DATA NUMBER AND BUFFER MEMORY ADRESS CONVERSION TABLE

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
1	3872	4272	4672	5072	5073	5872	6272	6672	7072	7073
2	3873	4273	4673	5074	5075	5873	6273	6673	7074	7075
3	3874	4274	4674	5076	5077	5874	6274	6674	7076	7077
4	3875	4275	4675	5078	5079	5875	6275	6675	7078	7079
5	3876	4276	4676	5080	5081	5876	6276	6676	7080	7081
6	3877	4277	4677	5082	5083	5877	6277	6677	7082	7083
7	3878	4278	4678	5084	5085	5878	6278	6678	7084	7085
8	3879	4279	4679	5086	5087	5879	6279	6679	7086	7087
9	3880	4280	4680	5088	5089	5880	6280	6680	7088	7089
10	3881	4281	4681	5090	5091	5881	6281	6681	7090	7091
11	3882	4282	4682	5092	5093	5882	6282	6682	7092	7093
12	3883	4283	4683	5094	5095	5883	6283	6683	7094	7095
13	3884	4284	4684	5096	5097	5884	6284	6684	7096	7097
14	3885	4285	4685	5098	5099	5885	6285	6685	7098	7099
15	3886	4286	4686	5100	5101	5886	6286	6686	7100	7101
16	3887	4287	4687	5102	5103	5887	6287	6687	7102	7103
17	3888	4288	4688	5104	5105	5888	6288	6688	7104	7105
18	3889	4289	4689	5106	5107	5889	6289	6689	7106	7107
19	3890	4290	4690	5108	5109	5890	6290	6690	7108	7109
20	3891	4291	4691	5110	5111	5891	6291	6691	7110	7111
21	3892	4292	4692	5112	5113	5892	6292	6692	7112	7113
22	3893	4293	4693	5114	5115	5893	6293	6693	7114	7115
23	3894	4294	4694	5116	5117	5894	6294	6694	7116	7117
24	3895	4295	4695	5118	5119	5895	6295	6695	7118	7119
25	3896	4296	4696	5120	5121	5896	6296	6696	7120	7121
26	3897	4297	4697	5122	5123	5897	6297	6697	7122	7123
27	3898	4298	4698	5124	5125	5898	6298	6698	7124	7125
28	3899	4299	4699	5126	5127	5899	6299	6699	7126	7127
29	3900	4300	4700	5128	5129	5900	6300	6700	7128	7129
30	3901	4301	4701	5130	5131	5901	6301	6701	7130	7131
31	3902	4302	4702	5132	5133	5902	6302	6702	7132	7133
32	3903	4303	4703	5134	5135	5903	6303	6703	7134	7135
33	3904	4304	4704	5136	5137	5904	6304	6704	7136	7137
34	3905	4305	4705	5138	5139	5905	6305	6705	7138	7139
35	3906	4306	4706	5140	5141	5906	6306	6706	7140	7141
36	3907	4307	4707	5142	5143	5907	6307	6707	7142	7143
37	3908	4308	4708	5144	5145	5908	6308	6708	7144	7145
38	3909	4309	4709	5146	5147	5909	6309	6709	7146	7147
39	3910	4310	4710	5148	5149	5910	6310	6710	7148	7149
40	3911	4311	4711	5150	5151	5911	6311	6711	7150	7151
41	3912	4312	4712	5152	5153	5912	6312	6712	7152	7153
42	3913	4313	4713	5154	5155	5913	6313	6713	7154	7155
43	3914	4314	4714	5156	5157	5914	6314	6714	7156	7157
44	3915	4315	4715	5158	5159	5915	6315	6715	7158	7159
45	3916	4316	4716	5160	5161	5916	6316	6716	7160	7161
46	3917	4317	4717	5162	5163	5917	6317	6717	7162	7163
47	3918	4318	4718	5164	5165	5918	6318	6718	7164	7165
48	3919	4319	4719	5166	5167	5919	6319	6719	7166	7167
49	3920	4320	4720	5168	5169	5920	6320	6720	7168	7169
50	3921	4321	4721	5170	5171	5921	6321	6721	7170	7171

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis)					(Y Axis)				
	Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
51	3922	4322	4722	5172	5173	5922	6322	6722	7172	7173
52	3923	4323	4723	5174	5175	5923	6323	6723	7174	7175
53	3924	4324	4724	5176	5177	5924	6324	6724	7176	7177
54	3925	4325	4725	5178	5179	5925	6325	6725	7178	7179
55	3926	4326	4726	5180	5181	5926	6326	6726	7180	7181
56	3927	4327	4727	5182	5183	5927	6327	6727	7182	7183
57	3928	4328	4728	5184	5185	5928	6328	6728	7184	7185
58	3929	4329	4729	5186	5187	5929	6329	6729	7186	7187
59	3930	4330	4730	5188	5189	5930	6330	6730	7188	7189
60	3931	4331	4731	5190	5191	5931	6331	6731	7190	7191
61	3932	4332	4732	5192	5193	5932	6332	6732	7192	7193
62	3933	4333	4733	5194	5195	5933	6333	6733	7194	7195
63	3934	4334	4734	5196	5197	5934	6334	6734	7196	7197
64	3935	4335	4735	5198	5199	5935	6335	6735	7198	7199
65	3936	4336	4736	5200	5201	5936	6336	6736	7200	7201
66	3937	4337	4737	5202	5203	5937	6337	6737	7202	7203
67	3938	4338	4738	5204	5205	5938	6338	6738	7204	7205
68	3939	4339	4739	5206	5207	5939	6339	6739	7206	7207
69	3940	4340	4740	5208	5209	5940	6340	6740	7208	7209
70	3941	4341	4741	5210	5211	5941	6341	6741	7210	7211
71	3942	4342	4742	5212	5213	5942	6342	6742	7212	7213
72	3943	4343	4743	5214	5215	5943	6343	6743	7214	7215
73	3944	4344	4744	5216	5217	5944	6344	6744	7216	7217
74	3945	4345	4745	5218	5219	5945	6345	6745	7218	7219
75	3946	4346	4746	5220	5221	5946	6346	6746	7220	7221
76	3947	4347	4747	5222	5223	5947	6347	6747	7222	7223
77	3948	4348	4748	5224	5225	5948	6348	6748	7224	7225
78	3949	4349	4749	5226	5227	5949	6349	6749	7226	7227
79	3950	4350	4750	5228	5229	5950	6350	6750	7228	7229
80	3951	4351	4751	5230	5231	5951	6351	6751	7230	7231
81	3952	4352	4752	5232	5233	5952	6352	6752	7232	7233
82	3953	4353	4753	5234	5235	5953	6353	6753	7234	7235
83	3954	4354	4754	5236	5237	5954	6354	6754	7236	7237
84	3955	4355	4755	5238	5239	5955	6355	6755	7238	7239
85	3956	4356	4756	5240	5241	5956	6356	6756	7240	7241
86	3957	4357	4757	5242	5243	5957	6357	6757	7242	7243
87	3958	4358	4758	5244	5245	5958	6358	6758	7244	7245
88	3959	4359	4759	5246	5247	5959	6359	6759	7246	7247
89	3960	4360	4760	5248	5249	5960	6360	6760	7248	7249
90	3961	4361	4761	5250	5251	5961	6361	6761	7250	7251
91	3962	4362	4762	5252	5253	5962	6362	6762	7252	7253
92	3963	4363	4763	5254	5255	5963	6363	6763	7254	7255
93	3964	4364	4764	5256	5257	5964	6364	6764	7256	7257
94	3965	4365	4765	5258	5259	5965	6365	6765	7258	7259
95	3966	4366	4766	5260	5261	5966	6366	6766	7260	7261
96	3967	4367	4767	5262	5263	5967	6367	6767	7262	7263
97	3968	4368	4768	5264	5265	5968	6368	6768	7264	7265
98	3969	4369	4769	5266	5267	5969	6369	6769	7266	7267
99	3970	4370	4770	5268	5269	5970	6370	6770	7268	7269
100	3971	4371	4771	5270	5271	5971	6371	6771	7270	7271

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
101	3972	4372	4772	5272	5273	5972	6372	6772	7272	7273
102	3973	4373	4773	5274	5275	5973	6373	6773	7274	7275
103	3974	4374	4774	5276	5277	5974	6374	6774	7276	7277
104	3975	4375	4775	5278	5279	5975	6375	6775	7278	7279
105	3976	4376	4776	5280	5281	5976	6376	6776	7280	7281
106	3977	4377	4777	5282	5283	5977	6377	6777	7282	7283
107	3978	4378	4778	5284	5285	5978	6378	6778	7284	7285
108	3979	4379	4779	5286	5287	5979	6379	6779	7286	7287
109	3980	4380	4780	5288	5289	5980	6380	6780	7288	7289
110	3981	4381	4781	5290	5291	5981	6381	6781	7290	7291
111	3982	4382	4782	5292	5293	5982	6382	6782	7292	7293
112	3983	4383	4783	5294	5295	5983	6383	6783	7294	7295
113	3984	4384	4784	5296	5297	5984	6384	6784	7296	7297
114	3985	4385	4785	5298	5299	5985	6385	6785	7298	7299
115	3986	4386	4786	5300	5301	5986	6386	6786	7300	7301
116	3987	4387	4787	5302	5303	5987	6387	6787	7302	7303
117	3988	4388	4788	5304	5305	5988	6388	6788	7304	7305
118	3989	4389	4789	5306	5307	5989	6389	6789	7306	7307
119	3990	4390	4790	5308	5309	5990	6390	6790	7308	7309
120	3991	4391	4791	5310	5311	5991	6391	6791	7310	7311
121	3992	4392	4792	5312	5313	5992	6392	6792	7312	7313
122	3993	4393	4793	5314	5315	5993	6393	6793	7314	7315
123	3994	4394	4794	5316	5317	5994	6394	6794	7316	7317
124	3995	4395	4795	5318	5319	5995	6395	6795	7318	7319
125	3996	4396	4796	5320	5321	5996	6396	6796	7320	7321
126	3997	4397	4797	5322	5323	5997	6397	6797	7322	7323
127	3998	4398	4798	5324	5325	5998	6398	6798	7324	7325
128	3999	4399	4799	5326	5327	5999	6399	6799	7326	7327
129	4000	4400	4800	5328	5329	6000	6400	6800	7328	7329
130	4001	4401	4801	5330	5331	6001	6401	6801	7330	7331
131	4002	4402	4802	5332	5333	6002	6402	6802	7332	7333
132	4003	4403	4803	5334	5335	6003	6403	6803	7334	7335
133	4004	4404	4804	5336	5337	6004	6404	6804	7336	7337
134	4005	4405	4805	5338	5339	6005	6405	6805	7338	7339
135	4006	4406	4806	5340	5341	6006	6406	6806	7340	7341
136	4007	4407	4807	5342	5343	6007	6407	6807	7342	7343
137	4008	4408	4808	5344	5345	6008	6408	6808	7344	7345
138	4009	4409	4809	5346	5347	6009	6409	6809	7346	7347
139	4010	4410	4810	5348	5349	6010	6410	6810	7348	7349
140	4011	4411	4811	5350	5351	6011	6411	6811	7350	7351
141	4012	4412	4812	5352	5353	6012	6412	6812	7352	7353
142	4013	4413	4813	5354	5355	6013	6413	6813	7354	7355
143	4014	4414	4814	5356	5357	6014	6414	6814	7356	7357
144	4015	4415	4815	5358	5359	6015	6415	6815	7358	7359
145	4016	4416	4816	5360	5361	6016	6416	6816	7360	7361
146	4017	4417	4817	5362	5363	6017	6417	6817	7362	7363
147	4018	4418	4818	5364	5365	6018	6418	6818	7364	7365
148	4019	4419	4819	5366	5367	6019	6419	6819	7366	7367
149	4020	4420	4820	5368	5369	6020	6420	6820	7368	7369
150	4021	4421	4821	5370	5371	6021	6421	6821	7370	7371

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
151	4022	4422	4822	5372	5373	6022	6422	6822	7372	7373
152	4023	4423	4823	5374	5375	6023	6423	6823	7374	7375
153	4024	4424	4824	5376	5377	6024	6424	6824	7376	7377
154	4025	4425	4825	5378	5379	6025	6425	6825	7378	7379
155	4026	4426	4826	5380	5381	6026	6426	6826	7380	7381
156	4027	4427	4827	5382	5383	6027	6427	6827	7382	7383
157	4028	4428	4828	5384	5385	6028	6428	6828	7384	7385
158	4029	4429	4829	5386	5387	6029	6429	6829	7386	7387
159	4030	4430	4830	5388	5389	6030	6430	6830	7388	7389
160	4031	4431	4831	5390	5391	6031	6431	6831	7390	7391
161	4032	4432	4832	5392	5393	6032	6432	6832	7392	7393
162	4033	4433	4833	5394	5395	6033	6433	6833	7394	7395
163	4034	4434	4834	5396	5397	6034	6434	6834	7396	7397
164	4035	4435	4835	5398	5399	6035	6435	6835	7398	7399
165	4036	4436	4836	5400	5401	6036	6436	6836	7400	7401
166	4037	4437	4837	5402	5403	6037	6437	6837	7402	7403
167	4038	4438	4838	5404	5405	6038	6438	6838	7404	7405
168	4039	4439	4839	5406	5407	6039	6439	6839	7406	7407
169	4040	4440	4840	5408	5409	6040	6440	6840	7408	7409
170	4041	4441	4841	5410	5411	6041	6441	6841	7410	7411
171	4042	4442	4842	5412	5413	6042	6442	6842	7412	7413
172	4043	4443	4843	5414	5415	6043	6443	6843	7414	7415
173	4044	4444	4844	5416	5417	6044	6444	6844	7416	7417
174	4045	4445	4845	5418	5419	6045	6445	6845	7418	7419
175	4046	4446	4846	5420	5421	6046	6446	6846	7420	7421
176	4047	4447	4847	5422	5423	6047	6447	6847	7422	7423
177	4048	4448	4848	5424	5425	6048	6448	6848	7424	7425
178	4049	4449	4849	5426	5427	6049	6449	6849	7426	7427
179	4050	4450	4850	5428	5429	6050	6450	6850	7428	7429
180	4051	4451	4851	5430	5431	6051	6451	6851	7430	7431
181	4052	4452	4852	5432	5433	6052	6452	6852	7432	7433
182	4053	4453	4853	5434	5435	6053	6453	6853	7434	7435
183	4054	4454	4854	5436	5437	6054	6454	6854	7436	7437
184	4055	4455	4855	5438	5439	6055	6455	6855	7438	7439
185	4056	4456	4856	5440	5441	6056	6456	6856	7440	7441
186	4057	4457	4857	5442	5443	6057	6457	6857	7442	7443
187	4058	4458	4858	5444	5445	6058	6458	6858	7444	7445
188	4059	4459	4859	5446	5447	6059	6459	6859	7446	7447
189	4060	4460	4860	5448	5449	6060	6460	6860	7448	7449
190	4061	4461	4861	5450	5451	6061	6461	6861	7450	7451
191	4062	4462	4862	5452	5453	6062	6462	6862	7452	7453
192	4063	4463	4863	5454	5455	6063	6463	6863	7454	7455
193	4064	4464	4864	5456	5457	6064	6464	6864	7456	7457
194	4065	4465	4865	5458	5459	6065	6465	6865	7458	7459
195	4066	4466	4866	5460	5461	6066	6466	6866	7460	7461
196	4067	4467	4867	5462	5463	6067	6467	6867	7462	7463
197	4068	4468	4868	5464	5465	6068	6468	6868	7464	7465
198	4069	4469	4869	5466	5467	6069	6469	6869	7466	7467
199	4070	4470	4870	5468	5469	6070	6470	6870	7468	7469
200	4071	4471	4871	5470	5471	6071	6471	6871	7470	7471

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
201	4072	4472	4872	5472	5473	6072	6472	6872	7472	7473
202	4073	4473	4873	5474	5475	6073	6473	6873	7474	7475
203	4074	4474	4874	5476	5477	6074	6474	6874	7476	7477
204	4075	4475	4875	5478	5479	6075	6475	6875	7478	7479
205	4076	4476	4876	5480	5481	6076	6476	6876	7480	7481
206	4077	4477	4877	5482	5483	6077	6477	6877	7482	7483
207	4078	4478	4878	5484	5485	6078	6478	6878	7484	7485
208	4079	4479	4879	5486	5487	6079	6479	6879	7486	7487
209	4080	4480	4880	5488	5489	6080	6480	6880	7488	7489
210	4081	4481	4881	5490	5491	6081	6481	6881	7490	7491
211	4082	4482	4882	5492	5493	6082	6482	6882	7492	7493
212	4083	4483	4883	5494	5495	6083	6483	6883	7494	7495
213	4084	4484	4884	5496	5497	6084	6484	6884	7496	7497
214	4085	4485	4885	5498	5499	6085	6485	6885	7498	7499
215	4086	4486	4886	5500	5501	6086	6486	6886	7500	7501
216	4087	4487	4887	5502	5503	6087	6487	6887	7502	7503
217	4088	4488	4888	5504	5505	6088	6488	6888	7504	7505
218	4089	4489	4889	5506	5507	6089	6489	6889	7506	7507
219	4090	4490	4890	5508	5509	6090	6490	6890	7508	7509
220	4091	4491	4891	5510	5511	6091	6491	6891	7510	7511
221	4092	4492	4892	5512	5513	6092	6492	6892	7512	7513
222	4093	4493	4893	5514	5515	6093	6493	6893	7514	7515
223	4094	4494	4894	5516	5517	6094	6494	6894	7516	7517
224	4095	4495	4895	5518	5519	6095	6495	6895	7518	7519
225	4096	4496	4896	5520	5521	6096	6496	6896	7520	7521
226	4097	4497	4897	5522	5523	6097	6497	6897	7522	7523
227	4098	4498	4898	5524	5525	6098	6498	6898	7524	7525
228	4099	4499	4899	5526	5527	6099	6499	6899	7526	7527
229	4100	4500	4900	5528	5529	6100	6500	6900	7528	7529
230	4101	4501	4901	5530	5531	6101	6501	6901	7530	7531
231	4102	4502	4902	5532	5533	6102	6502	6902	7532	7533
232	4103	4503	4903	5534	5535	6103	6503	6903	7534	7535
233	4104	4504	4904	5536	5537	6104	6504	6904	7536	7537
234	4105	4505	4905	5538	5539	6105	6505	6905	7538	7539
235	4106	4506	4906	5540	5541	6106	6506	6906	7540	7541
236	4107	4507	4907	5542	5543	6107	6507	6907	7542	7543
237	4108	4508	4908	5544	5545	6108	6508	6908	7544	7545
238	4109	4509	4909	5546	5547	6109	6509	6909	7546	7547
239	4110	4510	4910	5548	5549	6110	6510	6910	7548	7549
240	4111	4511	4911	5550	5551	6111	6511	6911	7550	7551
241	4112	4512	4912	5552	5553	6112	6512	6912	7552	7553
242	4113	4513	4913	5554	5555	6113	6513	6913	7554	7555
243	4114	4514	4914	5556	5557	6114	6514	6914	7556	7557
244	4115	4515	4915	5558	5559	6115	6515	6915	7558	7559
245	4116	4516	4916	5560	5561	6116	6516	6916	7560	7561
246	4117	4517	4917	5562	5563	6117	6517	6917	7562	7563
247	4118	4518	4918	5564	5565	6118	6518	6918	7564	7565
248	4119	4519	4919	5566	5567	6119	6519	6919	7566	7567
249	4120	4520	4920	5568	5569	6120	6520	6920	7568	7569
250	4121	4521	4921	5570	5571	6121	6521	6921	7570	7571

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
251	4122	4522	4922	5572	5573	6122	6522	6922	7572	7573
252	4123	4523	4923	5574	5575	6123	6523	6923	7574	7575
253	4124	4524	4924	5576	5577	6124	6524	6924	7576	7577
254	4125	4525	4925	5578	5579	6125	6525	6925	7578	7579
255	4126	4526	4926	5580	5581	6126	6526	6926	7580	7581
256	4127	4527	4927	5582	5583	6127	6527	6927	7582	7583
257	4128	4528	4928	5584	5585	6128	6528	6928	7584	7585
258	4129	4529	4929	5586	5587	6129	6529	6929	7586	7587
259	4130	4530	4930	5588	5589	6130	6530	6930	7588	7589
260	4131	4531	4931	5590	5591	6131	6531	6931	7590	7591
261	4132	4532	4932	5592	5593	6132	6532	6932	7592	7593
262	4133	4533	4933	5594	5595	6133	6533	6933	7594	7595
263	4134	4534	4934	5596	5597	6134	6534	6934	7596	7597
264	4135	4535	4935	5598	5599	6135	6535	6935	7598	7599
265	4136	4536	4936	5600	5601	6136	6536	6936	7600	7601
266	4137	4537	4937	5602	5603	6137	6537	6937	7602	7603
267	4138	4538	4938	5604	5605	6138	6538	6938	7604	7605
268	4139	4539	4939	5606	5607	6139	6539	6939	7606	7607
269	4140	4540	4940	5608	5609	6140	6540	6940	7608	7609
270	4141	4541	4941	5610	5611	6141	6541	6941	7610	7611
271	4142	4542	4942	5612	5613	6142	6542	6942	7612	7613
272	4143	4543	4943	5614	5615	6143	6543	6943	7614	7615
273	4144	4544	4944	5616	5617	6144	6544	6944	7616	7617
274	4145	4545	4945	5618	5619	6145	6545	6945	7618	7619
275	4146	4546	4946	5620	5621	6146	6546	6946	7620	7621
276	4147	4547	4947	5622	5623	6147	6547	6947	7622	7623
277	4148	4548	4948	5624	5625	6148	6548	6948	7624	7625
278	4149	4549	4949	5626	5627	6149	6549	6949	7626	7627
279	4150	4550	4950	5628	5629	6150	6550	6950	7628	7629
280	4151	4551	4951	5630	5631	6151	6551	6951	7630	7631
281	4152	4552	4952	5632	5633	6152	6552	6952	7632	7633
282	4153	4553	4953	5634	5635	6153	6553	6953	7634	7635
283	4154	4554	4954	5636	5637	6154	6554	6954	7636	7637
284	4155	4555	4955	5638	5639	6155	6555	6955	7638	7639
285	4156	4556	4956	5640	5641	6156	6556	6956	7640	7641
286	4157	4557	4957	5642	5643	6157	6557	6957	7642	7643
287	4158	4558	4958	5644	5645	6158	6558	6958	7644	7645
288	4159	4559	4959	5646	5647	6159	6559	6959	7646	7647
289	4160	4560	4960	5648	5649	6160	6560	6960	7648	7649
290	4161	4561	4961	5650	5651	6161	6561	6961	7650	7651
291	4162	4562	4962	5652	5653	6162	6562	6962	7652	7653
292	4163	4563	4963	5654	5655	6163	6563	6963	7654	7655
293	4164	4564	4964	5656	5657	6164	6564	6964	7656	7657
294	4165	4565	4965	5658	5659	6165	6565	6965	7658	7659
295	4166	4566	4966	5660	5661	6166	6566	6966	7660	7661
296	4167	4567	4967	5662	5663	6167	6567	6967	7662	7663
297	4168	4568	4968	5664	5665	6168	6568	6968	7664	7665
298	4169	4569	4969	5666	5667	6169	6569	6969	7666	7667
299	4170	4570	4970	5668	5669	6170	6570	6970	7668	7669
300	4171	4571	4971	5670	5671	6171	6571	6971	7670	7671

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
301	4172	4572	4972	5672	5673	6172	6572	6972	7672	7673
302	4173	4573	4973	5674	5675	6173	6573	6973	7674	7675
303	4174	4574	4974	5676	5677	6174	6574	6974	7676	7677
304	4175	4575	4975	5678	5679	6175	6575	6975	7678	7679
305	4176	4576	4976	5680	5681	6176	6576	6976	7680	7681
306	4177	4577	4977	5682	5683	6177	6577	6977	7682	7683
307	4178	4578	4978	5684	5685	6178	6578	6978	7684	7685
308	4179	4579	4979	5686	5687	6179	6579	6979	7686	7687
309	4180	4580	4980	5688	5689	6180	6580	6980	7688	7689
310	4181	4581	4981	5690	5691	6181	6581	6981	7690	7691
311	4182	4582	4982	5692	5693	6182	6582	6982	7692	7693
312	4183	4583	4983	5694	5695	6183	6583	6983	7694	7695
313	4184	4584	4984	5696	5697	6184	6584	6984	7696	7697
314	4185	4585	4985	5698	5699	6185	6585	6985	7698	7699
315	4186	4586	4986	5700	5701	6186	6586	6986	7700	7701
316	4187	4587	4987	5702	5703	6187	6587	6987	7702	7703
317	4188	4588	4988	5704	5705	6188	6588	6988	7704	7705
318	4189	4589	4989	5706	5707	6189	6589	6989	7706	7707
319	4190	4590	4990	5708	5709	6190	6590	6990	7708	7709
320	4191	4591	4991	5710	5711	6191	6591	6991	7710	7711
321	4192	4592	4992	5712	5713	6192	6592	6992	7712	7713
322	4193	4593	4993	5714	5715	6193	6593	6993	7714	7715
323	4194	4594	4994	5716	5717	6194	6594	6994	7716	7717
324	4195	4595	4995	5718	5719	6195	6595	6995	7718	7719
325	4196	4596	4996	5720	5721	6196	6596	6996	7720	7721
326	4197	4597	4997	5722	5723	6197	6597	6997	7722	7723
327	4198	4598	4998	5724	5725	6198	6598	6998	7724	7725
328	4199	4599	4999	5726	5727	6199	6599	6999	7726	7727
329	4200	4600	5000	5728	5729	6200	6600	7000	7728	7729
330	4201	4601	5001	5730	5731	6201	6601	7001	7730	7731
331	4202	4602	5002	5732	5733	6202	6602	7002	7732	7733
332	4203	4603	5003	5734	5735	6203	6603	7003	7734	7735
333	4204	4604	5004	5736	5737	6204	6604	7004	7736	7737
334	4205	4605	5005	5738	5739	6205	6605	7005	7738	7739
335	4206	4606	5006	5740	5741	6206	6606	7006	7740	7741
336	4207	4607	5007	5742	5743	6207	6607	7007	7742	7743
337	4208	4608	5008	5744	5745	6208	6608	7008	7744	7745
338	4209	4609	5009	5746	5747	6209	6609	7009	7746	7747
339	4210	4610	5010	5748	5749	6210	6610	7010	7748	7749
340	4211	4611	5011	5750	5751	6211	6611	7011	7750	7751
341	4212	4612	5012	5752	5753	6212	6612	7012	7752	7753
342	4213	4613	5013	5754	5755	6213	6613	7013	7754	7755
343	4214	4614	5014	5756	5757	6214	6614	7014	7756	7757
344	4215	4615	5015	5758	5759	6215	6615	7015	7758	7759
345	4216	4616	5016	5760	5761	6216	6616	7016	7760	7761
346	4217	4617	5017	5762	5763	6217	6617	7017	7762	7763
347	4218	4618	5018	5764	5765	6218	6618	7018	7764	7765
348	4219	4619	5019	5766	5767	6219	6619	7019	7766	7767
349	4220	4620	5020	5768	5769	6220	6620	7020	7768	7769
350	4221	4621	5021	5770	5771	6221	6621	7021	7770	7771

Positioning Data Number and Buffer Memory Address Conversion Table

Data No.	(X Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper	(Y Axis) Positioning Information	Positioning Speed	Dwell Time	Positioning Lower	Address Upper
351	4222	4622	5022	5772	5773	6222	6622	7022	7772	7773
352	4223	4623	5023	5774	5775	6223	6623	7023	7774	7775
353	4224	4624	5024	5776	5777	6224	6624	7024	7776	7777
354	4225	4625	5025	5778	5779	6225	6625	7025	7778	7779
355	4226	4626	5026	5780	5781	6226	6626	7026	7780	7781
356	4227	4627	5027	5782	5783	6227	6627	7027	7782	7783
357	4228	4628	5028	5784	5785	6228	6628	7028	7784	7785
358	4229	4629	5029	5786	5787	6229	6629	7029	7786	7787
359	4230	4630	5030	5788	5789	6230	6630	7030	7788	7789
360	4231	4631	5031	5790	5791	6231	6631	7031	7790	7791
361	4232	4632	5032	5792	5793	6232	6632	7032	7792	7793
362	4233	4633	5033	5794	5795	6233	6633	7033	7794	7795
363	4234	4634	5034	5796	5797	6234	6634	7034	7796	7797
364	4235	4635	5035	5798	5799	6235	6635	7035	7798	7799
365	4236	4636	5036	5800	5801	6236	6636	7036	7800	7801
366	4237	4637	5037	5802	5803	6237	6637	7037	7802	7803
367	4238	4638	5038	5804	5805	6238	6638	7038	7804	7805
368	4239	4639	5039	5806	5807	6239	6639	7039	7806	7807
369	4240	4640	5040	5808	5809	6240	6640	7040	7808	7809
370	4241	4641	5041	5810	5811	6241	6641	7041	7810	7811
371	4242	4642	5042	5812	5813	6242	6642	7042	7812	7813
372	4243	4643	5043	5814	5815	6243	6643	7043	7814	7815
373	4244	4644	5044	5816	5817	6244	6644	7044	7816	7817
374	4245	4645	5045	5818	5819	6245	6645	7045	7818	7819
375	4246	4646	5046	5820	5821	6246	6646	7046	7820	7821
376	4247	4647	5047	5822	5823	6247	6647	7047	7822	7823
377	4248	4648	5048	5824	5825	6248	6648	7048	7824	7825
378	4249	4649	5049	5826	5827	6249	6649	7049	7826	7827
379	4250	4650	5050	5828	5829	6250	6650	7050	7828	7829
380	4251	4651	5051	5830	5831	6251	6651	7051	7830	7831
381	4252	4652	5052	5832	5833	6252	6652	7052	7832	7833
382	4253	4653	5053	5834	5835	6253	6653	7053	7834	7835
383	4254	4654	5054	5836	5837	6254	6654	7054	7836	7837
384	4255	4655	5055	5838	5839	6255	6655	7055	7838	7839
385	4256	4656	5056	5840	5841	6256	6656	7056	7840	7841
386	4257	4657	5057	5842	5843	6257	6657	7057	7842	7843
387	4258	4658	5058	5844	5845	6258	6658	7058	7844	7845
388	4259	4659	5059	5846	5847	6259	6659	7059	7846	7847
389	4260	4660	5060	5848	5849	6260	6660	7060	7848	7849
390	4261	4661	5061	5850	5851	6261	6661	7061	7850	7851
391	4262	4662	5062	5852	5853	6262	6662	7062	7852	7853
392	4263	4663	5063	5854	5855	6263	6663	7063	7854	7855
393	4264	4664	5064	5856	5857	6264	6664	7064	7856	7857
394	4265	4665	5065	5858	5859	6265	6665	7065	7858	7859
395	4266	4666	5066	5860	5861	6266	6666	7066	7860	7861
396	4267	4667	5067	5862	5863	6267	6667	7067	7862	7863
397	4268	4668	5068	5864	5865	6268	6668	7068	7864	7865
398	4269	4669	5069	5866	5867	6269	6669	7069	7866	7867
399	4270	4670	5070	5868	5869	6270	6670	7070	7868	7869
400	4271	4671	5071	5870	5871	6271	6671	7071	7870	7871

IMPORTANT

(1) Design the configuration of a system to provide an external protective or safety inter locking circuit for the PCs.

(2) 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.

(a) Ground human body and work bench.

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

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100 TELEX: J24532 CABLE MELCO TOKYO
NAGOYA WORKS : 1-14 , YADA-MINAMI 5 , HIGASHI-KU , NAGOYA , JAPAN

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