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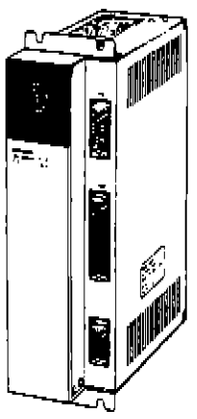
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OMRON

Cat No.O003-E1-1

USER'S MANUAL



TYPE 3F88M-115A/MPG/F

Type 3F88M-115 SERIES

SERVO POSITIONER

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		Applied Type A	MPG	F
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● Note :

Last letters in this type nomenclature

has the following meanings :

A = 3F88M-115A : Standard type

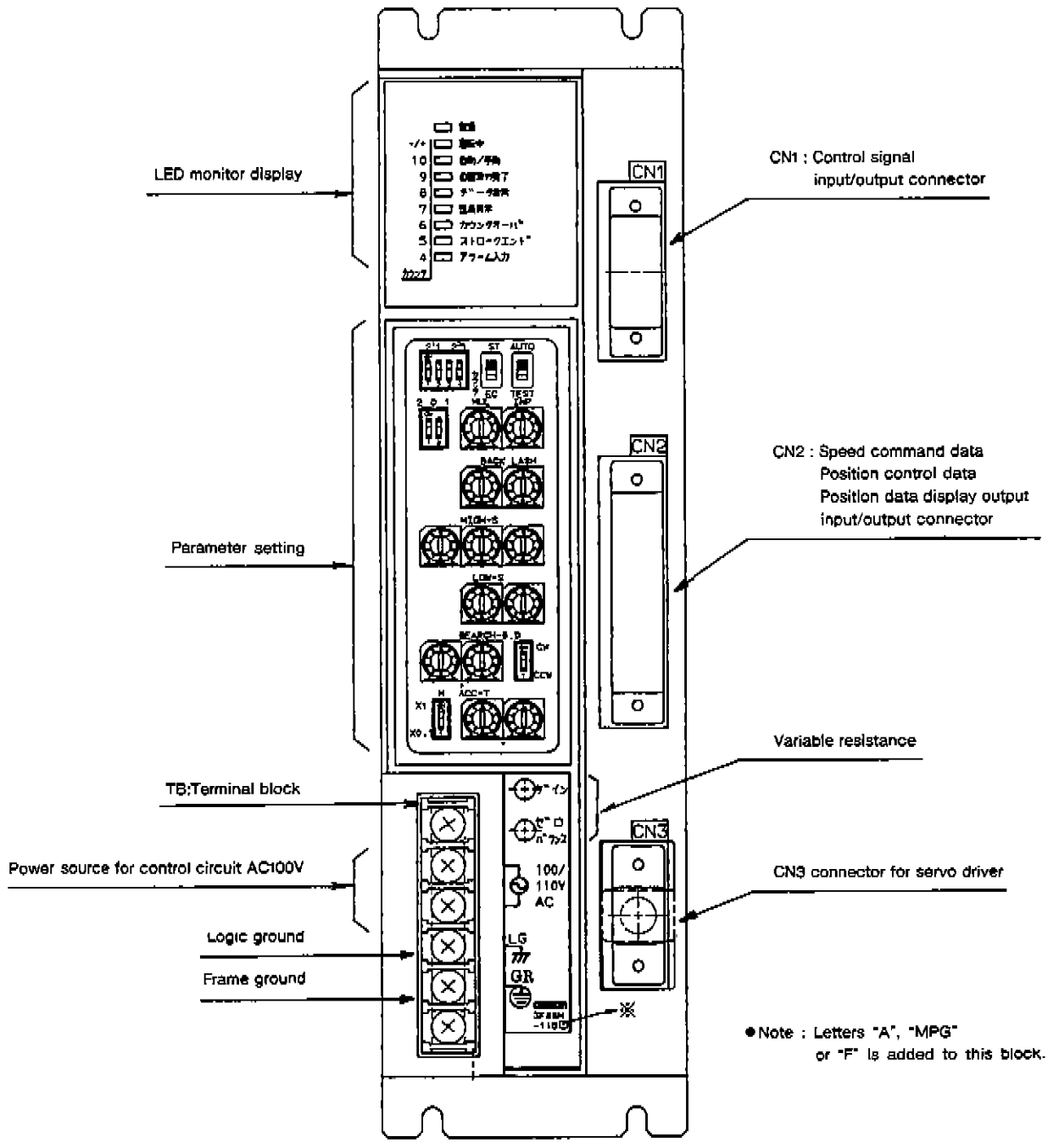
MPG = 3F88M-115MPG : MPG connection type

F = 3F88M-115F : Feeder control type

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1. EXPLANATION OF THIS EQUIPMENT

1-1. Front View



Uncovered front view

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1-2. Terminal Block

Symbol	Function	Applied type		
		A	MPG	F
100/110V AC	This terminal is for connect AC power source of control circuit. Apply wires of 0.75mm² or more. Capacity of this line should be about 50VA.	○	○	○
LG	This is a ground terminal for a noise filter of AC power source. Connect an earth item 3 or more when a miss operation with noise is occurred.	○	○	○
GR	This is a terminal for frame ground. Connect item 3 or more earth with wires of 2mm² min.	○	○	○

1-3. Connector 1 (CN1)

Terminal No.	Name	Function	Applied type		
			A	MPG	F
1	DC+24V	This is a terminal of+24V power source for a input interface. Supply+24V±10% constant-voltage from outside of this unit.	○	○	○
2	Alarm input (Negative logic signal)	This is a terminal for input abnormal stop command signal to this unit. Supply OFF pulse over 40ms. To restart the system, input initial reset signal.	○	○	○
3	Origin shift	This is a terminal for input a command signal to alter present position in software without mechanical operation.	○	○	×
4	Ready	This is a terminal for input ready for operation mode by execution of position loop, and position command signal becomes available.	○	○	○
5	Origin return deceleration	This is a terminal for input a signal of a limit switch to decelerate speed near the mechanical origin.	○	○	×
6	CW limit switch (Negative logic signal)	This is a terminal for input a stroke end limit switch signal at clock-wise direction.	○	○	×
7	MPG A phase	This is a terminal for input A phase of a manual pulse generation.	×	○	×
8	MPG B phase	This is a terminal for input B phase of a manual pulse generation.	×	○	×
9	Origin output	This is a terminal for output signal when present position value is less than 0± in position.	○	○	○
10	Initial reset	This is a terminal for input a signal to initialize inside of the unit. Supply a pulse signal continuously over 40ms. Be careful that when this signal is still ON (high) after reset, other every signal will be useless and outputs the Alarm Signal. Thus, put off this signal after initialization.	○	○	○
11	Hold	This is a terminal for input signal to stop feed with deceleration during positioning with Auto. Start Command signal. Positioning will re-start by put off this signal.	○	○	○
12	Return-to-origin	This is a terminal for input a signal for command feed from present position to software origin position.	○	○	×

●Note : Terminals marked "X" in the above chart mean unavailable.

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Terminal No.	Name	Function		Applied type		
				A	MPG	F
13	Manual feed to CW direction	This is a terminal for command manual feed to CW (Clock-wise) direction. The unit feed 1 pulse range when the signal length is 0.5 seconds at longest, and continuously feed when the signal is continuously input more than 0.5 seconds.		○	○	○
14	Origin limit switch	This is a terminal for input a signal of the origin position limit switch. This signal is used in place of Z phase signal of an encoder.		○	○	×
15	MPG power output	This is a terminal for 12V power supply to MPG. Output DC 12V (+10%,−15%) 100mA max.		×	○	×
16	Positioning finish	When positioning is completed, a signal is output. In other words, when output of the command pulse is terminated and the deflection counter is within the in-position range, this signal turns on. The interval of this signal output turns off after supply position command signal is more than specified one with selected time of the timer.		○	○	○
17	OV	This is a terminal of 24V GND for the Input Interface.		○	○	○
18	Automatic start	A, MPG	When this signal is Input, the unit operates positioning with a position data. When this signal turns off before positioning finish, the unit stops feed with deceleration.	○	○	×
		F	When this signal is input, the unit operate positioning present position as "0". INC/ABS signal is not checked by the unit. When override setting is "0" or feed length is "0", the present position indication is turned to "0".	×	×	○
19	Origin search	This is a terminal for input a signal to search the origin. The signal should be kept ON while searching operation.		○	○	×
20	Manual/automatic selection	This is a terminal to input a signal to select mode between manual and automatic. ON - Manual operation OFF - Automatic operation		○	○	○
21	Manual CCW	This is a terminal for input a signal to command to start manual feed CCW direction. The unit feed 1 pulse range when the signal length is 0.5 seconds at longest, and continuously feed when the signal is continuously input more than 0.5 seconds.		○	○	○
22	CCW limit switch(Negative logic)	This is a terminal for input a stroke end limit switch signal of CCW direction.		○	○	×
23	MPG multiplication	This is a terminal for input a signal to changeover multiplication rate of MPG among × 1 and × 10. On ····· × 10.		×	○	×
24 · 25	Alarm output(Negative logic)	This is a terminal for connect an alarm signal to other unit. When the following conditions occur, this signal turns off. (On at normal condition) ——Turns off the alarms input signal from PC. ——Turns off the servo alarm signal from the servo driver. ——Abnormal condition in the unit. ——Power failure to the unit.		○	○	○

● Note : Terminals marked "X" in the above chart mean unavailable.

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1-4. Connector 2 (CN2)

Terminal No.	Name	Function	Applied type		
			A	MPG	F
1	DC +24V	This is a terminal of +24V power supply to an interface. Supply +24V ±10% constant voltage power supply from outside.	○	○	○
2-29	Position control data	This is a terminal for input position control data accepted when time of origin shift and automatic start command operation. Terminal "2" symbolizes −/+ signs and, ON shows "−". Terminal "3" symbolizes ABS/INC (data type). ABS as absolute position data. INC as incremental data. On condition shows ABS data. 4, 5 - 10^6 digit 6-9 - 10^5 digit 10-13 - 10^4 digit 14-17 - 10^3 digit 18-21 - 10^2 digit 22-25 - 10^1 digit 26-29 - 10^0 digit	○	○	○
30-32 34-37	Speed override	This is a terminal for input speed override data accepted at the time of automatic start command, origin return command and manual start command. Terminal 30 is to select high/low speed. ON as high speed. Terminal 32 is upper digit for override value. Terminal 34-37 is lower digit for override value. 10^0 digit as 0	○	○	○
38	0V	This is a terminal for 24V GND of an input interface.	○	○	○
39-50	Present position data-output strobe	These are terminals for output present position data to outside of the unit. The conditions of output strobe signals (47-50) indicate the followings: *Output strobe = 1 (47 as ON: 48-50 as OFF) Terminal 39 for−/+ (sign) : ON shows "−" 45, 46 as 10^6 digit *Output strobe = 2 (48 as ON : 47, 49, 50 as OFF) 39-42 as 10^5 digit 43-46 as 10^4 digit *Output strobe = 3 (49 as ON: 47, 48, 50 as OFF) 39-42 as 10^3 digit 43-46 as 10^2 digit *Output strobe = 4 (50 as ON: 47-49 as OFF) 39-42 as 10^1 digit 43-46 as 10^0 digit *When present position is not defined, all terminal from 39 to 46 are ON.	○	○	○

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1-5. Connector 3 (CN 3)

Terminal No.	Name	Function	Applied type		
			A	MPG	F
1	DC+24V	This is a terminal for input 24V power source to an input interface. Supply +24V ±10% constant voltage power source from outside of the unit.	○	○	○
2	Servo alarm (Negative logic)	This is a terminal for input a signal from a servo driver. When this signal is OFF, position command signal becomes unavailable. To reset it, put on this signal. Then turn Ready signal to ON from OFF.	○	○	○
4	0V	This is a terminal for input 24V GND to a input interface.	○	○	○
5, 6	Run	This is a signal to give acceptance of operation to a servo driver. This signal is ON on the condition that when Ready signal is ON, inside of this unit is normal and signal from other unit is normal.	○	○	○
9, 10	Servo command voltage	This is a terminal for output a speed command voltage to a servo driver. Output voltage is in proportion to pulse amount in a deflection counter. Maximum voltage is ±10V. Terminal 10 is GND for speed command voltage.	○	○	○
11, 12	Encoder A phase	This is a terminal for A phase input from an encoder. Terminal 11 as positive (+) A phase Terminal 12 as negative (−) A phase	○	○	○
13, 14	Encoder B phase	This is a terminal for B phase input from an encoder. Terminal 13 as positive (+) B phase Terminal 14 as negative (−) B phase	○	○	○
15, 16	Encoder Z phase	This is a terminal for Z phase input from an encoder. Terminal 15 as positive (+) Z phase Terminal 16 as negative (−) Z phase.	○	○	×

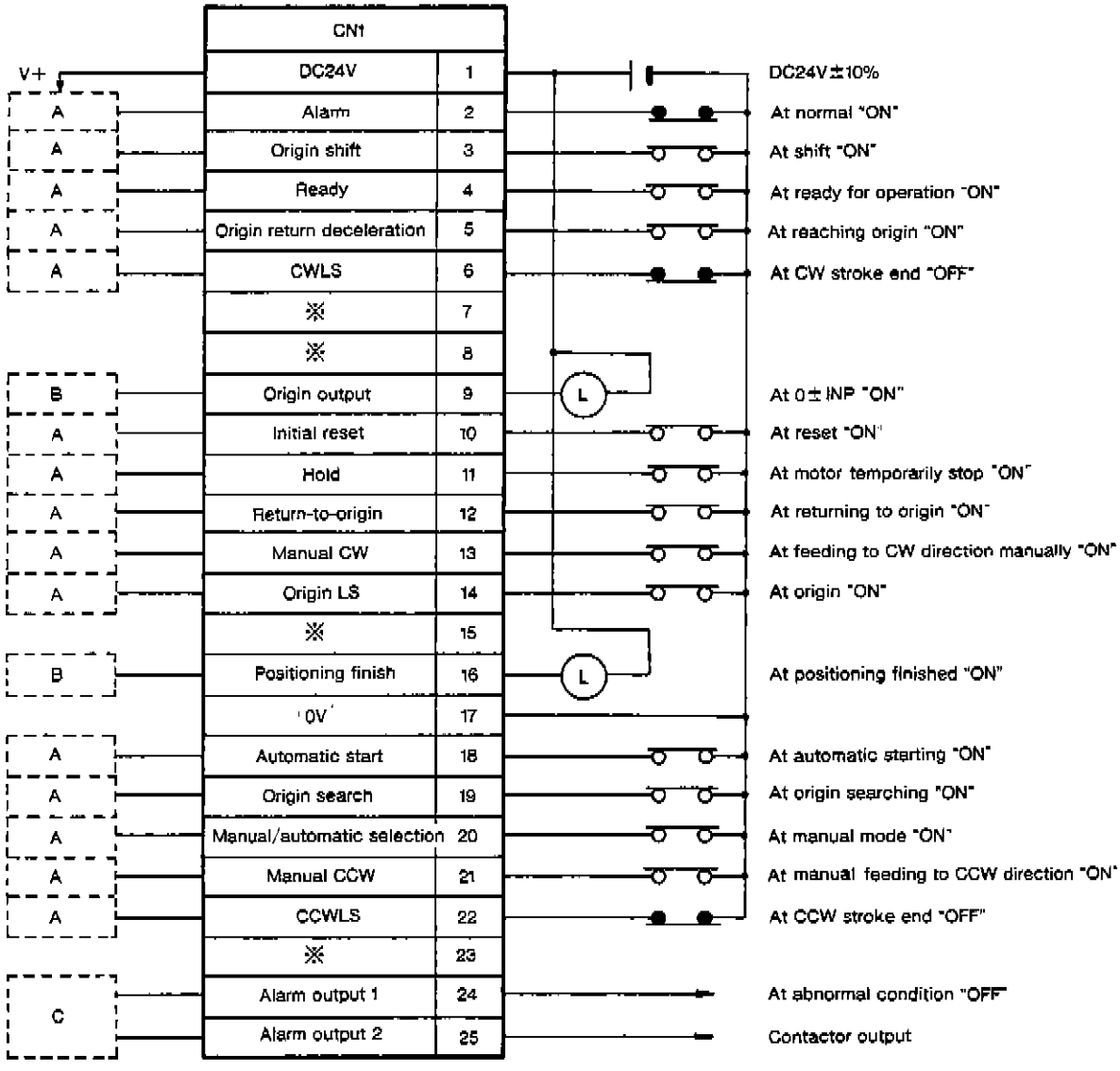
● Note : Terminals marked "X" in the above chart mean unavailable.

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1-6. Pin Assignment of Each Connector

1-6-1. Connector 1 (CN 1)

(a) Type 3F88M-115A



● Note : Terminals marked "X" in the above chart should not be connected.

Outside connector are supplied together with this unit.

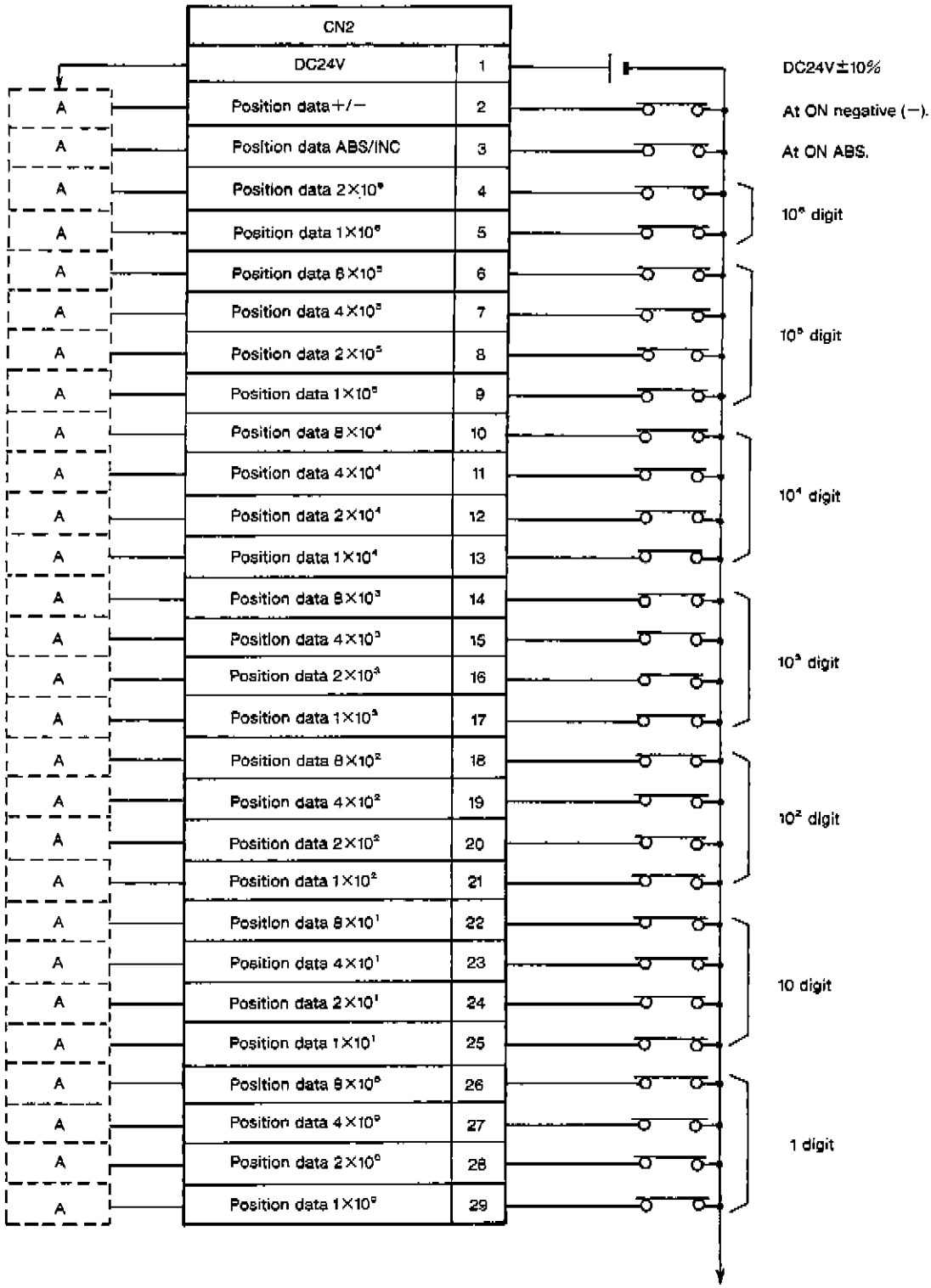
Plug type : MR-25M

Connector cover type : MR-25L

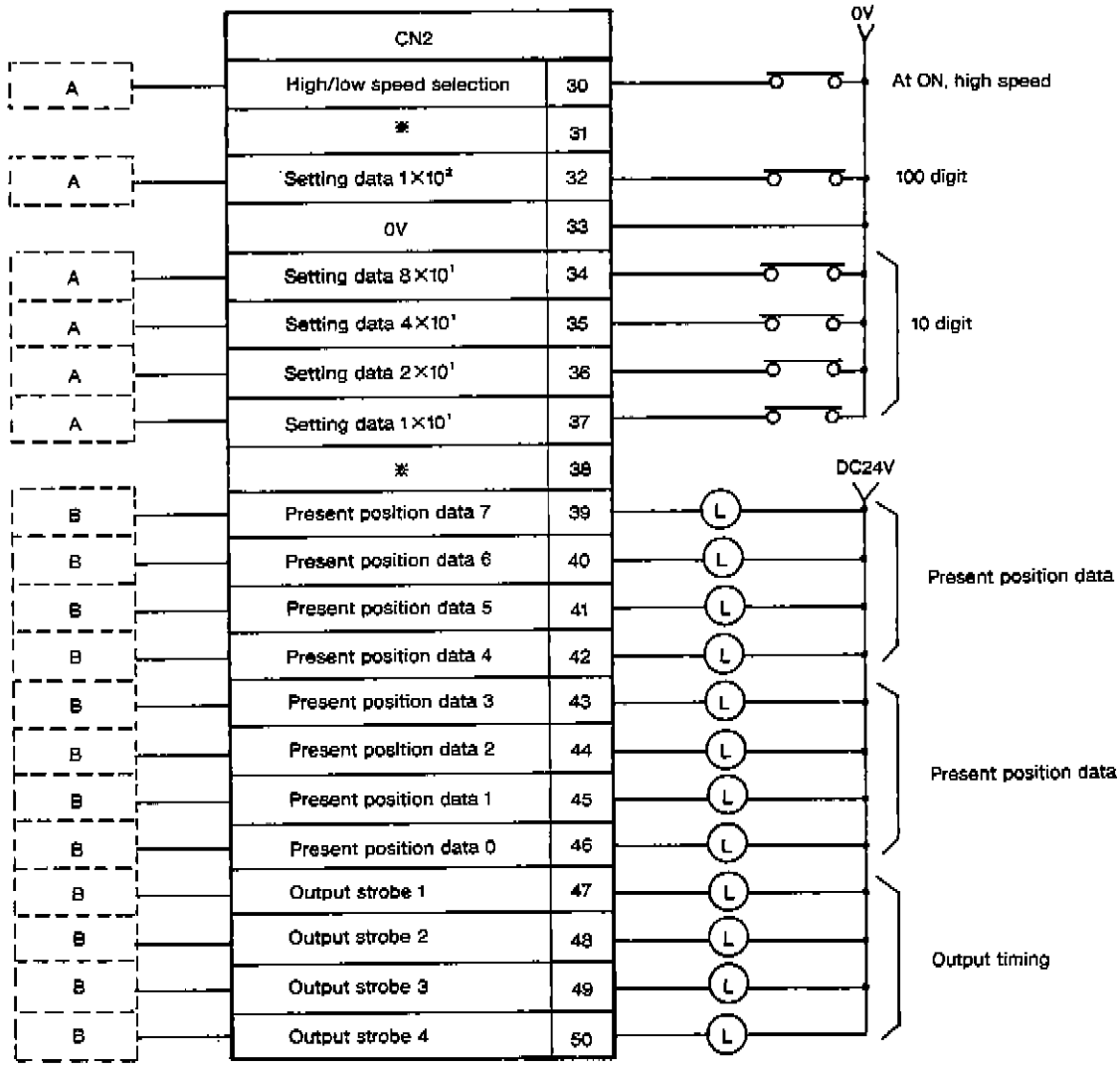
(Honda tushin)

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1-6-2. Connector 2 (CN2)



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●Note : Terminals marked "X" shold not be connected.

Outside connector are supplied together with this unit.

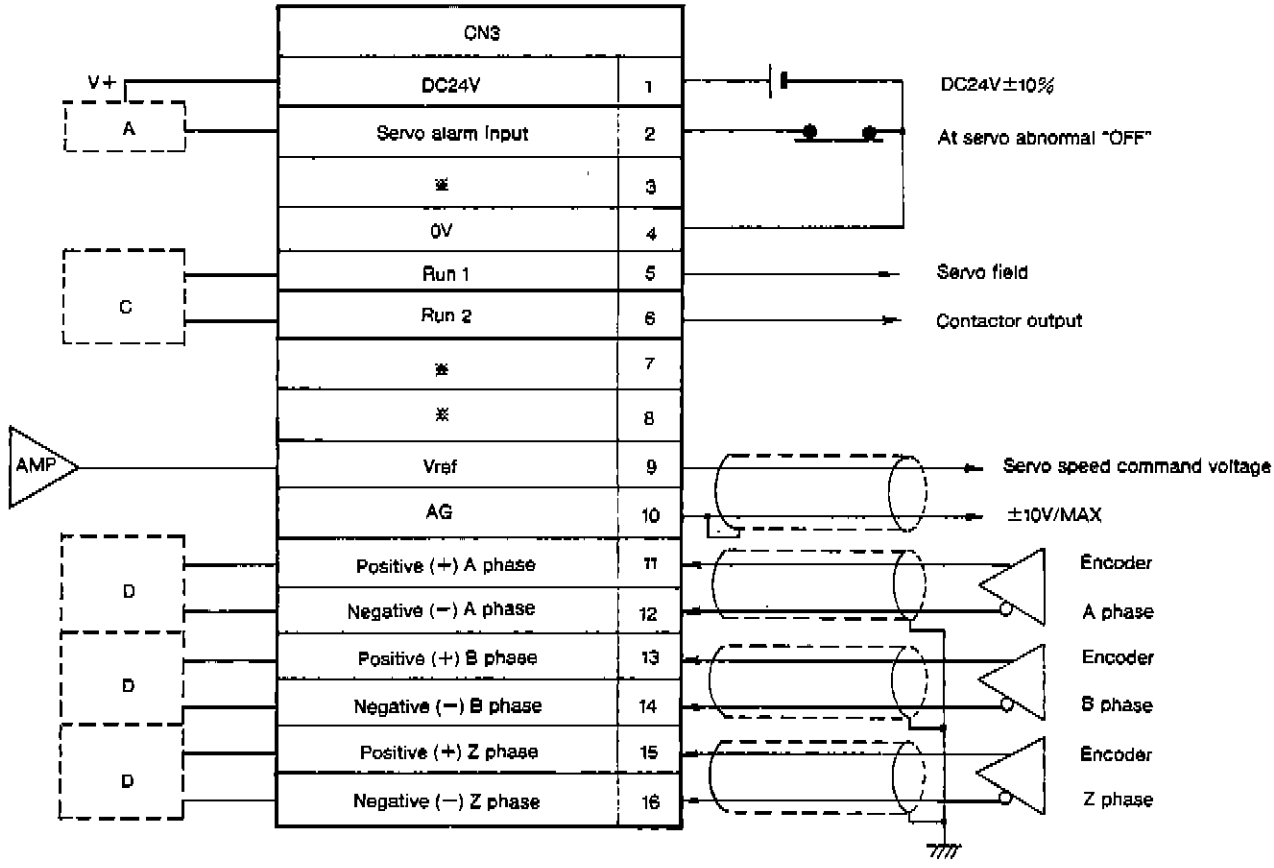
Plug type : MR-50M

Connector cover type : MR-50L

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1-6-3. Connector 3 (CN3)



● Note : Terminals marked "X" should not be connected.

Outside connector are supplied together with this unit.

Plug type : MR-50M

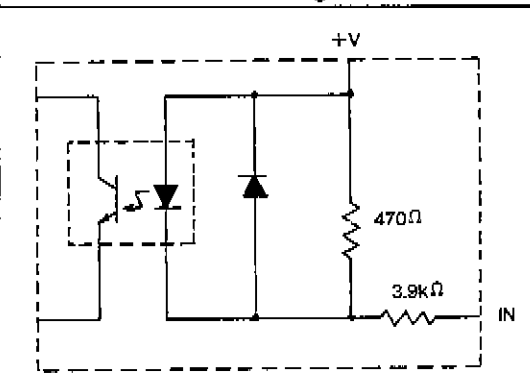
Connector cover type : MR-16L

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1-7. Details of Each Section

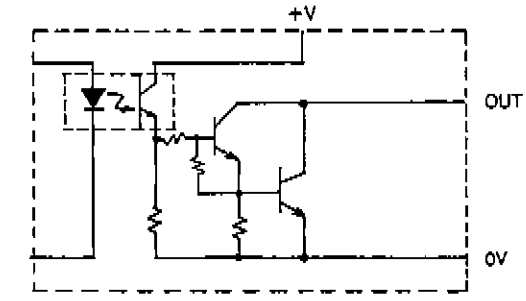
1-7-1. A section details

Capacity		Circuit configuration
Rated input voltage	DC 24V	
Rated input current	7 mA	
Allowable voltage variation range	DC 20.4V - DC 26.4V	
ON delay time	1 msec max.	
OFF delay time	1.45 msec max.	
ON voltage	11V max.	
OFF voltage	19V min.	
Number of circuits	50	

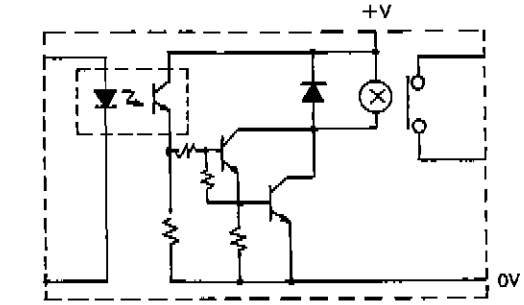
● Note :

1. Above ON delay time and OFF delay time mean numerical value on hardware, not included software process time.
2. ON delay time and OFF delay time in the terminal for data input (Connector 2) are fixed to 6 sec each.

1-7-2. B section details (transistor output)

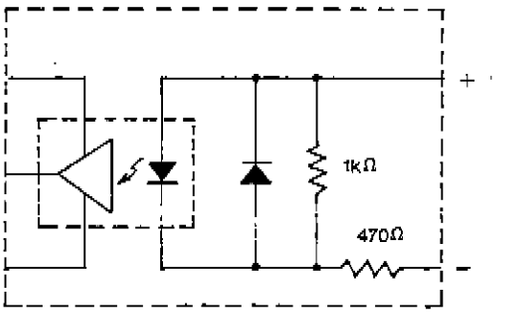
Capacity		Circuit configuration
Max. operating capacity	DC 50 mA	
leakage current	DC 0.1 mA max.	
Max. load current	DC 1.6 V max.	
ON delay time	0.2 msec max.	
OFF delay time	3 msec max.	
Number of circuits	15	
Outer supply voltage	DC 24V +10% −15%	

1-7-3. C section details (contactor output)

Capacity		Circuit configuration
Max. operating capacity	DC 30V - 2A, AC125V - 0.4A	
Min. operating capacity	DC 10mV 0.1mA	
ON delay time	5 ms max.	
OFF delay time	5 ms min.	
Life	100 thousand times min.	
Number of circuits	2	
Outer supply voltage	DC 24V +10% −15% (for relay actuation)	

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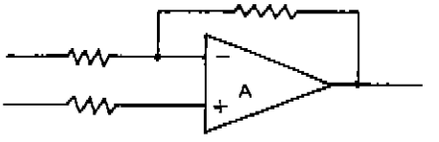
1-7-4. D section details

Capacity		Circuit configuration
Rated input voltage	DC 15 V	
Rated input current	10 mA	
Allowable voltage variation range	DC 3V-5.5V	
ON delay time	4.5μsec TYP : Note 1	
OFF delay time	2.5μsec TYP : Note 1	
Number of circuits	3	

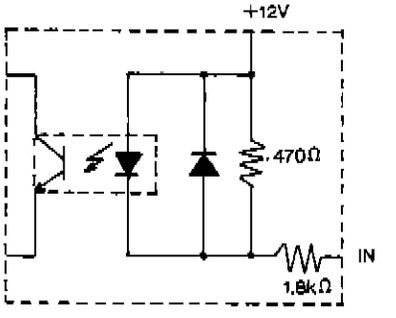
● Note :

1. Above ON delay time and OFF delay time mean numerical value on hardware, not included processing time in software. Z phase input is ton 26μsec. TYP. toff 27μsec.

1-7-5. E section details (Analogue voltage output)

Capacity		Circuit configuration
Max. output voltage	±10V	
Output impedance	approx 22 ohm	
Load impedance	10 K ohm min.	

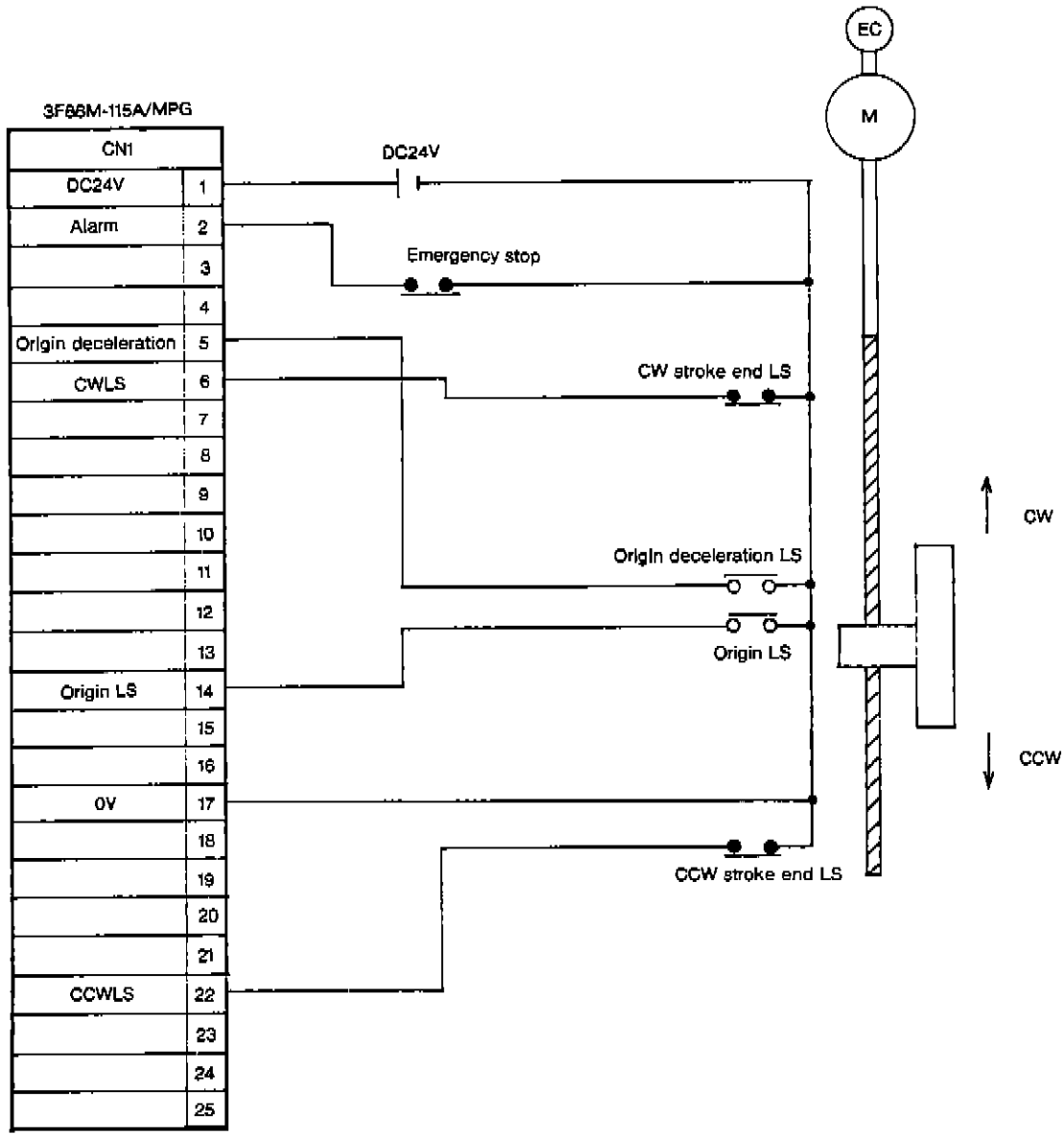
1-7-6. F section details

Capacity		Circuit configuration
Rated input current	7 mA	
ON delay time	4.5μsec TYP	
OFF delay time	2.5μsec TYP	
ON voltage	4 V max.	
OFF voltage	9 V min.	
Number of circuits	2	

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2. EXAMPLES OF CONNECTION

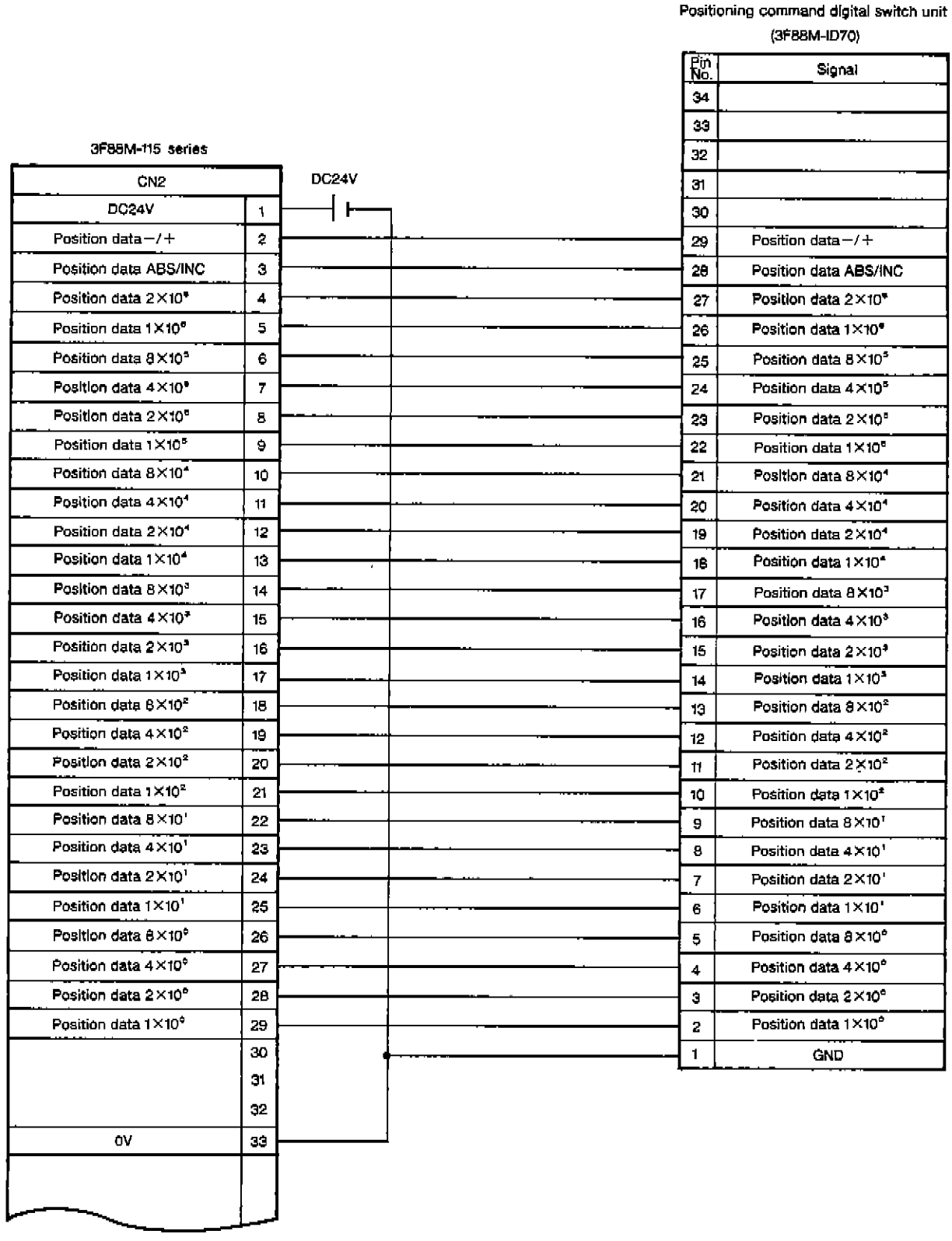
2-1. Position of LS (In case of 3F88M-115A/MPG)



● Note : In case there is Z phase in an encoder (EC), origin LS is not necessary.

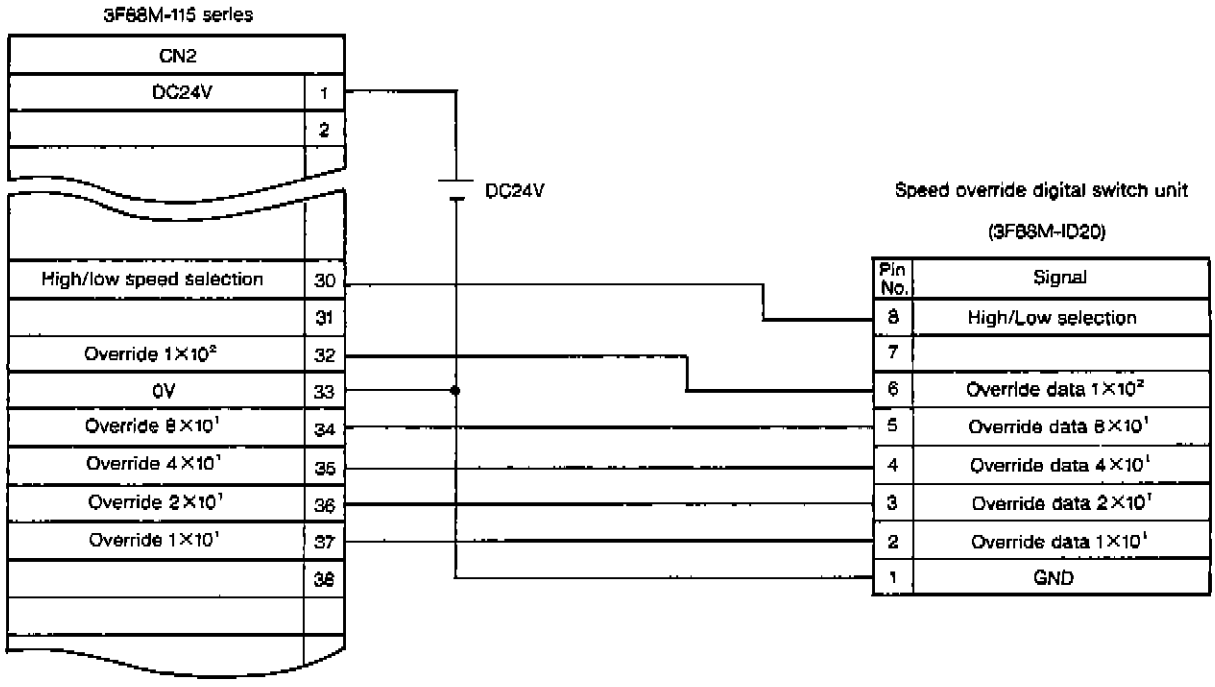
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2-2. Positioning Command Digital Switch Unit

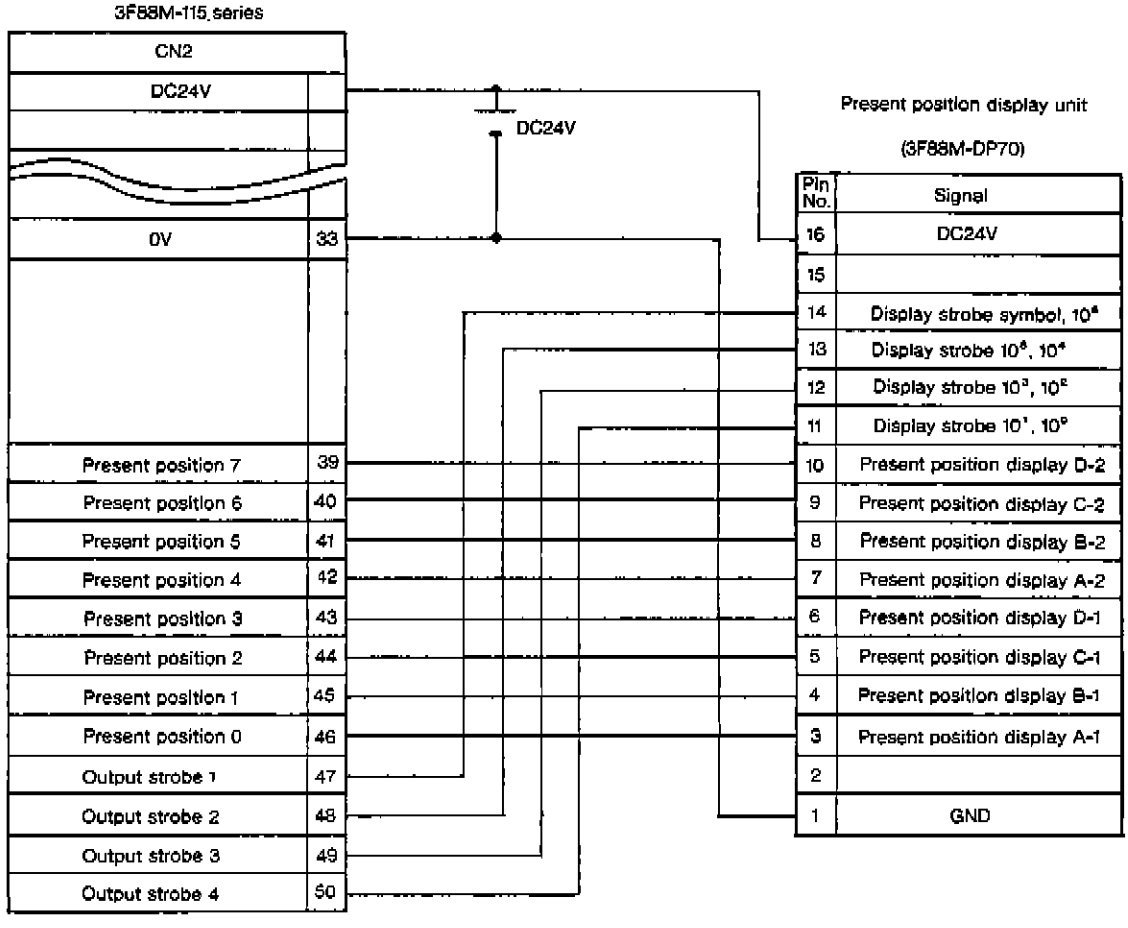


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2-3. Speed Override Digital Switch Unit



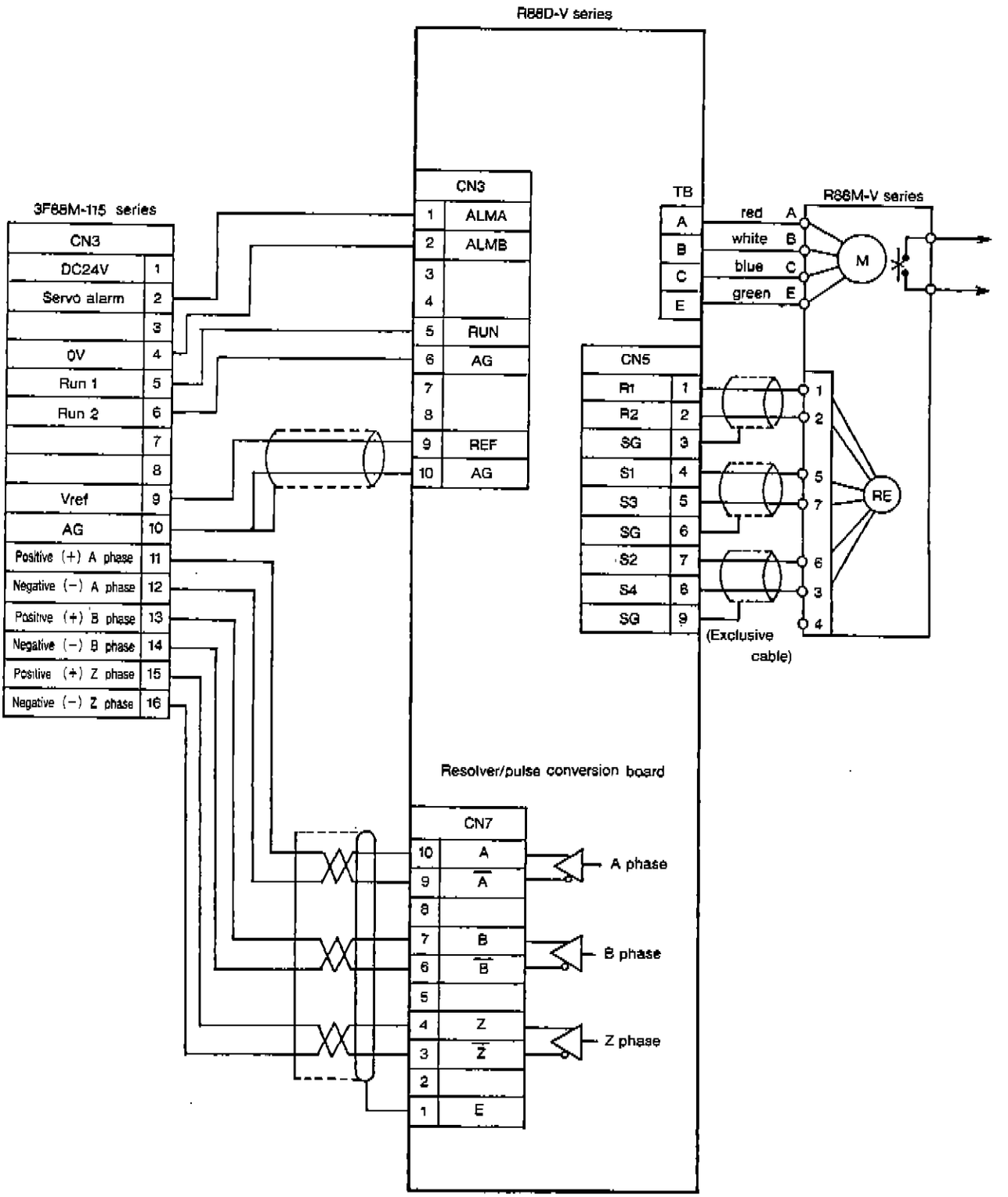
2-4. Present Position Display Unit



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2-5. Servo Driver

■ Connection with V series



● Note :
The above diagram shows an example supplying DC24V for the interface from CN 1 or CN 2.

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3. EXPLANATION OF EACH SIGNAL

3-1. Operation Command Signal

In this section, the following operation command signals are explained.

(1) Initial reset signal

(2) Alarm signal

(3) Ready signal

3-1-1. Initial reset signal

(1) This is a signal to initialize inner section of the unit and used in the following :

(a) When set-up the servo system

(b) When alter parameter setting

(c) When release alarm input signal stop condition.

(d) When emergency stop.

(2) This signal should be supplied with continuously ON signal of 40 ms or longer. But when this signal is kept "ON" during operation, "RUN" LED monitor display flickers every one second. Also, all other signals are unavailable, and alarm output is kept output (OFF with negative logic).

(3) After initializing inner section by this signal, input for Ready signal becomes acceptable. (This signal and Ready signal can be input at once.)

(4) If this signal is ON during positioning, the following condition occur.

(a) Speed command voltage becomes 0V

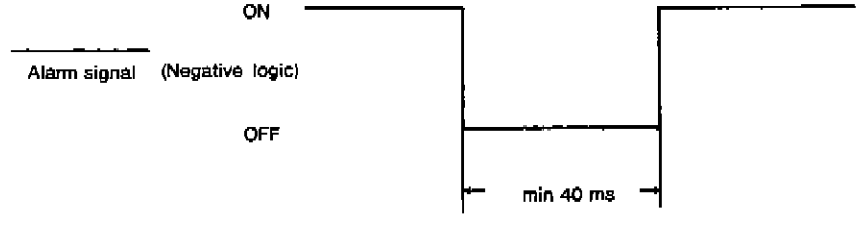
(b) Put off "Run Command" to the servo driver after one second.

(c) This system is initialized.

3-1-2. Alarm signal (negative logic)

(1) This is a signal to abnormal stop command.

(2) Supply OFF signal 40ms or longer.



(3) If this signal is input (turns off) during positioning, following conditions occur.

(a) Speed command voltage becomes 0V.

(b) Put off Run Command Signal after one second.

(c) Put off Alarm Output Signal.

(d) Put on all present position output data, then position data display unit turns off.

(4) To re-start the system after alarm signal is turned OFF, put on Initial Reset Signal.

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3-1-3. Ready signal

(1) This is a signal to command start operation of this unit.
Position loop function is effective with this signal. When Ready Signal is OFF, position loop is released. Then Position Command Signal is unavailable.

(2) If this signal is tuned OFF when positioning is completed, following conditions will be given :
(a) Put off Positioning Finish Signal.
(b) Put off Run Signal.
(c) "Run" LED monitor display flickers every one second.

(3) When alarm output becomes OFF by stroke LS abnormal, data abnormal and speed abnormal, or counter over (beyond feed range), these abnormal conditions are reset by this signal and put on Alarm output.

(4) When this signal is turned OFF during positioning, speed voltage becomes 0V and Run Signal becomes OFF after one second.

(5) When this signal is turned OFF while present position data is displayed at the position indicator, the display data will turned to position date by position feedback pulse. Using this system, teaching-play-back can be operated. If feed back pulse is beyond feed range, "Counterover"LED monitor turns on, then position data display turns off, and alarm output turns OFF.

(6) Switch on power source to the unit with Ready Signal ON is available. But when power source is supplied to the unit together with the servo driver at once, Servo Alarm Signal from the servo driver may be detected by the unit and alarm output signal may be turned OFF.
In this case, system up the unit with Initial Reset Signal.

3-2. Command data

There are two command data, namely "Position Command Data" from the position command digital switch unit (or PC) and "Speed Command Data" from a speed override digital switch unit (or PC).

3-2-1. Position command data

(1) There are the following two data as Position Command Data.
(a) Absolute position data (ABS)
Absolute position data from origin
(In case of 3F88M-115F, this data is unavailable.)
(b) Incremental data (INC)
Relative data from present position

(2) Position data is accepted by the unit at origin shift command and automatic start command only.

(3) Check of Position Command Data
When position control data is supplied to this unit, the following checks are done with or without encoder.

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■ **Without encoder (In case of 3F88M-115, this case is unavailable.)**

(a) BCD format check

(b) At absolute mode

〔 Position command data 〕≧ (2048 / command pulse multiplication rate)

(c) At incremental mode

〔 Present position + position command data 〕≦ (2048 − command pulse multiplication rate)

■ **With encoder**

(a) BCD format check

(b) At absolute mode with automatic start signal ON :

〔 Position Command Data 〕≦ (3999999 / command pulse multiplication rate)

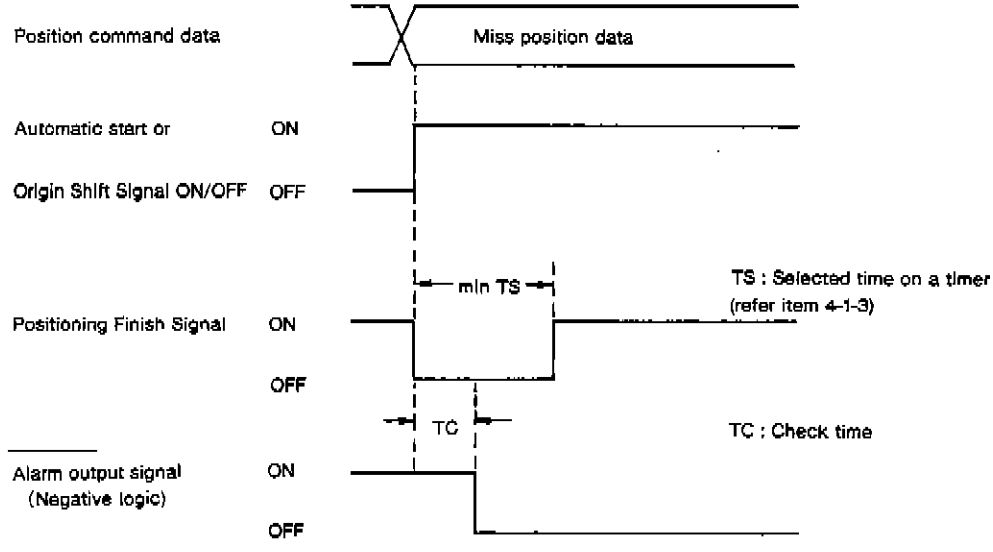
(c) At incremental mode with automatic start signal ON :

〔 Present position + Position Command Data 〕≦ (3999999 / command pulse multiplication rate)

(d) At origin shift signal ON :

〔 Present position − Position Command Data 〕≦ (3999999 / command pulse multiplication rate)

When some abnormal are found during the above checking operation such as different format at (a) or no match the equality formula in (b), (c) or (d), the unit judge these as errors.
If data error is detected, "Data Abnormal" LED monitor display turns ON and the unit cannot execute positioning.



● Note :

1. When Position Command Date is "0", the unit does not treat as "data abnormal".
2. To recover normal condition from "data abnormal", input newly axis start signal. That is, set correct position control data, and re-start operation.

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3-2-2. Speed command data

(1) This Speed Command Data is an override data against the high speed and the low speed set by parameter.

(2) Speed Command Data is specified as follows :
High speed x (0-190) (%) or
Low speed x (0-190) (%)

(3) When speed designated by speed command data exceeds 200 kpps (limited speed) of this unit, the unit feeds at 200 kpps.
Accordingly, be careful when the high speed is fixed at more than 106 kpps.
(106 kpps x 190% = 200 kpps)

(4) Speed command data are accepted to the unit at the following command, and are not accepted to the unit at other positioning command signals.
(a) Automatic Start Command
(b) Origin Command
(c) Manual Feed Command

(5) Speed command data is checked BCD format.
If data error is detected, "data abnormal" LED monitor display turns ON and the unit stops positioning.
When speed command data is 0, the unit does not treat as abnormal.

3-3. Position Command Signal

3-3-1. Basic operation

Following signal lines are position command signals. Input system are different according to operation mode and operation purpose of this unit.

Table for availability of Position Command Signals

Operation Mode / Signals	Automatic	Manual	Without Encoder	Applied Type		
				A	MPG	F
Origin search	O	O	×	O	O	×
Origin shift	O	O	×	O	O	×
Return to Origin	O	O	O	O	O	×
Automatic start	O	×	O	O	O	O
Hold	O	×	O	O	O	O
Manual CW	×	O	O	O	O	O
Manual CCW	×	O	O	O	O	O

O : Available × : Unavailable

- When manual/automatic signal is selected autmatic mode, automatic mode is effective, and vise versa.
- "Without encoder" mode meams to set parameter S1 as OFF.
(Refer item 4-1-1)

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(1) Positioning command signal is unavailable while Positioning Finish Signal is not ON. This command signal keeps itself ON till Positioning Finish Signal becomes ON.
(Hold signal is not applied in this case.)

(2) When Position Command Signal is turned OFF before Positioning Finish Signal becomes ON, positioning is interrupted.

(3) In case plural position command signals are ON at once, all these signals will be unavailable. Positioning Finish Signal keeps ON.
(Hold signal is not applied in this case.)

(4) It takes 25 msec max. from inputing the Position Command Signal to start rotation of the motor. However, feeder type unit (3F88M-115F) takes only 15 msec. max. to start.

(5) When the following signals are input during positioning, Speed Command Voltage becomes 0V. After one second, Run Signal to servo driver becomes OFF.
- Initial reset · Servo alarm (Negative logic)
- Alarm input (Negative logic) · Ready
- Stroke End LS toward feed direction (Negative logic)
(When origin is searched, both stroke end LS are OFF.)

3-3-2. Origin designation

(1) Soon after power source was input, Positioning Command Signal can be input while both Ready Signal and Positioning Finish Signal are ON. But present position display unit is turned off this time.

(2) At this condition, the inner CPU of the unit judges that present position is in Origin. However, in order to display "0" (Origin) of the present position display unit, the following measures are available :

How to Designate Origin

Signal	Description	Applied Type		
		A	MPG	F
Origin search	Search mechanical origin, and displays 0 when stopped.	○	○	×
Return to Origin	Set override other than "0" before input.	○	○	×
Origin shift	Set position command data as "0" before input.	○	○	×
Automatic start	Before input, set override any value except "0" and set position command data as "0".	○	○	○
Manual CW	Before input, set CW stroke LS as OFF, but after input Run signal turns OFF.	○	○	○
Manual CCW	Before input, set CCW stroke LS as OFF. But after input Run signal turns OFF.	○	○	○

(3) When present position display unit indicates "0", backlash amount is accepted in accordance with origin search direction set by a parameter.
(Above function is unavailable, in 3F88M-115F)

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In case present position is set as "0" by other signals than Origin Search signal, mechanical position (joint point of screw thread) is accepted as it is in origin search direction.

EX) In case of backlash amount is 10 and origin search direction is CW, present position is not altered unless pulse start is executed 10 times by manual CCW.
(In case of pulse command multiplication rate is 1)

3-3-3. Origin search (3F88M-115A/MPG)

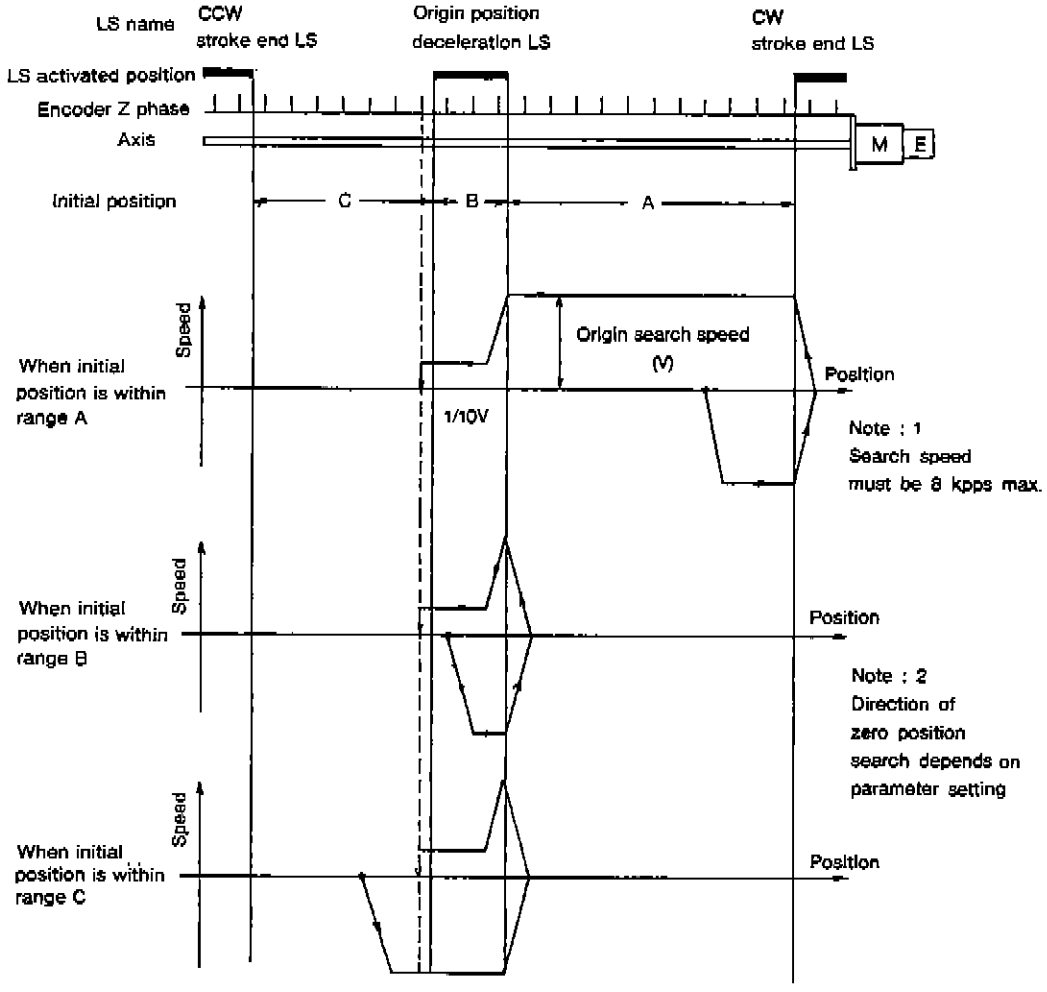
This is a function to search machine origin with rotating axis after input power.
To search origin, next outside signals are necessary.

(1) CW stroke end LS
(2) CCW stroke end LS
(3) Origin deceleration LS
(4) Z phase or origin LS

There are standard pattern in which each signal (1),(2) and (3) is input individually, and special pattern in which (1) and (3) or (2) and (3) signals are input as one signal or input at once.

■ Standard pattern

Operation at origin search are following three movement in accordance with the position at put on power source.



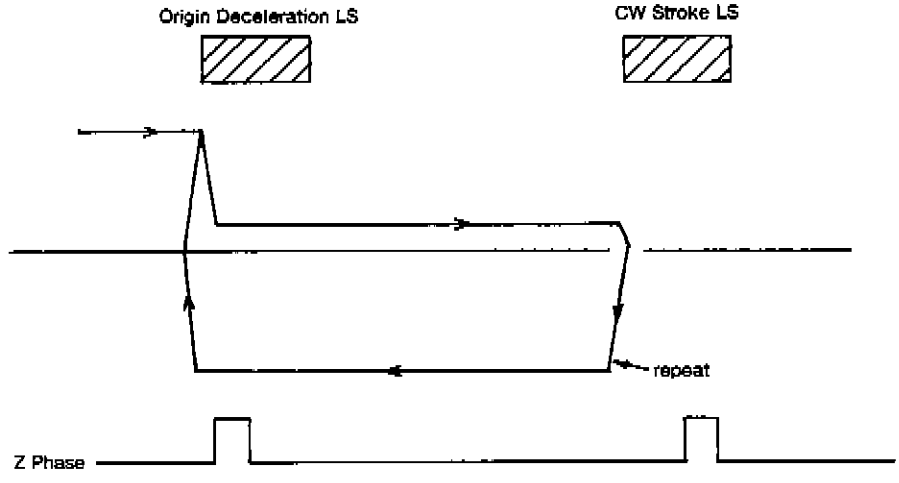
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● Note :

1. Above diagram uses Z phase and shows origin search direction as CCW. That is, direction at the beginnig of movement is opposite to the direction of origin search direction.
2. The relation between the previous position of origin search and the motion are as the followings ;

	Position before origin search	Motion to origin search
A	Between origin deceleration input point and CW input point	Feed toward CW direction at origin search speed and turn-over with CW OFF input, then decelerate to 1/10 of origin search speed by origin deceleration ON input, and stop by first Z phase ON after origin deceleration input OFF.
B	On the position where origin deceleration input is ON	Feed out from origin deceleration LS toward CW direction. Then turns to CCW direction. Decelerate to 1/10 of origin search speed with origin deceleration ON input again. Then stop by first Z phase ON input after Origin Deceleration Signal is OFF.
C	Between CCW input point and origin deceleration input point.	Pass through Origin Deceleration LS at origin search speed toward CW direction. Then, feeds to CCW direction and decelerate to 1/10 of origin search speed with origin deceleration ON again. Then stop at first Z phase ON after origin deceleration OFF input.

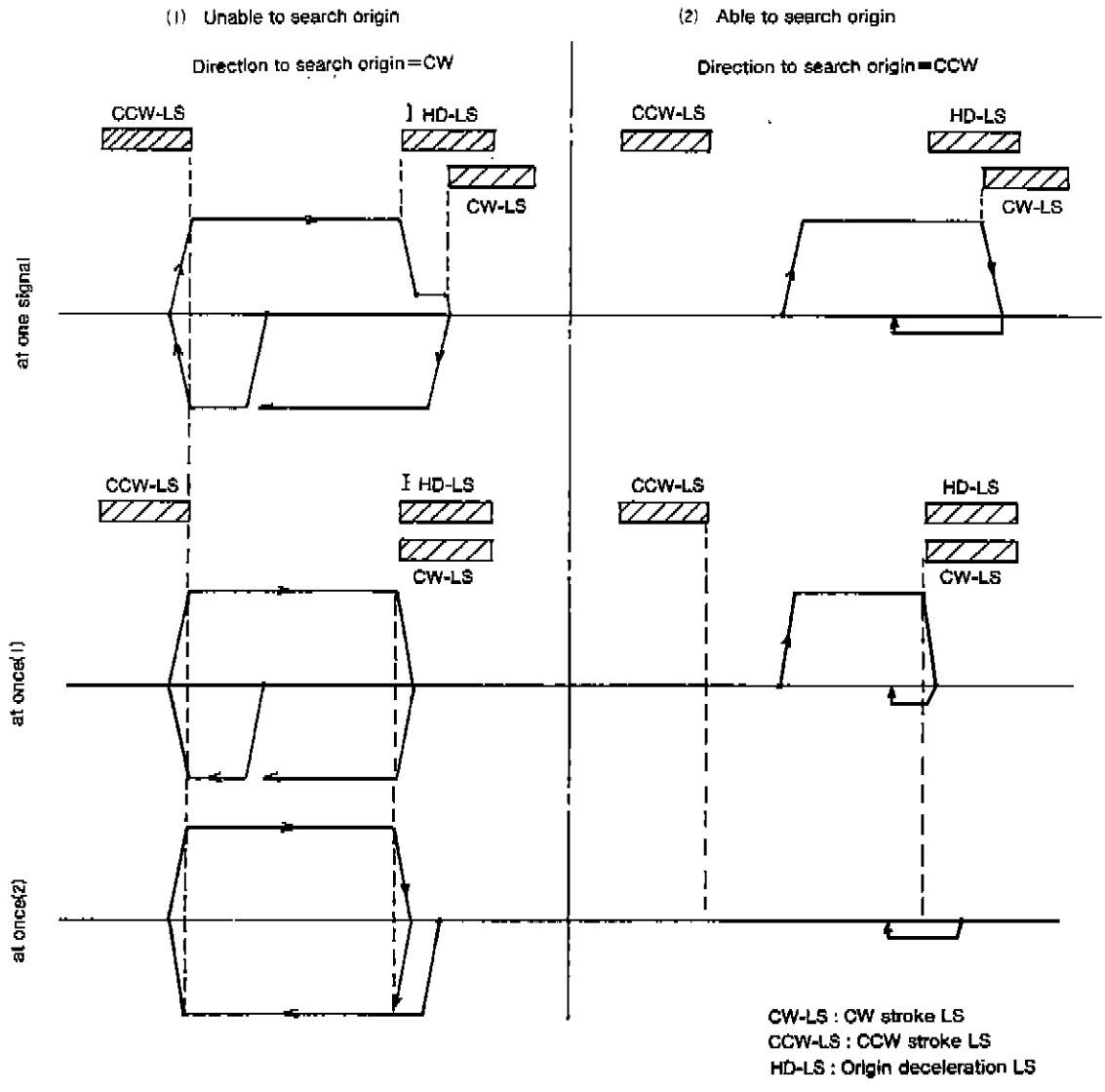
3. If there is no origin deceleration LS between both stroke end LS, this motion repeats forward and reverse feed between them. If there is no Z-phase input in front of stroke end LS after put off origin deceleration input at 1/10 speed of origin search speed, this motion repeats forward and reverse feed between origin deceleration LS and stroke end LS.



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■ Special pattern

When the signals of origin deceleration LS and of one stroke end LS are input as one signal or input at once, motion conditions are as the following : (In case of item (1), unable origin search. So, change search direction)



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■ **Abnormal condition during origin search**

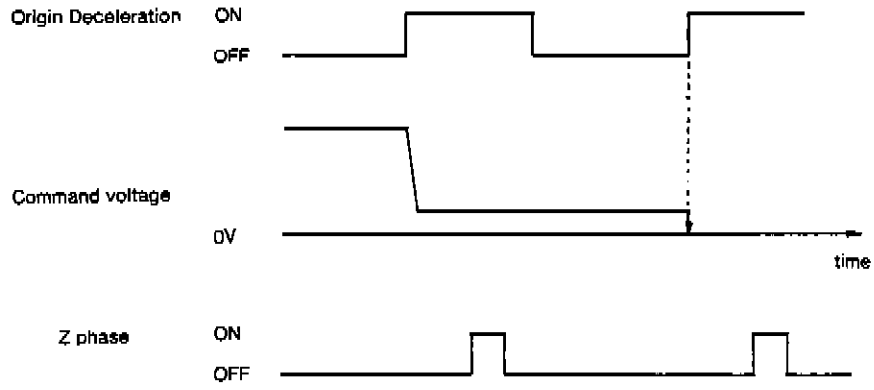
(1) When the following conditions are occurred at the same time, "Stroke End" LED monitor display flickers every 250 ms.

a. Feed speed is decelerated to 1/10 of origin search speed.

b. Origin deceleration LS is already OFF.

c. Origin deceleration LS turns ON again before Z phase (or origin LS) ON input.

This means chattering of origin deceleration LS.

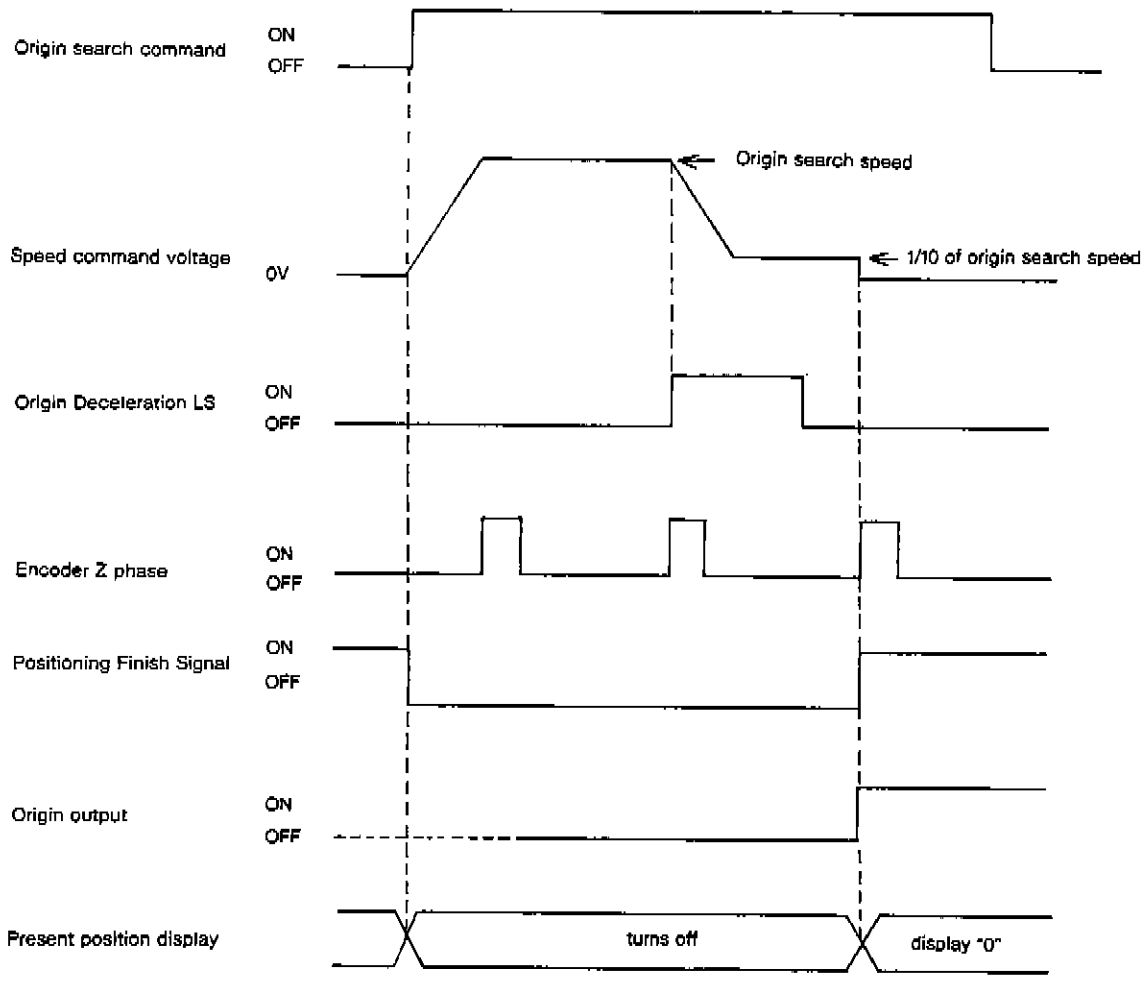


In the above, the indicator shows the second ON signal positive-going-edge of Origin Deceleration Input Signal. So chattering position of origin deceleration LS can be seen.

(2) When both stroke end LS input become OFF at the beginning of origin search or during origin search, origin search operation is interrupted and Run Command to servo driver becomes OFF, and present position display is OFF.

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■ Zero position search time chart



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3-3-4. Automatic start signal

When Automatic Start Signal is input, positioning operation starts accepting speed override data and positioning data.

In this unit, positioning operation starts after checking following points.

(1) Ready Signal is ON.

(2) Positioning Finish Signal is ON.

(3) Manual/automatic input is selected to Automatic Mode.

(4) Check Positioning Data.

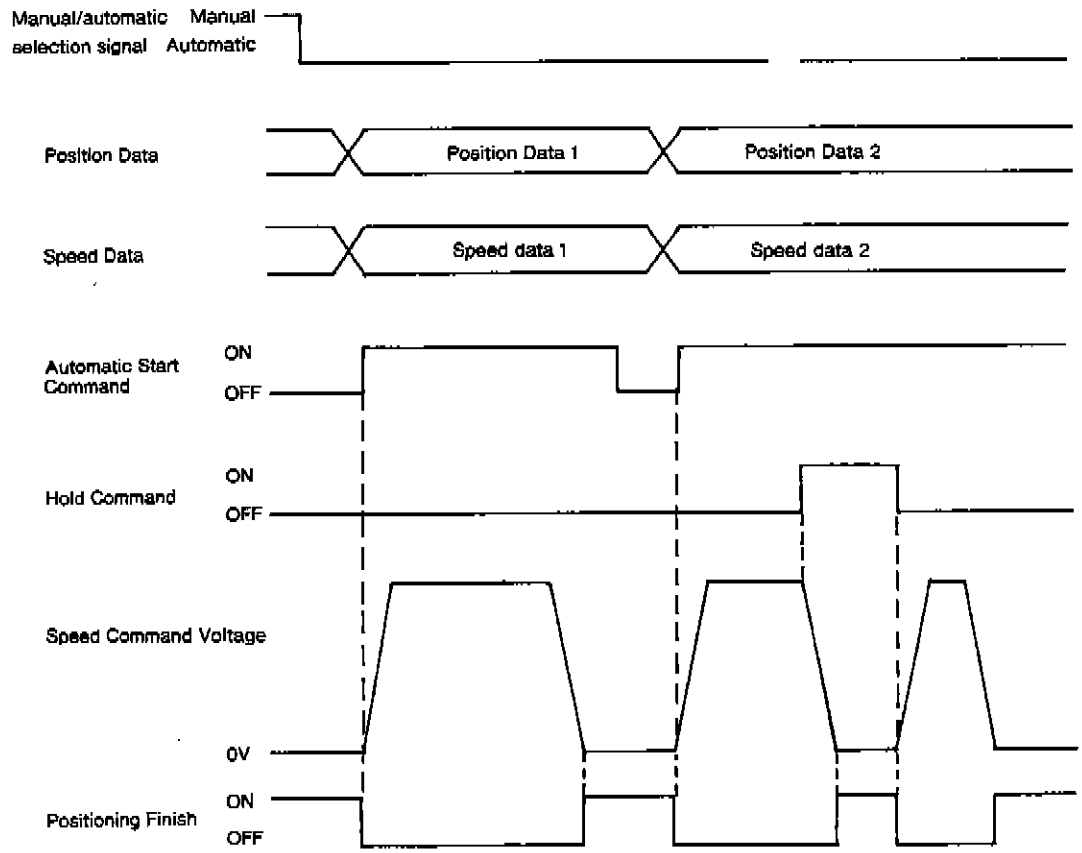
- Whether data is BCD format.
- Whether data is within the feed range.
- Whether feed amount is other than "0".

(5) Check Speed Override Data.

- Whether data is BCD format.
- Whether data is other than "0".

(6) Hold Input Signal is OFF.

(7) Stroke End LS to feed direction is ON (Negative logic).



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■ **Cautions at automatic start**

(1) When Manual/automatic Selection Input is altered from Automatic to Manual before finish positioning, positioning is continued untill the desired position.

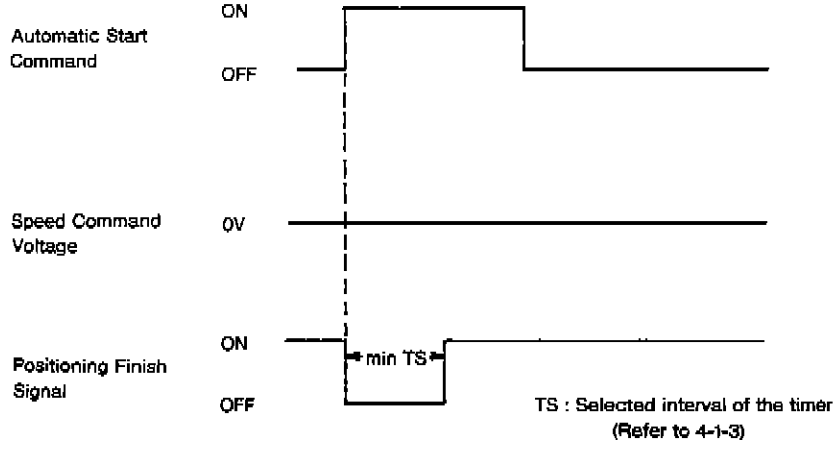
(2) When Automatic Start signal turns OFF before positioning finished, the unit stops feed with deceleration. Remained length to the desired position is ignored.

(3) Positioning Command Data and Speed Command Data are able to ready next data with Positioning Finish Signal OFF.

(4) When position date is "0" or override setting is 0, OFF interval of Positioning Finish Signal is a time selected in the built-in timer.

In this case, "Data Abnormal" LED monitor display dose not turn on and alarm signal is not output. Accordingly, when specified axis only is stopped while controlling over two axes, this function is used. Then. automatic start signal of all axes can be ON.

As for feeder type (3F88M-115F), present position display turns to "0" at this case.



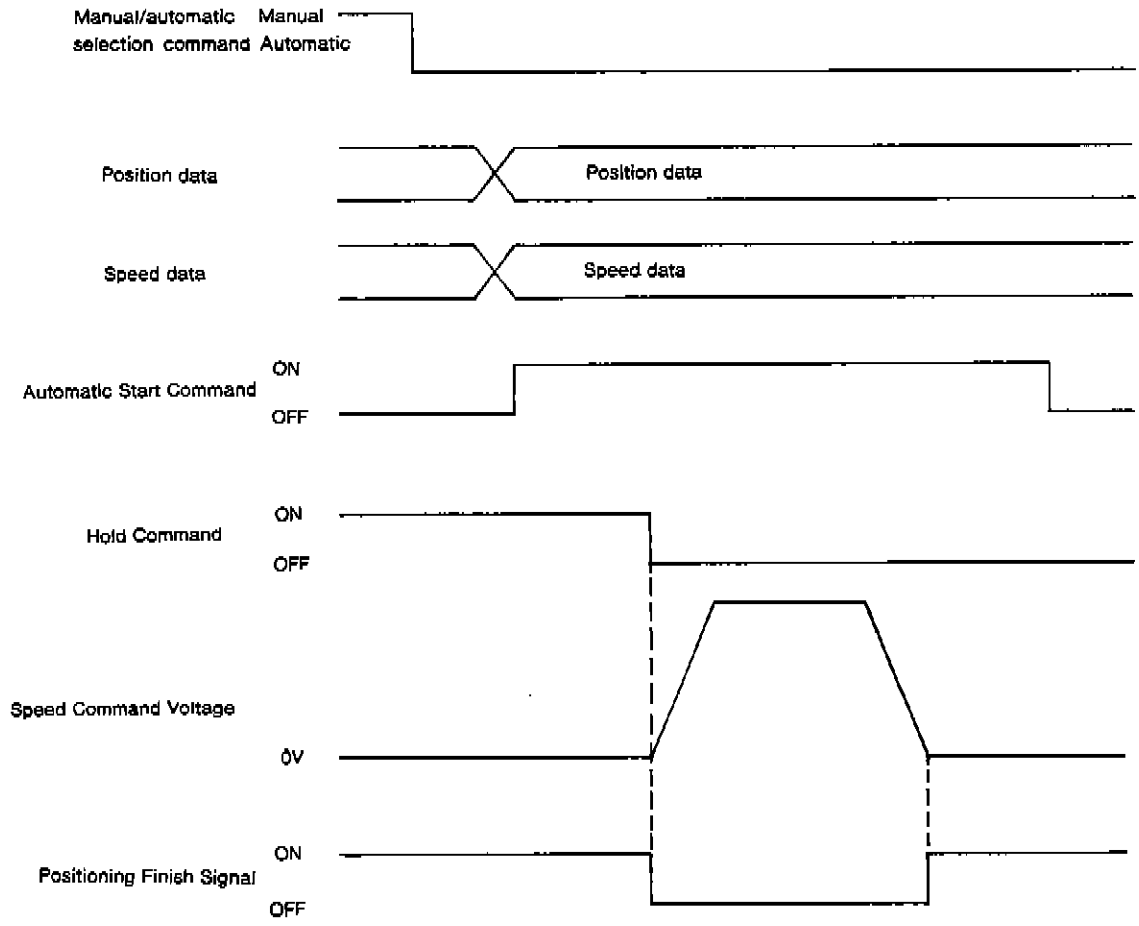
In case feed amount=0, Override setting=0

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3-3-5. Hold

(1) Hold signal is a signal to stop feed operation with deceleration during positioning operation with automatic start command.
When hold signal turns OFF from ON, positioning to the destined position is operated again.

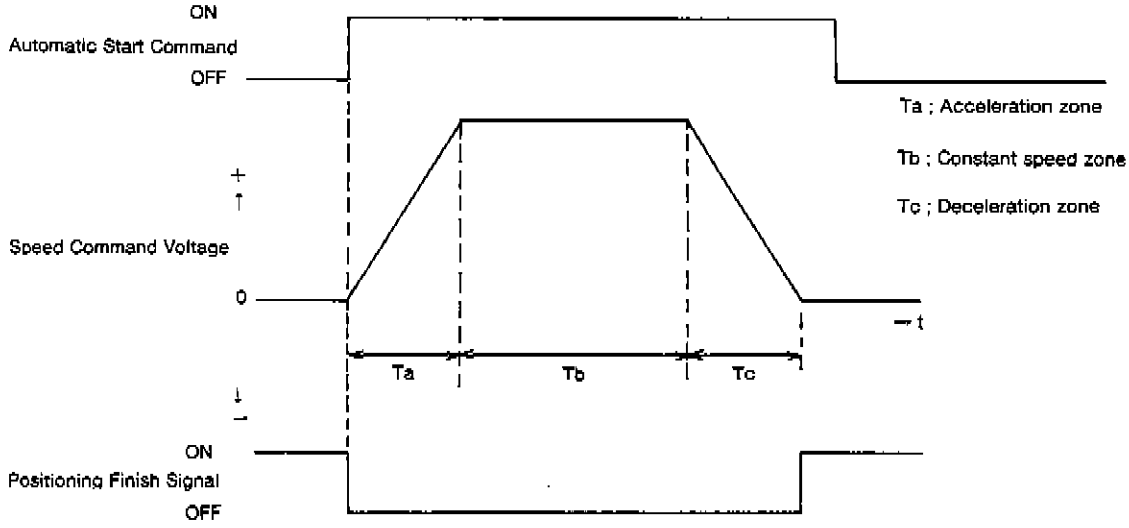
(2) When Automatic start is tuned ON with Hold signal On, the unit accepts position data and speed date. But, positioning is not started until Hold signal turns off.



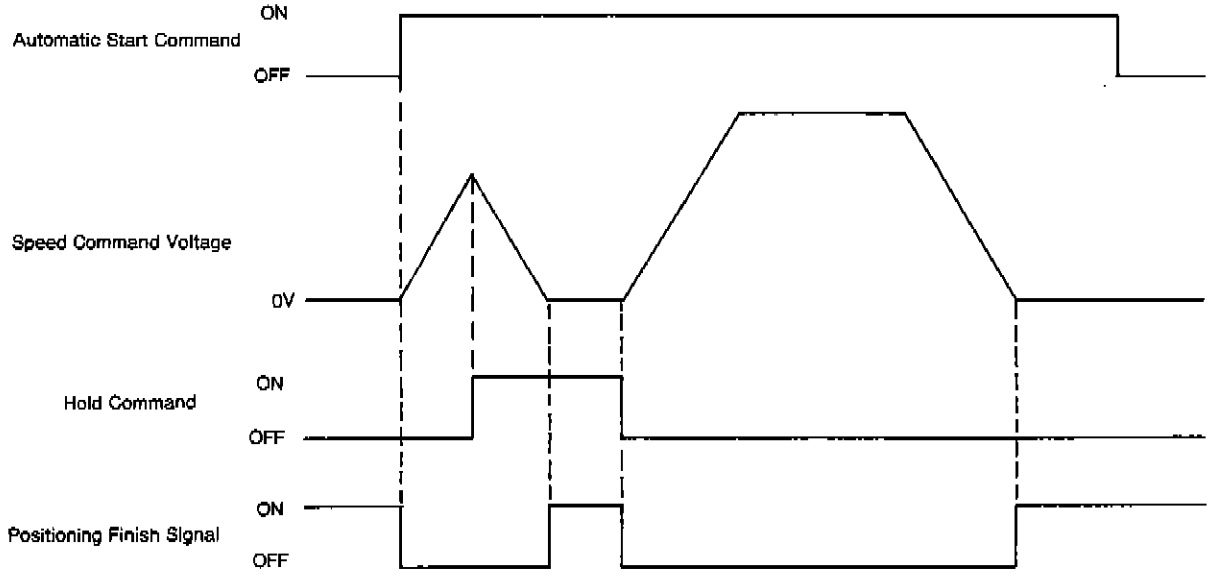
In case of Automatic Start Command is turned ON while holt signal is ON

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(3) Relation between Hold Signal input timing and feed motion in standard operation is shown as follows :



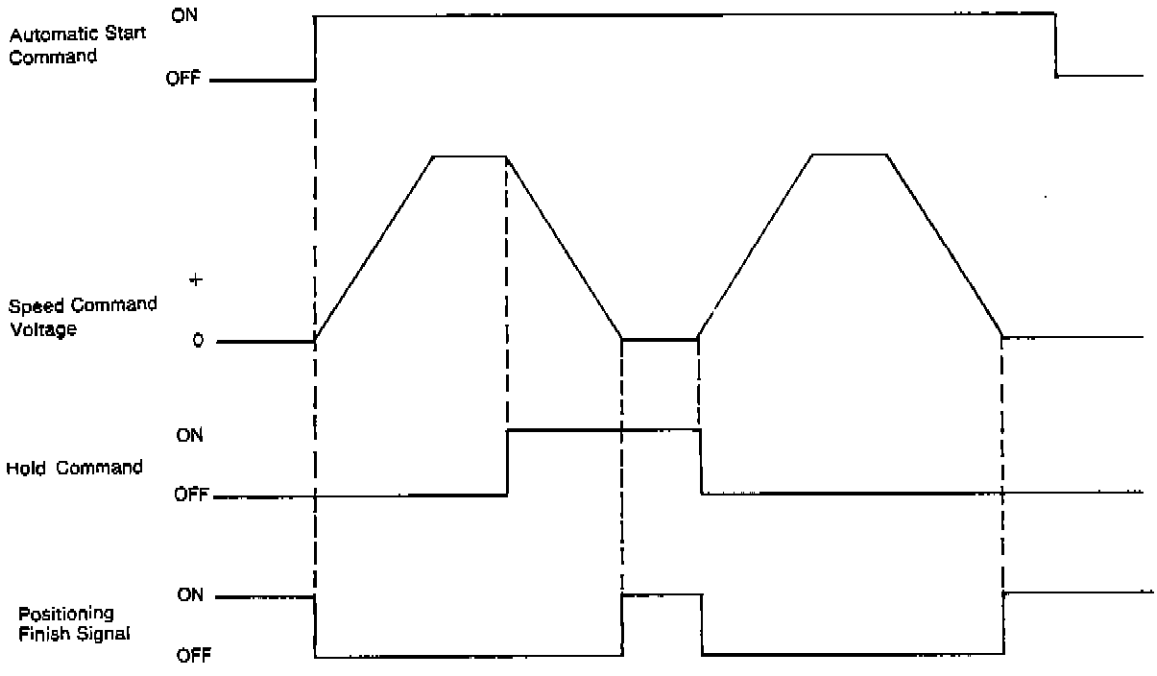
(a) Hold at acceleration zone (Ta)



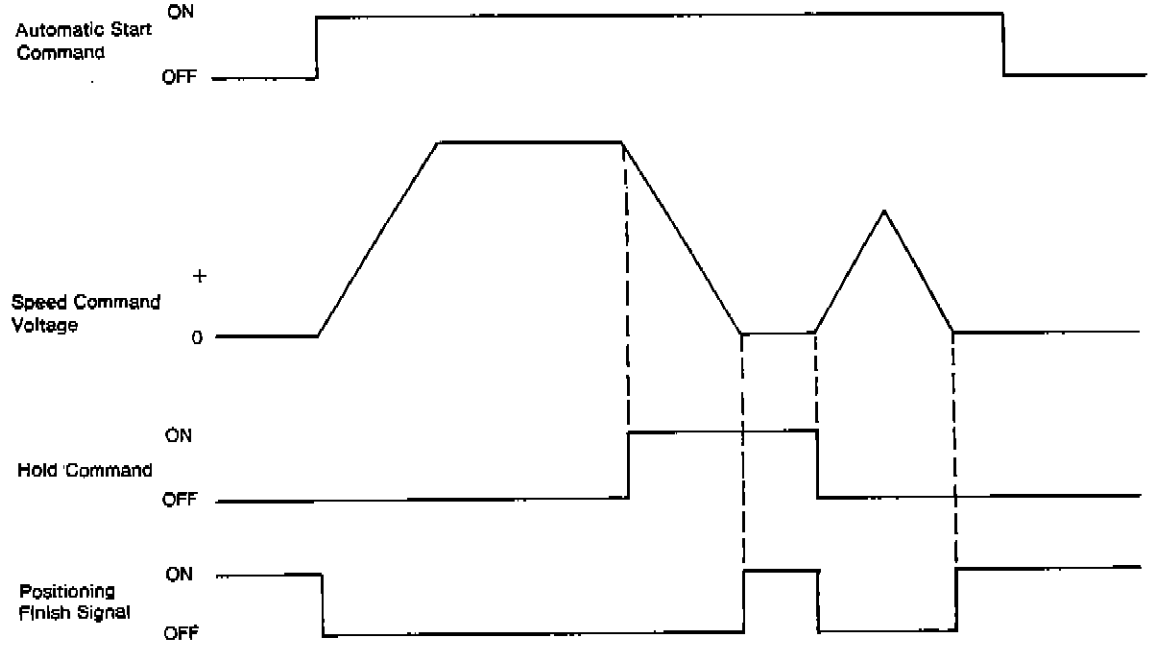
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(b) Hold at constant speed zone (Tb)

○ Hold at the begining of constant speed zone

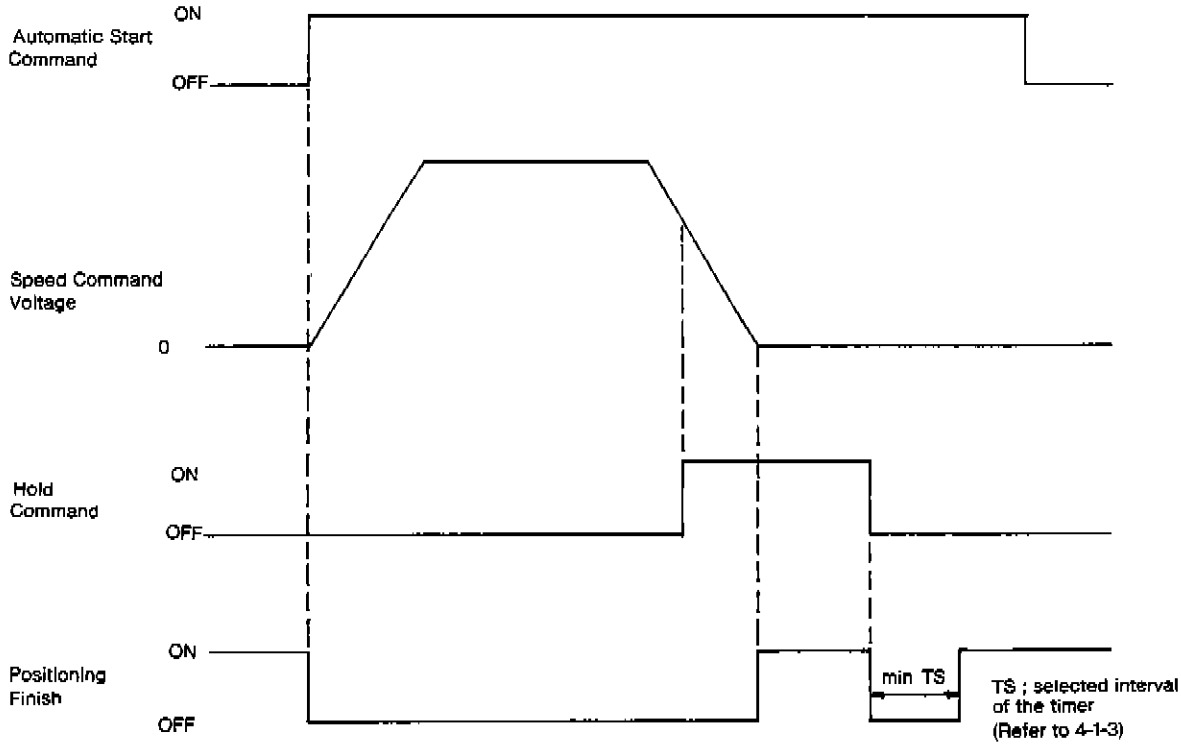


○ Hold at the final position of constant speed zone.



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(c) Hold at deceleration zone (Tc)



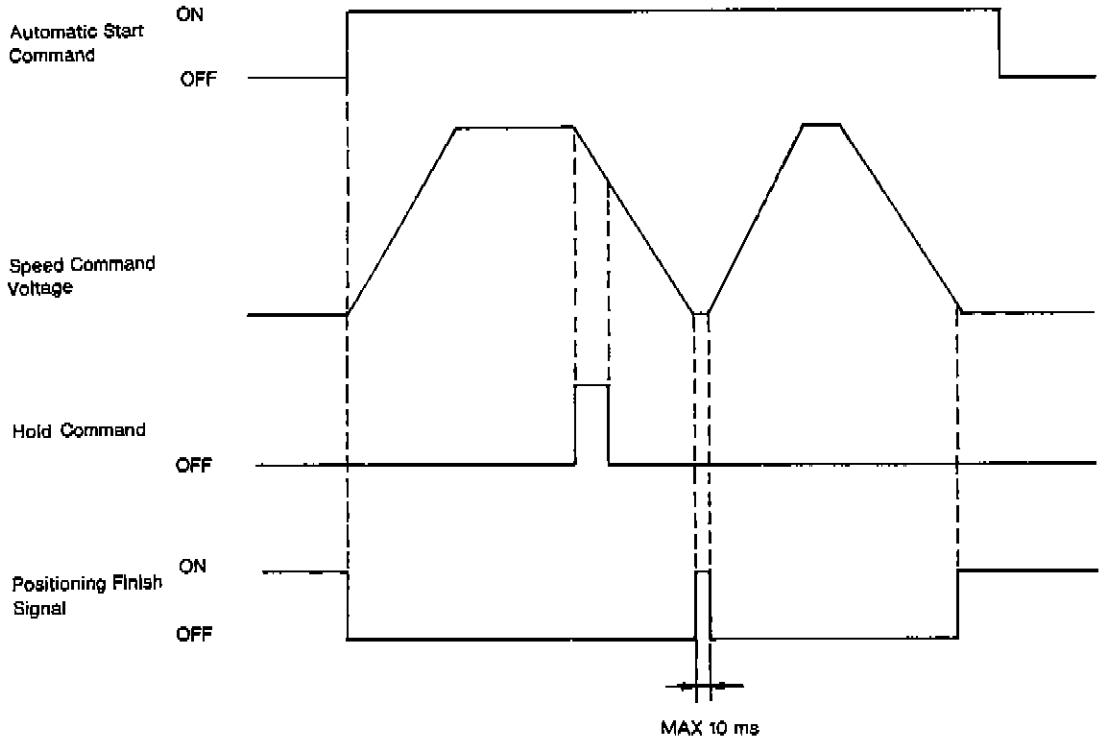
- When Hold signal is turned ON at deceleration zone, the motion is as same as no Hold Signal ON while motor rotation.
- When Hold Signal turns OFF, Positioning Finish Signal will turn OFF at shortest selected interval of the timer.

  Accordingly, the relation between Hold Signal and Positioning Finish Signal at deceleration zone is as same as one at constant speed zone and acceleration zone.

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(4) Short Hold command signal

Even if Hold Command Signal is shorter than deceleration time, the system continue deceleration operation to stop. And, acceleration operation begins soon after stop.



- Positioning Finish Signal is ON during 10 ms max. after stop by Hold Signal.
- For above reason, interfaces which is treated to eliminate noise is not able to earth this Positioning Finish Signal. Thus, Hold Signal should be kept ON till Positioning Finish Signal ON as usual.

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3-3-6. Manual mode

When Manual/Automatic Selection Signal is selected to manual mode, manual operation toward CW and CCW direction is available. Different points from Automatic Start Signal are as follows :

(1) Position data is not necessary. Command pulse frequency by override is supplied when manual CW or CCW signals is ON.

(2) Override setting speed can be altered during operation.

(3) At manual operation, Hold Signal is unavailable.

(4) When Manual/Automatic Selection Signal is changed to automatic during manual operation, the manual feed is stopped with deceleration.

■ Standard specification of manual operation

(1) When Positioning Finish Signal is ON, manual CW or CCW input is available.

(2) Both manual CW and CCW input at once is unavailable, and Positioning Finish Signal is not turned "OFF".

(3) Another manual operation signal is not available till present manual operation finished.

(4) When CW (or manual CCW) is ON less than 0.5 second, it feeds 1 pulse feed value toward CW (or CCW) direction.

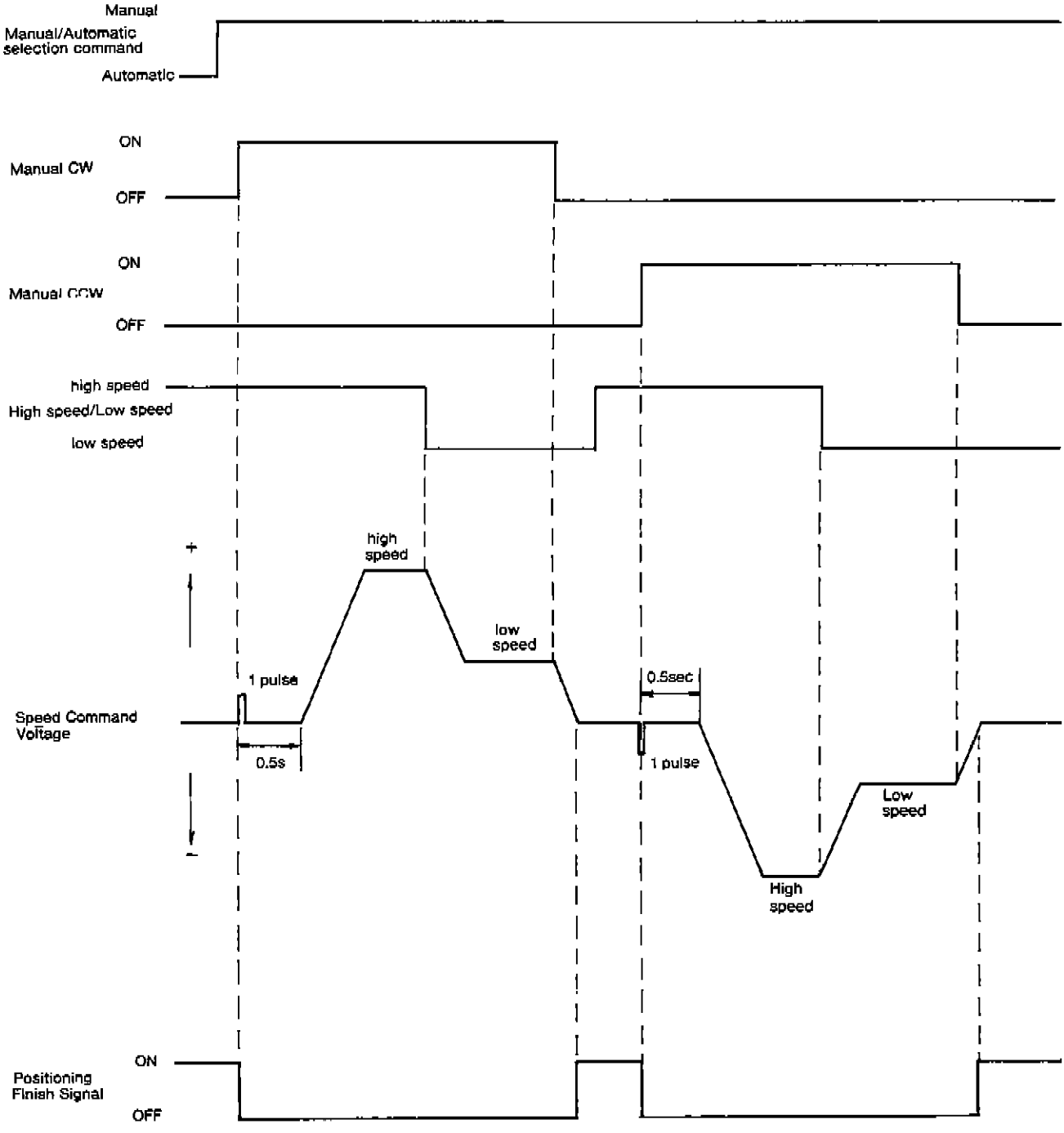
(5) When manual CW (or manual CCW) is ON more than 0.5 second, it feeds toward CW (or CCW) direction continuouslly during ON condition.

(6) Speed of continuous operation reaches the speed of override with acceleration and deceleration control.

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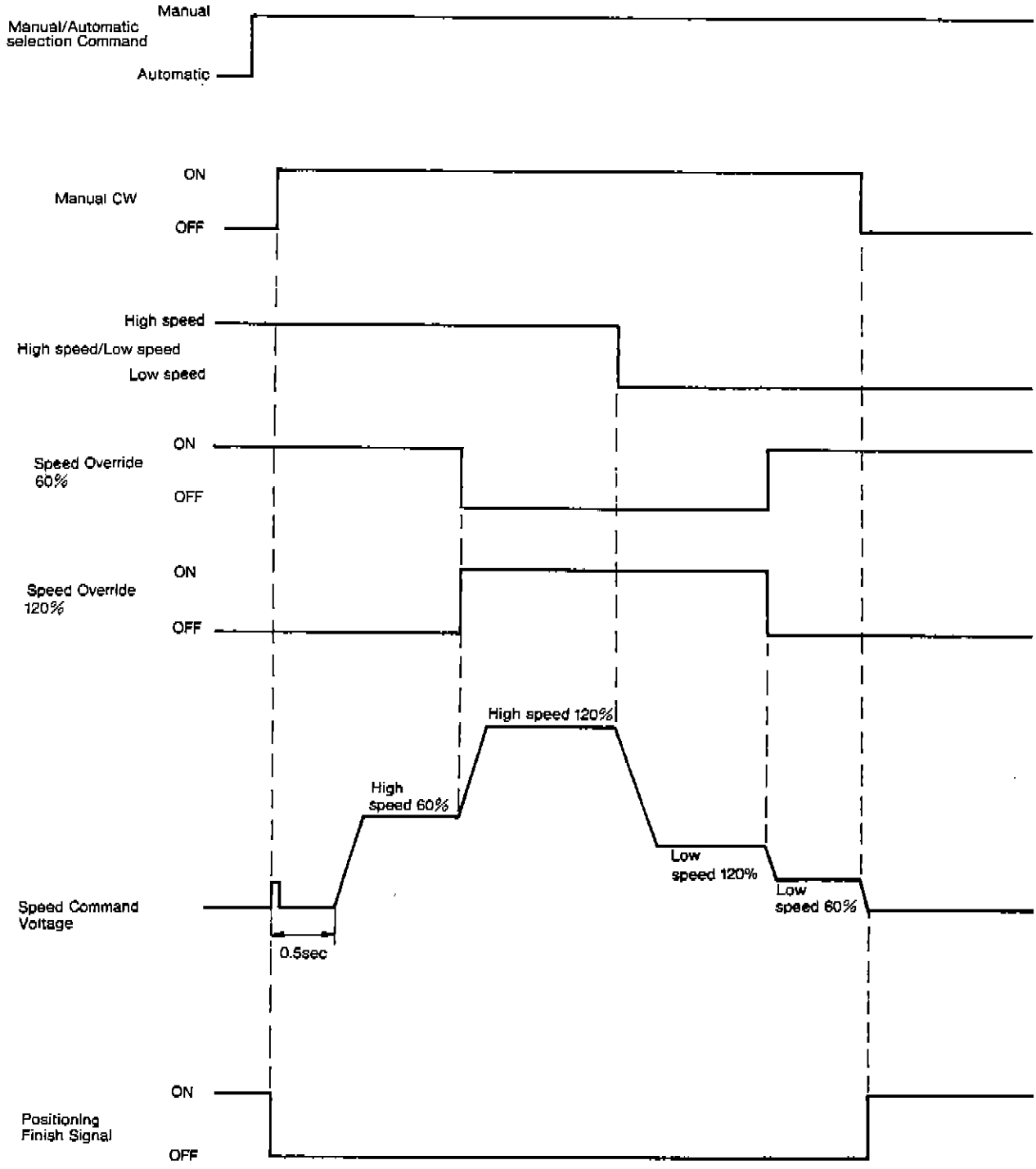
■ Time chart for manual feed (Manual CW, Manual CCW)

(1) When only high/low speed mode is changed (at speed override 100%)



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(2) When speed override signal is changed.



● Note :

During positioning, speed override is always stored by inner CPU.

To alter override setting, set new override value after "0" setting less than 1 second. If shorting type switches are used for override setting, data abnormal (BCD format error) may occur.

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■ **Cautions at manual operation**

(1) When override setting is "0" and put on Manual CW (or Manual CCW) signal, the unit feed one pulse length and Positioning Finish Signal is turned ON. With this way, one pulse feed is gotten when 0.5 second signal is hard to supply.

(2) When override setting becomes "0" one second or longer, the motor stops with deceleration at accel/decel. control just like stop with manual CW (or CCW) signal is turned OFF.

(3) When the position exceeding feed range during manual operation, the system decelerates with accel/decel. control. And present position display turns off. If continuous operation is necessary beyond feed range, input Return-to-origin Signal and put on power source again.

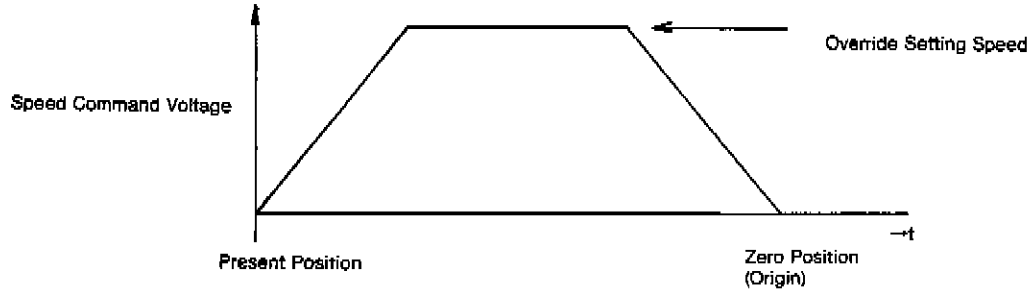
(4) When the system is constructed without an encoder, the following point is differ from previous cases.

When pulse amount in the deflection counter exceeds 2048, Positioning Finish Signal turns ON and manual operation is terminated.

3-3-7. Return-to-origin (3F88M-115/MPG)

Origin return command is a function to feed from present position to origin position (position where present position data is "0").

Namely, this operation is as same as the motion of automatic mode in which position data is 0 at ABS and Automatic Start Signal is ON.



■ **Standard specification of return to origin.**

(1) Available feed at both automatic and manual mode.

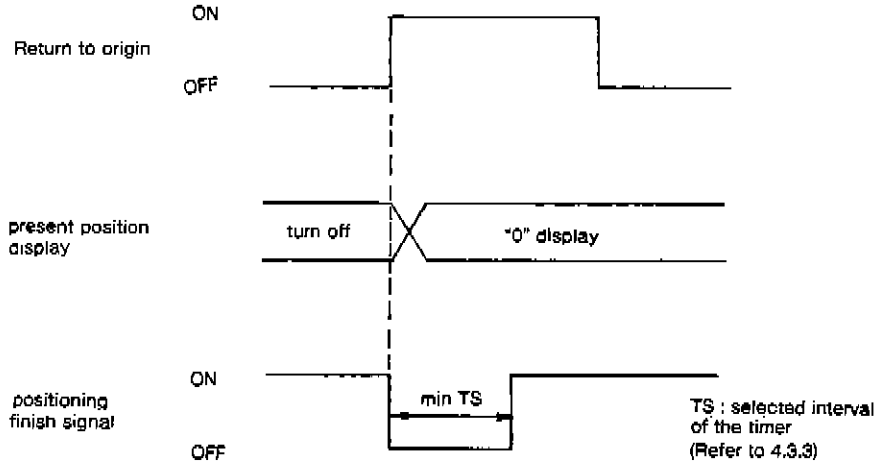
(2) With override setting speed and accel/decele control, the unit feed to origin.

(3) Hold signal is unavailable.

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■ **Cautions at return to origin**

(1) When present position is not displayed (origin is not designated), a present position before return to origin is treated as "0". After return, the indicator displays present position as "0". Time chart at this case is as the same as "0" at present position display.



(2) If Return-to-origin Signal is turned OFF before it returns to origin, the feed decelerates and stops with accel/decel. control and the stopped position is displayed as present position.

3-3-8. Origin shift (3F88M-115A/MPG)

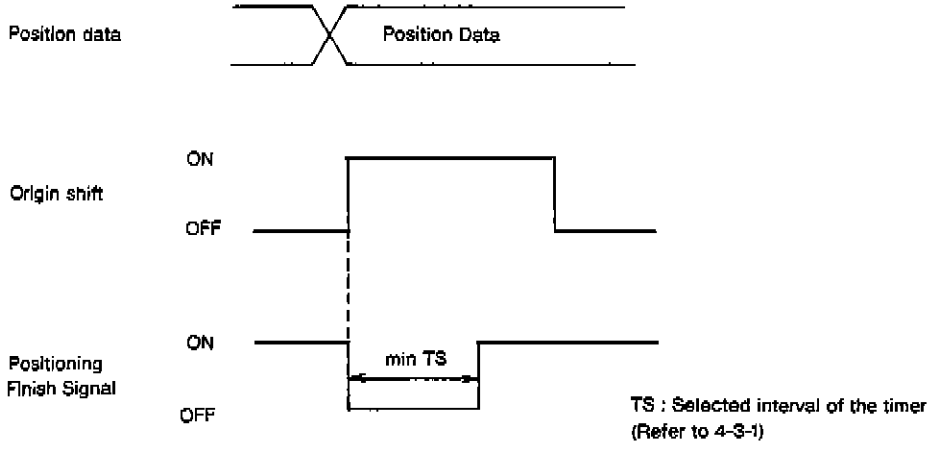
(1) Origin Shift Signal is used to alter present position in software despite mechanical change.

(2) When Origin Shift Signal is ON, position data is recognized and read as a shifting amount. Then, alters present position by following formula :

$$\begin{bmatrix}\text{Present position}\\ \text{after origin shift}\end{bmatrix} = \begin{bmatrix}\text{Present position}\\ \text{befor origin shift}\end{bmatrix} - [\text{position data}]$$

When position data is 0, present position is compulsory treated as "0".

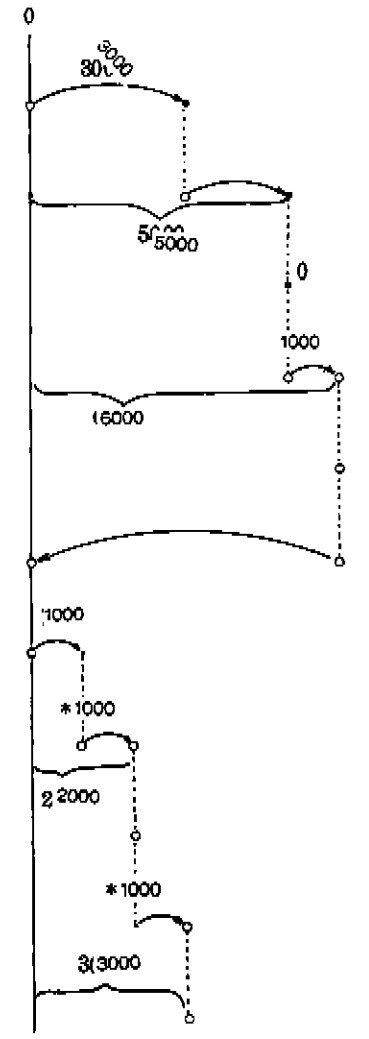
(3) Time chart



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(4) Example

Operation of origin shift

Step	Position data	Origin shift	Start	Present position	Mechanical origin
1.				0	
2.	3000		ON	3000	
3.	5000		ON	5000	
4.	5000	ON	0	0	
5.	1000		ON	1000	
6.	−5000	ON		6000	
7.	0		ON	0	
8.	1000		ON	1000	
9.	*1000		ON	2000	
10.	1000	ON		1000	
11.	*1000		ON	2000	
12.	1000	ON		1000	

● Note : * Shows INC (incremental) data.

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(5) Cautions at origin shift

(a) Origin shift is available only when an encoder is installed.

(b) When present position is not displayed, present position before origin shift is treated as "0".

(c) When Run Command signal is OFF before Origin Shift Command is ON, Run Command Signal is maintained OFF even with Origin Shift Command is supplied without mechanical motion.

(d) As position data at origin shift, present position after operation must be in feed range. If it is out of feed range, "abnormal data" LED turns on and the unit does not alter present position.

(e) As the unit does not check "INC/ABS" signal, both mode are available.

(f) Origin shift command is processed when Positioning Finish Signal is OFF. Even if Origin Shift Command Signal is OFF after origin shift is commanded and before Positioning Finish Signal is ON, origin shift does not stop operation.

(g) Return-to-origin command after origin shift feeds to the position in which present position data is "0". Feeding to mechanical origin should be operated by origin search signal.

3-3-9. MPG input (3F88M-115MPG)

MPG type is a type to be able to MPG (manual pulse generator) input by built-in MPG board.

(1) MPG input is available when manual mode and the Manual CW, and Manual CCW Input Signal are OFF.

Accordingly, when Manual CW (or Manual CCW) Input is ON at MPG input, feeding is operated by Manual CW (or Manual CCW) with positioning finish signal ON.

(2) Positioning Finish Signal output is ON when the deflection counter is in position while MPG input is available.

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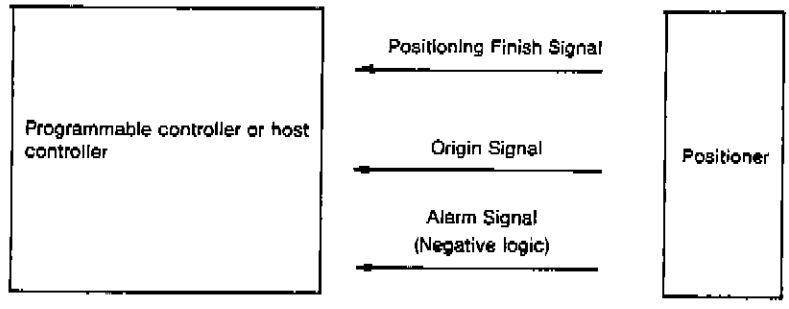
3-4. Control Output Signal

In this section, the following output signals to PC or a controller are explained.

(1) Positioning Finish Signal.

(2) Origin Signal.

(3) Alarm Signal.



3-4-1. Positioning finish signal

(1) Positioning Finish Signal shows positioning is completed.

(2) "Positioning finish" means when the of Command pulse finished delivery and the deflection counter is in-position range.

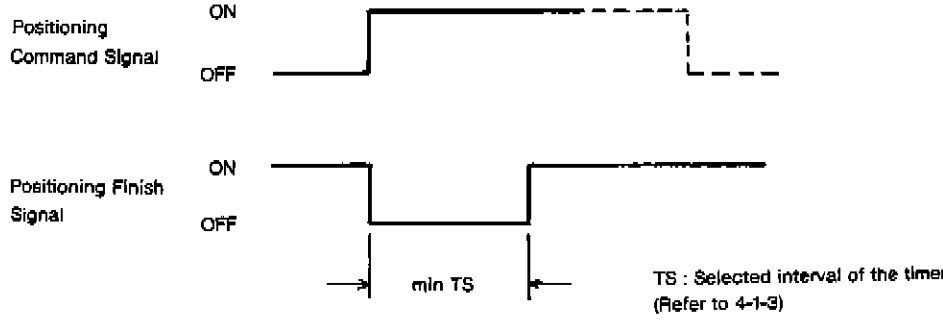
(3) Positioning Finish Signal turns OFF when the following condition :

(a) From the power source input or Initial Reset Signal is turned OFF to Ready signal ON

(b) During positioning

(c) Ready Signal is OFF

(4) OFF time of Positioning Finish Signal by Positioning Command Signal is selected interval of the timer at the shotest.



● Note : This timing is applied for when feed amount = 0, speed override = 0 and data abnormal.

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3-4-2. Origin output signal

When the relation between present position (unit : pulse) and in-position setting amount (INP) is (present position) ≦ INP, Origin Output Signal is turned ON.

● Note :

1. When present position data is not defined (turned off), display this signal remain OFF.
2. In case of "without encoder", Origin Output Signal is ON even with present position = 0.
3. It outputs while passing through origin during positioning operation.

3-4-3. Alarm output signal (Negative logic)

Alarm Output Signal is turned OFF by inner processing or by outside signals as follows :

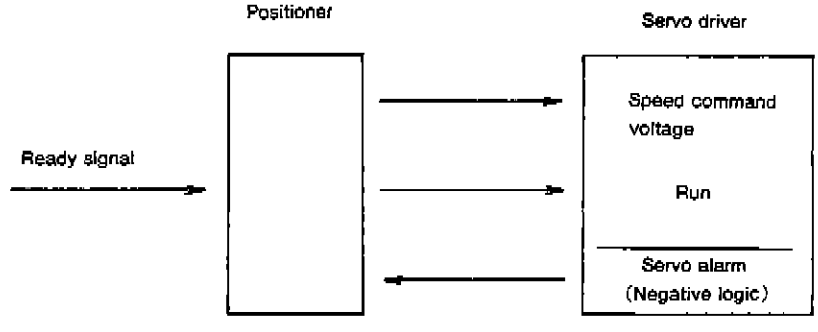
(1) Alarm Input Signal is OFF.
(2) Counter over (feed range over, servo lock abnormal, line disconnection)
(3) Servo Alarm Signal is OFF.
(4) Stroke LS is OFF during positioning operation.
(5) Abnormal speed (When the deflection counter exceeds ± 8192.)
(6) Abnormal date (When positioning command date or speed command date is error.)
(7) CPU abnormal
(8) Power failure to this unit

● Note :

1. The above items (2), (3) and (6) are not applicable "without encoder" case.
2. When alarm output is OFF, speed command voltage is turned to 0V.
3. Method to reset alarm output conditions differs from types of error.
   (Refer to item 5-1-1)

3-5. Servo Control Signal

Control signals of this unit and the servo driver are as following diagram :



Run Signal and Servo Alarm Signal are explained in this section.

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3-5-1. Run output signal

(1) Run Output Signal is turned ON only Ready Command Signal is turned ON. This signal is turned OFF in spite of Ready Signal is ON on following conditions :
- When Initial Reset Signal is ON.
- When Alarm Input Signal is OFF (Negative logic).
- When Stroke End LS of its direction is OFF (Negative logic) while positioning.
- When both Stroke End LS are OFF (Negative logic) at origin search.
- When parameters are set incorrectly.
- When the unit detects disconnection of line.
- When servo lock function is abnormal.
- When origin LS is chattering at origin search.

(2) When Ready Command Signal is turned OFF at positioning, speed command voltage output is turned to 0V. Then, about one second later, Run Output Signal is turned OFF.

(3) When there are conditions to turn OFF Run Signal while positioning, same operation as above item (2) will occur.

3-5-2. Servo alarm input signal (ON at normal)

(1) Servo Alarm Input Signal becomes effective after Ready Input Signal is ON. That is, after power source input or initial reset signal is turns ON, to put off Servo Alarm Input Signal does not output alarm output. Accordingly, power source of the servo driver can be input after power source input to this unit and power source sequence is easily designed.

(2) When Servo Alarm Input Signal is OFF at positioning, speed command voltage is turned to 0V and Run Output Signal is turned OFF about one second later.

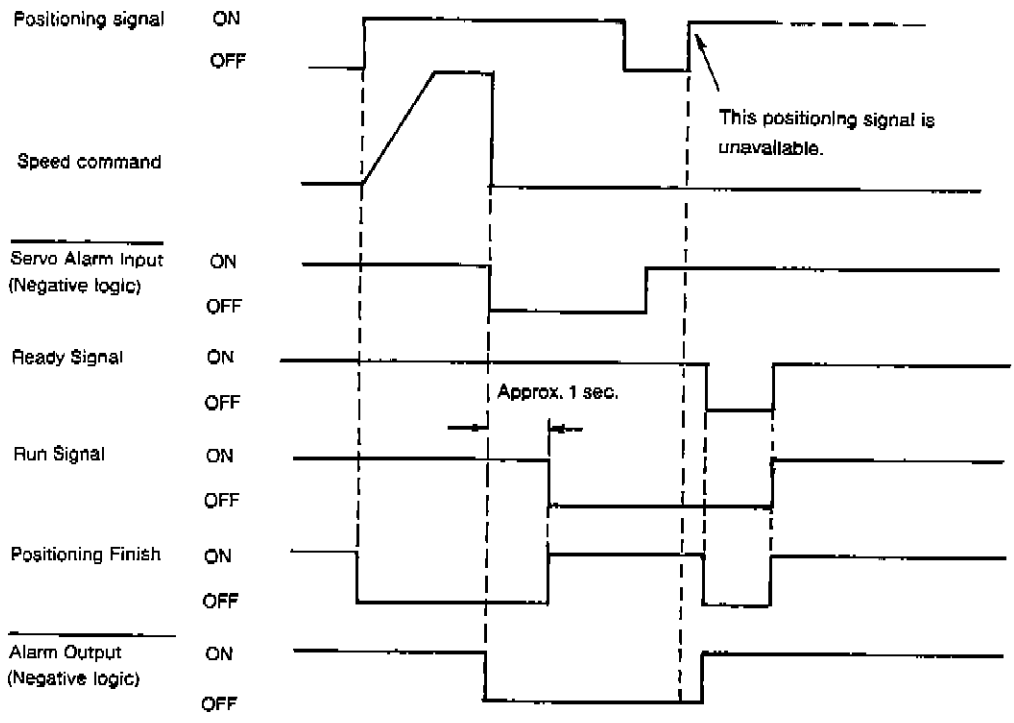
(3) When Servo Alarm Input Signal is OFF while displays present position data, it is continued dosplay. After Servo Alarm Input Signal is reset, positioning is operated based on position display data. Therefore, if feedback pulse from the encoder, etc. is terminated, start from initial reset signal.

(4) To recover condition from Servo Alarm Input is OFF, operate as follows in order :
(a) Turn on Servo Alarm Input Signal.
(b) Turn Ready Input Signal ON from OFF.

● Note :

When Alarm Output is OFF as a result of the condition of Servo Alarm Input Signal, positioning command is unavailable.

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Time chart to recover from servo alarm condition

3-6. Present Position Output

(1) This unit starts output of present position data/display strobe after inner initial processing is finished. From initial reset is turned OFF to positioning signal is turned ON, displayed sign of present position display unit is "−", and Position Data Signal is turned off.

(2) Then, Positioning Signal turns ON, and present position display unit starts display of position data.

(3) After position data displayed, it will turn off in following conditions :

  (a) When position data exceeds the feed range.

  (b) Among abnormal conditions, one which can be recovered by re-input of power source or initial reset is occur.

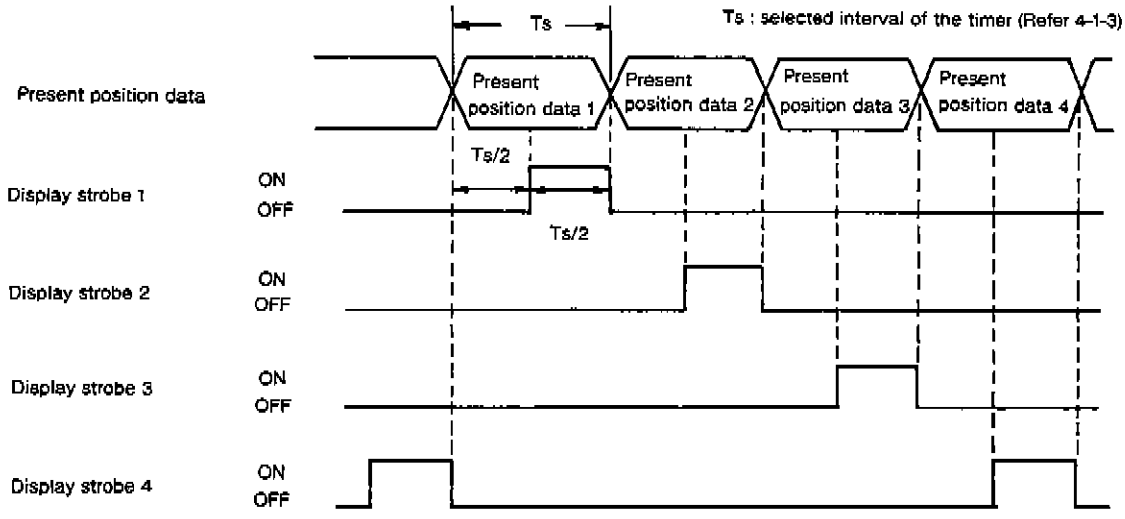
(4) Present position data indicates following data :

  (a) "Without encoder" : Stored amount of the deflection counter (= Speed command voltage)

  (b) "With encoder" : Position data (position data divided by position command pulse multiplication rate)

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(5) Output timing of present position data is as follows :



· As shown in the above diagram, time Ts × 4 is necessary to output present position data. For example, when Ts = 40 ms, new present position data is output every 160 ms.

· Present position data can not be changed its value during output of present position 1-4.

(6) Contents of present position data

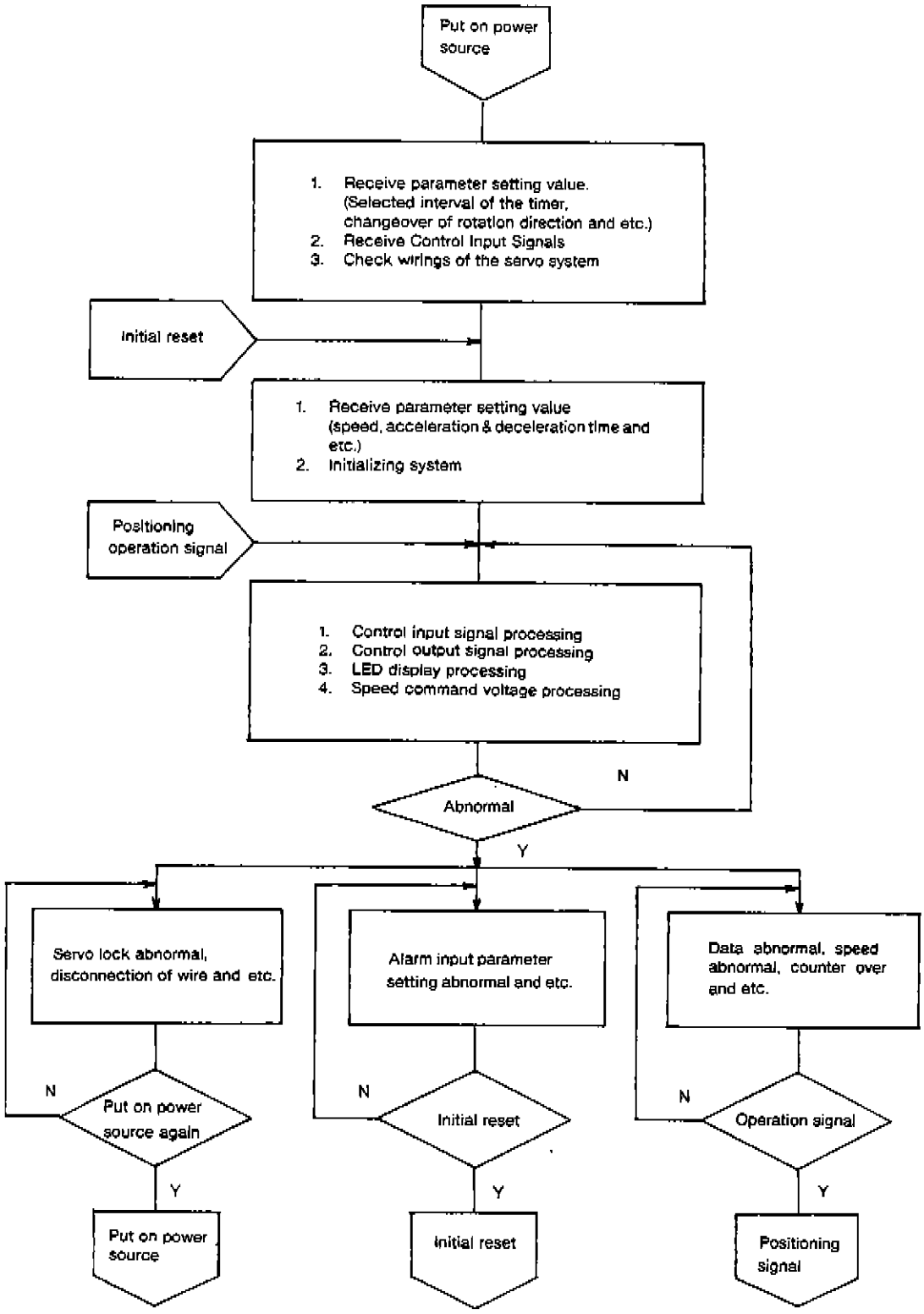
Present position bit No. / Present position data	7	6	5	4	3	2	1	0	Used display strobe No.
Position data 1	Sign −/+						Position data 2×10^0	Position data 1×10^0	1
Position data 2	Position data 8×10^5	Position data 4×10^5	Position data 2×10^5	Position data 1×10^5	Position data 8×10^4	Position data 4×10^4	Position data 2×10^4	Position data 1×10^4	2
Position data 3	Position data 8×10^3	Position data 4×10^3	Position data 2×10^3	Position data 1×10^3	Position data 8×10^2	Position data 4×10^2	Position data 2×10^2	Position data 1×10^2	3
Position data 4	Position data 8×10	Position data 4×10	Position data 2×10	Position data 1×10	Position data 8	Position data 4	Position data 2	Position data 1	4

(1) When present position is not fixed, all signals is turned ON.
(In case of using present position display unit, the unit turns off all segment.)

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3-7. Inner Processing Function

A general flow of the inner processing function of this unit is shown in the following diagram :



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3-7-1. Processing at put on power source

Process at put on power source receives the followings in addition to the contents at initial reset signal is turned OFF.

(1) Following contents are received among parameter setting.
  (a) Selected interval of the timer : T1, T2
  (b) Automatic operation/test operation : AUTO/TEST
  (c) With/without encoder : S1 (3F88M-115F is unavailable.)
  (d) Changeover rotation direction : S2
  (e) With/without disconnection line detection function : JT1
  (f) Low speed setting × 1/× 0.1 : JT2

(2) Origin Shift Input Signal and Return-to-origin Input Signal are sent to CPU among control input signals.
  Turn OFF this signal before input next positioning signal. The function can be altered by next control input signal ON between the time from power source ON to next positioning signal for following cases.
  · To alter the content of present position display
  · To command continuously at manual operation
  · Turn off
  However, this function is unavailable without encoder.
  (a) When Origin Shift Signal is ON :
    Present position output data does not accept the contents of the deflection counter, but output present position data in the inner command counter. This can solve flicker problem of display data at servo lock condition. However, in this case actual mechanical present position is not displayed, and the desired position is displayed during positioning.
  (b) When Return-to-origin Signal is ON :
    When manual operation is commanded beyond the feed range, continuous manual operation becomes possible by making present position "0".

(3) When disconnection detection (JT1 : shorted)
  When disconnection is detected, check disconnection among the servo system wirings.
  (a) At the first servo lock after turned on power supply, wiring check of the servo system can be done as follows :
    ① Send few pulses over the in-position range value toward CW direction after 100 ms later of Ready Signal is turned ON, then check it to enter the in-position range.
    ② Send above few pulses to CCW direction and check it entering the in-position range.

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(b) Wiring check is detected as follows. And "counter over" LED display flickers every 250 ms, if error occurs.

① Check whether it enters the in-position range within one second after sending command pulse.

② Check whether the deflection counter does not increase after sending command pulse.

(c) Causes of errors for wiring check

① In-position range is too small.

② Offset voltage is too large.

③ Speed command voltage is not supplied by mis-wiring or no connection.

④ Position feedback pulse does not return by mis-wiring or no connection.

⑤ Mis-wiring or no connection between the motor and the driver.

(d) Recover from error detection condition

Turn power source from OFF to ON after causes of error are removed.

(4) Without disconnection detection (JT1 : open)

In this case, only check whether reverse wiring of servo system.

① When during operation command signal turns to ON to servo driver, send speed command voltage with few pulses.

② Check about one second that deflection counter does not increase.

③ If deflection counter is increased, "counter over" LED flickers every 250 ms.

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3-7-2. Processing at initial reset ON

The processes at initial reset ON is also executed when turning on power source.

(1) The unit read and check the following parameters among parameter settings :

No.	Parameter contents	Check range	Note	Applied type		
				A	MPG	F
1	In-position range	——	*	○	○	○
2	Command pulse multiplication rate	——		○	○	○
3	Backlash amount	——	*	○	○	×
4	High speed	0 < setting value ≦ 200		○	○	○
5	Low speed	0 < setting value		○	○	○
6	Origin search speed	0 < setting value	*	○	○	×
7	Origin search direction	——	*	○	○	×
8	Accel. & decel. time	——		○	○	○

○ : available × : unavailable

● Note :
- In case "without encoder", parameter marked * is not accepted.
- Every parameter performs BCD format check.

(2) When error was detected at parameter setting, "data abnormal" LED monitor flickers every 250 ms and positioning operation becomes unavailable.
Reset parameter correctly and turn initial reset signal from ON to OFF.

(3) Only in-position range is always read at positioning operation. By this function, setting of this parameter is altered without using Initial Reset Signal.
Positioning Finish Signal keeps ON condition even if in-position range is increased more than pulse amount storing in the deflection counter. Thus, fix proper value of the in-position range by the present position display data.

(4) When ether high and low speed is using, set the non-used speed setting within check range. When "High/Low" Selection Signal is disconnected, the unit reads low speed for safety purpose. So set each speed as [high speed] > [low speed].

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3-7-3. Detection of abnormal condition

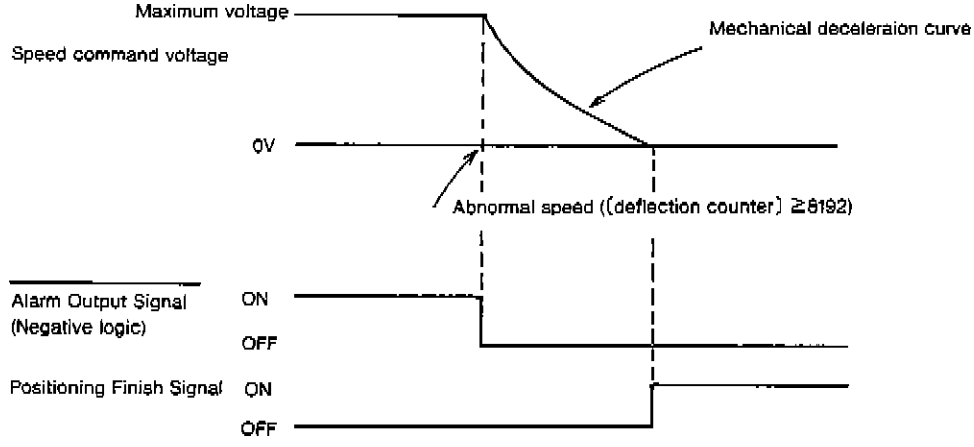
Following two abnormalities are judged in the inside of the unit in case of "with encoder" . When the abnormal condition is occur, the unit turns OFF alarm output signal.

(a) Speed abnormal

(b) Counter over

(1) Speed abnormal

At positioning, when the amount of the deflection counter exceeds ± 8192, positioning is interrupted and stops remaining amount of the deflection counter. Namely, accel. and decel. time of parameter setting is not applied. But, it decelerates inaccordance with response characteristic of the servo system including mechanical factor.



To recover from abnormal speed condition, correct speed setting and start operation again.

(2) Counter over

For the following abnormality, "Counter over" LED is displayed.

	Conditions	Counter over LED display	
1) When the system exceeds operation range	* * 1	Continuous indication	Present position display turns off
2) When the system detects disconnection	* * 2	Flicker every 250 ms	* * 4
3)Abnormal servo lock	* * 3		

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* *1

(1) In manual operation, when Manual CW or Manual CCW Signal is supplied continuously exceeding feed limit range, or when exceed feed limit range in deceleration after these signal is turned OFF.

(2) The amount of position feedback pulse exceeds the feed limit range.

* *2

When there is no feedback pulse for about one second in spite of output speed command voltage at positioning.

* *4

(1) When abnormal disconnection is detected, turn speed command voltage to OV, and turn off Run Command Signal about one second later.

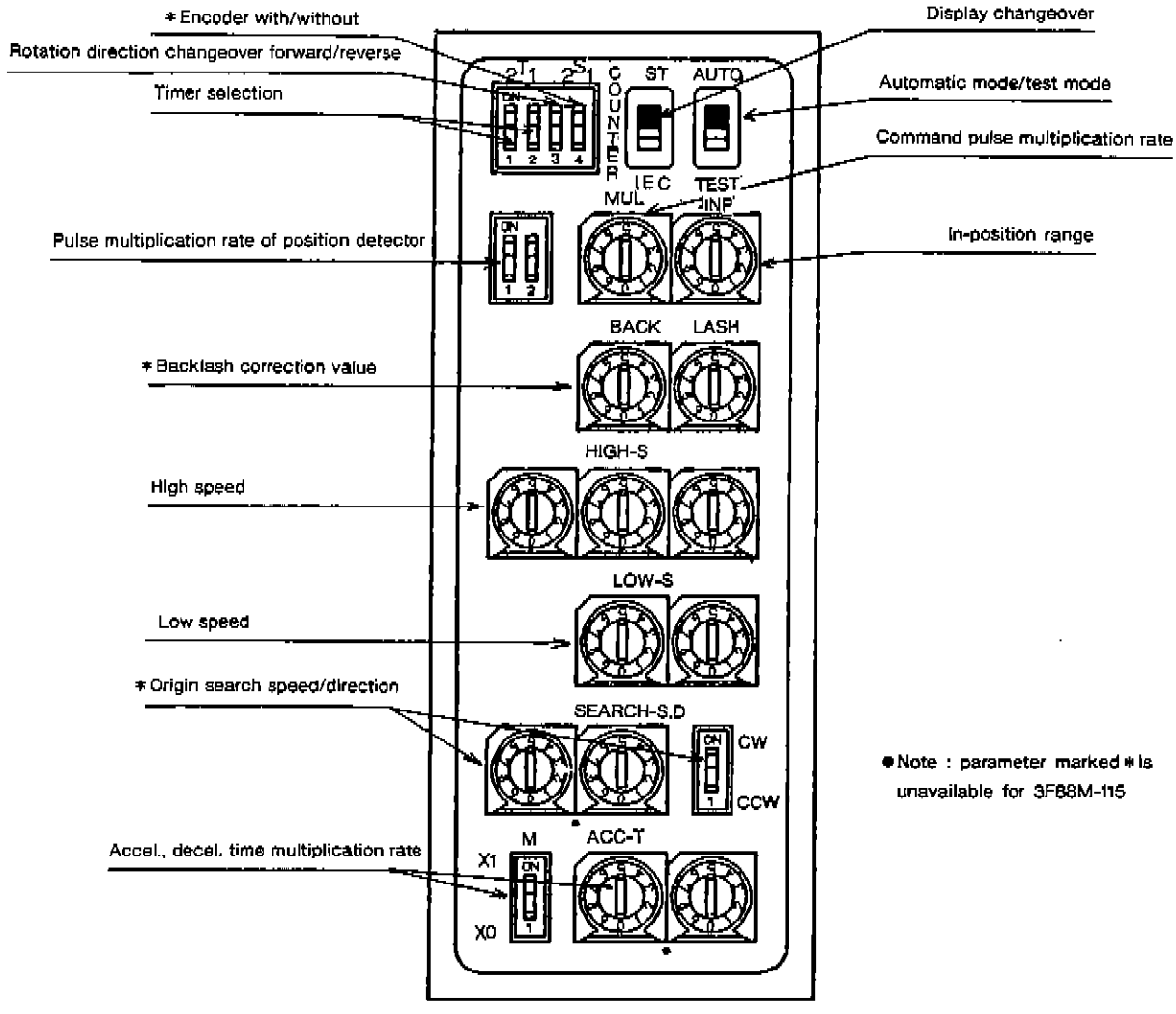
(2) To recover from abnormal disconnection detection condition, turn ON power source after confirmation of wiring.

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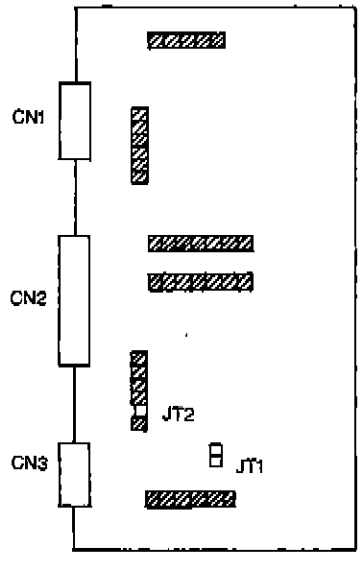
4. SETTING AND ADJUSTMENT

4-1. Parameter Setting

There are following parameters shown below in this unit.



There is following circuit board (I/O board) in the inside of right cover of the unit.



Short pin	Function	Setting
JT1	Disconnection detection changeover.	Short : with (Factory-set position) Open : without
JT2	Low speed setting changeover.	Short : × 1 (Factory-set position) Open : without

▨ : photo-coupler

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There are three timing to read parameter.

(1) When put on power source

(2) When initial reset

(3) Any time at operation

It is necessary to read altered setting according to those timing suitable for each parameter.

Timing to read parameter	Content of parameter	SW symbol	Item referred to	Applied type		
				A	MPG	F
When power is source turned on	1 Encoder with/without	S1	4.1.1	○	○	×
	2 Rotation direction changeover forward/reverse	S2	4.1.2	○	○	○
	3 Timer selection	T1, T2	4.1.3	○	○	○
	4 Automatic mode/test mode	AUTO/TEST	4.1.4	○	○	○
	5 In-position range	INP	4.1.5	○	○	○
	6 Command pulse multiplication rate	MUL	4.1.6	○	○	○
	7 Backlash amount	BACKLASH	4.1.7	○	○	×
	8 High speed	HIGH-S	4.1.8	○	○	○
	9 Low speed	LOW-S, JT2	4.1.9	○	○	○
	10 Origin search speed/direction	SEARCH-S, D	4.1.10	○	○	×
	11 Acceleration, deceleration time	M, ACC-T	4.1.11	○	○	○
	12 Pulse multiplication rate of position detector	D1, D2	4.1.12	○	○	○
	13 Disconnection detection with/without	JT1	4.1.13	○	○	○
	14 Low speed setting changeover	JT2	4.1.9	○	○	○
When initial reset	1 In-position range	INP	4.1.5	○	○	○
	2 Command pulse multiplication rate	MUL	4.1.6	○	○	○
	3 Backlash amount	BACKLASH	4.1.7	○	○	×
	4 High speed	HIGH-S	4.1.8	○	○	○
	5 Low speed	LOW-S	4.1.9	○	○	○
	6 Origin search speed, direction	SEARCH-S,D	4.1.10	○	○	×
	7 Acceleration, deceleration time	M, ACC-T	4.1.11	○	○	○
Any time at operation	1 In-position range	INP	4.1.5	○	○	○
	2 Pulse multiplication rate of position detector	D1, D2	4.1.12	○	○	○

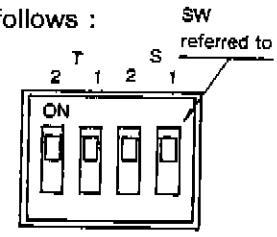
○ : available × : unavailable

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4-1-1. Encoder "with/without" (3F88M-A/MPG)

(1) By setting this switch, application of this unit can be altered as follows :

Encoder with/without	Control system
With (ON)	Semi-closed loop system
Without (OFF)	Speed control system



(2) Main function differences of encoder with/without are as follows :

Function	With encoder	Without encoder	Note
Wiring check at servo lock	○	×	
Detection of disconnection	○	×	
Origin search	○	×	
Origin shift	○	×	
Present position display output	Present position = (command counter) - (deflection counter)	Present position = (command counter)	Note 1
Positioning finish judgement	Command counter is at command position and also (deflection counter) ≦ In-position	Command counter = (Command position (speed))	
Judgement of abnormal speed	When (deflection counter) ≧ 8192	When (deflection counter) ≧ 2048	Note 2
Check of position command data	(Destined position) ≦ 3,999,999	(Destined position) (speed) ≦ 2048	
Backlash amount	○	×	Note 3

○: available × : unavailable

Note 1 : There is a method to make present position = command counter with encoder.

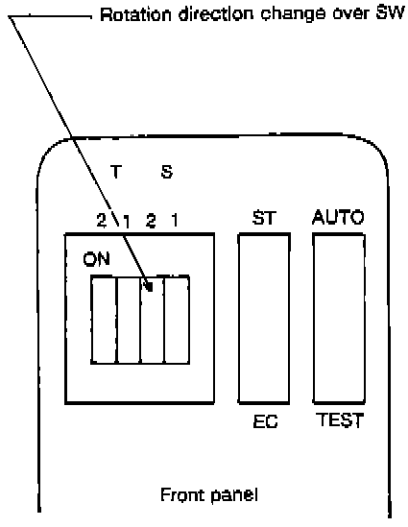
Note 2 : Abnormal speed without encoder is detected inside of this unit and it is not output to other unit.

Note 3 : Without encoder, the unit processes backlash as "0" .

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4-1-2. Rotation direction changeover switch

(1) By S2. dip switch on the front panel, rotation direction can be altered.



ON : Command voltage "positive" = clockwise rotation
OFF : command voltage "negative" = clockwise rotation

When encoder feedback is wired reverse, encoder phases are exchanged automatically..

(2) Cautions

(a) When the detection for disconnection is not applied at servo lock, this detection does not function. But, this switch functions as command voltage pole change switch. That is, automatic phase change cannot function in this case.
Accordingly, it may be possible to runaway when disconnection is changed from "detect" to "non-detect" ·

(b) Command voltage pole change SW is as follows :

Pole changeover	Voltage at CW direction	Voltage at CCW direction
ON	+	−
OFF	−	+

When monitor display is selected "deflection counter" , the same contents as command voltage is displayed. So when changeover switch is OFF position and the unit is executing positioning toward CW direction, the sign turns to "−".

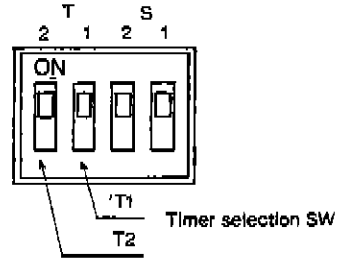
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4-1-3. Timer selection

(1) Set necessary time to receive signals from this unit to PC. Usually set longer time than PC scan time.

(2) Timer among 10 ms, 20 ms, 40 ms and 80ms is selectable by the following method.

Timer time	T2	T1
10 ms	OFF	OFF
20 ms	OFF	ON
40 ms	ON	OFF
80 ms	ON	ON



(3) Usage of timer

On this unit, selected timer time is used at output of Positioning Finish Signal, and Display Strobe Signal of Present Position Display Data.

(a) Use at Positioning Finish Signal

After input positioning command signal, positioning finish signal is turned OFF. To keep the OFF interval, the time is used.

EX) Pulse length of Positioning Finish Signal at feed amount = 0 or override = 0.

(b) Use at Display Strobe Signal of Present Position Display Data

Renewal cycle of present position display data output and pulse range of display strobe signal are set with the timer.

4-1-4. Auto/test mode changeover

(1) Auto mode/test mode changeover switch is set to "AUTO" position at normal operation.

(2) "TEST" mode is used to test inside function of this unit and input/output connector.

It is used to confirm wiring at setting and operation or analyze causes of abnormal conditions.

4-1-5. In-position range

(1) After connect the servo motor to mechanical system, it may occur to stop the servo motor just before positioning finish and pulse amount remains in the deflection counter due to mechanical inertia and friction. Then, it may happen that Positioning Finish Signal is not supplied or is supplied late. By setting in-position range suitable length, Positioning Finish Signal is output before positioning is completely finished and can be speed-up system process time.

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(2) In-position range can be set as follows :

Position of switch	In-position range (pulse)	Position of switch	In-position range (pulse)
0	±1	5	±11
1	±3	6	±13
2	±5	7	±15
3	±7	8	±17
4	±9	9	±19

(3) Even after Positioning Finish Signal is supplied, positioning operation continues its operation with stored pulse in the deflection counter. And if positioning is not completely finished, remaining stored pulse is not reset but added in the next positioning pulse input.

(4) Set in-position range usually about three pulse. And five pulse or so is recommended in case of machines in production lines.

(5) When there is offset voltage owing to improper adjustment of the servo system, the unit may treat as "disconnection" after start feed. And "Counter over" LED flickers every 250 ms.

(6) To check how much offset voltage in the servo system, see present position display data after origin search.

If the data displays +5, the amount of deflection counter is −5, it means this unit output negative voltage offset.

4-1-6. Command pulse multiplication rate

(1) Output pulse is multiplied with a value selected by this switch against commanded position data.

According to this setting, maximum position command amount (feed range) is altered.

(2) Command pulse multiplication rate can be selected as follows :

Position of switch	Command pulse multiplication rate	Maximum position command amount	
		with encoder	without encoder.
0	1	±3,999,999	±2,048
1	3/2	±2,666,666	± 1,365
2	2	± 1,999,999	± 1,024
3	3	± 1,333,333	± 682
4	10/3	± 1,199,999	± 614
5	4	± 999,999	± 512
6	5	± 799,999	± 409
7	10	± 399,999	± 204
8	10/π	± 1,255,999	± 643
9	1	±3,999,999	±2,048

● Note : π = 3.14

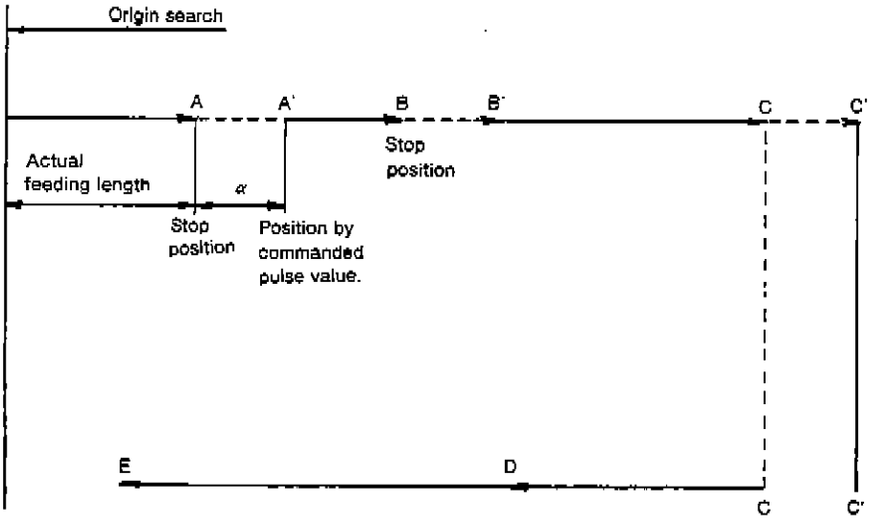
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4-1-7. Backlash amount (F88M-115A/MPG)

(1) This is a setting switch to correct backlash of mechanical system (gear, ball screw, etc.). If there is backlash in mechanical system, inaccurate positioning to right or left is occur.

(2) Setting should be done converting backlash length into pulse unit. Setting range for two digit is available from 0 to 99 pulses.

(3) Example of operation



α : Backlash amount

Command No.	Position data	Commanded pulse amount	Present position display
1	A	A + α	A' − α
2	B	B − A	B' − α
3	C	C − B	C' − α
4	D	C' − D	D
5	E	D − E	E

4-1-8. High speed

This is a switch to set pulse frequency used for high speed selected by High/low Speed Command Input Signal. High speed is fix accel./decel., speed unit arising from accel./decel. time described later, and it is set in three digits.

(1) Setting unit : kpps

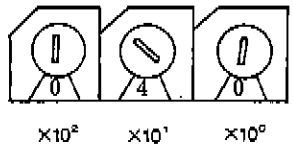
(2) Setting range : 1-200 (200 kpps max)

(3) Accel./decel. speed unit : This unit is given by dividing high speed into 64. If high speed is 64 kpps, the unit is 1 kpps.

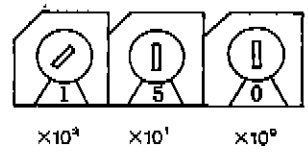
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(4) Examples of setting :

(a) Setting 40 kpps



Setting 150 kpps



(b) In case of setting the maximum speed according to response speed of the servo motor and a machine to be used.

Suppose :

Motor rated speed (working speed) N = 3000rpm

Ball screw pitch L = 8mm

Number of encorder pulse P = 500p/rev

Maximum speed = P × N/60 = 500 × 50 = 25 kpps

namely 25 kpps is set.

And mechanical speed at this time is :

Mechanical speed = L ×N/60 = 8 × 50 = 400 mm/S = 24 m/minutes

Speed override can be set to 190 %. It is possible to set maximum speed divided by (1.9).

4-1-9. Low speed

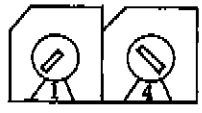
(1) This is a switch to set pulse frequency used for low speed selected by High/low Speed Command Input Signal. Set with two digits.

① Setting unit : kpps

② Setting range : 0.1 - 99

③ Example of setting :

When setting 14 kpps



(2) Low speed setting value of parameter setting can be changed by short pin (JT2) in the I/O board.

Short : low speed setting × 1

Open : low speed setting × 0.1

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Feed speed range is as follows.

Short pin (JT2)	low speed setting range	Feed speed range
short (× 1)	1kpps ~ 99kpps	100pps ~ 188.1kpps (1kpps × override 10 %) (99kpps × override 190 %)
Open (× 0.1)	0.1kpps ~ 9.9kpps	10pps ~ 18.81kpps (0.1kpps × override 10 %) (9.9kpps × override 190 %)

4-1-10. Origin search speed/direction (3F88M-115A/MPG)

■ Origin search speed

This is to set feed speed at origin search command till Origin Deceleration LS is ON. Then, the speed decelerates to 1/10 of the speed set by orignin search speed until it stop with position detector Z phase or Origin LS.

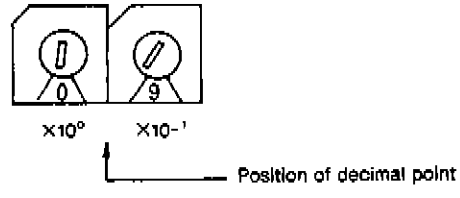
Set under 8 kpps at origin search, because acceleration is sharp with non accel/decel. control.

(1) Setting unit : kpps

(2) Setting range : 0.1 - 9.9

(3) Example of setting :

When setting is 0.9 kpps

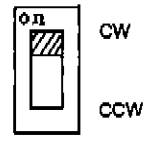


■ Origin search direction

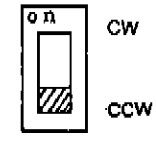
This is a switch to changeover origin search direction to forward (CW) direction or reverse (CCW) direction.

As for origin search, refer to item 3-3-3.

Setting : Forward direction



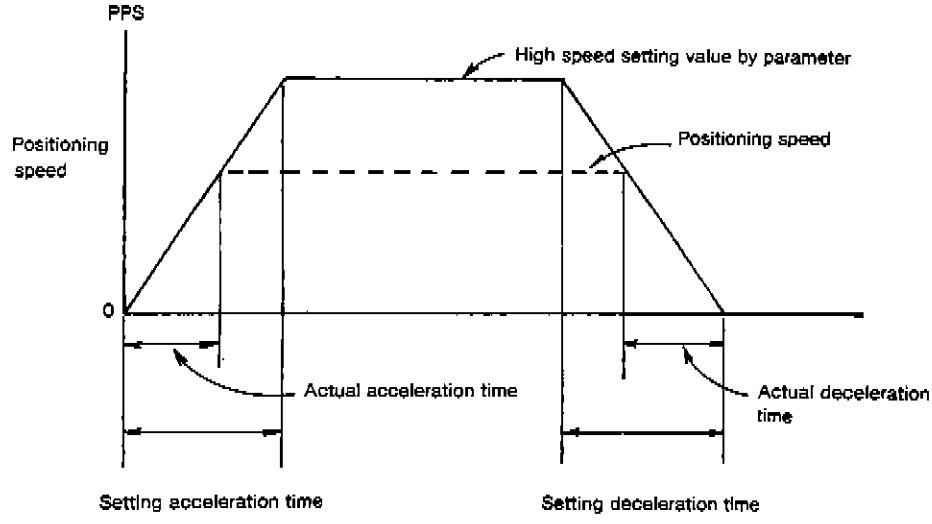
Setting : Reverse direction



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4-1-11. Acceleration and deceleration time

This is to set the time from start operation to reach high speed set in parameter.



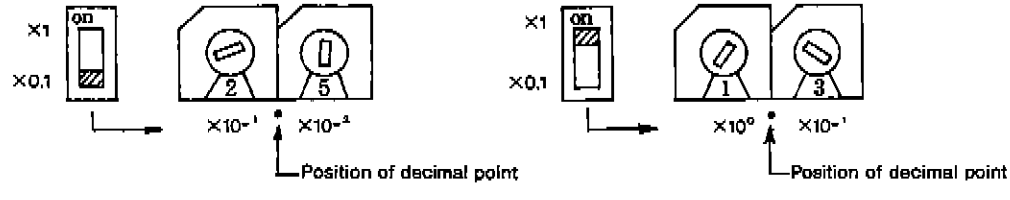
Acceleration time and deceleration time are equal. These are not set separately.
Acceleration and deceleration are controlled in fix rate. When positioning speed is set to lower speed that high speed set by parameter, accel./decel. time is shorter in proportion. On the other hand, when positioning speed is set to higher speed that high speed set by parameter, acceleration is longer in proportion. But it is proportionally increase to the highest positioning speed 200 kpps. As standard, accel./decel. control curve is trapezoidal figure. In case of few feed amount not to reach command positioning speed, or long accel./decel. time, accel/decel. control curve is compulsely made trapezoidal figure despite triangle figure by lower positioning speed.

(1) Setting unit : When × 1, 1 sec : When × 0.1, 0.1 sec

(2) Setting range : when × 1, 0.0-9.9, when × 0.1, 0.00-0.99

(3) Example of setting :

When setting is 0.25 sec When setting is 1.3 sec



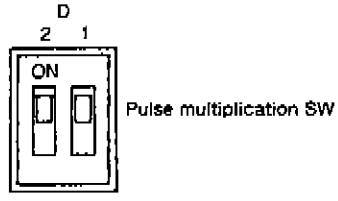
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4-1-12. Pulse multiplication rate of position detector

(1) This is to set multiplication rate of feedback pulse from position detector among 1,2,4 unit. For example, 500 pulses per rotation encoder substantially takes same precision as 1000 pulses and 2000 pulses.

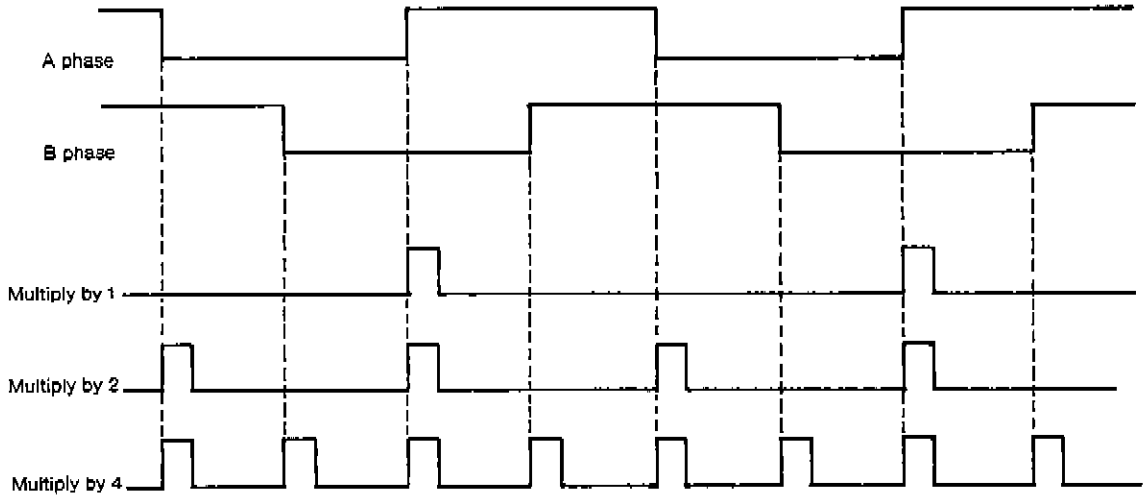
(2) By the following method, multiplication rate of 1,2 and 4 can be selected.

Pulse multiplication rate of position detector	D2	D1
1	OFF	OFF
2	OFF	ON
4	ON	OFF
0	ON	ON



● Note :
When pulse multiplication rate is set to "0" with encoder, servo lock abnormal is occur. (= "Counter over" flickers every 250 ms.)

(3) Phase of position detector



(4) Cautions

Positioning accuracy is increased if number of encoder pulse is substantially increased by pulse multiplication rate. But there may be an osciliation phenomenon. When these condition occur, take some measures such as decrease gain.

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4-1-13. Disconnection detection "with/without"

(1) Disconnection detection function at servo check can be changed with short pin (JT 1) in the I/O board. (As for the position JT 1, refer to 4-1)
Short : "with" disconnection detection
Open : "without" disconnection detection

(2) "With" disconnection detection has the same function as present type.

(3) "Without" disconnection detection checks reverse wiring only as follows.
(a) When Run Signal turns ON to servo driver first, speed command voltage by few pulses is sent.
(b) Check that no increase of the deflection counter for about one second.
(c) When the deflection counter increased, "Counter over" LED flickers every 250 ms.

Cautions

(1) "Without" disconnection detection, rotation direction change over SW (front panel SW. S2) becomes command voltage pole change SW of the present type. That is, automatic phase change is not executed. By this reason when disconnection is changed from "with" to "without", there may be possible to runaway motor.

(2) "Without" disconnection detection it takes about one second from Ready Signal ON to Positioning Finish Signal ON.

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4-2. ADJUSTMENT

4-2-1. Variable resistance

Though gain and zero balance variable resistances located on the front panel are factory-adjusted, adjust them if necessary.

■ Servo command gain minute adjustment (Gain)

This is to adjust the highest command voltage in accordance with the servo driver.

In case of the following :

Servo command voltage : 1000 rpm/6V

Rated rotation speed : 2000 rpm

If the maximum working rotation speed is 1500 rpm, adjust to MAX 9V.

For adjustment, put off "with/without" encoder setting (SI) and set pulse multiplication rate of position detector (D1, D2) to ON respectively. And make free the servo driver axis.

In manual mode, supply 2048 pulse to CW (forward) direction and voltage becomes 9V. When CCW (reverse) direction, supply 2048 pulse. So in this case,−9V is the adjusted voltage. Repeat this process for both directions several times.

■ Zero adjustment (zero balance)

This is the volume to make speed command voltage "0" when the amount of the deflection counter is "0". This is already factory adjusted to "0" volt. However, when this unit is connected to the servo motor system, the servo motor may get rotation power of one direction with the condition of analog GND. To adjust it, with output Run Command Signal, adjust driver side to "0" first. If this adjustment in driver side is not sufficient, set EC position of ST/EC changeover switch and adjust to flicker LED display (−/+) by "0" adjustment of this unit.

● Note :

Variable resistance volume vary from minimum to maximum value by three turn. When it is turned to more than three times, the value is kept on minimum or maximum value.

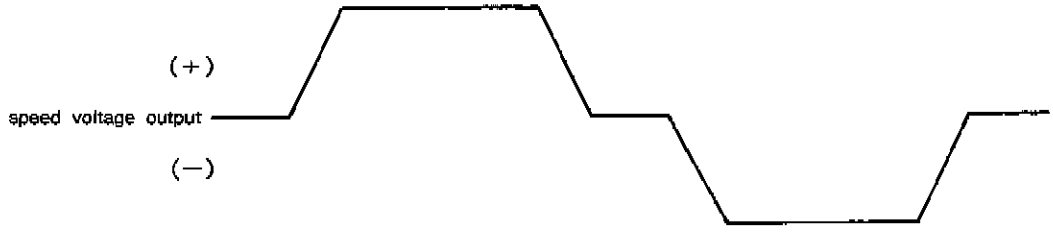
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4-2-2. Servo adjustment

When servo motor rotates normally after trial operation, adjust the unit connecting actual load to motor axis. The followings are the measures for this adjustment :

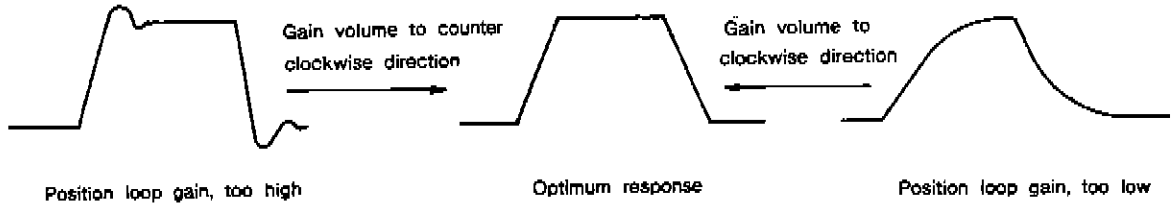
(1) Observe speed voltage output curve of the servo driver by a oscilloscope or the one with a memory function. In case of a DC servo motor, observes output from terminal TGFB +, TGFB − of tachogenerator as speed voltage (at 1000 rpm, about 7 V). In case of AC servo motor, observes output from terminal SDET, AG of CN4 (at two poles AC servo motor, 2000 rpm and 4.2V, at four poles AC servo motor, 1000 rpm and 4.2V).

(2) Making the servo motor rotate forward and reverse direction with high speed, monitor speed voltage output curve of the servo driver with oscilloscope.
The following is an example of response wave of the most suitable response.



(3) When overshoot or undershoot is occurs at up-going-edge or at down-going-edge of speed voltage output. This may be caused from high position loop gain. To solve this problem, turn servo command gain volume (gain) on the front panel of this unit to counter clockwise direction, and set at the optimum response (just before the condition in which overshoot or under shoot may occur in response waves.)

(4) When it takes much time to up-going/down-going of response waves of speed voltage output, position loop gain is too low. In this case, turn servo command gain volume (gain) to clockwise, and set to the optimum response (just before the condition in which overshoot or undershoot may occur in response waves).



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(5) When positioning takes much time because of too low position loop gain, raise high speed setting frequency and increase pulses for one rotation of position feed back.
When multiplication rate of this unit is one unit, change to two or four unit, when two unit, then change to four unit.

(6) When overshoot and undershoot of speed voltage output cannot be solved with the above mentioned adjustment, set accel./decel. time setting longer.
Also, to turn speed adjustment (MAXS) of the servo driver side to counter clockwise can make position loop gain smaller.

(7) When ripple occurs during up/down going of speed voltage output waves or plain wave, the servo driver should be adjusted again. In this case, adjust the servo driver referring to a manual of the servo driver.

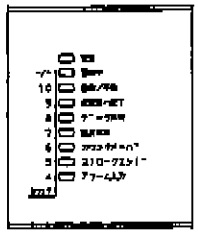
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5. MAINTENANCE AND TROUBLESHOOTING

5-1. LED Monitor Display Section

Among 9 LEDs on the front panel, one for indication of the power input, the other 8 LEDs are for indication of the alternative between status and the deflection counter by the indication changeover slide switch.

Display changeover slide switch	Display items
ST	Status
EC(counter)	Deflection counter



5-1-1. Status display

The contents of each LED and the methods to recover are as follows :
Generally, flicker indication of each LED means "Error" indication.

Name of LED	Indication	Contents	Recover
At operation	ON	Put on the command signal during operation	—
	Flicker every 1 sec	① Ready signal is OFF ② Initial Reset Signal is ON	Put on Ready Signal Turn OFF initial reset signal
	Flicker every 250m sec	① Run signal is turned off by servo alarm ② Stroke end LS is off during positioning.	① Put on servo alarm signal, then turn ready to operate signal from OFF to ON. ② Put on stroke end LS. then start feed.
	OFF	① Alarm input is off ② Abnormal servo lock (mis-wiring, no connection, mis-setting of INP) ③ CPU is out of order.	① Turn intial reset signal from ON to OFF ② Clear causes of abnormal, then turn on power source. ③ Put on power again.
Auto/Manual	ON	① At positioning with auto mode ② Selected auto mode other than above item 1)	—
	Flicker 250 ms	CPU is abnormal	Put on power source again
	OFF	① Positioning on manual mode ② Selected manual mode other than above item 1) case.	—

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Name of LED	Indication	Contents	Recover
Positioning finish	ON	① Positioning completed ② Occur condition to alarm output	① —— ② Clear causes of alarm
	OFF	① Positioning ② Ready signal is OFF.	① —— ② Turn ON Ready signal
Abnormal data	ON	① BCD format error of override or position data. ② Destined position exceeds feed limit range.	① ② Set data correctly and start feed.
	Flicker every 250 ms	Mis-setting parameter	Reset parameter and turn on Initial Reset signal.
Abnormal speed	ON	Amount of the deflection counter exceeds ± 8192	Check speed data and restart feed.
Counter over	ON	Except Auto Mode, the unit fed exceeds feed limit range	Restart feed again
	Flicker every 250 ms	① Servo lock abnormal (mis-connection, mis-setting INP and etc) ② Detected disconnection	① Clear causes and put on power source again ② Same as above
Stroke End	ON	One of CW or CCW stroke end LS is OFF	——
	Flicker every 250 ms	Detected chattering of Origin. Deceleration LS while origin search.	Clear causes and turn on Initial Reset Signal.
Alarm Input	ON	① Alarm Input is OFF. ② Servo Alarm is OFF.	① Release Alarm Input ② Release Servo Alarm
	Flicker every 1 sec	Interrupted positioning by Servo Alarm	Put on Ready Signal
	Flicker every 250 ms	Interrupted positioning by Alarm Input	Put on Initial Reset Signal

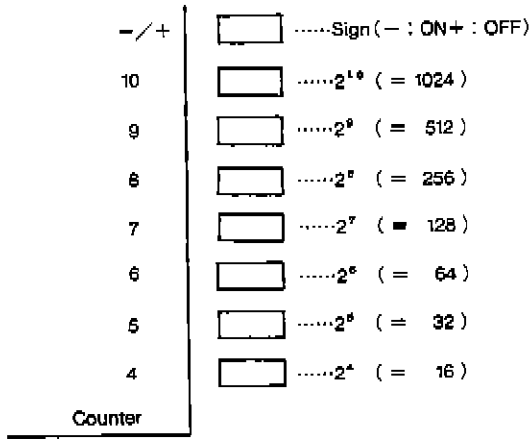
● Note :

1. LED which is not nominated "OFF" in display item means normal condition at "OFF".
2. In case of 3F88M-115F, Stroke End LED is unavailable, and turn OFF at any time.

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5-1-2. Deflection counter display

When display changeover slide switch is in EC (counter) side, this display shows upper 8 bits of the deflection counter.



Ex)

1. When all LEDs are on, this indicates that stored pulse amount of the deflection counter is −2047 to −2032.
2. When all LEDs are off, this indicates that stored pulse amount of deflection counter is 0 to 15.

There are two displays for the deflection counter display. One is for indicates the deflection counter which is output to D/A converter at present. The other is for indicates the deflection counter which is memorized at previous positioning.

(1) Display present deflection counter.

When servo motor is rotating or positioning is finished with deflection counter indication, the display indicate present contents of the deflection counter.

(2) Display memorized deflection counter

In this mode, memorized deflection counter is indicated every interval of divided into 10 of accel./dececl. time when the positioning is executed with Auto Start Signal or Return-to-origion signal. This is indicated when display changeover slide switch is shifted from ST to EC (counter) side at positioning finished.

Display procedure is as follows :

-Indicates memorized deflection counter at acceleration every 1 second

-Turn off two seconds.

-Indicates memorized deflection counter at deceleration every 1 second.

-Turn off.

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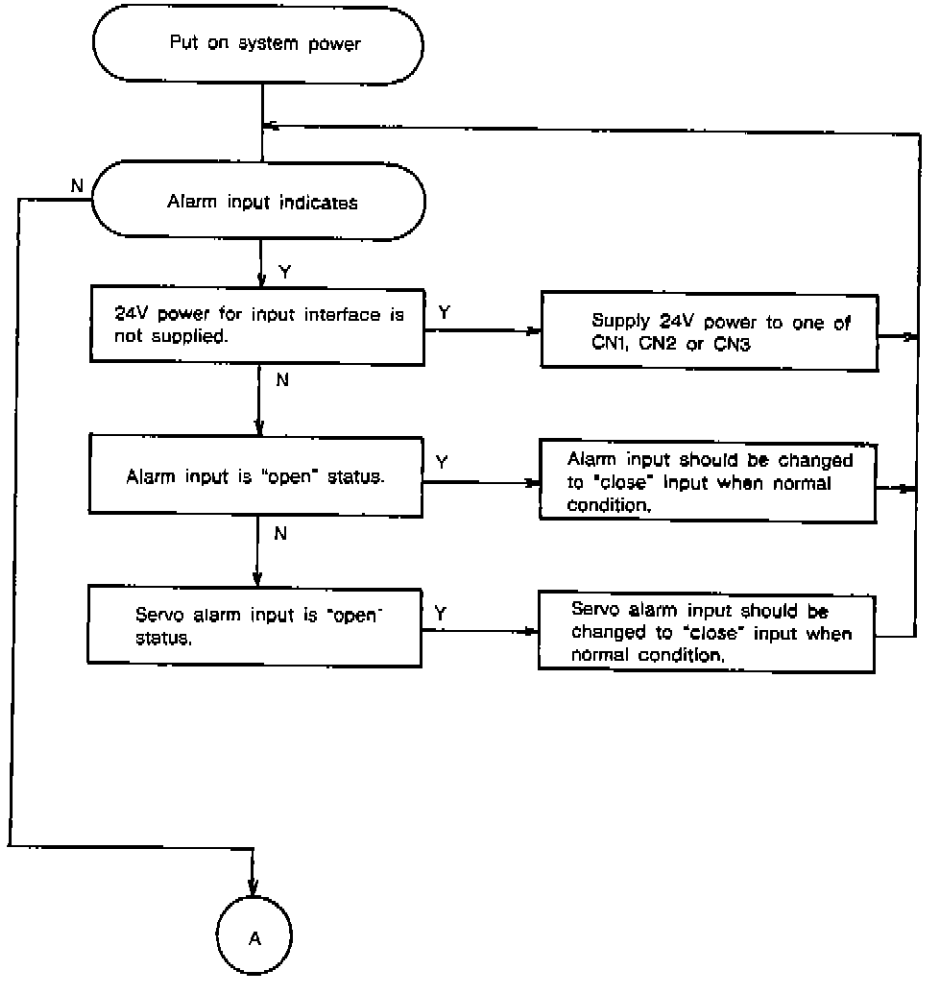
5-2. Trouble Shooting

When trouble occurs during test operation or auto operation, check this unit in accordance with this trouble check flow chart.

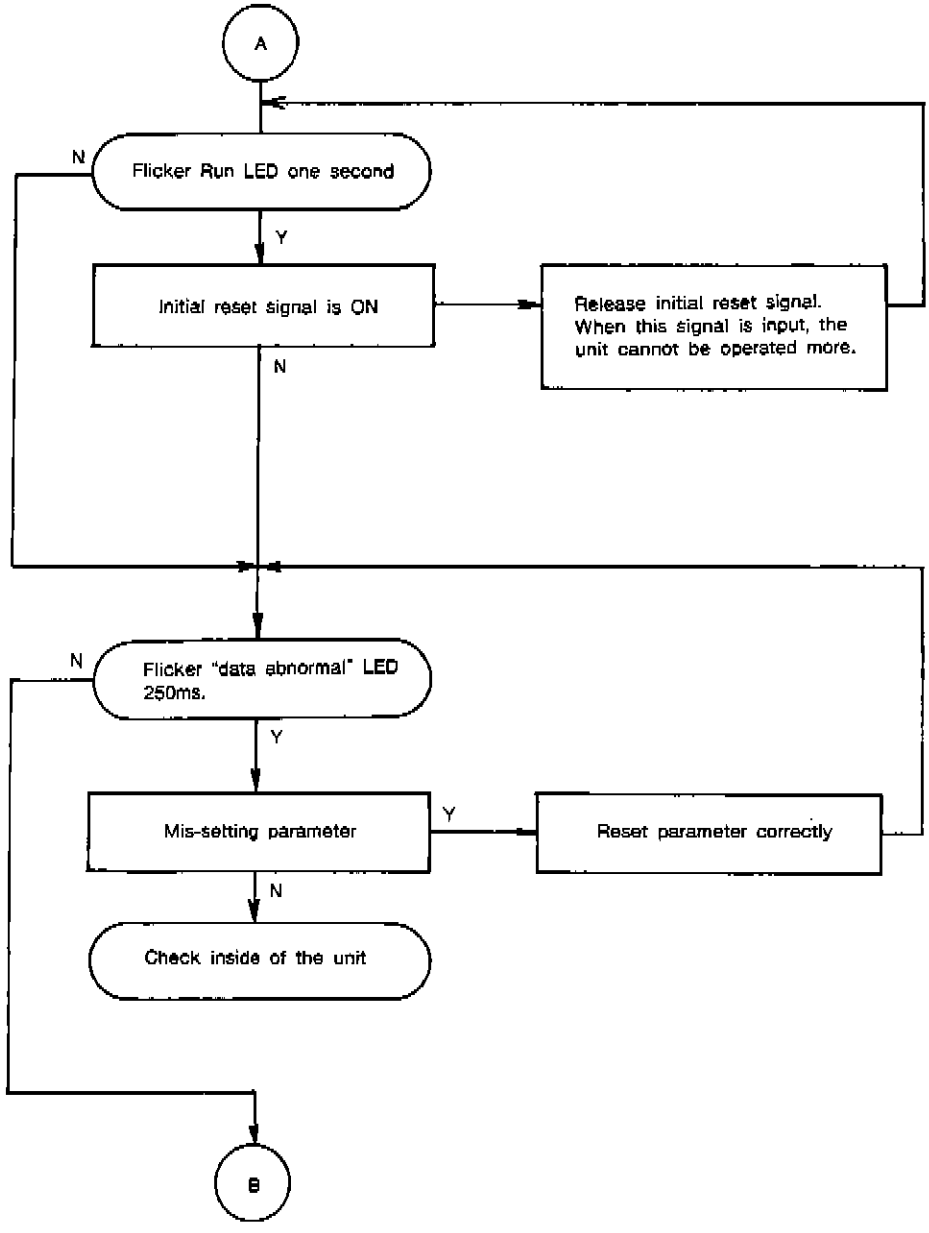
In this flow chart, check items for servo drivers and servo motors are not described. Thus, refer each instructions for these trouble.

When you check each function, refer input/output time chart for each explanation for functions.

5-2-1. Check flow chart from power on until ready for operation is finished.

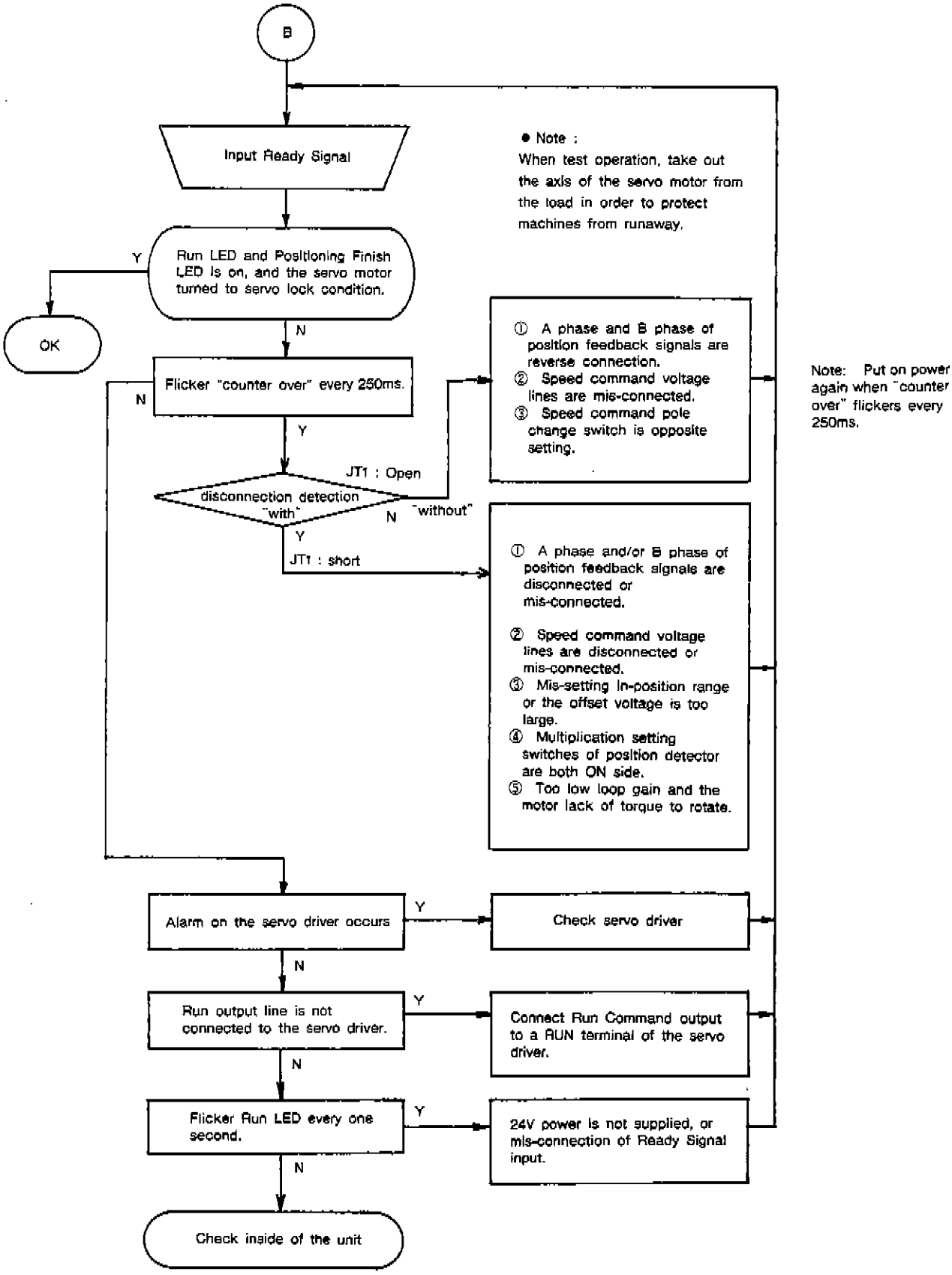


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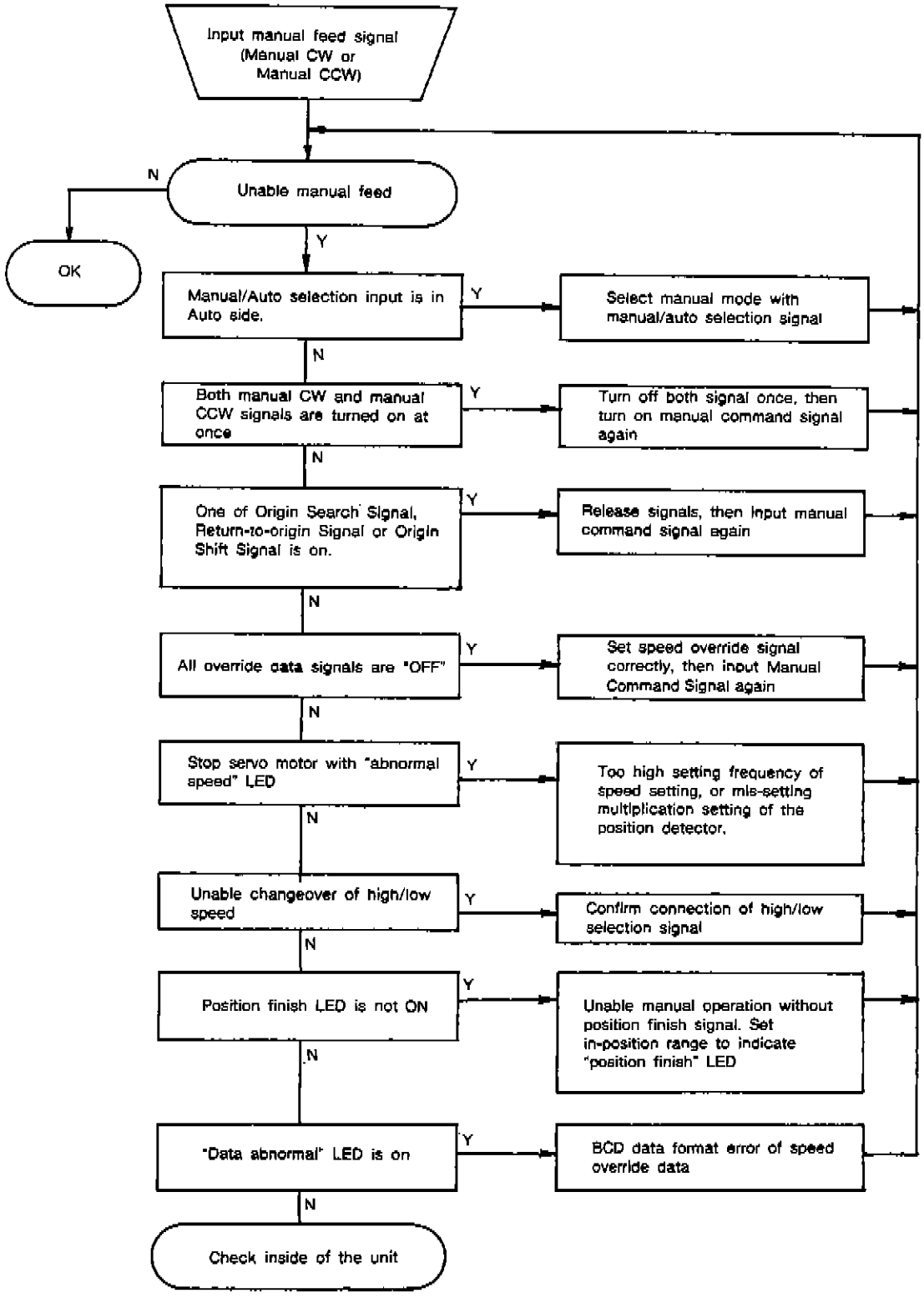
● Note : In case of mis-setting parameter, input initial reset for recover.

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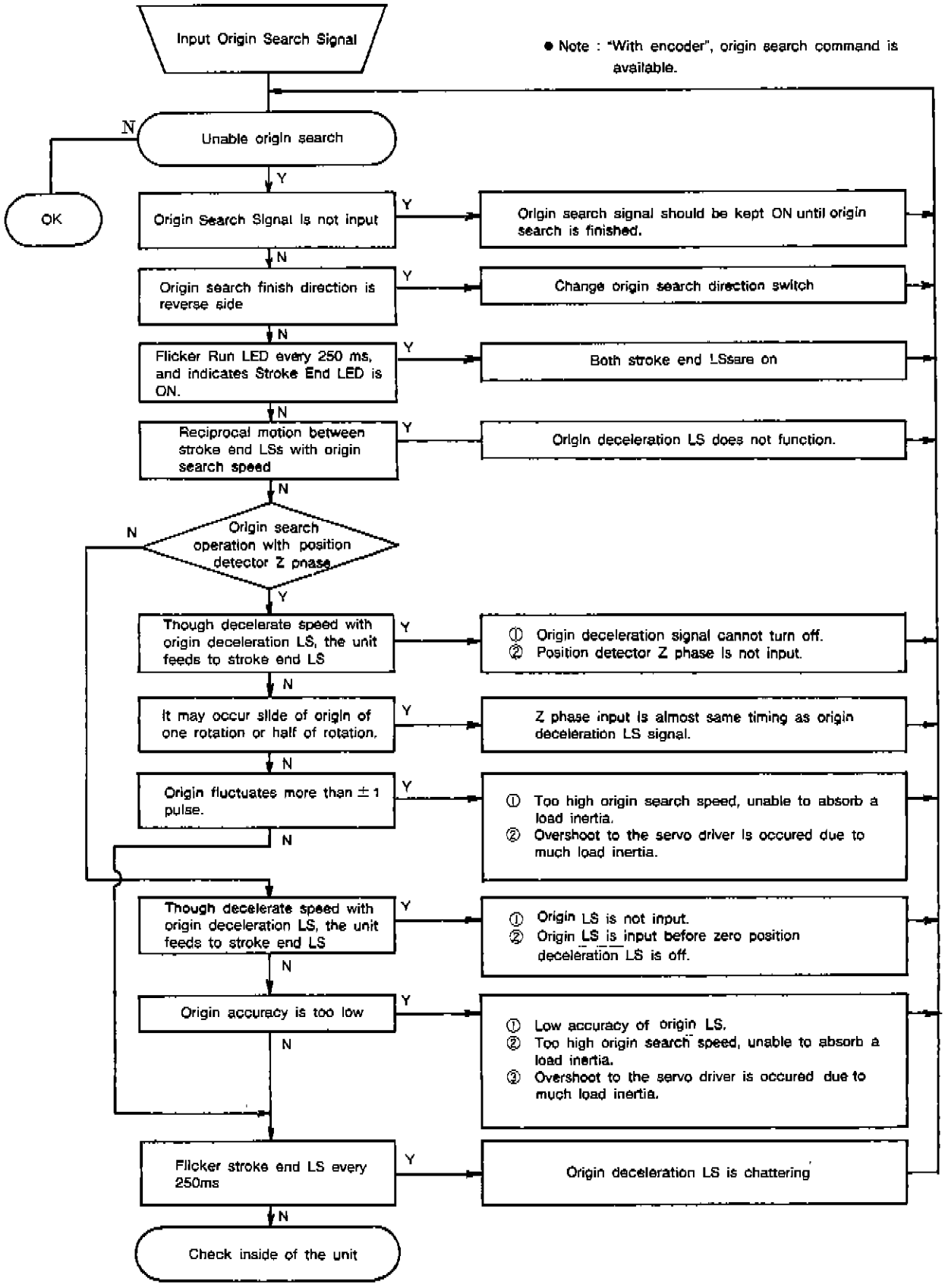
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5-2-2. Manual feed check flow chart



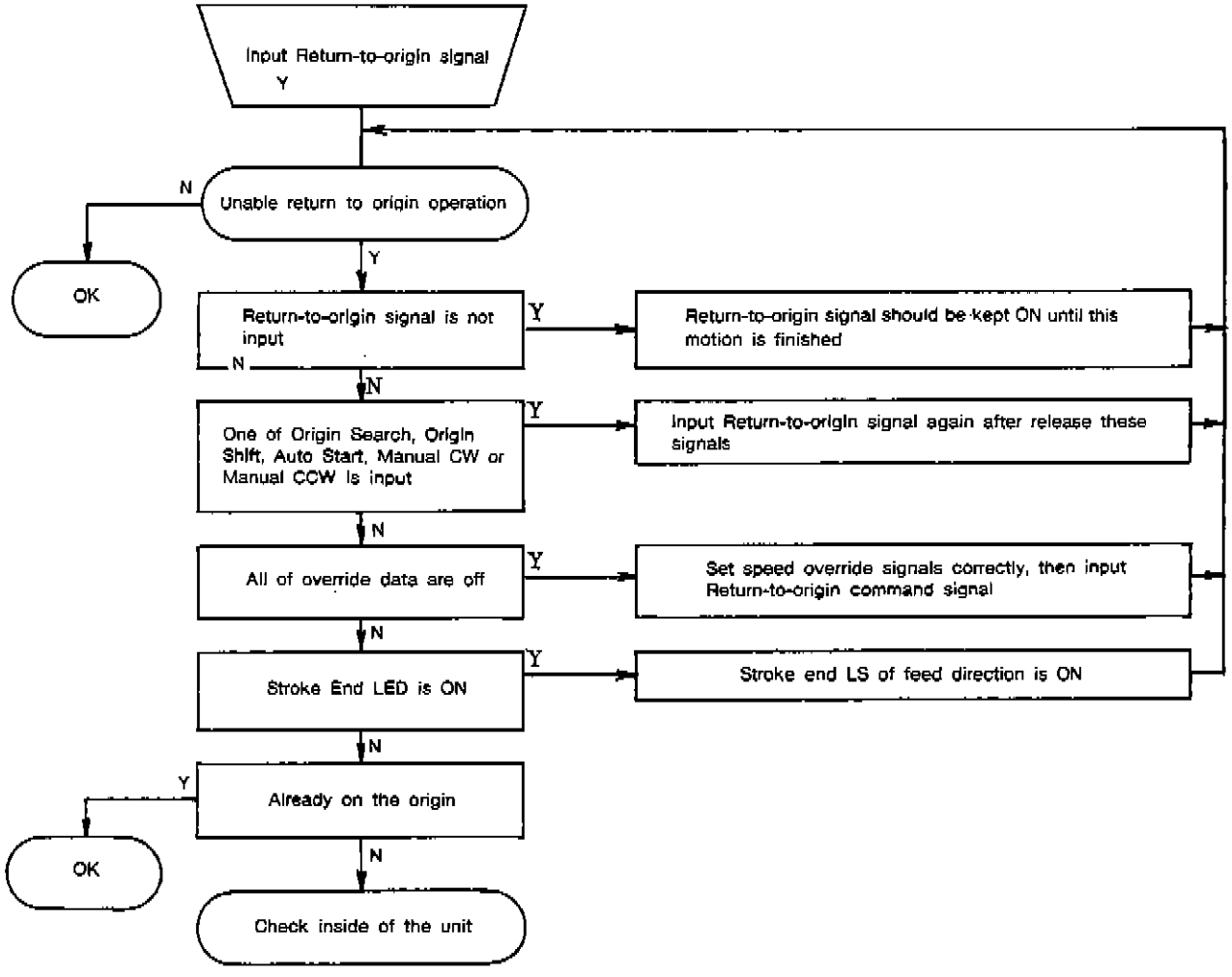
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5-2-3. Origin search check flow chart (in case of 3F88M-115A/MPG)



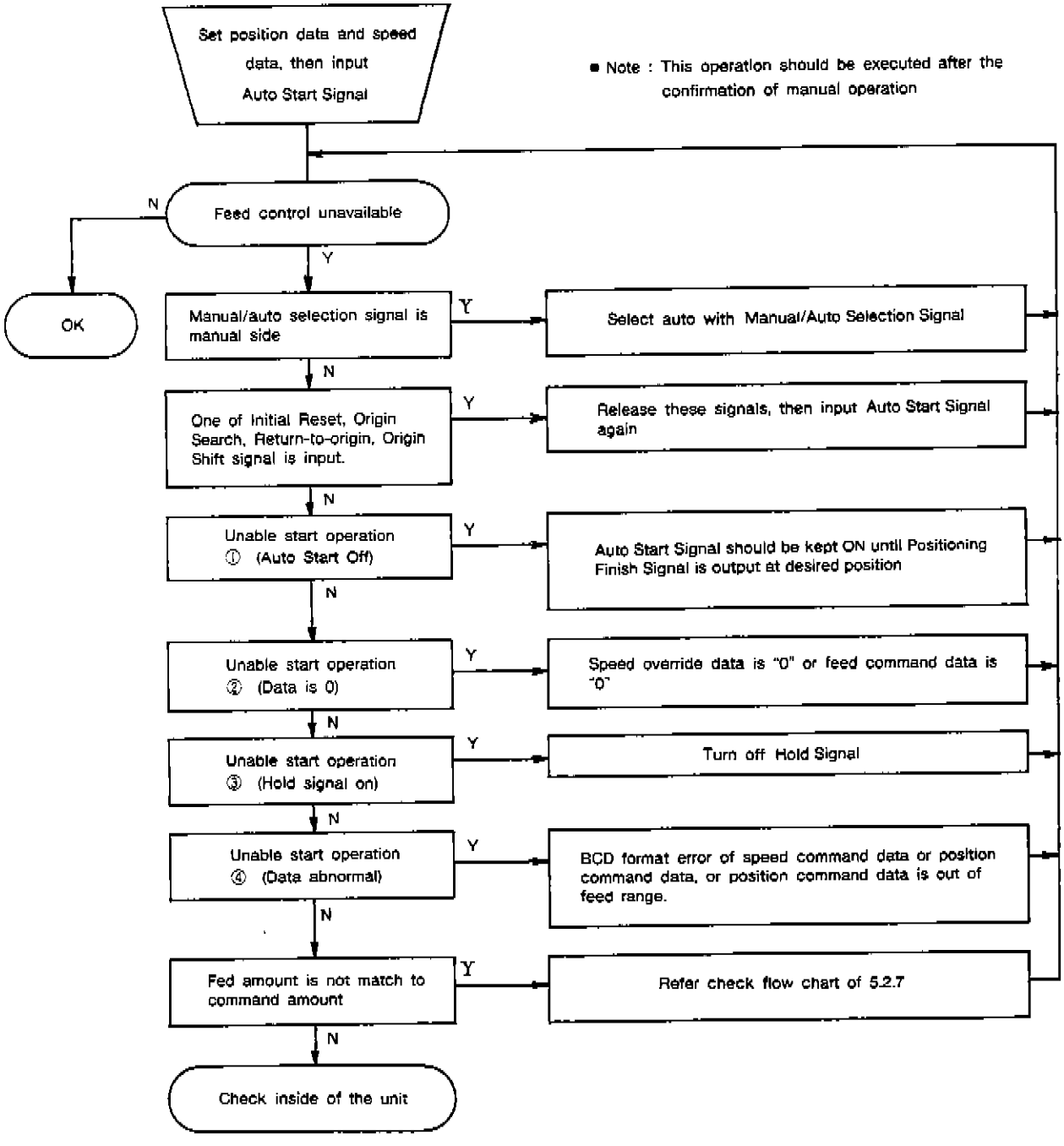
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5-2-4. Return-to-origin check flow chart (In case of 3F88M-115A/MPG)



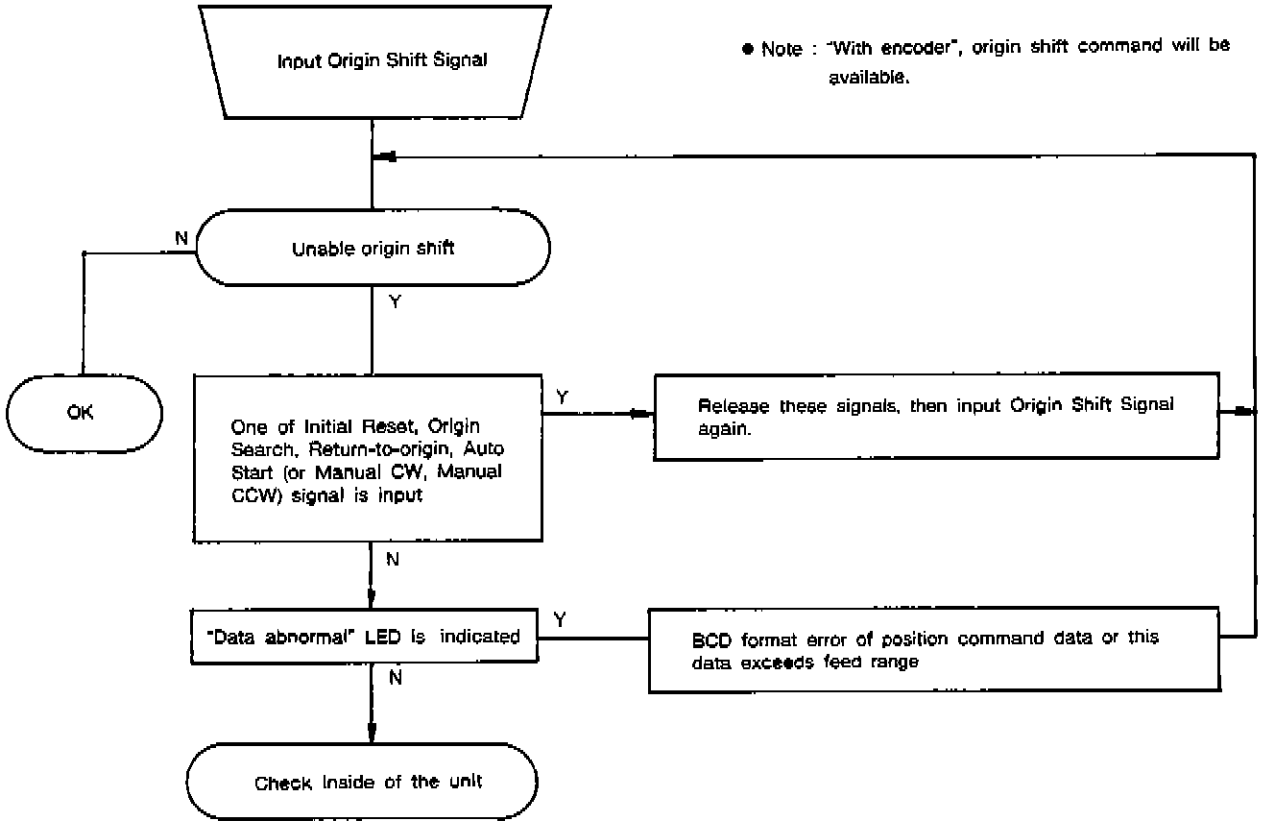
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5-2-5. Auto start check flow chart



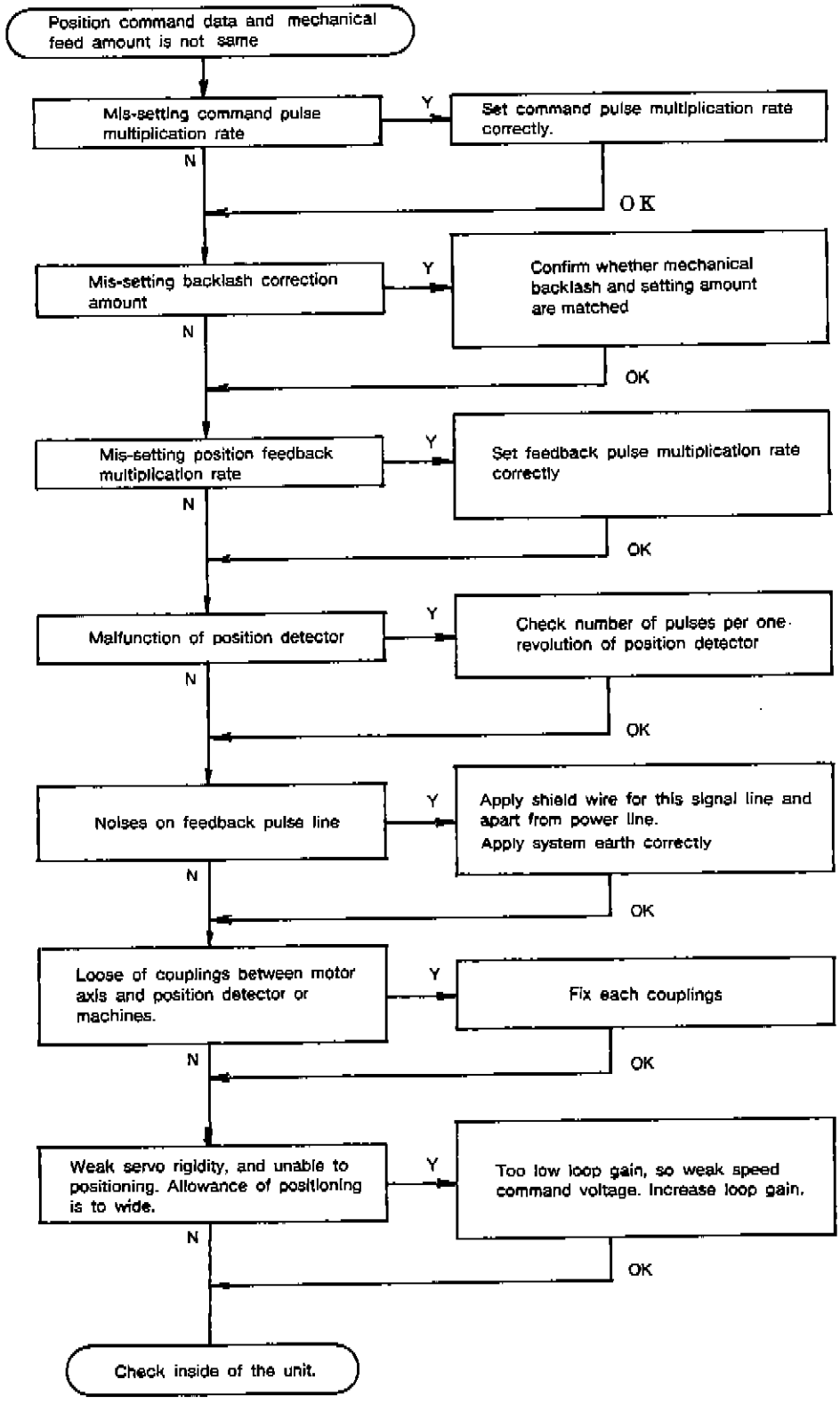
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5-2-6. Origin shift check flow chart (In case of 3F88M-115A/MPG)



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5-2-7. Mismatch position command data and mechanical feed amount



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