NIKKI AC SERVO CONTROLLER

N E X S RT

N C S － F I TYPE

N C S － F S TYPE

＜VOLUME: BASIC FUNCTION＞

I N S T R U C T I O N MANUAL

Ver. 1. 2

NIKKI DENSO CO.,LTD.

Manual No. TIE-12400B

Preface

Thank you for adopting Nikki Dedicated Function Control AC Servo Controller ＜ＮＥＸＳＲＴ　ＮＣＳ－ＦＩ／ＦＳ series＞.

＜ＮＥＸＳＲＴ　ＮＣＳ－ＦＩ／ＦＳ series＞ is a high performance and multi-function controller, high speed and very accurate full digital AC servo combined with 1 axis NC which was developed by our long term experience of servo know-how, and sophisticated / latest technology.

Using the function and performance effectively which conventional units do not have, new function can be available to your machine system, consequently additional value will be increased.

【Notice of this manual】

This instruction manual explains about installation, wiring, operation, maintenance, trouble diagnosis, shooting, and etc. of the AC servo controller, NCS-FI/FS series .
In order for you to use this unit properly, please deeply understand the contents of this manual.
At the time of installation, wiring, operation, maintenance, etc., please follow the conditions and guidance procedure of this manual.
As for setting and display contents of an applied controller, please refer to the separate instruction manual (Volume Dedicated Function).
Description in the instruction manual (Volume Dedicated Function) is prior to the same item description of this manual if both are not identical.

【Warranty period】

Warranty period of our product is 1 year after shipping from our factory.
However please note that any failure or abnormality resulting from the following causes is not covered by our warranty.

① Modification by parties other than NIKKI DENSO
② None standard operation different from the description in our manual.
③ Natural disasters
④ Connection with an other maker's unit not approved by us.

When you find a failure or an abnormality during the warranty period, please contact our sales man.

When you receive the ordered units, please immediately check outlook of them and presence of accessories.
At unpacking if outlook of units is abnormal, non-specified accessories are found, or quantity is wrong, please do not use them and inform the results to our sales man.

※ NIKKI DENSO retains the right to revise this publication no matter how it is altered. Although the information from NIKKI DENSO is reliable, NIKKI DENSO will not assume responsibility whatever results may arise from the use of this information unless specially guaranteed by NIKKI DENSO.

Cautions for Safety

Before conducting installation, running, maintenance, and inspection, please deeply understand this manual, and all associated manuals / materials as well as the knowledge of all the applied equipment and information for safety and then use this unit properly.

In this manual, cautions for safety are ranked as『Danger』and『Caution』.
And cautions for handling are divided into 『Prohibition』and 『Compulsion』which are defined (Action not to be done) and (Action to be done.), respectively.

Danger : If mis-handling is made, dangerous situation as death or serious injury could occur.

Caution : If mis-handling is made, dangerous situation as medium or light injury and mechanical damage could occur.

However, (Caution) marked item could cause serious results depending on the actual situation. Since both of the above description include important contents, please be sure to follow them.

Prohibition : **Prohibited action**

If this caution is ignored, this unit does not perform properly.

Compulsion : **Compulsory action**

If this is ignored, this unit does not perform properly.

【Cautions when using unit】

⚠ Danger

☆ Since electric shock and injury may occur, please comply with the following suggestions.

① Never touch inside of this unit (AC servo controller) and terminal blocks.
『Electric shock may occur.』

② Be sure to make grounding of an earth terminal or lead wire of this unit (AC servo controller).
Use larger earth cables for JIS Class 3 or better grounding.
『Electric shock may occur.』

③ Transportation, wiring, maintenance, and inspection shall be conducted stipulated time after confirming complete lit off condition of front panel display, by power off.
『Electric shock may occur.』

④ Do not damage, force excessively, put on heavy thing, or nip cables.
『Electric shock may occur.』

⑤ Never touch rotating section of a running motor.
『Injury may occur.』

⚠ Caution

① Use specified motor and this unit (AC servo controller).
『Fire or failure may occur.』

② Never use in the atmosphere such as water splash, corrosive or low flashing point gas and near flammable things.
『Fire or failure may occur.』

③ Since temperature of a motor, this unit (AC servo controller), and peripherals raises quite high, do not touch them.
『Burn of a worker may occur.』

④ In supplying power, or for a while after shutting power off, since a radiator, a regenerative unit, a motor etc. could be very hot, do not touch them.
『Burn of a worker may occur.』

【Receiving and checking of packages】

⚠ Caution

① When you receive ordered units, please check contents. if wrong thing is found or quantity is wrong, please do not use them and inform the status to our sales man.
『Electric shock, injury, damage or failure may occur.』

② If packages of our products are broken, do not un-pack them and inform the fact to our sales man.
『Electric shock, injury, damage or failure may occur.』

【Storage】

⃠ Prohibition

① Do not store units in a place of raining, water dripping, and harmful gas / liquid.

❗ Compulsion

① Store units in a place of no sun-shine but controlled temperature / humidity within specified range.
② If storage term became quite long, please consult purchased or nearest sales office before using them.

【Transportation】

⚠ Caution

① Do not hold a cable and a motor shaft during transporting units.
『Injury or failure may occur.』

❗ Compulsion

① Comply with proper suggestion and avoid excess amount transportation which may break the whole package.

【Installation】

⚠ Caution

① Do not climb or put any heavy thing on this unit.
『Injury or failure may occur.』
② Do not disturb or choke intake / outlet air holes with foreign thing.
『Fire may occur.』
③ Use specified direction for installation.
『Fire or failure may occur.』
④ Keep specified distance between this unit and control panel inside or other equipment.
『Fire or failure may occur.』
⑤ Never apply heavy shock to this unit.
『This unit may be damaged.』
⑥ Conduct proper attachment suitable for the output or weight of this unit.
『This unit may be damaged.』
⑦ Attach this unit to non-flammable thing as metal.
『Fire may occur.』

【Wiring】

⚠ Caution

① Be sure to conduct correct wiring.
『Running away, burning of a motor, injury or fire may occur.』
② To prevent this unit from noise influence, use specified length treated (shielded / twisted, etc.) cables.
『Running away of a motor, injury or machine damage may occur.』
③ To prevent this unit (NC servo controller) from noise influence, use separate control I/O cables of the unit from other power cables.
『Running away of a motor, injury or machine damage may occur.』
④ To avoid electric shock and noise influence, be sure to make proper grounding (earthing).
『Running away of a motor, electric shock, injury or machine damage may occur.』

【Operation・Run】

⚠ Caution

① There is no applicable protection to motors. For the protection, over-current protector, earth leakage breaker, over-heat protector, and emergency stop device shall be provided.
『Injury or fire may occur.』

② Confirm that power source specification is correct.
『Injury, fire or machine damage may occur.』

③ At test run, fix a motor to a place separating from its machine system and confirm the motion, then connect the motor to the machine.
『Injury or machine damage may occur.』

④ Since the brake is only for holding machine position, do not use it for safety system of your machine.
『Injury or machine damage may occur.』

⑤ Since excess adjustment change may cause this unit unstable, avoid this situation.
『Injury or machine damage may occur.』

⑥ When an alarm occurs, eliminate the cause, reset the alarm and then resume this unit.
『Injury or machine damage may occur.』

⑦ When power recovers from black out status, since sudden restart may occur, do not approach the machine.
(Machine system design shall be considered to maintain safety of workers against the restart.)
『Injury may occur.』

⃠ Prohibition

① Do not apply power in the motor turning or vibrating status.
『Running away of a motor, injury or machine damage may occur.』

② Since the brake installed on a motor is only for holding, do not use it for actual braking.

❗ Compulsion

① Provide external shut down circuit in order to stop running and shut the power off, immediately.

【Maintenance・Inspection】

⚠ Caution

① Capacity of condensers in the power line will be deteriorated.
To prevent secondary damage caused by condenser failure, we recommend to replace them for about every 5 years.
『Failure may occur.』

② Cooling efficiency of a cooling motor will be deteriorated as time going.
To prevent secondary damage caused by condenser failure, we recommend to replace them for about every 5 years.
『Failure may occur.』

⃠ Prohibition

① Overhaul / repair shall be conducted only by us or suggested shop.

Contents

Chapter 1 Outline

1－1 Feature

＜ＮＥＸＳＲＴ　ＮＣＳ－ＦＩ／ＦＳ Series＞ is a high performance and multi-function controller, high speed and very accurate full digital AC servo combined with 1 axis NC which was developed by our long term experience of servo know-how and sophisticated / latest technology.

NCS-FI/FS (Hereafter, this unit or controller is used.) is a general name of the following 2 types which function and operation are identical.

NCS-FI type：AC servo controller for induction AC servo motor
NCS-FS type：AC servo controller for synchronous AC servo motor

This unit has several following features suitable for positioning control of various industrial machines.

【NCS-FI/FS series features】

① By combining 1 axis positioning unit with AC servo driver, less wiring system and compact size were realized.
② Full digital control achieved less temperature drift, fine adjustment, strengthened Man-machine interface, and etc., seeking for better reliability and easier operation.
③ The custom made LCD module supports each Monitoring, Alarm history record, Self-diagnostic function, and etc. . And reliability and maintenance method are improved.
④ Many custom made LSIs and less wiring structure improved reliability and realized compact size of this unit.
⑤ Adoption of IPM (IGBT) in the power switching section, improved servo performance and lowered noise.
⑥ Either Positioning run, or Pulse train run mode can be selected for wide range of application requirements.
⑦ Internal stored data positioning and External trigger positioning can be conducted.
⑧ Position data and speed data can be set by Index data.
⑨ The electronic gear realized Ratio synchronizing control by Pulse train.
⑩ Control such as Linear / S shape curve accel./decel. , Feed-forward, Torque command filter, gain change at stop status, R2 compensation, Non-coherence, etc. can be conducted by advanced software servo suitable for machine rigidity.
⑪ By setting a parameter, one unit can be available for various AC servo motor types.
⑫ Through Serial communication, peripherals as host computer, personal computer, PT, servo display, MDI, and etc. can be interfaced.
⑬ A sequencer (BCD data) can be interfaced. ＊1
⑭ Zero return is not neccessory by using an optional absolute encoder.
⑮ By Pulse train communication, Synchronizing control of max. 10 axes can be conducted.
⑯ 1 controller with sequence control can conduct sequence control of max.16 axes. ＊1
⑰ Either induction servo motor or synchronous servo motor can be controlled by same operation.

＊1：Some types have the function.

1－2 Types

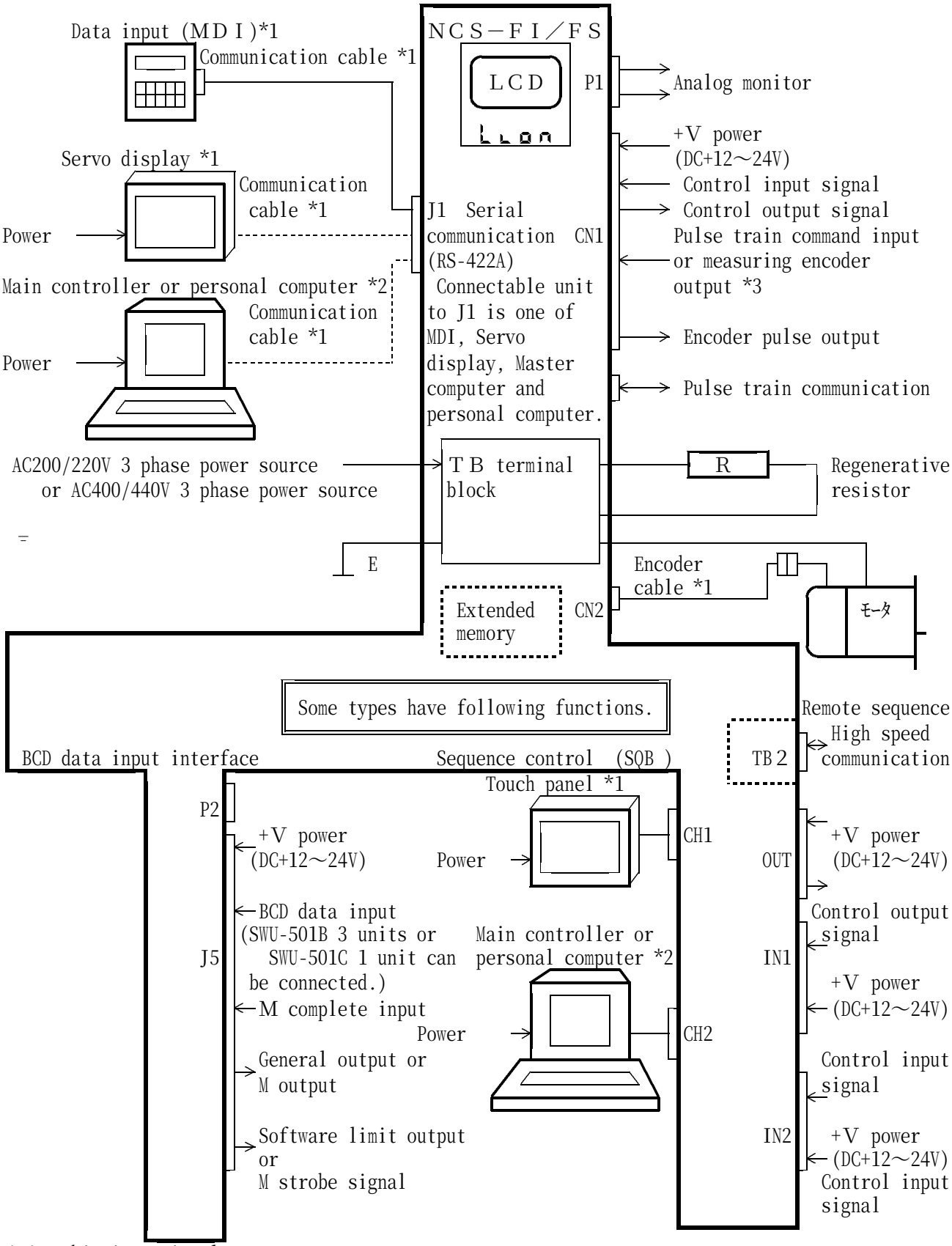
＜ＮＥＸＳＲＴ ＮＣＳ－ＦＩ／ＦＳ series＞ is divided into 5 types by dedicated functions. As for details of individual features, peripheral system configuration, functions, and etc., please refer to the separate instruction manual (Volume: Dedicated function).

Type	Name	Summary of functions
ＮＣＳ－ＦＩ１ ＮＣＳ－ＦＳ１	Stop point positi-oning control	1 axis positioning or individual independent axis control of plural axis system consisted of several axes.
ＮＣＳ－ＦＩ２ ＮＣＳ－ＦＳ２	Integrated control	Integrated control of servo driver, NC, and sequencer for 1 axis or small size machine system.
ＮＣＳ－ＦＩ３ ＮＣＳ－ＦＳ３	Travel positioning control	Synchronizing of a cutter, press ram, and etc., and machining of a traveling work at specified length can be conducted.
ＮＣＳ－ＦＩ４ ＮＣＳ－ＦＳ４	Synchronizing control	Ratio synchronizing control by pulse train Synchronizing control to a master shaft, a line and etc. can be widely applied.
ＮＣＳ－ＦＩ６ ＮＣＳ－ＦＳ６	Free curve motion control	A slave axis is synchronized to a master axis (base axis) and conducts continuous positioning and free curve motion. Three dimensional motion of a slave axis can also be conducted. And also, Cycle run of fixed motion pattern set by a parameter is possible without specifying base axis.

［Tab.１－１］ Controller type and name

1－3　System configuration

Peripheral system configuration of NCS-FI/FS unit is as ［Fig.1－1］.



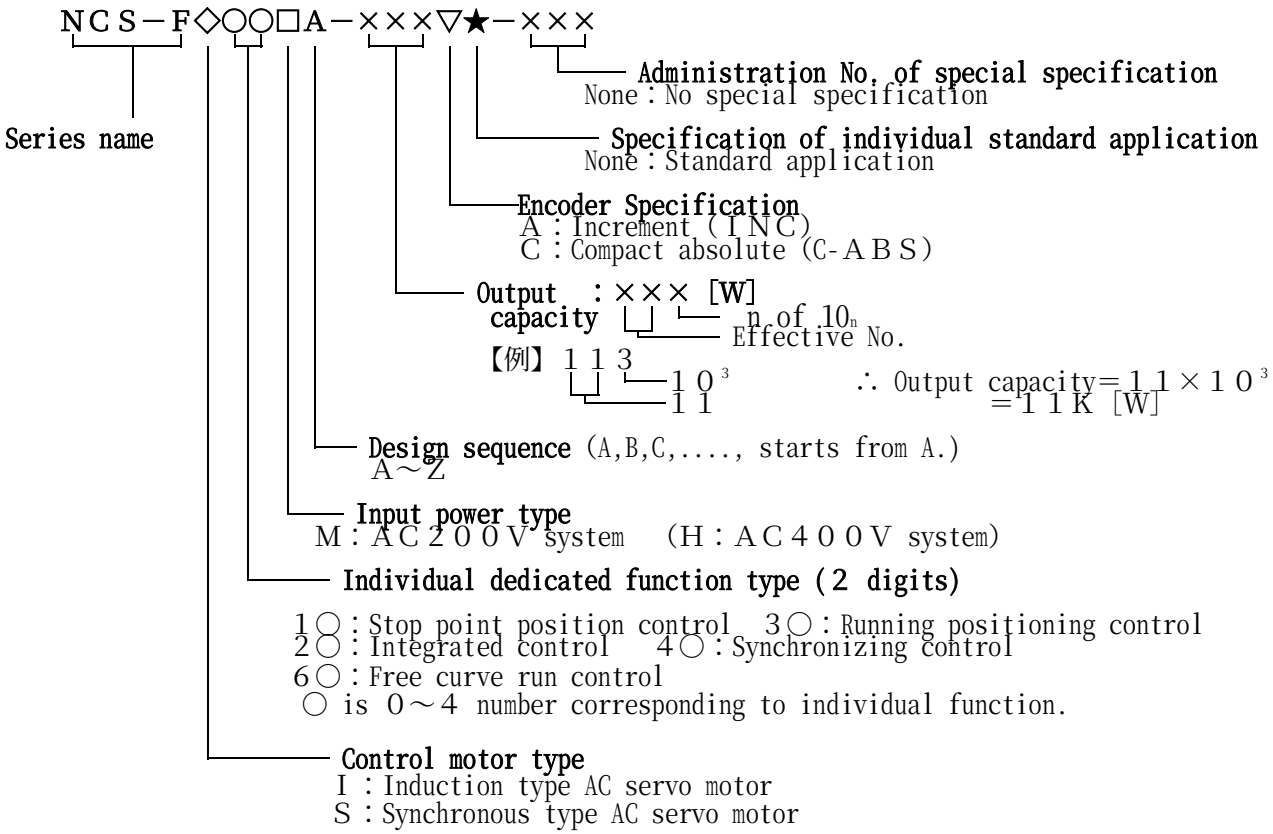
＊1：This is optional.
＊2：Please use an unit on the general market.
＊3：It can be changed to feedback pulse input from a measuring encoder by setting a parameter.

※ NCS-FI/FS series system configuration is depending on a type.
For more details, please refer to separate instruction manual (Volume Dedicated function).

［Figure 1－1］　System configuration

Chapter 2 Specification

2－1 Types



[Fig.2－1] Type display

2－2 General Specification

Item		Contents
Outline		Refer to「Controller outline」.
Environment.	Tempera.	0～55℃ (Unit circumference) / Stored temp. －20～60℃
	Humidity	85% or less, non-condensing
	Altitude	1000m or less
	Location	Do not install it in harmful atmosphere, such as corrosive gas, grinding oil, metal powder, oil, etc.
Power source		NCS-FI**M／NCS-FS**M : 3 phase AC180～242V, 50/60Hz (NCS-FI**H : 3 phase AC360～484V, 50/60Hz)
Cooling method		Forced air cooling / Natural air cooling (NCS-FI**M-401/801 only)
Mount.method		Panel mounting type (Until NCS-FI/FS**M-401～113 versions, imbedded mounting can be optionally applied at our factory.)
Vibration resistance		0．5G （10～50Hz）
Shock resist.		5G
Noise resistance		Line noise : 2000V (50ns, 1μs) 1 minute Radiation noise : 1000V (50ns／10cm) 1 minute Electro-static noise : 10kV (between earth and case)
Accessories		Regenerative resistor (with thermostat)

※ Controller rating (electric specification) can be referred to
[10-1 Electric specification of controller]

[Tab.2－1] General specification

2－3 Function specification

Item	Contents ・ Specification	
Number of axes	1 axis	
Max. speed	1Mpps (4 times of encoder pulse frequency)	
Control factor	Position (Position control data / Pulse train)	
Control method	Position control ┬ Auto. run (Positioning) └ Pulse train run	
Command input types	Auto. run	① Internal stored data 280 points (Address 0～255 set by control signal) ② Serial communication 《BCD data input by a digital switch or a sequencer can be conducted for some types.》
	Pulse train command	① 90° different phase pulse ② Directional pulse ③ Directional signal + feed pulse 《Either Line driver method or Open collector method output can be used. However in the point of noise resistance, Line driver method is recommended.》 ④ Pulse train communication pulse
Major function	Zero return run, Manual (Jog) run, Pulse train run, Serial communication run, Program run (Positioning, Simple continuous positioning, External trigger positioning, Four rules of arithmetic / Logic computing, Timer, Un-conditional / Conditional jump, Sub-routine, Spinner control), Self-diagnosis, Torque limit, Backlash compensation, Feed-forward ratio set, Electric gear ratio set, Feedback (encoder pulse) division output, Electric thermal	
Accel./Decel. pattern	Linear accel./decel., S shape accel./decel	
Input signal	[36 kinds] Servo ON (SON(*)), Emergency stop (EMG*), Reset (RST), Remote / Local change (PC), Mode selection (MD1,MD2), Auto. start (PST), Address set (SS1～PS8), Forward jog (FJ), Reverse jog (RJ), Hold (HLD), Speed override (OR1～4), Deviation clear (CLR), Command pulse input inhibit (CIH(*)), External trigger (TRG), Zero point decel. (ZLS), Forward over travel (FOT*), Reverse over travel (ROT*) <Below signals can be allocated by Remote control or input signal allocation and used.> M complete (MFIN), Block stop (BSTP), Program cancel (PCAN), Speed gain selection (GSEL), Forced brake ON (BRON), Torque limit (TL), External auto. stop inhibit (EPIH), Jog speed change (JOSP)	
Output signal	[34 kinds] Servo ready (RDY), Alarm (ALM(*)), Warning (WNG(*)), In torque limit (LIM), Speed zero (SZ), Positioning complete (PN), Brake release (BRK), Rough matching (PRF) <Below signals can be allocated by Remote control or output signal allocation and used.> Program end (PEND), Auto. run ready (PRDY), In Manual run (MMOD), In Auto. run (AMOD), In Remote mode (RMOD), In Zero return run (HMOD), In Pulse train run (PMOD), M strobe (MSTB), Software limit switch (SLSA,SLSB), General output (OUT1～8), M output (M01～M80)	
Operation / display func.	Individual data input and status can be displayed on the front panel LCD module.	
Monitor function	① Signal status is displayed on the signal display section of the front panel LCD module. ② Individual motion status, setting status (data), and detected abnormal cause history is displayed on the signal display section of the front panel LCD module. ③ Analog monitor : 2 kinds (2 kinds out of several motion status can be selected and monitored.)	
Data memory function	Next data are retained by non-volatile memory. Parameter, Command, Index data (Partial) , Alarm history (Last 5 cause history is retained.), (Non-volatilel memory can be re-written up to 10000 times.)	
Protective function	IPM fault, Over voltage, Under voltage, Over speed, Over load (electric thermal), Deviation overflow, Communication error, Data error, CPU fault, Encoder fault, Absolute encoder fault, etc.	
Communication function	Various data can be transmitted and received by Serial communication (RS-422A) .	

[Tab. 2－2] Function specification

2－4 Outline type

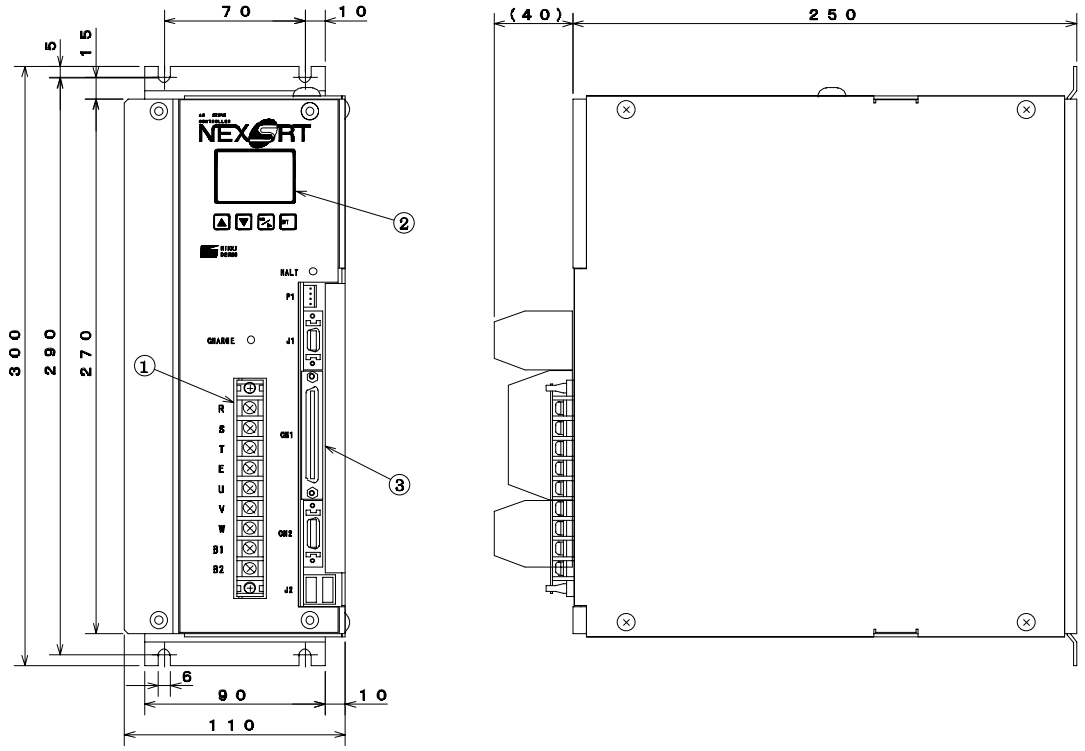
Outline types of NCS-FI/FS are as below.

Outline type	Dedicated function type (Type○○)	Encoder spec. (Type▽)
ＴＹＰＥ１	１０、３０、４０，６０	Ａ
ＴＹＰＥ２	１０、３０、４０，６０	Ｃ
ＴＹＰＥ３	１２，１３，３１，３２ ４１，４２　６１，６２	ＡｏｒＣ
ＴＹＰＥ４	２２，２３，３３，３４ ４３，４４，６３，６４	ＡｏｒＣ

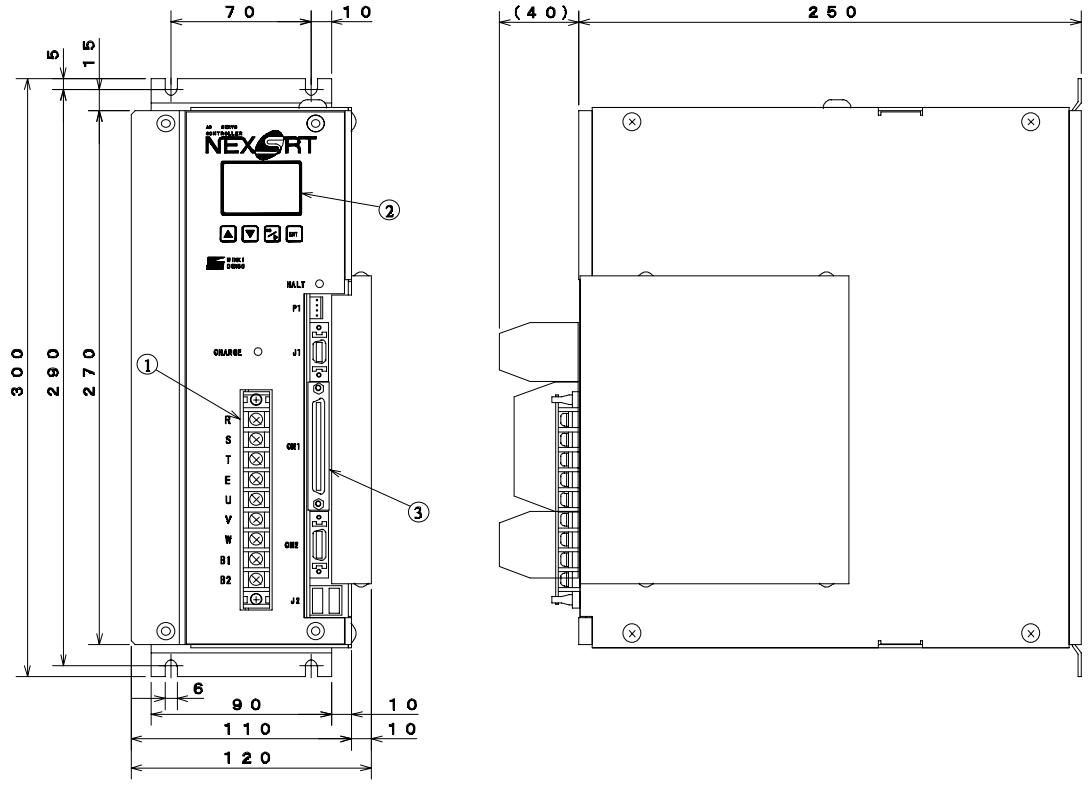
[Tab.２－３]　　Controller type list

2－5　Outline

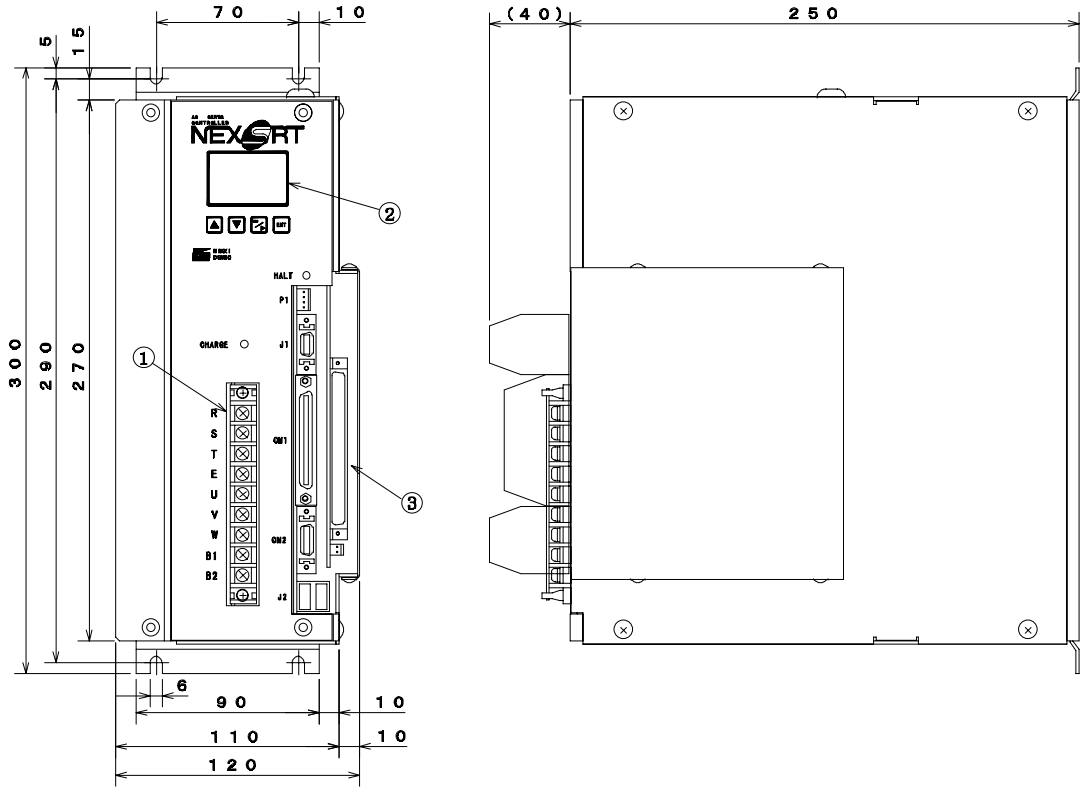
2－5－1　　ＮＣＳ－ＦＩ＊＊－４０１／８０１



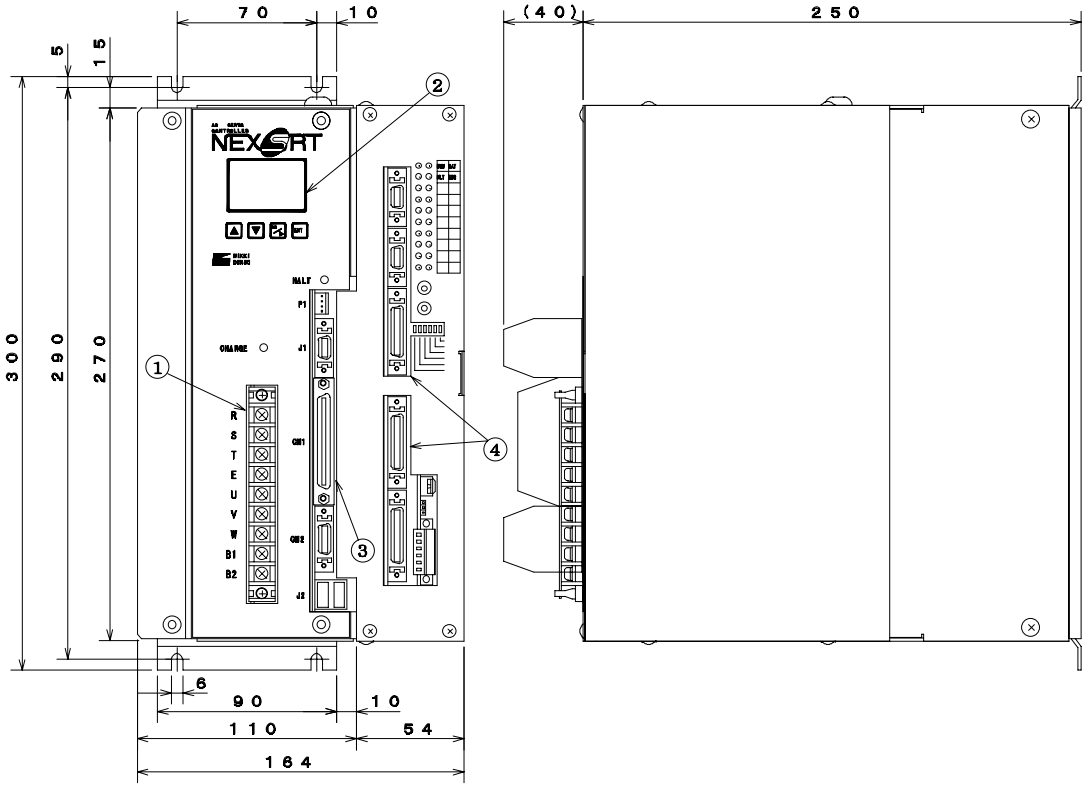
ＴＹＰＥ１：ＮＣＳ－ＦＩ＊＊Ｍ－４０１Ａ／８０１Ａ　　(**=10,30,40,60)



ＴＹＰＥ２：ＮＣＳ－ＦＩ＊＊Ｍ－４０１Ｃ／８０１Ｃ　　(**=10,30,40,60)

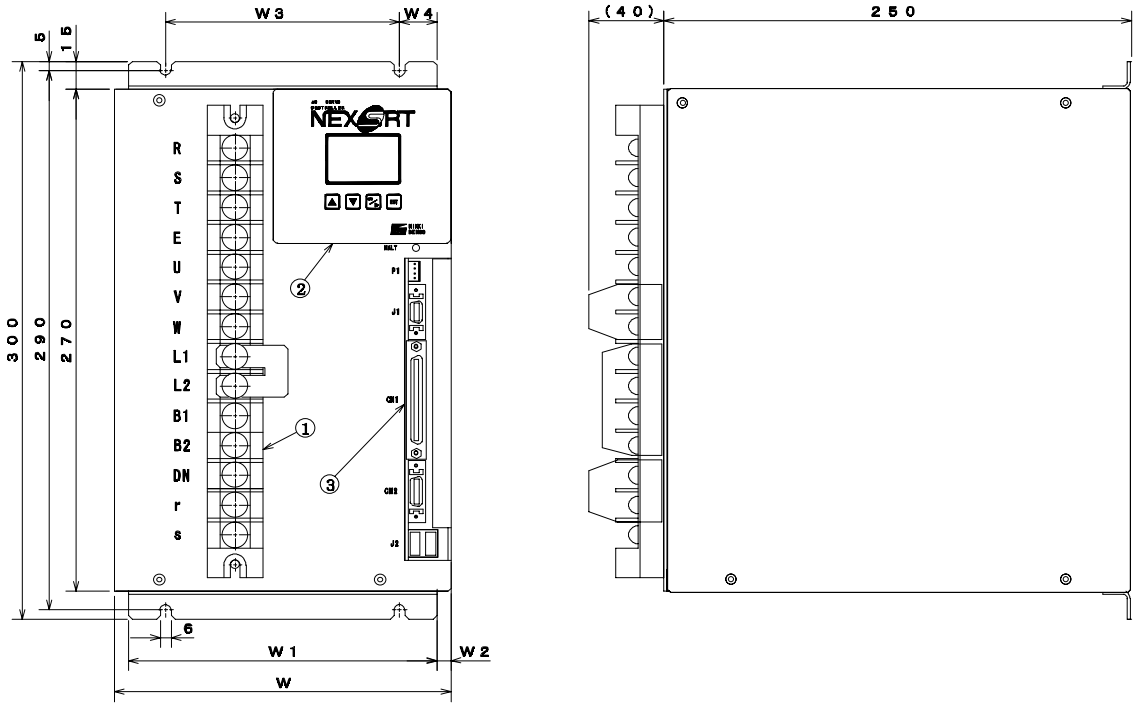


ＴＹＰＥ３：ＮＣＳ－ＦＩ＊＊Ｍ－４０１＊／８０１＊　(**=12,13,31,32,41,42,61,62/*=AorC)



ＴＹＰＥ４：ＮＣＳ－ＦＩ＊＊Ｍ－４０１＊／８０１＊　(**=22,23,33,34,43,44,63,64/*=AorC)

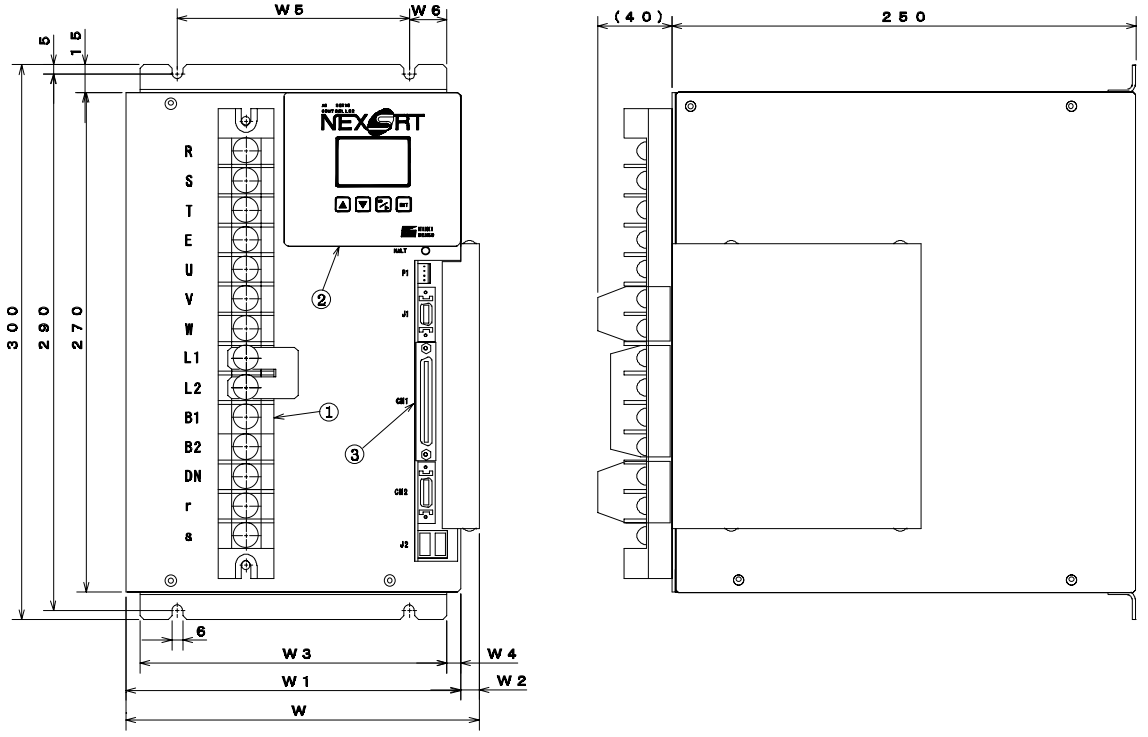
2－5－2　NCS－FI／FS＊＊－122～113



TYPE1

Controller type	W	W1	W2	W3	W4
NCS-FI/FS**M-122A/242A/402A	140	130	5	100	15
NCS-FI/FS**M-752A	180	165	7.5	125	20
NCS-FI/FS**M-113A	220	165	30	125	20

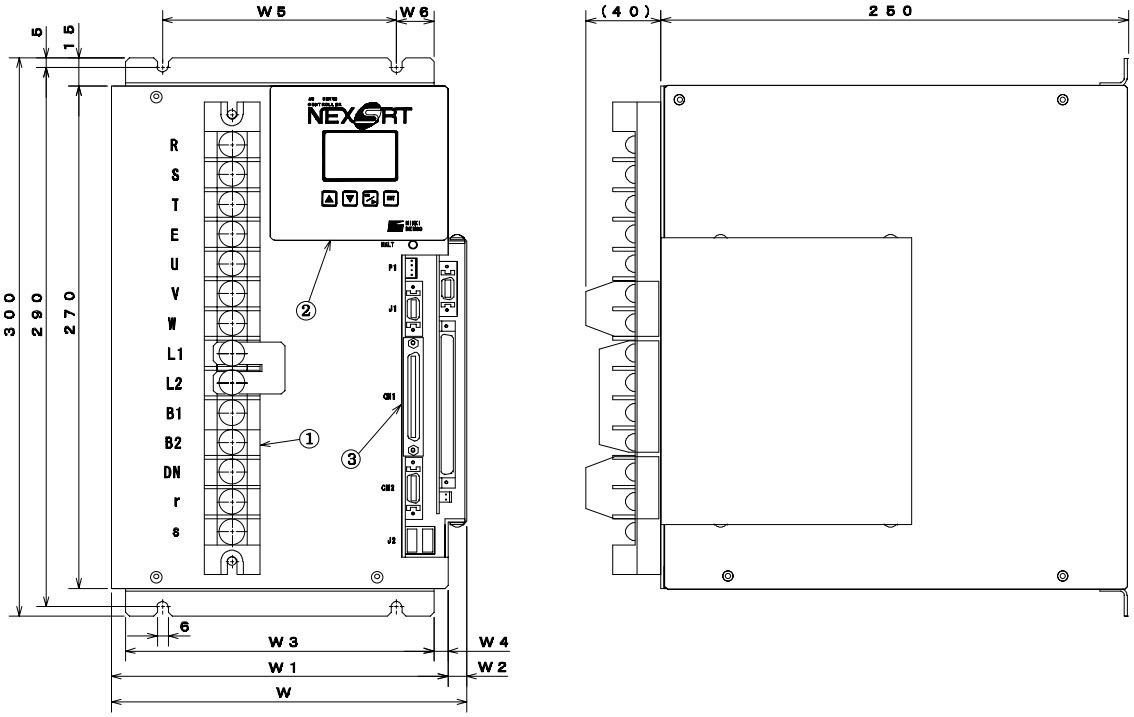
(**=10,30,40,60)



TYPE2

Controller type	W	W1	W2	W3	W4	W5	W6
NCS-FI/FS**M-122C/242C/402C	150	140	10	130	5	100	15
NCS-FI/FS**M-752C	190	180	10	165	7.5	125	20
NCS-FI/FS**M-113C	230	220	10	165	30	125	20

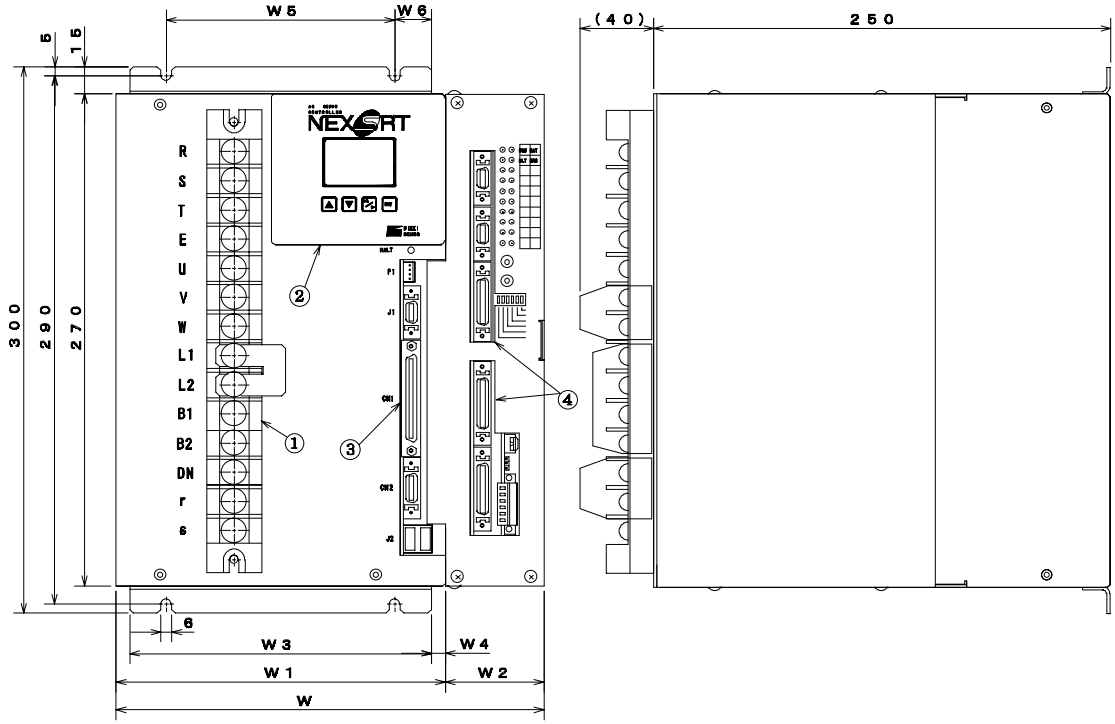
(**=10,30,40,60)



TYPE3

Controller type	W	W1	W2	W3	W4	W5	W6
NCS-FI/FS**M-122*/242*/402*	150	140	10	130	5	100	15
NCS-FI/FS**M-752*	190	180	10	165	7.5	125	20
NCS-FI/FS**M-113*	230	220	10	165	30	125	20

(**=12,13,31,32,41 42,61,62/*=AorC)

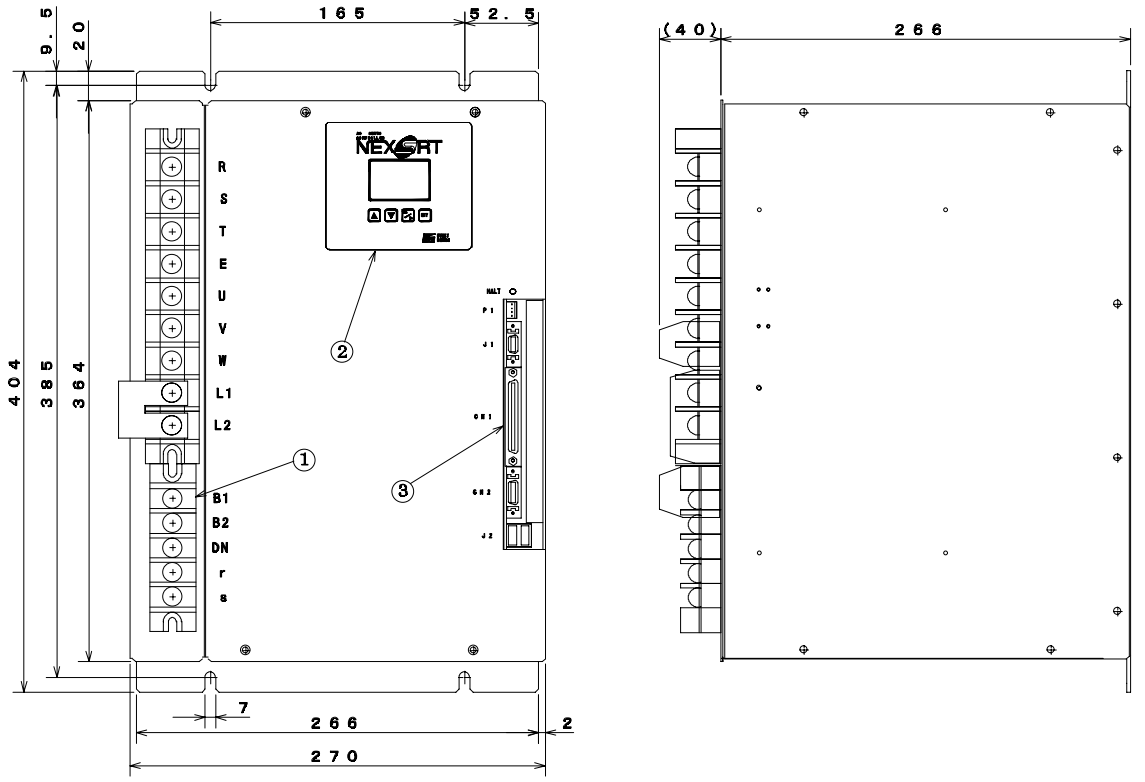


TYPE4

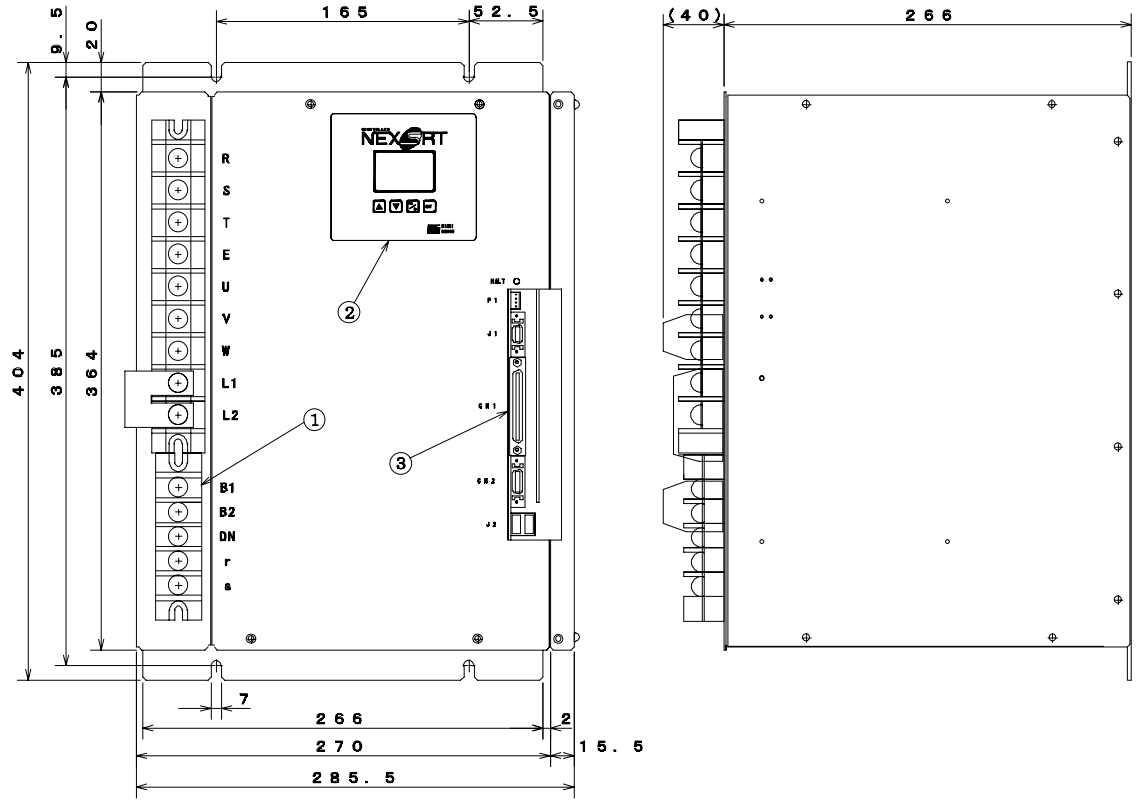
Controller type	W	W1	W2	W3	W4	W5	W6
NCS-FI/FS**M-122*/242*/402*	194	140	54	130	5	100	15
NCS-FI/FS**M-752*	234	180	54	165	7.5	125	20
NCS-FI/FS**M-113*	274	220	54	165	30	125	20

(**=22,23,33,34,43 44,63,64/*=AorC)

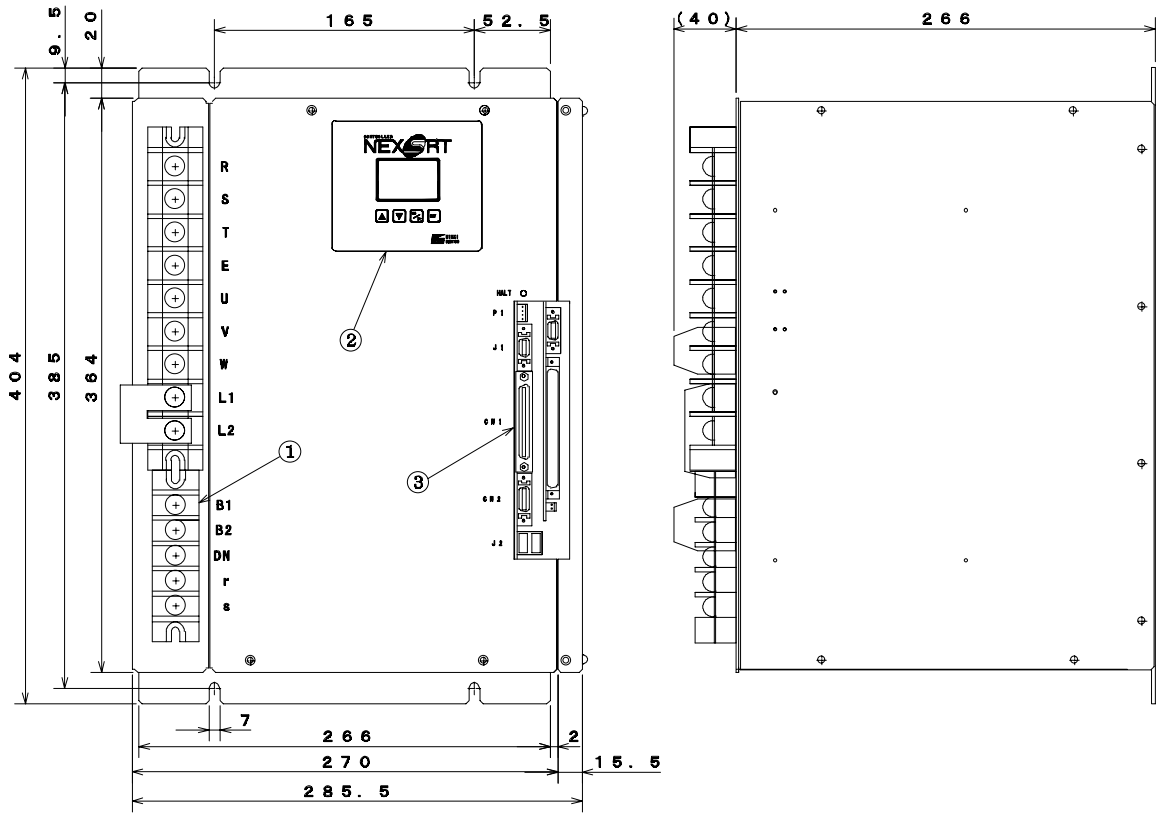
2－5－3　NCS－FI／FS＊＊－153



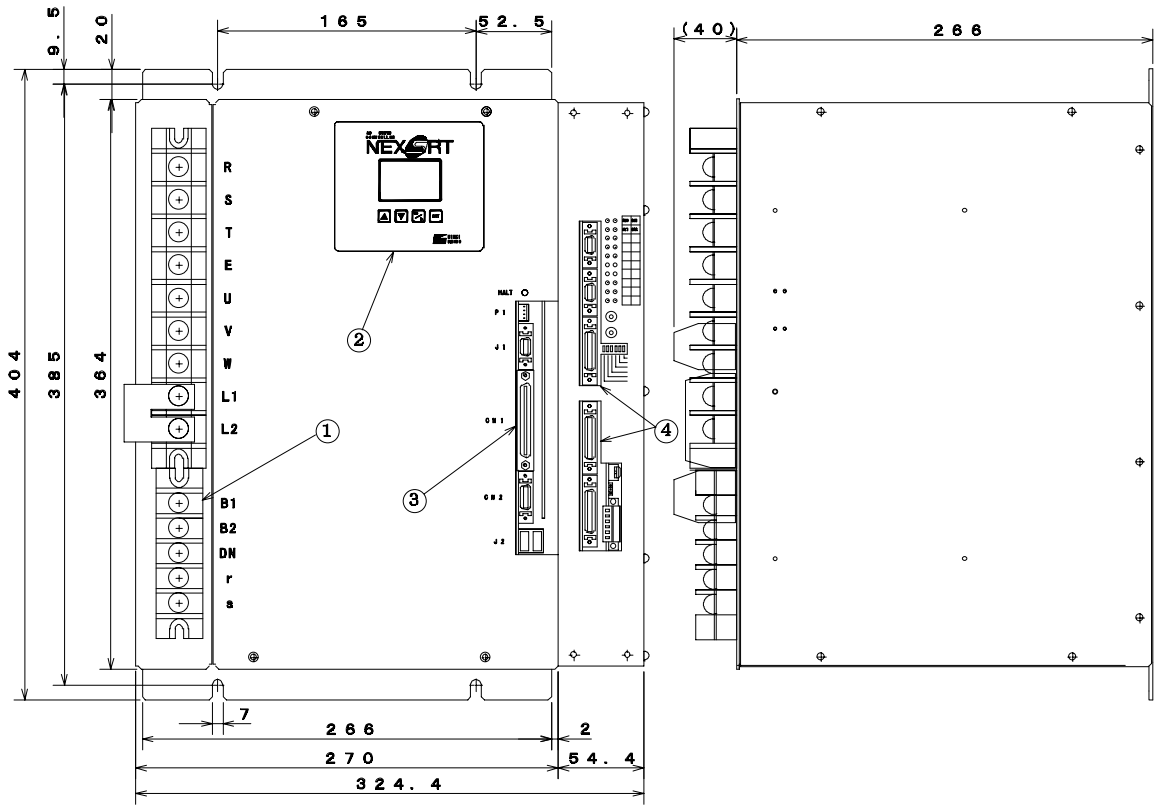
TYPE1：NCS－FI／FS＊＊M－153A　　(**=10,30,40,60)
（NCS－FI＊＊H－113A／153A）



TYPE2：NCS－FI／FS＊＊M－153C　　(**=10,30,40,60)
（NCS－FI＊＊H－113C／153C）

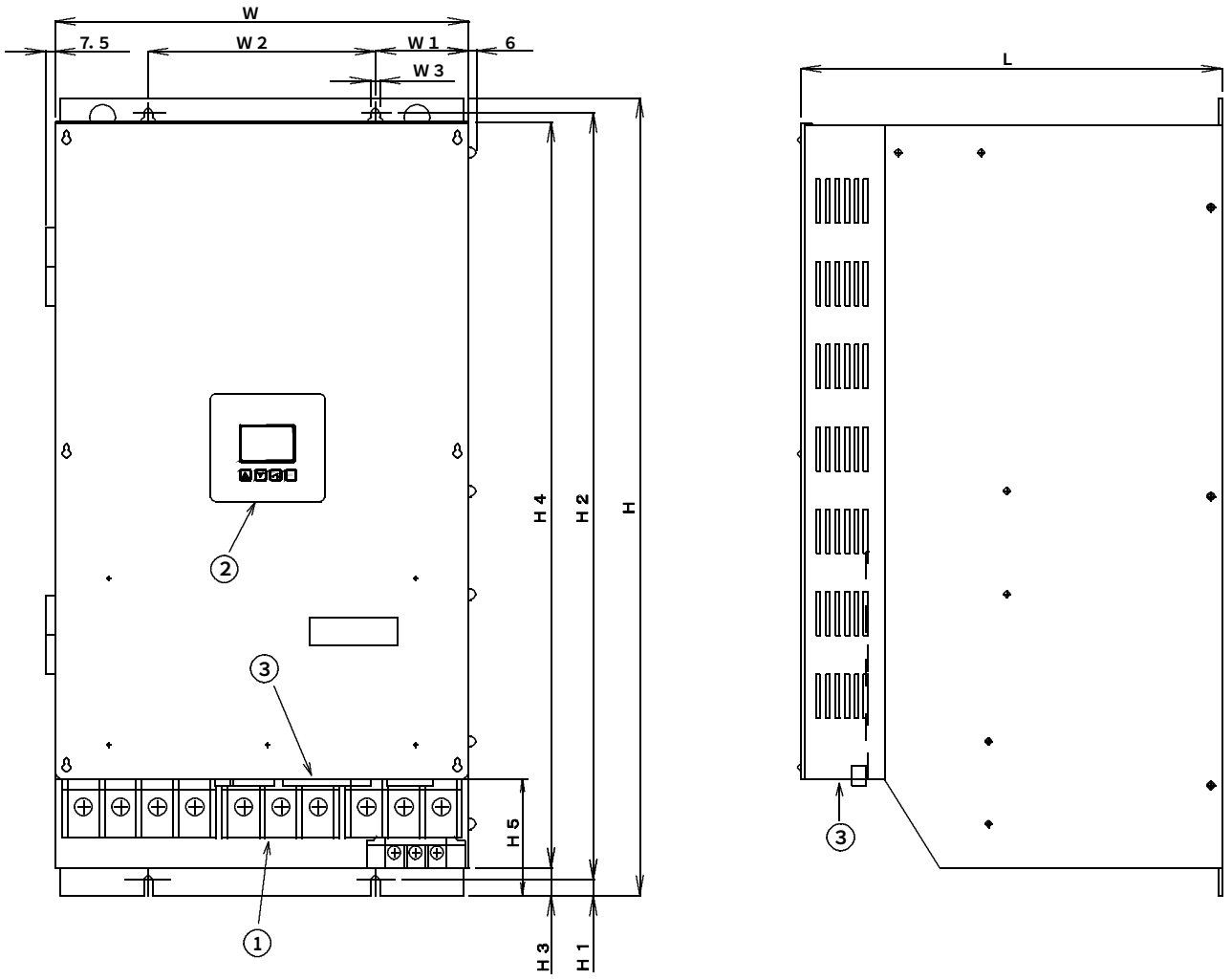


ＴＹＰＥ３：ＮＣＳ－ＦＩ／ＦＳ＊＊Ｍ－１５３＊　　(**=12,13,31,32,41,42,61,62/AorC)
（ＮＣＳ－ＦＩ＊＊Ｈ－１１３＊／１５３＊）



ＴＹＰＥ４：ＮＣＳ－ＦＩ／ＦＳ＊＊Ｍ－１５３＊　　(**=22,23,33,34,43,44,63,64/AorC)
（ＮＣＳ－ＦＩ＊＊Ｈ－１１３＊／１５３＊）

2－5－4　NCS－FI／FS＊＊－223／303／373

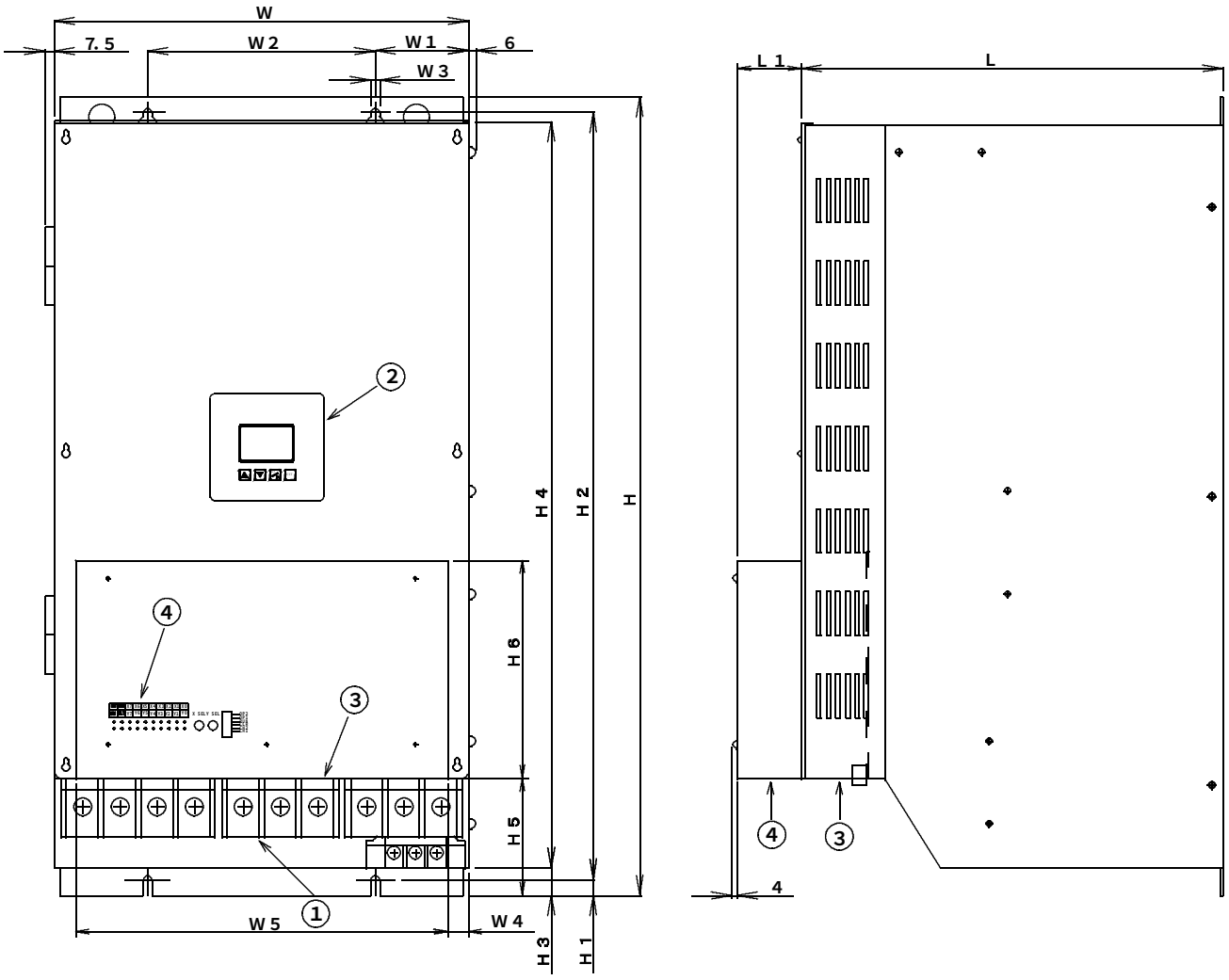


Unit：mm

Controller type	H	H1	H2	H3	H4	H5	W	W1	W2	W3	W4	W5	L
NCS-FI/FS**M-223*,303* (NCS-FI**H-223*,303*)	580	11	558	20	540	85	300	67.5	165	7	15	270	305
NCS-FI**M-373* (NCS-FI**H-373*)	700	11	678	20	660	120	450	95	260	9	41	270	330

ＮＣＳ－ＦＳ＊＊Ｍ－２２３＊
ＮＣＳ－ＦＩ＊＊Ｍ－２２３＊／３０３＊
（ＮＣＳ－ＦＩ＊＊Ｈ－２２３＊／３０３＊）
ＮＣＳ－ＦＩ＊＊Ｍ－２２３＊／３０３＊
ＮＣＳ－ＦＩ＊＊Ｍ－３７３＊
（ＮＣＳ－ＦＩ＊＊Ｈ－３７３＊）

ＴＹＰＥ１
　＊＊＝１０，３０，４０，６０／＊＝Ａ
ＴＹＰＥ２
　＊＊＝１０，３０，４０，６０／＊＝Ｃ
ＴＹＰＥ３
　＊＊＝１２，１３，３１，３２，４１，４２，
　　６１，６２／＊＝ＡｏｒＣ



Ｕｎｉｔ：mm

Controller type	H	H1	H2	H3	H4	H5	H6	W	W1	W2	W3	W4	W5	L	L1
NCS-FI/FS**M-223*,303* (NCS-FI**H-223*,303*)	580	11	558	20	540	85	158.6	300	67.5	165	7	15	270	305	46
NCS-FI**M-373* (NCS-FI**H-373*)	700	11	678	20	660	12	158.6	450	95	260	9	41	270	330	46

ＮＣＳ－ＦＳ＊＊Ｍ－２２３＊
ＮＣＳ－ＦＩ＊＊Ｍ－２２３＊／３０３＊
（ＮＣＳ－ＦＩ＊＊Ｈ－２２３＊／３０３＊）
ＮＣＳ－ＦＩ＊＊Ｍ－２２３＊／３０３＊
ＮＣＳ－ＦＩ＊＊Ｍ－３７３＊
（ＮＣＳ－ＦＩ＊＊Ｈ－３７３＊）

ＴＹＰＥ４
＊＊＝２２，２３，３３，３４，４３，４４
６３，６４／＊＝ＡｏｒＣ

2－6 Each component name and function

Type	No.	Name	Function
Common to all types	①	R、S、T、E	● AC input power terminal block
		U、V、W	● Motor connection terminal block
		B1、B2 (DN ＊1)	● Regenerative resistor connection terminal block (BI-DN is an optional terminal block for power regeneration.)
		r、s (＊1)	● Control power connection terminal block
		L1、L2 (＊1)	● Reactor connection terminal block (Reactor is option.)
Common to all types	②	LCD module	● 1 module which combines LCD display and key switches Input of data, parameters, and confirmation of each monitor
	③	CN1	● Connector for Control I/O signal and Torque limit command input
		CN2	● Connector for Encoder feedback pulse input Encoder feedback pulse signal from an encoder on a motor is inputted.
		J1	● Connector for Serial communication By connecting an external unit or an optional unit, Serial communication is conducted.
		P1	● Connector for Analog monitor Speed feedback, Torque command, External torque limit,Deviation, NC speed command, and NC target speed is confirmed as analog voltage.
		HALT	● CPU fault display LED This is lit when CPU fault as watch dog timer error,etc. .
		J2	● Connector for Pulse train communication By connecting other NCS-FI/FS to this, Synchronizing control can be conducted.
＊2		J5	● Connector for BCD data input BCD data are inputted to this from external unit and Index data are set.
		P2	● Connector for external power connection
＊3		TB2	● Connector for high speed communication In case of a unit with sequence control and plural axis sequence control is required, high speed communication can be conducted.
		ID	● This sets ID No. of high speed communication.。
		Jumper switch	● This sets terminal end resistance of high speed communication.
＊4	④	CH1	● Serial communication connector Channel 1
		CH2	● Serial communication connector Channel 2
		OUT	● Output signal connector
		IN1	● Input signal connector (X000 ～ X037)
		IN2	● Input signal connector (X040 ～ X077)
		XSEL、YSEL	● I/O signal display selection switch
		DSW	● Function selection switch
		Display LED	● Monitoring LED for Battery fault, Error, Run, Controller stop, I/O signal, etc.

Note 1) ＊1 in type column is for units excluding NCS-FI/FS**M-402 and smaller types.
Note 2) ＊2～＊4 in type column are for next types.

Dedicated function type	＊2	＊3	＊4
Positioning	NCS-FI/FS12	NCS-FI/FS13	
Integrated cont.		NCS-FI/FS23	NCS-FI/FS22 NCS-FI/FS23
Running positioning	NCS-FI/FS31	NCS-FI/FS32 NCS-FI/FS34	NCS-FI/FS33 NCS-FI/FS34
Synchronization	NCS-FI/FS41	NCS-FI/FS42 NCS-FI/FS44	NCS-FI/FS43 NCS-FI/FS44
Free curve	NCS-FI/FS61	NCS-FI/FS62 NCS-FI/FS64	NCS-FI/FS63 NCS-FI/FS64

Note 3) ①～④ in No. column is corresponding to ①～④ of [2－5 Outline] .

[Tab.2－4] Controller name list

Chapter 3 Installation

3－1 Check at receipt of our products

Please confirm following points when you receive our products.

① If the products are exactly the ones you ordered. (type, rated output, etc.)

② If any damage was made during transportation. (package damage, abnormal outlook of units, etc.)

③ If accessories are packed together.

If above points are unclear or damage is found, please immediately contact our sales man.

And accessories depends on a controller type as follows.

Controller type	Accessories	
ＮＣＳ－ＦＩ＊＊Ｍ－４０１＊ Input voltage：２００Ｖ Capacity：０．４ｋＷ	Cement resistor［ＲＧＨ－６０－ＦＶ－８０］ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］ Thermostat attachment plate	×１ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－８０１＊ Input voltage：２００Ｖ Capacity：０．８ｋＷ	Cement resistor［ＲＧＨ－６０－ＦＶ－８０］ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］ Thermostat attachment plate	×１ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－１２２＊ Input voltage：２００Ｖ Capacity：１．５ｋＷ	Cement resistor［ＲＧＨ－２００－ＦＶ－４０］ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］ Thermostat attachment plate	×１ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－２４２＊ Input voltage：２００Ｖ Capacity：２．２ｋＷ	Cement resistor［ＲＧＨ－２００－ＦＶ－４０］ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］ Thermostat attachment plate	×１ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－４０２＊ Input voltage：２００Ｖ Capacity：３．７ｋＷ	Cement resistor［ＲＧＨ－４００－ＦＶ－２０］ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］ Thermostat attachment plate	×１ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－７５２＊ Input voltage：２００Ｖ Capacity：７．５ｋＷ	Enamel resistor［ＲＧＨ２００ＧＯＳ４０ΩＪ］ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］ Thermostat attachment band	×３ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－１１３＊ Input voltage：２００Ｖ Capacity：１１ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］ Thermostat attachment band	×３ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－１５３＊ Input voltage：２００Ｖ Capacity：１５ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］ Thermostat attachment band	×４ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－２２３＊ Input voltage：２００Ｖ Capacity：２２ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］ Thermostat attachment band	×６ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－３０３＊ Input voltage：２００Ｖ Capacity：３０ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］ Thermostat attachment band	×８ ×１ ×１
ＮＣＳ－ＦＩ＊＊Ｍ－３７３＊ Input voltage：２００Ｖ Capacity：３７ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］ Thermostat attachment band	×１０ ×１ ×１

［Tab.３－１－１］ Accessory list

Controller type	Accessories
ＮＣＳ－ＦＳ＊＊Ｍ－１２２＊ Input voltage：２００Ｖ Capacity：１．２ｋＷ	Cement resistor［ＲＧＨ－２００－ＦＶ－４０］　×１ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］　×１ Thermostat attachment plate　×１
ＮＣＳ－ＦＳ＊＊Ｍ－２４２＊ Input voltage：２００Ｖ Capacity：２．４ｋＷ	Cement resistor［ＲＧＨ－２００－ＦＶ－４０］　×１ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］　×１ Thermostat attachment plate　×１
ＮＣＳ－ＦＳ＊＊Ｍ－４０２＊ Input voltage：２００Ｖ Capacity：４．０ｋＷ	Cement resistor［ＲＧＨ－４００－ＦＶ－２０］　×１ Thermostat［１ＮＴ０１Ｌ０８５７Ｌ９０－１０］　×１ Thermostat attachment plate　×１
ＮＣＳ－ＦＳ＊＊Ｍ－７５２＊ Input voltage：２００Ｖ Capacity：７．５ｋＷ	Enamel resistor［ＲＧＨ２００ＧＯＳ４０ΩＪ］　×３ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＳ＊＊Ｍ－１１３＊ Input voltage：２００Ｖ Capacity：１１ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］　×３ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＳ＊＊Ｍ－１５３＊ Input voltage：２００Ｖ Capacity：１５ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］　×４ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＳ＊＊Ｍ－２２３＊ Input voltage：２００Ｖ Capacity：２２ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ２４ΩＪ］　×６ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１

［Tab.３－１－２］ Accessory list

Controller type	Accessories
ＮＣＳ－ＦＩ＊＊Ｈ－１１３＊ Input voltage：４００Ｖ Capacity：１１ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ１００ΩＪ］　×３ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＩ＊＊Ｈ－１５３＊ Input voltage：４００Ｖ Capacity：１５ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ１００ΩＪ］　×４ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＩ＊＊Ｈ－２２３＊ Input voltage：４００Ｖ Capacity：２２ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ１００ΩＪ］　×６ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＩ＊＊Ｈ－３０３＊ Input voltage：４００Ｖ Capacity：３０ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ１００ΩＪ］　×８ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１
ＮＣＳ－ＦＩ＊＊Ｈ－３７３＊ Input voltage：４００Ｖ Capacity：３７ｋＷ	Enamel resistor［ＲＧＨ５００ＧＯＳ１００ΩＪ］　×１０ Thermostat［５００３－Ｌ－１３０℃Ｂ－１］　×１ Thermostat attachment band　×１

［Tab.３－１－３］ Accessory list

▪ Caution

① If packages as cartons, etc. are broken, please do not unpack the packages and inform our sales man.

3－2　Precautions before installation (handling)

When you transport a controller or a motor, handle with care so as not to drop and damage th em.

▪ Caution
① Do not pile controllers but also put anything on the controller. 『Distortion and damage may occur.』 ② Be careful not to add shock to a motor shaft. 『An encoder on the motor could be damaged.』 ③ Do not move a motor around with having a motor cable. 『The cable could be broken.』

3－3　Controller installation

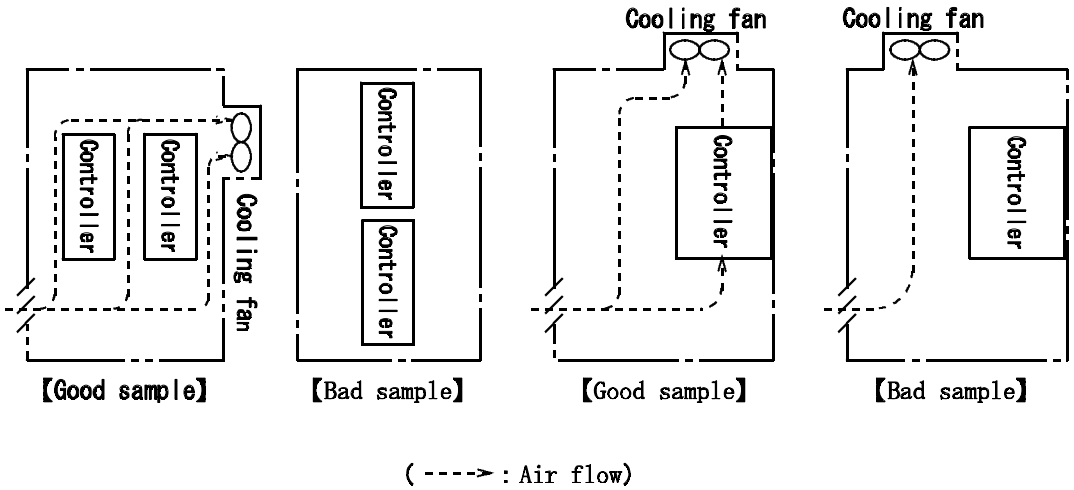
3－3－1　Installation conditions

① Ambient condition of a controller can be referred to [2－2　General specification] .

② We recommend to design layout to satisfy the condition that temperature increase in the control cabinet where this unit is installed, shall be ＋10℃ or less above ambient temperature.
Consider generation loss of equipment in the control cabinet and a controller, and influence of convection and radiation in the cabinet, and keep the temperature around the controller lower than allowable range.
Heat energy of a controller is about 7 % of motor capacity + 50W.

③ When you select a cooling fan or a heat exchanger, calculate generation loss and select them which can cover the loss.

④ When plural controllers are placed in a control cabinet, consider cooling system, specially. If layout of controllers and location of cooling fans are not proper, ambient temperature of the controller may increase and radiation efficiency will be lowered. Therefore, please pay special attention to this matter. ([Fig.3－1] Reference)



[Fig.3－1]　Fan location to use plural controllers in a cabinet

▪ Caution
① When ambient temperature exceeds allowable range, internal parts of a controller could be failed or damaged. It could cause abnormal performance of the controller. Be sure to keep allowable ambient temperature within the specified range.

⑤ If a heating element or vibration source is near a controller, design the layout to avoid the influence.

⑥ Avoid to install a controller in a place of high temperature, high humidity, large amount of dust, dirt, metal powder, lamp soot, etc. and corrosive gas.

⑦ If there is a noise source such as electric welders, etc. , near a controller, induction noise could influence the controller. In the case, ensure that the controller is properly grounded. And in some cases, a noise filter may be required.
Please refer to [4－1 Wiring precautions] and take proper anti-noise measures.

3－3－2 Installation method

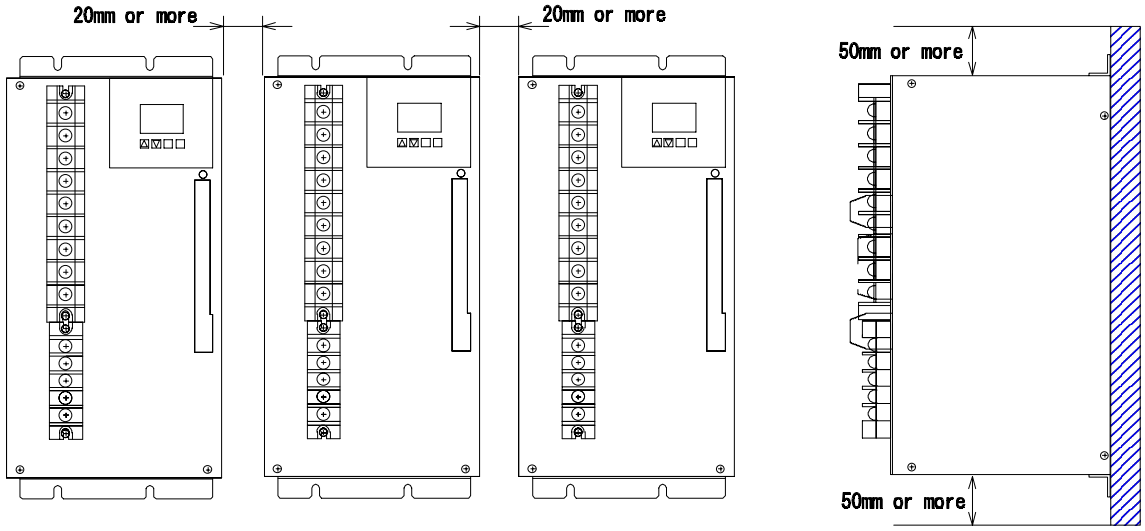
① Vertical installation is normal. In order to get normal radiation effect, be sure to install a controller vertically.

② In the points of radiation and maintenance, design to install ＮＣＳ－ＦＩ／ＦＳ＊＊－４０１／８０１／１２２／２４２／４０２／７５２／１１３／１５３ at least 50mm vertically and 20mm horizontally away from other units, parts, and face of a control cabinet.
［Fig.３－２］Reference

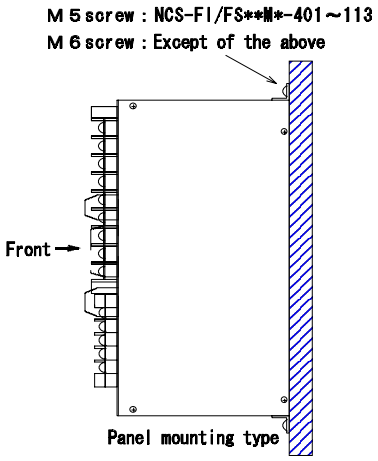
③ ＮＣＳ－ＦＩ／ＦＳ＊＊－４０１／８０１／１２２／２４２／４０２／７５２／１１３／１５３ are panel mounting types.
［Fig.３－３］Reference

④ In the points of radiation and maintenance, design to install ＮＣＳ－ＦＩ／ＦＳ＊＊－２２３／３０３／３７３ at least 100mm vertically and 80mm horizontally away from other units, parts, and face of a control cabinet.
［Fig.３－４］Reference

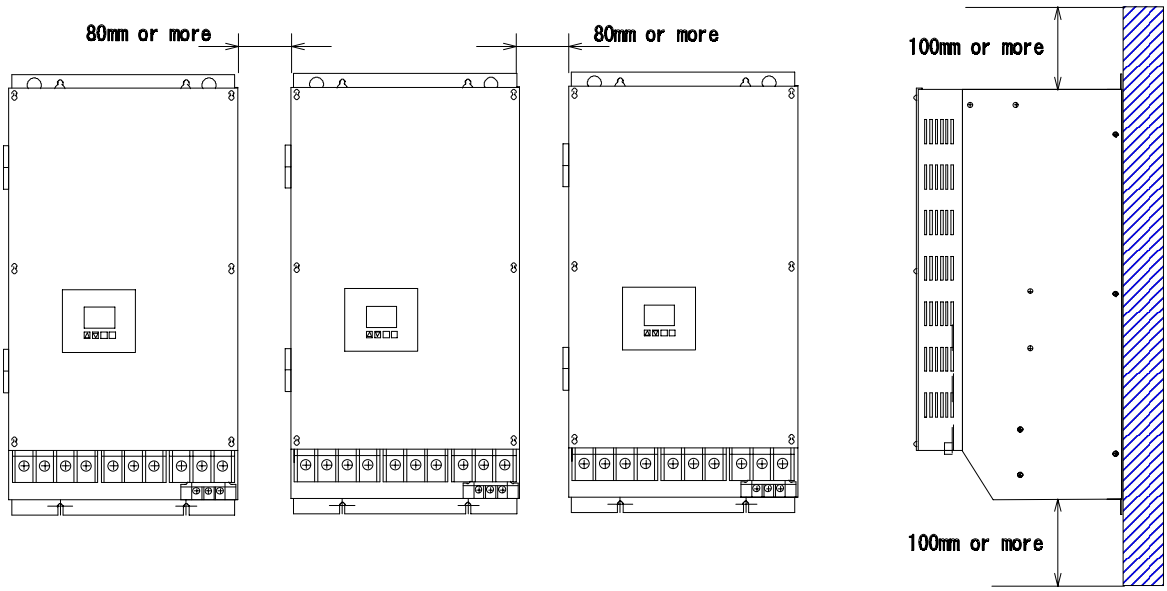
⑤ ＮＣＳ－ＦＩ／ＦＳ＊＊－２２３／３０３／３７３ are panel mounting types
［Fig.３－５］Reference



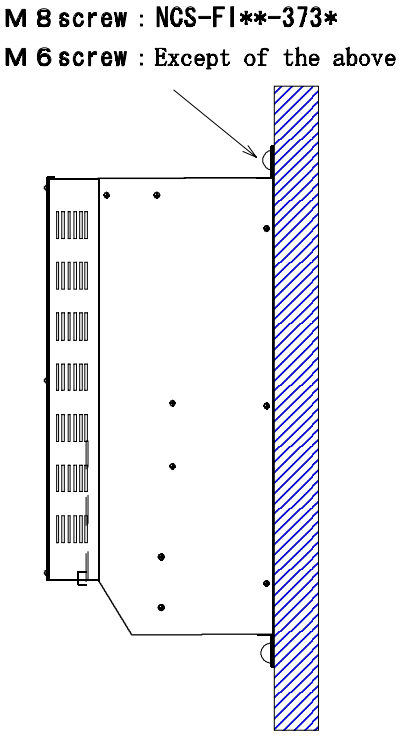
［Fig.３－２］ ＮＣＳ－ＦＩ／ＦＳ＊＊－４０１／８０１／１２２／２４２／４０２／７５２ １１３／１５３ controller installation and ventilation



［Fig.３－３］ ＮＣＳ－ＦＩ／ＦＳ＊＊－４０１／８０１／１２２／２４２／４０２ ７５２／１１３／１５３ controller installation method



[Fig.３－４]　ＮＣＳ－ＦＩ／ＦＳ＊＊－２２３／３０３／３７３
controller installation and ventilation



[Fig.３－５]　ＮＣＳ－ＦＩ／ＦＳ＊＊－２２３／３０３／３７３
controller installation method

3－3－3 Cautions of storage and transportation

① Cautions of storage

If our products are not used immediately after you receive them, store them under the following conditions in order to prevent deterioration of insulation, rust formation, etc.

.

However, unpack the products soon after you receive them and check damage and other non-conformance incurred during transportation.

Item		Contents
Ambient condition	Temp.	－２０℃～＋６０℃
	Humidity	８５% or less (non-condensing)
	Storage place	Store it in a clean place free from dust and dirt. Do not store it in harmful atmosphere such as corrosive gas, grinding liquid, metal powder, oil, etc.
Vibration		Store it in a place free from vibration.
Others		If storage of a controller is planned for long period, please make rust prevention to the screws of terminal blocks and inspect them, periodically.

[Tab.３－２] Storage conditions of controller

② Precaution of transportation

If you transport our products after you got them, please satisfy next conditions.

Item		Contents
Ambient condition	Temp.	－２０℃～＋６０℃
	Humidity	８５% or less (non-condensing)
	Trans. environment	Store it in a clean place free from dust and dirt. Do not store it in harmful atmosphere such as corrosive gas, grinding liquid, metal powder, oil, etc.
Vibration		０．５G or less

[Tab.３－３] Transportation condition of controller

▪ Caution
① Temperature condition largely influence life time of LCD module in a controller. We recommend to store and transport the controller in humidity 65 % RH or less. If humidity is supposed more than 65 % RH, please consult our sales man.

3－4 Installation of Regenerative resistor, Thermostat

3－4－1 Regenerative resistor

Regenerative resistor assists to exhaust generative energy over-floating the regenerative condenser capacity, caused by large loading inertia (GD^2) during motor braking.
[Fig.3－6], [Fig.3－7] Reference

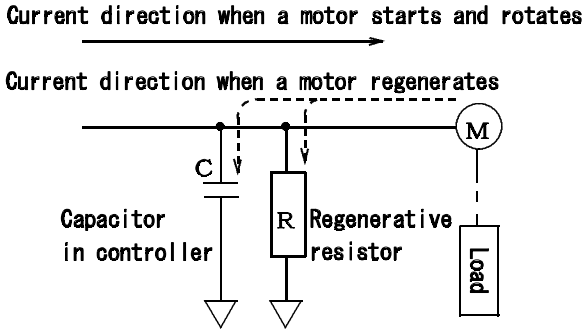
Since Regenerative resistor radiates heat, when you install it, do not leave flammable or materials weak to heat, nearby.

Regenerative energy is shown as below expression.

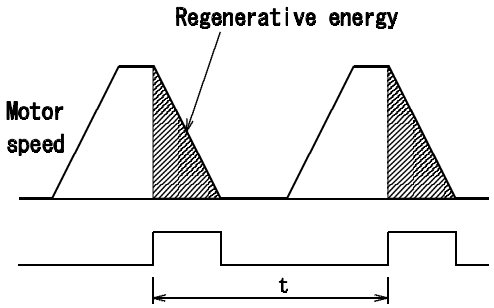
$$Er = \frac{GD^2 \times N^2}{730 \times 10^3} \quad [kW \cdot s]$$

$$Wr = Er / t \quad [kW]$$

Er : Whole regenerative energy [kW・s]
GD^2 : Total GD^2 [kgf・m^2]
N : Motor speed [rpm]
Wr : Mean regenerative wattage [kW]
t : Time [sec] [Fig.3－7] Ref.



[Fig. 3－6] Current direction

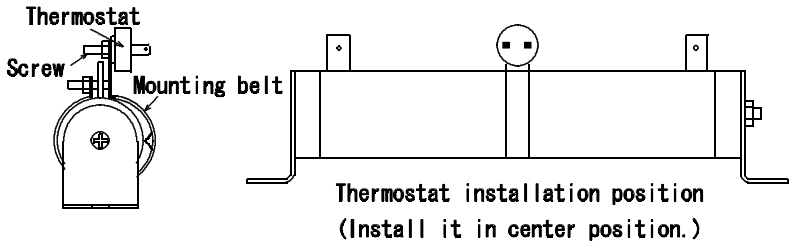


[Fig. 3－7] Motor motion and regenerative energy

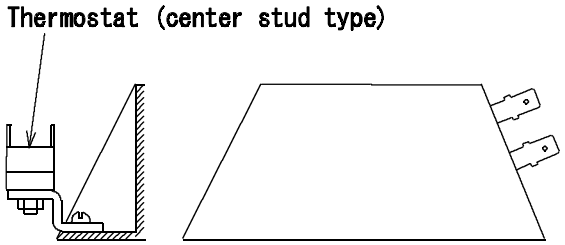
Caution 1 : If load inertia is large, rotating direction change or start / stop change is too frequent, the supplied Regenerative resistor capacity may be insufficient. In the case please consult our sales man when you order our products.
Caution 2 : When plural Regenerative resistors are supplied as accessories, connect them, in parallel. In case of tandem connection, a controller could be damaged.

3－4－2　Thermostat

When Regenerative resistor is heated too much, a thermostat is activated and outputs a contact signal. Contact this contact signal to the power circuit of a controller and be sure to shut electric power supply OFF when the signal is received.
Thermostat contact capacity is ＡＣ２００Ｖ／１Ａ, normal close contact.



[Thermostat attachment with enamel resistor]



[Thermostat attachment with enamel resistor]

[Fig.３－８]　Thermostat attachment position

▪ Caution
① If abnormal current flows in Regenerative resistor, it becomes hot in very short time, and a part in a thermostat will be melted. Please be sure to design circuit to shut electric power supply OFF by the contact signal.

Chapter 4 Wiring

4－1 Wiring precautions

4－1－1 Noise protection

External noise may enter via the power supply and signal cables.
Entered external noise may cause mal-function and troubles.
To prevent trouble by noise, it is important to depress noise occurrence and not to induce occurred noise.
Please completely understand description of [4-1 Wiring precautions] , [4-2 Power connection] , [4-3 motor connection] , [4-4 Applicable cable] and conduct wiring.
And since notice **《Noise protection》** is added to the points to require special attention, take proper measures in accordance with the suggestion.

4－1－2 Control circuit

1) Pulse rain command, Encoder pulse output

① Be careful not to break cables by strong tension, etc. .
② Pulse train command and Encoder pulse output are high speed pulse train signals. Please apply twist-pair shield cables and surely connect the shield to FG pin. **《Noise protection》**
③ Cable length of Line driver output pulse train command and Encoder pulse output shall be 3m or less. **《Noise protection》**
④ Cable length of Open collector pulse train command shall be 1.5m or less. **《Noise protection》**

2) Encoder feedback pulse signal

① Encoder feedback signal is high speed pulse train command signal for position and speed detection. Please use twist-pair shield cable and surely connect the shield to a shield metal fitting. As for shield treatment of cables, please refer to [4-1-3 Cable treatment] . **《Noise protection》**
② If a mobile motor is required, make the cable bending radius as large as possible to avoid excess stress.
③ Applicable cable types and cable length can be referred to [Tab.４－５] .
④ Dedicated encoder cable sets are optionally available.

3) Control I/O signals (ＰＳＴ, ＳＯＮ(*), ＲＳＴ, etc.)

① When relays and switches are used for control input and output signal, please provide micro-current types.
② Be careful not to break cables by strong tension, etc. .
③ Please apply twist-pair shield cables for control I/O signals and surely connect the shield to 「CN connector: FG pin」and「Other than CN connector : Connector shield metal fitting.」 **《Noise protection》**
④ Cable length shall be 3m or less.
When a cable longer than 3m is used, relay the signal via a micro-current type relay to shorten the length between the relay contact and the controller to 3 m or less. **《Noise protection》**

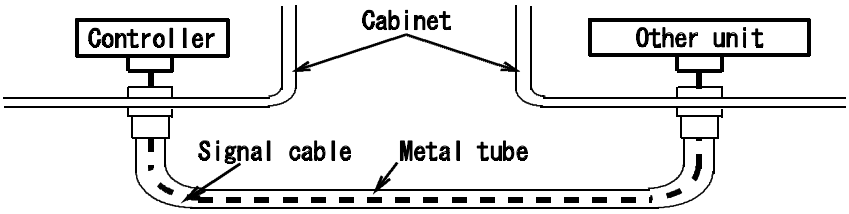
▪ Caution

① For control I/O signal wiring, select specified type and diameter cable and comply with wiring precautions without fail.
Unexpected malfunction could occur and it is very dangerous.
② Be sure to separate control I/O signal cables from the power line (power source, motor, etc.) , and never place them in a same duct and bundle.

4－1－3 Cable treatment

1） Signal cable arrangement

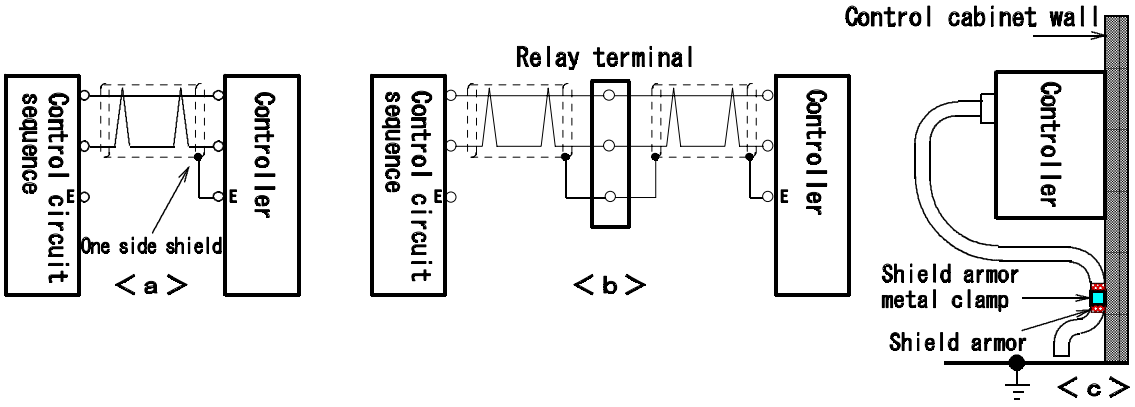
① Be sure to separate signal cables from the power line (power source line, motor line, power relay, solenoid, etc.), and never place them in a same duct and bundle.
② Please separate signal cables and the power line at least 20cm when wiring is conducted.
③ If it is difficult to separate signal cables and the power line, pass signal cables through a metal tube to shut noise off.



[Fig. 4－1] Cable arrangement using metal tube

2） Shield cable arrangement

① Connect shield armor securely to「CN1 connector : FG pin」, or「Other than CN1 connector : Controller shield metal fitting」and keep the other end free. [Fig. 4－2＜a＞] Reference
② If possible, do not relay shield cable. If un-avoidable, connect shields securely at the relay terminal point. [Fig. 4－2＜b＞] Reference
③ In case of Encoder feedback pulse signal cables, connect both ends to controller side connector shield metal fitting and encoder side connector shield terminal.
In a very noisy environment, it is more effective to remove the cable cuticle from the encoder cable at nearest point to the controller and ground the shield armor directly to a control cabinet. In the case , make electric potential of the wall on which the controller case is attached equal to that of the ground terminal of the control cabinet. And please do not place any insulator such as rubber, etc. between the wall and the controller case. [Fig. 4－2＜c＞] Reference



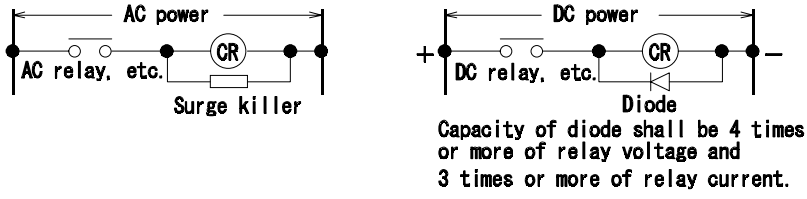
Caution: Only both ends of Encoder cables shall be shielded.

[Fig. 4－2] Shield armor arrangement

4－1－4 Installation of surge killer and noise filter

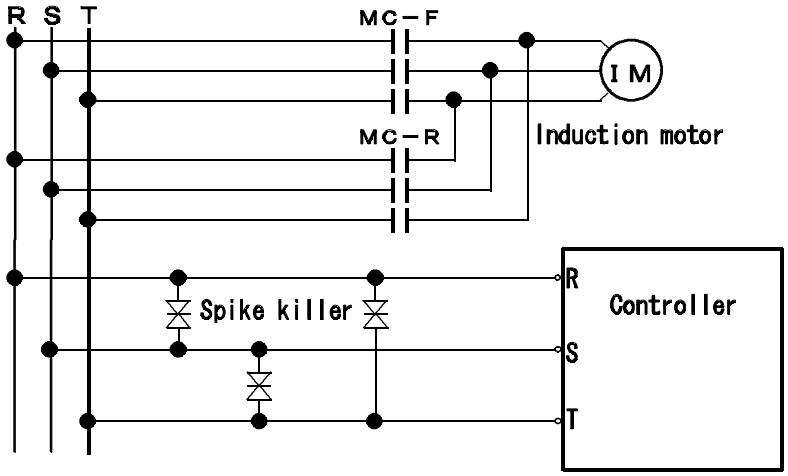
1） Installation of surge killer

① To depress noise generation, install surge killer (for AC power source) or a diode (for DC power source) on each relay, magnet contact, solenoid, electro magnetic brake, etc. used near the controller. [Fig. 4－3] Reference



[Fig. 4－3] Anti-noise measures for relay, etc.

② As [Fig.４－４], in case that common power supply is used to a induction motor and a controller main power, spike noise occurred at forward / reverse rotation change of the induction motor(IM), may break rectifiers of the controller. Specially, when a large capacity induction motor is used, insert a spike killer, etc. to main power (between R-S-T) and depress the spike voltage.



[Fig.４－４] Common power supply to induction motor

2) Installation of noise filter

① In very noisy power line, for example when noise source such as welders and electric discharge machines etc. are nearby, install a noise filter or noise cut transformer, etc. in the main power source of the controller for noise protection of the power line. When a noise filter is used, be sure to separate input from output cables of the filter, and never bind them to a same bundle. Also, do not bind the filter ground cable to the same bundle of filter output cables but ground it in the shortest distance.

② Since switching power supply is used to the controller, switching noise is generated. If it is supposed that this noise influence other equipment, insert a noise filter in main power line of the controller and conduct noise measures such as passing the power and motor lines through a metal tube.

４－２ Power connection

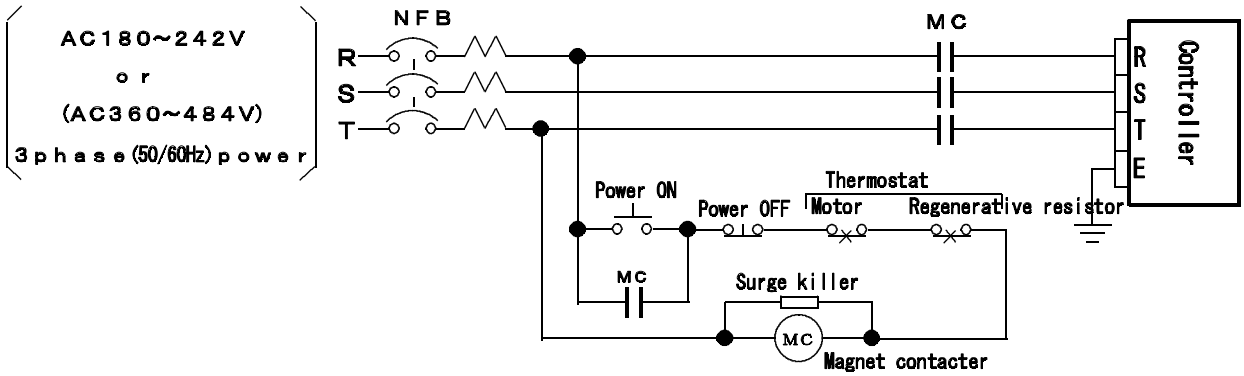
４－２－１ Input power source

① Input power source depends on an applied type as below.
ＮＣＳ－ＦＩ／ＦＳ＊＊Ｍ＊－＊：「AC180～242V, 50/60Hz 3 phase power source」
(ＮＣＳ－ＦＩ＊＊Ｈ＊－＊：「AC360～484V, 50/60H 3 phase power source」)
Please keep this range regardless to power source fluctuation due to factory load change.

② Since main power source is a condenser input type, rush current will flow when power is turned on. depending on power source capacity or impedance, large voltage drop may occur,therefore, apply sufficiently large capacity of the power source, and cables.

③ Do not mis-connect AC power source (R,S,T,E) to motor connection terminals (U,V,W) of the controller. **If mis-wiring is made, the controller will be damaged.**

④ Typical power source circuit is described in [Fig.４－５].



Caution : Be sure to install a surge killer.

[Fig. 4－5] Typical power source circuit

⑤ In order to protect power source line, and avoid accident as fire, be sure to install no-fuse breaker.

▪ Caution

① Be sure to keep specified spec. range of the power sour source. If not, the controller could be damaged.
② In order to protect power source line, and avoid accident as fire, be sure to install no-fuse breaker.
③ If a magnet contactor is used, be sure to install a surge killer.
④ If possible, separate controller power source from other large power consumption equipment.

▪ Prohibition

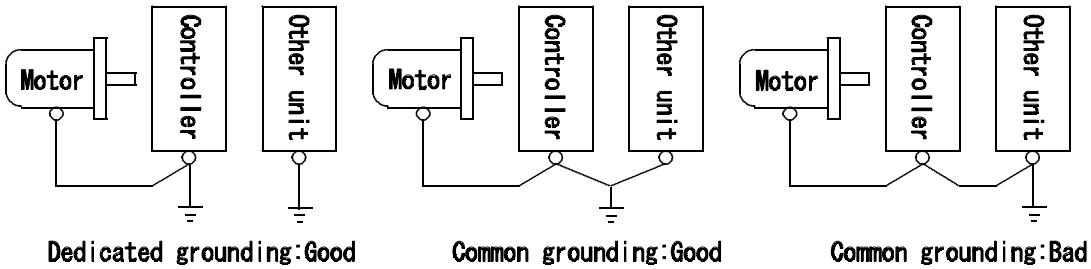
① Do not apply AC 400V to AC 200V input type.
『The controller will be damaged.』

4－2－2 Grounding

① Be sure to conduct grounding to prevent electric shock and noise influence.
② Use a specified area cable for the grounding satisfy JIS Class 3 or better (Grounding resistance 100 Ω or less). connect ground cable to the terminal (E) of the controller.
③ Dedicated ground is recommended if possible. If shared ground is used, be sure to ground cables to 1 point.
④ To ground a motor, be sure to connect motor body ground terminal (E) to controller ground terminal (E).

▪ Caution

① To reduce common mode noise and prevent malfunction of units, use dedicated ground and satisfy JIS Class 3 or better (Grounding resistance 100 Ω or less).
② When no dedicated grounding can not be made, connect cables only at 1 common Point [Fig. 4－6] Reference
③ Never use common ground with large power line or connect to iron structure, etc. .

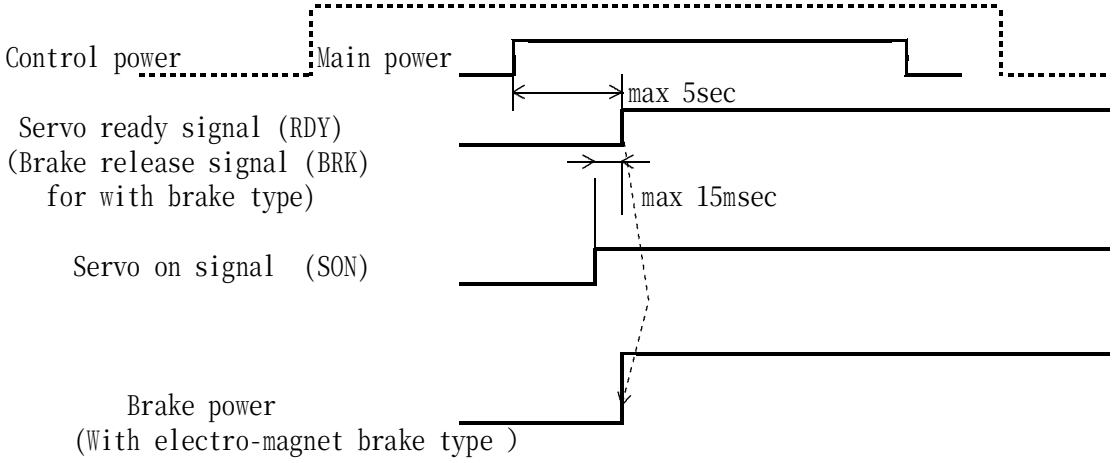


[Fig. 4－6] Grounding method

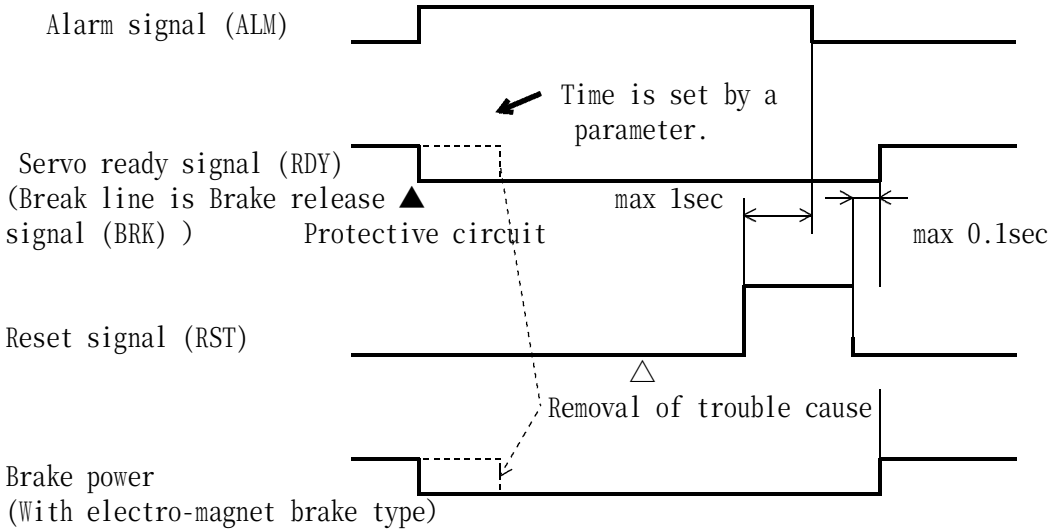
4－2－3 Power supply sequence

① Since main power source circuit is condenser input type, if ON/OFF switching of power is frequently conducted, main power circuit elements will be deteriorated. Power re-input shall be conducted 3 minutes or more after the power is turned off.
Control power input timing shall be before or same timing main power is inputted, and power off timing shall be after main power is off.
However, for integrated power type NCS-FI/FS**M-401～402, only main power timing is required.

② [Fig.4－7] and [Fig.4－8] are timing charts when power is turned on and a problem occurs.



[Fig.4－7] Timing chart when power is ON



[Fig.4－8] Timing chart when a trouble occurs.

▪ Caution

① If power is re-inputted within 1 minute after power is off, units may not work.
② If over-current and over-load protection are repeatedly reset in a short period, a controller temperature will be extremely increased and damaged. Remove the cause, cool the controller for about 30 minutes and resume it.
③ If more than 10ms black out happens, under voltage protective circuit may be activated. If it continues, control power is lost and protective circuit is reset. After then, when the power recovers, again, the situation is same as normal power input. If automatic motor drive sequence when power is on is planned, change the sequence to automatically release motor drive when a protective circuit works.

4－2－4 Selection of no-fuse breaker and earth leakage breaker

In order to prevent units from short-circuit caused by a unit failure, select a suitable shut down capacity breaker to meet power source capacity.
As for beaker capacity for one unit can be referred to ［10－1 Electric specification of controller］.
When line capacity (power source capacity) is quite large to unit capacity, inset a reactor and conduct electric coordination.
And in case of using earth leakage breaker, since control inverter section is PWM control, output contains high harmonic components leakage current is generated by earth electrostatic capacity of cable route between a controller and a motor and floating capacity between motor coil and iron core.
Since leakage current of this high harmonic components could activate a earth leakage breaker
select an inverter type (50/60hz) earth leakage breaker for the controller main power circuit.

▪ Caution
① Since as wiring route is made longer, leakage current increases, make shortest cables, and place the cables apart from the ground cable and ground as far as possible (30cm or more).

4－3 Motor connection

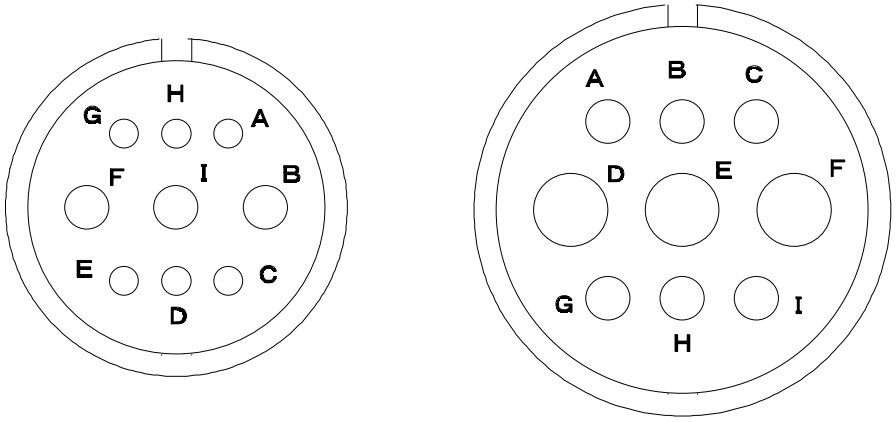
4－3－1 Motor wiring

① Connect motor and controller terminals (U,V,W) in the correct phase sequence. (Connect U-U, V-V, and W-W respectively.)
If phase sequence is wrong, normal control can not be conducted and a motor could vibrate, start to run without command input or does other action which is very dangerous.

② Motor connection terminals (U,V,W) of synchronous motor types, NA720-122/182/242/402 are cannon types (male). The wiring side cannon plug shall be provided by customer side or our optional ones.
The wiring side cannon plug (female) types are shown in the below tabulation and motor connector No. and connector connection list are in ［Fig.4－9］.

		NA720-122/182/242	NA720-402
Motor side cannon plug		MS3102A20-18P	MS3102A24-11P
Option for cannon	Wiring side	MS3106B20-18S (straight)	MS3106B24-11S (straight)
	Cable clamp	MS3057-12A	MS3057-16A

NA720-122/182/242　　NA720-402　*angle type : option



［Fig.4－9］ Motor cable connector No. location

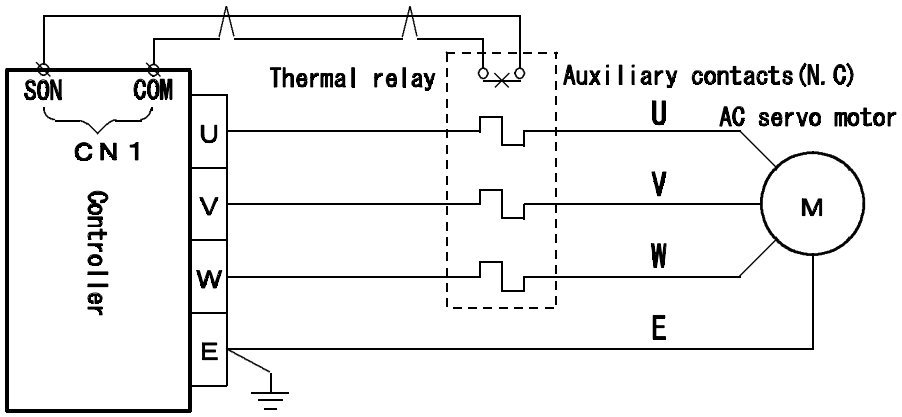
Pin No.	NA720-122/182/242	NA720-402
A	----------	(Brake)
B	W Phase	(Brake)
C	----------	
D	----------	U phase
E	Frame ground (E)	V phase
F	U phase	W phase
G	(Brake)	Frame ground (E)
H	(Brake)	----------
I	V phase	----------

The specifications of power supply for the brake are listed in the table below.
Please make sure to have a power source that is higher than the required capacity.

Motor type	Rated voltage [V]	Electricity consumption [W]
NA720-122/182/242 BAMKS	DC 24	20
NA720-402BAMKS	DC 24	33

③ Do not connect a magnet contactor or a no-fuse breaker between a controller and a motor.
④ When a motor equipped with a brake is used, be sure to release it before starting a motor. Otherwise, the motor may burn out.
⑤ Though an electric thermal is installed on a controller, if a thermal relay is added, externally, set the motor rated current to the relay current value .
By using an auxiliary contact of the thermal relay, make a sequence to turn Servo ON signal (SON(*)) OFF to stop motor motion. [Fig.4－10] Reference
⑥ For motor over heat protection, a B contact (normal close) type thermostat is assembled in NA100 series, NA720-372, 552～233 type motors.
Referring to [Figure4－5] , conduct wiring to shut main power OFF when this relay is activated. Thermostat contact specification is as follows.

Contact V	Contact A (Max./Min.)
DC 24V	2A／0.05A
AC240V	1A／0.05A



[Fig.4－10] Motor wiring

▪ Caution

① Be sure to connect a motor ground terminal (E) to a controller ground terminal(E).

4－3－2 Selection of motor rotating direction

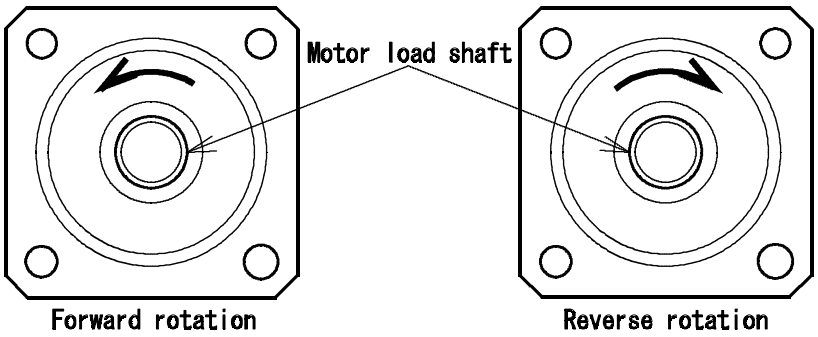
Motor rotating direction is set as below.

① Relation of each command and motor rotating direction in case of connecting standard motor and encoder, is shown in [Tab. 4－1] .
(When the parameter [P300:Rotating direction selection] is ‘FORWARD’.)

Command type	Command	Motor direction
Positioning data command	Forward direction (+)	Forward (CCW)
	Reverse direction (−)	Reverse (CW)
90° different phase pulse train command	B phase ahead pulse	Forward (CCW)
	A phase ahead pulse	Reverse (CW)
Directional pulse train command	Pulse input to FC	Forward (CCW)
	Pulse input to RC	Reverse (CW)
Directional signal + feed pulse command	RC is OFF / Pulse input to FC	Forward (CCW) ※
	RC is ON / Pulse input to FC	Reverse (CW) ※

※ ON / OFF of Directional signal is defined that it is ON when current is flowing in circuits in case of Open collector I/F. (Open collector driver is absorbing current.) And in case of Line driver I/F, when the driver positive polarity signal (RC) is "H" and negative polarity signal (RC＊) is "L" , it is defined ON and when opposite status it is defined OFF.

[Tab. 4－1] Each command input and motor rotating direction



Forward (CCW)： CCW rotation viewed from motor load shaft
Reverse (CW) ： CW rotation viewed from motor load shaft

[Fig. 4－1 1] Motor rotating direction

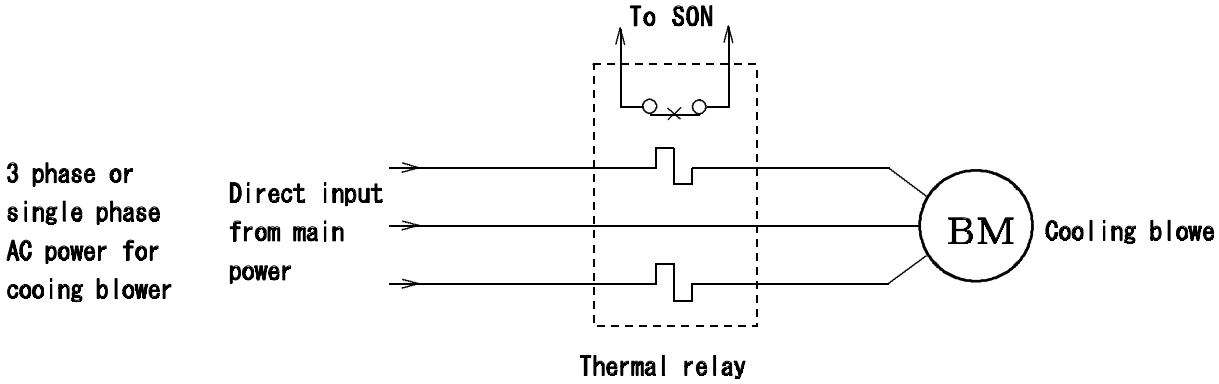
② By setting the parameter [P300: Rotating direction selection] , motor rotating direction to each command input can be changed as [Tab. 4－2] .
Hereunder in this manual, 「Motor forward direction」 is defined that a motor runs forward to a forward command input and 「Motor reverse direction」 is defined that a motor runs reverse to a forward command input.

Command	Set of 「Rot. direc.selection」	Moor rotation
Forward	FORWARD (factory set)	Forward (CCW)
	REVERSE	Reverse (CW)
Reverse	FORWARD (factory set)	Reverse (CW)
	REVERSE	Forward (CCW)

[Tab, 4－2] Parameter and motor rotating direction

4－3－3　Cooling blower wiring

A cooling blower is installed to an un-load shaft side of a motor.
Please attach a thermal relay to a cooling blower. Our relay is available optionally.
Please set rated current value of a cooling blower to the thermal relay.
The rated current value of a cooling blower can be referred to ［10-3 Electric specification of a cooling blower］.



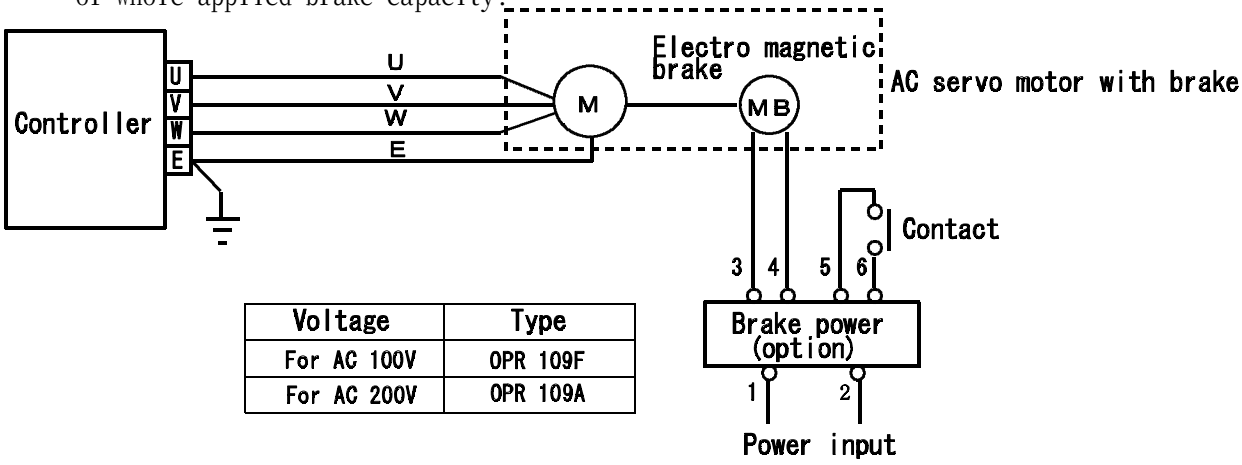
［Tab.４－１２］Cooling blower wiring

▪ Caution
① Set rated current value of a cooling blower to a thermal relay. ② Since power is not supplied to a cooling blower by a controller, please provide power source. ③ Be sure not to connect cooling blower terminals to U,V,W of a controller.

4－3－4　Electro magnet brake wiring

Some of our motors are equipped with a brake to hold when power is failed, or emergency case occurs.

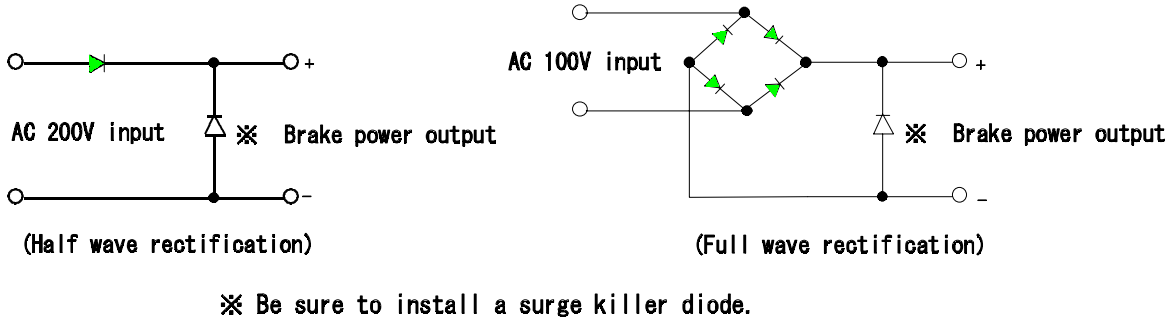
① Brakes are de-energized type. They are released when a voltage is supplied, and are activated when the voltage is cut.
②The brake is activated about 0.5 sec. after voltage is supplied.
③ Optional brake power connection is as ［Tab.４－１３］.
④ The brake terminal has no polarity.
⑤ When the brake terminal P is connected to the output terminal 3, connect the brake terminal N to the output terminal 4.
⑥ Do not short-circuit the output terminal 3 and 4.
⑦ Capacity of a contact between the output terminal 5 and 6 is recommended 5 to 6 times of whole applied brake capacity.



Voltage	Type
For AC 100V	OPR 109F
For AC 200V	OPR 109A

［Fig.４－１３］ Brake power connection

When you provide the brake power, please refer to ［Fig.４－１４］.

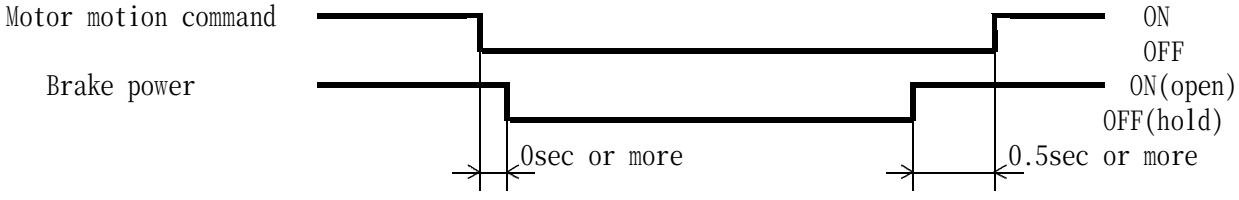


※ Be sure to install a surge killer diode.

［Fig.４－１４］ Brake power circuit

▪ Caution

① Sine an electro-magnetic brake is released about 0.5 sec. after voltage is supplied consider it and set timing to motor motion commands. Be sure to turn OFF motor motion command before activating the electro-magnetic brake.
② Since the electro-magnetic brake is holding purpose only, never activate the brake during a motor is running.



［Fig.４－１５］ Brake power and motion command timing

4－4 Applicable cable

Please use cables described in ［Tab.４－４］and［Tab.４－５］.
※ Please use our optional cable for control circuits.

▪ Caution

① Cable type and size can be changed depending on actual conditions and environment. Please consult our sales man for further information.
② If control signal cable is longer, the unit likely to be influenced, keep the specified length. And be sure to use specified cable type.

Unit: mm^2

Item		Terminal	NCS-FI**M*-401	NCS-FI**M*-801	NCS-FI**M*-122
Main circ.	AC in. power, ground	R, S, T, E	2 or more	2 or more	2 or more
	Motor	U, V, W, E	1.25 or more	2 or more	2 or more
	Control AC in. power	r, t	----------	----------	----------
	Cooling blower motor		----------	----------	----------
	Regenerative resistor	B1, B2	1.25 or more	2 or more	2 or more

［Tab.４－４－１］ Applicable cable for main circuit

Unit:mm^2

Item		Terminal	NCS-FI**M*-242	NCS-FI**M*-402	NCS-FI**M*-752
Main circ.	AC in. power, ground	R, S, T, E	2 or more	3.5 or more	8 or more
	Motor	U, V, W, E	2 or more	3.5 or more	8 or more
	Control AC in. power	r, t	0.75 or more	0.75 or more	0.75 or more
	Cooling blower motor		0.75 or more	0.75 or more	0.75 or more
	Regenerative resistor	B1, B2	2 or more	3.5 or more	3.5 or more

［Tab.４－４－２ ］ Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FI**M*-113	NCS-FI**M*-153	NCS-FI**M*-223
Main circ.	AC in. power, ground	R, S, T, E	14 or more	22 or more	38 or more
	Motor	U, V, W, E	14 or more	22 or more	38 or more
	Control AC in. power	r, t	0.75 or more	0.75 or more	0.75 or more
	Cooling blower motor		0.75 or more	0.75 or more	0.75 or more
	Regenerative resistor	B1, B2	5.5 or more	8 or more	0.75 or more

［Tab.４－４－３］ Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FI**M*-303	NCS-FI**M*-373	
Main circ.	AC in. power, ground	R, S, T, E	50 or more	60 or more	
	Motor	U, V, W, E	50 or more	60 or more	
	Control AC in. power	r, t	0.75 or more	0.75 or more	
	Cooling blower motor		1.25 or more	1.25 or more	
	Regenerative resistor	B1, B2	14 or more	22 or more	

[Tab.4－4－4] Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FS**M*-122	NCS-FS**M*-242	NCS-FS**M*-402
Main circ.	AC in. power, ground	R, S, T, E	2 or more	2 or more	3.5 or more
	Motor	U, V, W, E	2 or more	2 or more	3.5 or more
	Control AC in. power	r, t	----------	----------	----------
	Cooling blower motor		----------	----------	----------
	Regenerative resistor	B1, B2	2 or more	2 or more	3.5 or more

[Tab.4－4－5] Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FS**M*-752	NCS-FS**M*-113	NCS-FS**M*-153
Main circ.	AC in. power, ground	R, S, T, E	8 or more	14 or more	22 or more
	Motor	U, V, W, E	14 or more	14 or more	22 or more
	Control AC in. power	r, t	0.75 or more	0.75 or more	0.75 or more
	Cooling blower motor		----------	----------	----------
	Regenerative resistor	B1, B2	3.5 or more	8 or more	8 or more

[Tab.4－4－6] Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FS**M*-223		
Main circ.	AC in. power, ground	R, S, T, E	30 or more		
	Motor	U, V, W, E	30 or more		
	Control AC in. power	r, t	0.75 or more		
	Cooling blower motor		----------	----------	----------
	Regenerative resistor	B1, B2	14 or more		

[Tab.4－4－7] Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FI**H*-113	NCS-FI**H*-153	NCS-FI**H*-223
Main circ.	AC in. power, ground	R, S, T, E	5.5 or more	5.5 or more	14 or more
	Motor	U, V, W, E	8 or more	8 or more	22 or more
	Control AC in. power	r, t	0.75 or more	0.75 or more	0.75 or more
	Cooling blower motor		0.75 or more	0.75 or more	0.75 or more
	Regenerative resistor	B1, B2	3.5 or more	3.5 or more	5.5 or more

[Tab. 4－4－8] Applicable cable for main circuit

Unit: mm^2

Item		Terminal	NCS-FI**H*-303	NCS-FI**H*-373	
Main circ.	AC in. power, ground	R, S, T, E	14 or more	22 or more	
	Motor	U, V, W, E	22 or more	30 or more	
	Control AC in. power	r, t	0.75 or more	0.75 or more	
	Cooling blower motor		1.25 or more	1.25 or more	
	Regenerative resistor	B1, B2	8 or more	8 or more	

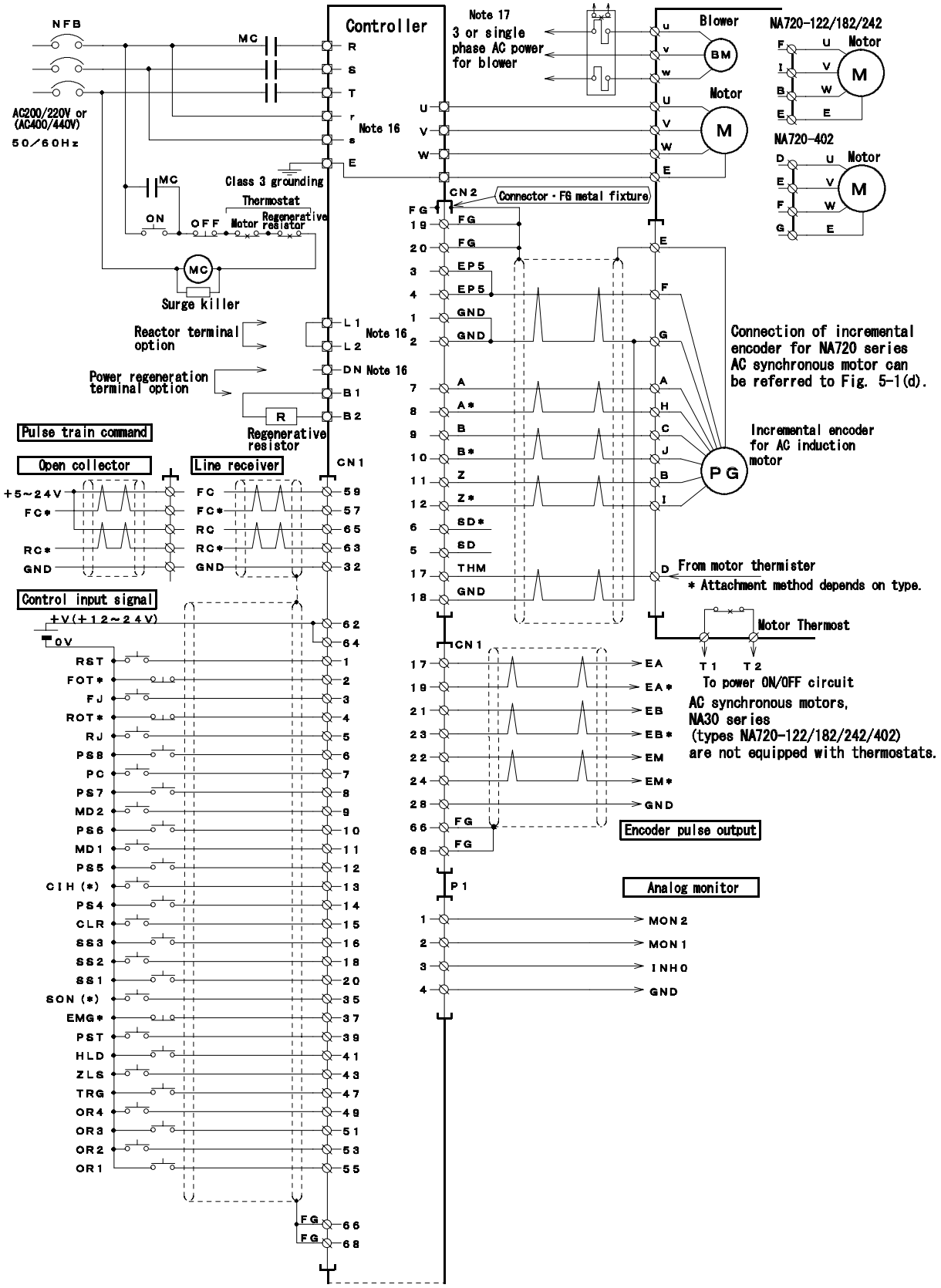
[Tab. 4－4－9] Applicable cable for main circuit

Item		Terminal	NCS-FI/FS**M*-*／(NCS-FI**H*-*)
Control circuit	Anal. V command inp. (Speed, torque) Anal. monitor output	INH,TQH TL+,TL-,GND INH0,MON1,2	AWG28 or more twist-pair shield cable : 3m or less
	Pulse train command input	FC/FC*,RC/RC* FC/GND RC/GND	AWG28 or more twist-pair shield cable Line driver output : 3m or less Open collector output : 1.5m or less
	Encoder pulse output	EA/EA*,EB/EB*, EM/EM*,GND	AWG28 or more twist-pair shield cable : Length: 3m or less (GND :0.5mm^2 or more)
	Encoder feedback pulse input	A/A*,B/B*, Z/Z* (EP5,GND)	0.2mm^2 or more twist-pair shield cable EP5,GND :0.5mm^2 or more Length : 50m or less
	Other control input / output		AWG28 or more shield cable Length : 3m or less (+24V,COM :0.5mm^2 or more)

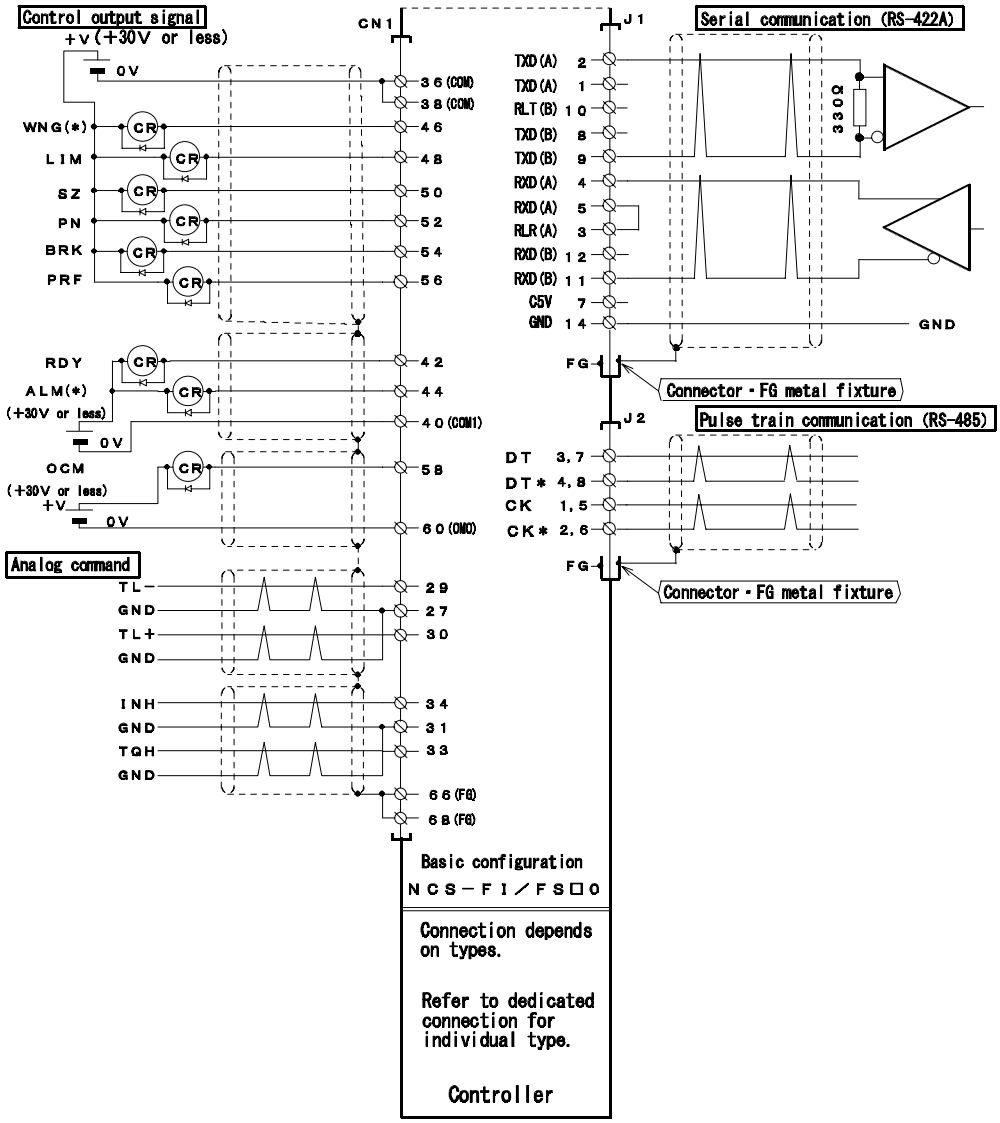
[Tab. 4－5] Applicable cable for main circuit

Chaper 5 Signal connection and control mode

5－1 External connecting diagram

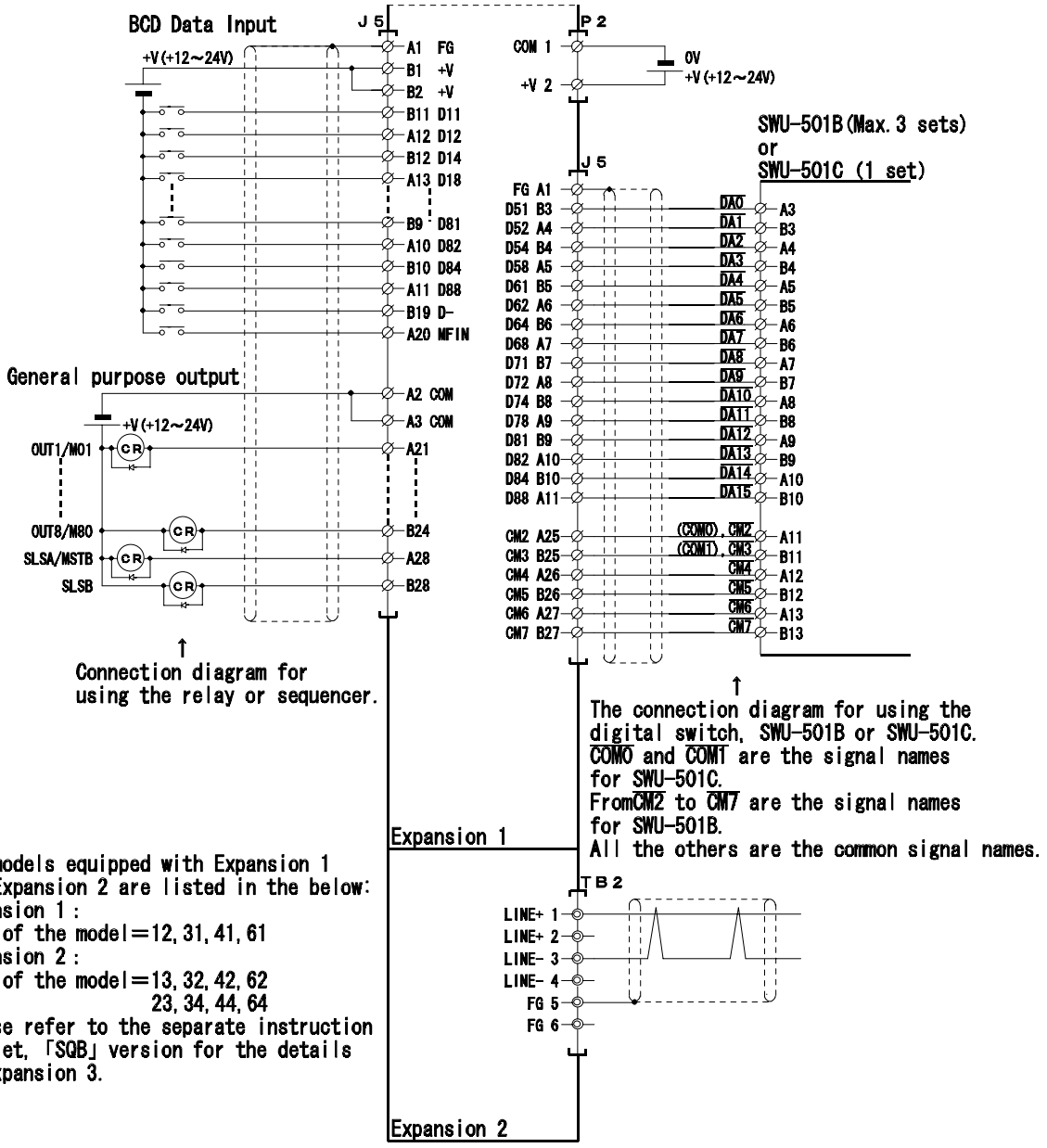


[Fig. 5－1 (a)] External connecting diagram 1/4



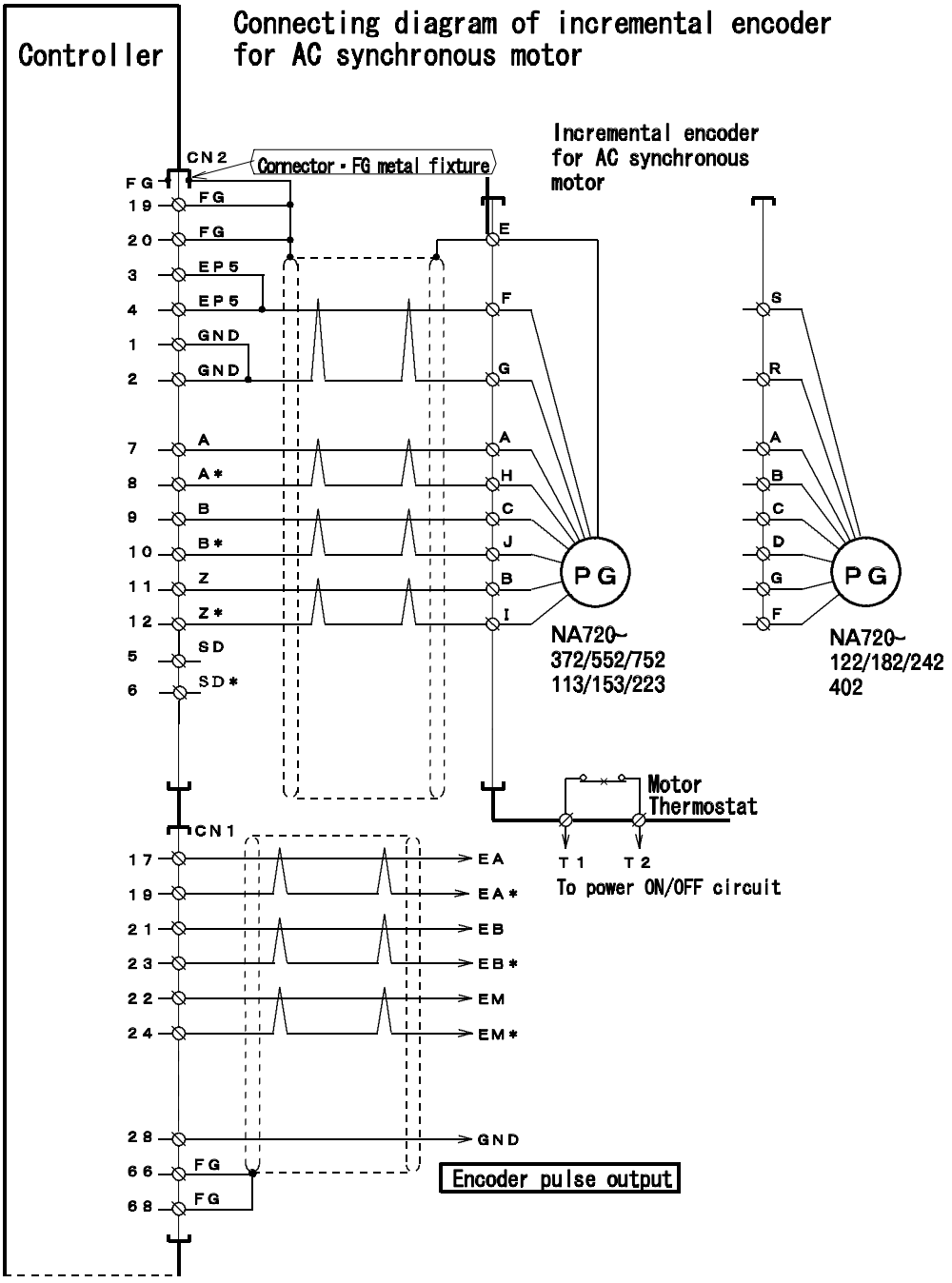
Note 1 : Please provide specified voltage and current for the control input signal power source.
Note 2 : COM of CN1 connector is common to the control output signals (except Servo ready, Alarm, and Encoder marker). COM1 of CN1 connector is common to Servo ready, and Alarm. GND is common to control power source (+5V) in the controller.
COM of J5 is isolated to COM, COM1, and OMO of CN1.
Note 3 : Since [COM COM1 OMO of CN1, COM of J5, and COM of P2] are is olated to GND, please do not put them in common cables and bundles.
Note 4 : +V of P2 connector is internally connected with +V of J5 connector.
And COM of P2 connector is internally connected with COM of J5 connector.
Note 5 : P2 and J5 connecters are used for some types.
Note 6 : P3, P4 and P5 connecters are used for some types.
Note 7 : Serial communication connection to J1 Please connect the internal terminating resistor of communication terminating controller as above described.
(Connection between 3 pin and 5 pin of connector J1 is for using the terminating resistor.)
Note 8 : Dedicated encoder cables can be optionally available.
Note 9 : Status of a switch connected with a control input signal indicates OFF condition of each input signal. However, signals with "(*)" mark at the right end can be changed those signal logic by parameters.
Note10 : Motor and encoder connection can be referred to individual motor manual.
Note11 : Pins without description in this diagram are NC.
Note12 : Connect all shields of CN1 connector to 66 and 68 pins (FG), altogether.
Note13 : As for SQB connection, please refer to separate manual [SQ block].
Note14 : 1-5, 2-6, 3-7, and 4-8 of J2 are internally connected.
Note15 : If this controller is used as a communication terminating unit for Pulse train communication, be sure to connect a terminating connector (option).
Note16 : Only NCS-FI/FS ＊＊M401～402 are not equipped with terminals, r, s, L1, L2, and DN.
Note17 : Motor types NA720 series, NA30 series, and NA100-20F, 40F, 75F are not equipped with blowers.

[Fig. 5－1 (b)] External connecting diagram 2/4



Caution 1. Pin 1 of P2 and Pin2 of P2, and Pin A2 and A2 as well as Pin A2 and A3 of J55 are internally connected each other.
Caution 2. Pin 1 and 2 of TB2, and Pin3 and P4 as well as Pin 5 and Pin 6 are internally connected each other.
Caution 3. Please refer to the 「5-3 Arrangement of Connector Pins」for the details for Pin numbers of Expansion 1 and Expansion 2.
Caution 4. The parameter P714 should be set up according to the usage of BCD data input and digital switch input for Expansion 1.

[Fig.5－1 (c)] External connecting diagram 3/4



[Fig. 5－1 (d)] External connecting diagram 4/4

5－2 Input and output signals

5－2－1 Input and output signal list

Individual signal function is changed by Run mode. Page in the column of function page explains the signal function for each mode.

Signal type	Signal			Inp./Out.	I/O terminal		Remote control
	Function page	Name	Code		Con. No.	Circuit No.	
Control mode signals	5-9	Remote / Local change	PC	Inp.	CN1	I－1	――
		In Remote control mode	RMOD	Out.	――	――	Yes
Common signals to all Run modes	5-10	Emergency stop	EMG＊	Inp.	CN1	I－1	Yes
		Forward over-travel	FOT＊				
		Reverse over-travel	ROT＊				
		Mode selection 1, 2	MD1, MD2				
		Servo ON	SON (＊)				
	5-11	Reset	RST				
		Deviation clear	CLR				
		Speed gain selection	GSEL		――		Yes
		Forced brake ON	BRON				
		Torque limit	TL				
		Torque limit command	TL+,TL-		CN1	I－7	――
	5-12	Servo ready	RDY	Out.	CN1	O－1	Yes
		Alarm	ALM (＊)				
		Warning	WNG (＊)			O－2	
		Speed zero	SZ				
		In Torque limit	LIM				
		Brake release	BRK				
	5-13	Soft.limit switch A, B	SLSA, SLSB		J5	O－6	
	5-23	Pulse train command	FC、FC*、RC、RC*	Inp.	CN1	I－3	――
	5-13	Encoder feedback pulse input	A、A*、B、B*、Z、Z* SD、SD*		CN2	I－4	
		Thermistor input	THM			I－8	
	5-14	Encoder pulse output	EA,EA*,EB,EB* EM,EM*,AD,AD*	Out.	CN1	O－4	
		Encoder marker	OCM			O－3	
		Analog monitor	MON1, MON2 INH0		P1	O－5	
		Serial communication	TXD(A)、TXD(B) RXD(A)、RXD(B) RLR(A)	Inp. Out.	J1	I0－1	
Manual run mode signals	5-15	Forward jog	FJ	Inp.	CN1	I－1	Yes
		Reverse jog	RJ				
		Speed override 1～4	OR1～OR4				
		Command pulse input inhibit	CIH (＊)				
	5-16	Jog speed change	JOSP		――		
		In Manual run mode	MMOD	Out.	――		

[Tab. 5－1 (a)] Input / Output signal list 1/2

Signal type	Signal			Inp. / Out.	I/O terminal		Remote control
	Function page	Name	Code		Con. No.	Circuit No.	
Zero return run mode signals	5-17	Forward jog	FJ	Inp.	CN1	I－1	Yes
		Reverse jog	RJ				
		Hold	HLD				
	5-15	Speed override 1～4※2	OR1～OR4			I－1	Yes
		Cmmd pls in.inhibit※2	CIH (＊)				
	5-17	Zero return decel.	ZLS			I－2	――
		Positioning complete	PN	Out.		O－2	Yes
		Rough matching	PRF				
		In Zero return run	HMOD		――		
Auto. run mode signals	5-18	Auto. start	PST	Inp.	CN1	I－1	Yes
		Address set 1～8	SS1～PS8				
	5-19	Hold	HLD				
	5-15	Speed override 1～4※2	OR1～OR4				
		Cmmd pls in.inhibit※2	CIH (＊)				
	5-17	Zero point decel. ※3	ZLS			I－2	――
	5-19	External trigger	TRG				
		M complete	MFIN		J5	I－5	Yes
		Ext.auto start inhibit	EPIH		――		
		Block stop	BSTP				
		Program cancel	PCAN				
	5-20	BCD data input	D11～D88、D-		J5	I－5	――
		Positioning complete	PN	Out.	CN1	O－2	Yes
		Rough matching	PRF				
		Auto. run ready	PRDY		――		
		Program end	PEND				
	5-21	In Auto. run	AMOD				
		General output 1～8	OUT1～OUT8		J5	O－6	
		M output 01～80	M01～M80				
		M strobe	MSTB				
	5-22	Dig. switch cmmn out.	CM2～CM7				――
		Speed command	INH	Inp.	CN1	I－8	――
		Torque command	TQH			I－9	
Pulse.train run signals	5-23	Cmmd pls input inhibit	CIH (＊)	Inp.	CN1	I－2	Yes
		Pulse train communication	DT,DT*、CK、CK*	Inp. Out.	J2	IO－2	――
	5-24	Positioning complete	PN	Out.	CN1	O－2	Yes
		In Pulse train run	PMOD		――		

※1 The column of signal function indicates page where individual signal function is described.

※2 Speed override signal and command pulse input inhibit functions are common to Manual run mode, Zero return run mode, and Auto. run mode.

※3 Zero return decel. signal function is common to Zero return run mode, and Auto. run mode.

※4 Signals with "＊" in the signal code column are negative-true logic signals, signals with " (＊) " can be changed those logic by parameters, and signals without "＊" are positive-true logic signals.
Relation of individual signal terminal status and logic is described in [5－2－3 Input / Output interface]

※5 I/O terminal and circuit No. columns show Input / Output interface circuit No. of individual signal. Please refer to [5－2－3 Input / Output interface] .

※6 In Remote control column, Yes or No of Remote control by individual signal is shown. Device No. of a signal which can be available for Remote control can be referred to [Tab.5－2 Remote control available signal list] . And regardless to positive-true or negative-true logic, Remote control signal is "ON" to data "1" and "OFF" to data "0".

[Tab.5－1 (b)] Input / Output signal list 2/2

Signal name	Code	Inp./Out.	Device No.		
			Serial communi.	Sequence control	Remote sequence control
Reset	RST	Inp.	X0000	M9144	Ymn00
Emergency stop	EMG*		X0001	M9145	Ymn01
Servo ON	SON(*)		X0002	M9146	Ymn02
Auto. start	PST		X0003	M9147	Ymn03
Hold	HLD		X0004	M9148	Ymn04
Deviation clear	CLR		X0005	M9149	Ymn05
Forward O.T	FOT*		X0006	M9150	Ymn06
Reverse O.T	ROT*		X0007	M9151	Ymn07
Address set 1	SS1		X0008	M9152	Ymn10
Address set 2	SS2		X0009	M9153	Ymn11
Address set 3	SS3		X000A	M9154	Ymn12
Address set 4	PS4		X000B	M9155	Ymn13
Address set 5	PS5		X000C	M9156	Ymn14
Address set 6	PS6		X000D	M9157	Ymn15
Address set 7	PS7		X000E	M9158	Ymn16
Address set 8	PS8		X000F	M9159	Ymn17
Forward jog	FJ		X0018	M9168	Ymn30
Reverse jog	RJ		X0019	M9169	Ymn31
Speed override 1	OR1		X001C	M9172	Ymn34
Speed override 2	OR2		X001D	M9173	Ymn35
Speed override 3	OR3		X001E	M9174	Ymn36
Speed override 4	OR4		X001F	M9175	Ymn37
Mode select. 1	MD1		X0020	M9176	Ymn40
Mode select. 2	MD2		X0021	M9177	Ymn41
Jog speed selec.	JOSP		X0022	M9178	Ymn42
Torque limit	TL		X0023	M9179	Ymn43
Cmmd pls input inhibit	CIH(*)		X0024	M9180	Ymn44
M complete	MFIN		X0031	M9193	Ymn61
Block stop	BSTP		X0033	M9195	Ymn63
Block cancel	PCAN		X0034	M9196	Ymn64
Auto. start inh.	EPIH		X0035	M9197	Ymn65
Forced brake ON	BRON		X0036	M9198	Ymn66
Spd gain select.	GSEL	↓	X0037	M9199	Ymn67

※1 Device No. column shows a device number of Remote control data area corresponding to individual signal.

※2 And regardless to positive-true or negative-true logic, Remote control signal is "ON" to data "1" and "OFF" to data "0".

※3 Mn of Ymn device is 2 digit numeral displayed by octal number for connection node ID No.

[Tab.5－2(a)] Remote control available signal list 1/2

Signal name	Code	Inp./Out.	Device No.		
			Serial communi.	Sequence control	Remote sequence control
Alarm	ALM(*)	Out.	X0060	M9208	Xmn00
Warning	WNG(*)		X0061	M9209	Xmn01
Servo ready	RDY		X0062	M9210	Xmn02
Speed zero	SZ		X0063	M9211	Xmn03
Position. complete	PN		X0064	M9212	Xmn04
Rough matching	PRF		X0065	M9213	Xmn05
Brake release	BRK		X0066	M9214	Xmn06
In Torque limit	LIM		X0067	M9215	Xmn07
Program end	PEND		X0068	M9216	Xmn10
Auto. run ready	PRDY		X0069	M9217	Xmn11
In Manual run	MMOD		X006A	M9218	Xmn12
In Zero return run	HMOD		X006B	M9219	Xmn13
In Auto. run	AMOD		X006C	M9220	Xmn14
In Pulse train run	PMOD		X006D	M9221	Xmn15
In Remote control	RMOD		X006E	M9222	Xmn16
General output 1	OUT1		X0070	M9224	Xmn20
General output 2	OUT2		X0071	M9225	Xmn21
General output 3	OUT3		X0072	M9226	Xmn22
General output 4	OUT4		X0073	M9227	Xmn23
General output 5	OUT5		X0074	M9228	Xmn24
General output 6	OUT6		X0075	M9229	Xmn25
General output 7	OUT7		X0076	M9230	Xmn26
General output 8	OUT8		X0077	M9231	Xmn27
Soft.lim. switch A	SLSA		X007E	M9238	Xmn36
Soft.lim. switch B	SLSB		X007F	M9239	Xmn37
M output 01	MO1		X0080	M9240	Xmn40
M output 02	MO2		X0081	M9241	Xmn41
M output 04	MO4		X0082	M9242	Xmn42
M output 08	MO8		X0083	M9243	Xmn43
M output 10	M1O		X0084	M9244	Xmn44
M output 20	M2O		X0085	M9245	Xmn45
M output 40	M4O		X0086	M9246	Xmn46
M output 80	M8O		X0087	M9247	Xmn47
M strobe	MSTB	↓	X008E	M9254	Xmn56

※1 Device No. column shows a device number of Remote control data area corresponding to individual signal.

※2 And regardless to positive-true or negative-true logic, Remote control signal is "ON" to data "1" and "OFF" to data "0".

※3 Mn of Xmn device is 2 digit numeral displayed by octal number for connection node ID No.

[Tab. 5－2 (b)] Remote control available signal list 2/2

5－2－2 Input and output signal functions

Description of input and output signal functions in this item is effective only when they are not described in the separate instruction manual <Volume Dedicated functions>.
If input and output signal functions are described in the manual <Volume Dedicated functions, they are prior to the same item description in this manual.

Input and output signal functions are described in [Tab.5－1 Input and output signal list] .
Please find page No. in the function column of list and refer to the page.
Next to signal codes, Input and output terminal No. / Serial communication device No. / Sequence control device No. / Remote sequence control device No. are shown in [ ] s.

Control mode signals

Remote / Local change	PC[CN1-7pin/--/--/--]	Inp.	Circuit No.：I-1
Func.	・Control mode is Remote mode when it is ON. ・Control mode is Local mode when it is OFF. ・［PC］of LCD module is lit ON when it is ON.		
Ref.	・In Local mode, External input disable / Remote input enable is set by the parameter「P516」. ・In Remote mode, External input enable is set by the parameter「P517」.		

In Remote control	RMOD[--/X006E/M9222/Xmn16]	Out.	Circuit No.：－－
Func.	・When it is ON, it indicates current mode is Remote mode. ・When it is OFF, it indicates current mode is Local mode.		
Ref.	・In executing Auto. pre-load with compact absolute specification, this signal is OFF. ・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external input signal by the parameters「P737-P739」, if it is ON, the corresponding signal allocated by 「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』 becomes "1".		

Common signal to all mode

Emergency stop	EMG＊[CN1-37pin/X0001/M9145/Ymn01]	Inp.	Circuit No: I-1
Func.	・A motor does not run in Emergency stop status. ・If ON status of this signal continues for more than 10 [ms] during a motor is running, a motor stops in accordance with the method and decel. time specified by parameters [P710] [P711] . After the motor stops and time set by the parameter [P712] passes, the motor becomes in Torque free status and Servo ready signal (RDY) is OFF. ・When Emergency stop is ON, [EMG] of LCD module is lit.		
Ref.	・To release Emergency stop status, turn Emergency stop signal OFF, and input Reset signal (RST). ・Connect normal close contact to this signal.		

Forward over travel	FOT＊[CN1-2pin/X0006/M9150/Ymn06]	Inp.	Circuit No.：I-1
Func.	・If this signal is ON when a motor is running forward, this unit judges that the motor reached forward travel limit point, the motor stops suddenly and becomes in Servo lock. However, reverse motion can be conducted in Manual run. ・When this signal is ON, [FOT] of LCD module is lit.		
Ref.	・Enable / Disable can be selected by the parameter [P705] . ・Connect normal close contact to this signal.		

Reverse over travel	ROT＊[CN1-4pin/X0007/M9151/Ymn07]	Inp.	Circuit No.：I-1
Func.	・If this signal is ON when a motor is running reverse, this unit judges that the motor reached reverse travel limit point, the motor stops suddenly and becomes in Servo lock. However, forward motion can be conducted in Manual run. ・When this signal is ON, [ROT] of LCD module is lit.		
Ref.	・Enable / Disable can be selected by the parameter [P705] . ・Connect normal close contact to this signal.		

Mode selection	MD1 [CN1-11pin/X0020/M9176/Ymn40] MD2 [CN1-9pin/X0021/M9177/Ymn41]	Inp.	Circuit No.：I-1

Func.
・Run mode is selected by the combination of MD1 and MD2 signals.
・Run mode is selected by this signal status as the right tabulation.
・The shift time to a new mode after signals are switched can be set by the parameter [P706] .
・When these signal are ON, [MD2] and [MD1] of LCD module are lit, respectively.

MD2	MD1	Run mode
OFF	OFF	Manual run
OFF	ON	Zero return run
ON	OFF	Auto. run
ON	ON	Pulse train run

Servo ON	SON (＊) [CN1-35pin/X0002/M9146/Ymn02]	Inp.	Circuit No.：I-1
Func.	・When this signal is ON, power transistors are driven and power is supplied to a motor. ・When this signal is OFF, power transistors are not driven and a motor becomes in Torque free. ・When this signal is OFF in motor running, the motor conducts free run stop. ・When this signal is ON, [SON] of LCD module is lit.		
Ref.	・This signal logic can be changed by the parameter [P704] (Initial set:Positive-true).		

Reset	ＲＳＴ[CN1-1pin/X0000/M9144/Ymn00]	Inp.	Circuit No.：I-1
Func.	・When this signal is ON in detecting Alarm, the detecting alarm is released and Alarm signal (ALM) is turned ＯＦＦ . ・During this signal is ON, a motor is in Torque free. ・When ON status is changed to OFF, this unit returns to normal control condition. ・This signal can be also used as a release signal of Emergency stop. ・When this signal is ON, ［ＲＳＴ］ of LCD module is lit.		
Ref.	・Alarm reset can be conducted also by re-inputting power to this unit. ・Alarm reset shall be made after removing the cause. ・This signal can be changed to CPU reset by the parameter (P742). ・Effective signal width is minimum 10［ｍｓ］.		

Deviation clear	ＣＬＲ[CN1-15pin/X0005/M9149/Ymn05]	Inp.	Circuit No.：I-1
Func.	・When this signal is ON, position deviation counter is cleared and a motor stops with zero speed command status. ・When this is ON in motor running, the motor stops suddenly. ・When this signal is ON, ［ＣＬＲ］ of LCD module is lit.		
Ref.	・Effective signal width is minimum 10［ｍｓ］.		

Forced brake ON	ＢＲＯＮ[--/X0036/M9198/Ymn66]	Inp.	Circuit No.：－－
Fu.	・When this signal is ON, Brake release signal (BRK) is forcibly changed to brake status.		
Ref.	・Effective signal width is minimum 10［ｍｓ］. ・This signal can be allocated to an external input signal by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1".		

Spd.gain selec.	ＧＳＥＬ[--/X0037/M9199/Ymn67]	Inp.	Circuit No.：－－
Fn.	・When this signal is ON, this unit is controlled with Speed gain set by P116～P119. ・When this signal is OFF, this unit is controlled with Speed gain set by P01～P104 or P105～P108.		
Ref.	・Effective signal width is minimum 10［ｍｓ］. ・This signal can be allocated to an external input signal by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1". ・Since explanation in this manual is written as this signal is OFF status, unless「When GSEL signal is ON.」is described, please remember this signal is OFF status.		

Torque limit	ＴＬ[--/X0023/M9179/Ymn43]	Inp.	Circuit No.：－－
Fun.	・When this signal is, motor output torque is controlled by parameters (P111,P112). However when output torque set by parameters (P111,P112) is larger than the torque set by parameters (P109,P110), the latter value is selected.		
Ref.	・Effective signal width is minimum 10［ｍｓ］. ・This signal can be allocated to an external input signal by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1".		

Torque limit command	ＴＬ－[CN1-29pin/--/--/--] ＴＬ＋[CN1-30pin/--/--/--]	Inp.	Circuit No.：I-6 Analog signal
Function	・「－１」is set to parameters［P111/112: Torque limit value 2±］ and when Torque limit signal (TL) is ON, motor output torque is limited by this signal voltage. ・「－１」is set to parameters［P111/112: Torque limit value 2±］and「ALM.TL.Y」is set to［P115: Torque limit selection at Alarm stop ］. And when Alarm occurs、motor output torque is limited by this signal voltage. ・However when output torque set by parameters (P111,P112) is larger than the torque set by parameters (P109,P110), the latter value is selected. ・Forward drive torque is limited by TL + command. ・Reverse drive torque is limited by TL - command. ・Based on GND terminals (CN1-27pin) voltage, both of TL+ and TL-ＴＬ＋ are inputted positive voltage. Input range is DC0～＋10V, and each limit value is 300% at ＋10V input.		

Servo ready	ＲＤＹ[CN1-42pin/X0062/M9210/Xmn02]	Out.	Circuit No.：0－1
Func.	・When this unit ready to control, this signal is ON. ・When a motor is in Torque free this signal is OFF. ・When this signal is ON, ［ＲＤＹ］of LCD module is lit.		
Ref.	・This signal can be outputted max. 5 second after re-inputting power. And this signal is ON max. 15 [ｍｓ]after Servo ON signal (SON(*)) is ON, and max. 20 [ｍｓ] after Reset signal (RST) is OFF. Please consider this timing to power re-input and trouble shooting sequence of an external equipment. ・Output condition when Alarm occurs can be changed by the parameter [P716] .		

Alarm	ＡＬＭ（＊）[CN1-44pin/X0060/M9208/Xmn00]	Out.	Circuit No.：0－1
Func.	・When Alarm occurs, this signal is ON. ・When this signal is ON, ［ＡＬＭ］of LCD module is lit.		
Ref.	・This signal logic can be changed by the parameter [P715] (Initial set:Negative-true). ・Alarm reset is conducted by Reset signal (RST) input or power re-input and is OFF max. 20 [ｍｓ] after Reset signal is ON.		

Warning	ＷＮＧ（＊）[CN1-46pin/X0061/M9209/Xmn01]	Out.	Circuit No.：0－2
Func.	・If it is supposed to detect an error and stop when current control is continued, this signal is ON as Warning signal. Even though this signal is ON, running status does not change. ・When it is confirmed that an abnormal error will not occur, this signal is OFF. ・When this signal is ON, ［ＷＮＧ］of LCD module is lit.		
Ref.	・This signal logic can be changed by the parameter [P715] (Initial set:Positive-true). ・This external output signal can be allocated to other external output signal by the parameter「P7401」.		

Spd zero	ＳＺ[CN1-50pin/X0063/M9211/Xmn03]	Out.	Circuit No.：0－2
Func.	・When motor speed is lower than the set of the parameter [P702] , this signal is ON. ・When motor speed is more than the set of the parameter [P702] , this signal is OFF. ・When this signal is ON, ［ＳＺ］of LCD module is lit.		
Ref.	・This external output signal can be allocated to other external output signal by the parameter「P740」.		

In Trq. limit	ＬＩＭ[CN1-48pin/X0067/M9215/Xmn07]	Out.	Circuit No.：0－2
Func.	・When torque is in limit area, this signal is ON. ・When torque is out of limit area, this signal is OFF. ・Torque limit area is determined by parameters [P109] ～ [P112] and Torque limit command (TL±). ・When this signal is ON, ［ＬＩＭ］of LCD module is lit.		
Ref.	・This external output signal can be allocated to other external output signal by the parameter「P741」.		

Brake relea.	ＢＲＫ[CN1-54/X0066/M9214/Xmn06]	Out.	Circuit No.：0－2
Func.	・Design an external sequence to release a motor brake when this signal is ON. ・When Alarm, Emergency stop, or Servo OFF occurs and Reset signal is inputted in motor torque free status, this signal is OFF . ・When this signal is ON, ［ＢＲＫ］of LCD module is lit.		
Ref.	・This external output signal can be allocated to other external output signal by the parameter「P741」.		

Software limit switch A,B	ＳＬＳＡ[J5-A28pin/X007E/M9238/Xmn36] ＳＬＳＢ[J5-B28pin/X007F/M9239/Xmn37]	Out.	Circuit No.：0−6

Function

- In accordance with the area set by parameters [P707] ～ [P709] , signals corresponding to the current position area are outputted.
- Output status of parameters and signals is shown in right tabulation.
- Since Software limit switch output is controlled by current command position, its output differs from its actual position. The error is position deviation amount.
- When machine position is not recognized by Zero return not complete, etc. , this signal is OFF.

SLSB	SLSA	Output condition
OFF	OFF	Before Zero return complete
OFF	OFF	Current position ＜[P707] setting
OFF	ON	[P707]setting≦Current position＜[P708] setting
ON	ON	[P708]setting≦Current position＜[P709]setting
ON	OFF	[P709]setting≦Current position

Ref.

- This signal output terminal is common to M strobe signal (MSTB) output terminal.
- An output signal is selected by the parameter [P718] .
- This signal can be allocated to an external input signal by parameters「P740-P741」.
- When this signal is allocated to an external input signal by parameters「P740-P741」and ON status, the corresponding signal allocated by「ＣＮＩＯ」of『Diagnosis display mode』becomes "1".

Encoder feedback pulse input	A[CN2-7pin/--/--/--], A＊[CN2-8pin/--/--/--], B[CN2-9pin/--/--/--], B＊[CN2-10pin/--/--/--], Z[CN2-11pin/--/--/--], Z＊[CN2-12pin/--/--/--], ＳＤ[CN2-5pin/--/--/--], ＳＤ＊[CN2-6pin/--/--/--]	Inp.	Circuit.No.：I-4

Func.

- Feedback pulse signal from an encoder attached to a motor is inputted.
- A , B and, Z phases of Line driver output [26LS31 or equivalent] are inputted.
- SD and SD＊ are absolute encoder position data.

Thermistor input	ＴＨＭ[CN2-17pin/--/--/--]	Inp.	Circuit.No.：I-7

Func.

- Temperature of a thermistor attached to a motor is inputted.

Encoder pulse output	EA[CN1-17pin/--/--/--], EA*[CN1-19pin/--/--/--] EB[CN1-21pin/--/--/--], EB*[CN1-23pin/--/--/--] EM[CN1-22pin/--/--/--], EM*[CN1-24pin/--/--/--] AD[CN1-25pin/--/--/--], AD*[CN1-26pin/--/--/--]	Out.	Circuit No.: O-4
Fun.	・Encoder feedback pulse input (CN2) is divided to 1/N (N=1～32) by the parameter [P004] set and outputted. ・Outputs are 90° different phase signals of Line driver output [26LS31 or equivalent] . Be sure to interface them with Line receiver [26LS32 or equivalent] .		
Ref.	・This signal (EA,EA*,EB,EB*,EM,EM*,AD,AD*) is unstable for max. 2 seconds after power is re-inputted.		
Encoder marker	OCM[CN1-58pin/--/--/--]	Out.	Circuit No.: O-3
Fun.	・When Encoder feedback marker signals (Z,Z*) are ON, this signal is ON.		
Analog monitor	MON1[P1-2pin/--/--/--], MON2[P1-1pin/--/--/--] INHO[P1-3pin/--/--/--]	Out.	Circuit No.: O-5
Fun.	・They are analog monitor outputs to confirm the controller and motor running status. ・Monitor output contents of MON1 signal are set by the parameter [P700] . ・Monitor output contents of MON2 signal are set by the parameter [P701] ・INHO signal outputs Speed command voltage (INH).		
Serial communication	TXD(A)[J1-1pin,2pin/--/--/--], TXD(B)[J1-8pin,9pin/--/--/--], RXD(A)[J1-4pin,5pin/--/--/--], RXD(B)[J1-11pin,12pin/--/--/--], RLR(A)[J1-3pin/--/--/--] RLT(B)[J1-10pin/--/--/--]	Inp. Out.	Circuit No.: IO-1
Fun.	・By connecting an external equipment to this unit, Serial communication (RS-422) can be conducted. ・Communication condition as baud rate and others can be set by parameters [P510] ～ [P515]) .		

Manual run mode signals

Forward jog	ＦＪ[CN1-3pin/X0018/M9168/Ymn30]	Inp.	Circuit No: I-1

Func.
- When ON status is continued for more than 10 [ｍｓ] , one shot Jog (minimum travel amount setting unit) motion is conducted to forward direction. When ON status is continued for more than 100 [ｍｓ] , Forward jog motion is conducted.
- When this signal is OFF, Forward jog motion is stopped.
  And if Reverse jog signal (RJ) is ON when this signal is ON, Forward jog motion is stopped.
- When this signal is ON, [ＤＲ／ＦＪ] of LCD module is lit.

Reverse jog	ＲＪ[CN1-5pin/X0019/M9169/Ymn31]	Inp.	Circuit No: I-1

Func.
- When ON status is continued for more than 10 [ｍｓ] , one shot Jog (minimum travel amount setting unit) motion is conducted to reverse direction. When ON status is continued for more than 100 [ｍｓ] , Reverse jog motion is conducted.
- When this signal is OFF, Reverse jog motion is stopped.
  And if Forward jog signal (FJ) is ON when this signal is ON, Reverse jog motion is stopped.
- When this signal is ON, [ＴＬ／ＲＪ] of LCD module is lit.

Jog spd.change	ＪＯＳＰ[--/X0022/M9174/Ymn42]	Inp.	Circuit No: ――

Func.
- When this signal is ON, Jog speed is setting value of the parameter [P401] .
- When this signal is OFF, Jog speed is setting value of the parameter [P400] .
- Time lag from signal input to change motion is about 15 [ｍｓ] .
- Signal status changes immediately regardless to Jog direction.

Ref.
- This signal can be allocated to an external input signal by parameters「P737-P739」.
- Current Jog speed can be confirmed by「ＪＳＰ」of『Diagnosis display mode』.

Speed override	ＯＲ１[CN1-55pin/X001C/M9172/Ymn34] ＯＲ２[CN1-53pin/X001D/M9173/Ymn35] ＯＲ３[CN1-51pin/X001E/M9174/Ymn36] ＯＲ４[CN1-49pin/X001F/M9175/Ymn37]	Inp.	Circuit No: I-1

Func.
- Speed can be set to 10%～150% by 10% rate (Resolution 10%) and 15 steps by this signal.
- Time lag from signal input to change motion is about 15 [ｍｓ] .
- OR4～OR1 are handled as 4 bit data and when this signal is ON, corresponding bit is '１'.
- Override rate setting value unit is [10%] and relation of signals and corresponding bit is shown in the right tabulation.
- Motion speed can be gotten by next formula.
  Motion speed ＝ Command speed × Override ratio.
  However if speed after override is more than the rated speed, it is clamped at the rated speed. (It is clamped at 120% speed in control by Speed control or Torque control command.)
- When all of OR4～OR1 are OFF, Override is invalid (100%).

Name	ＯＲ４	ＯＲ３	ＯＲ２	ＯＲ１
bit No	bit３	bit２	bit１	bit０

Ref.
- Set sample : Condition OR4=OFF,OR3=ON,OR2=OFF,OR1=ON,
  Motion speed ＝ Command speed ×５０ [%]
- Current Speed override setting can be confirmed by『Diagnosis display mode』.
- This external output signal can be allocated to other external output signal by the parameter「P739」.

Command pulse input inhibit	ＣＩＨ (＊) [CN1-13pin/X0024/M9180/Ymn44]	Inp.	Circuit No: I-1

Func.
- When this unit is applied to measuring encoder system, this signal selects Pulse train command signal (FC,FC*,RC,RC*) or Encoder feedback pulse input signal for position feedback signal.
- When this signal is ON, [ＣＩＨ] of LCD module is lit.

Ref.
- This signal function is effective by the parameter [P600] .
- This signal logic can be changed by the parameter [P600] .

In Manual run	MMOD[-----/X006A/M9218/Xmn12]	Out.	Circuit No: ――
Func.	・When Run mode is Manual run, this signal is ON.		
Ref.	・Time from Mode selection signal (MD1, MD2) change to this signal output is determined by the parameter [P706] set. (Time lag: [P706] setting value + about 20 [ms]). ・In executing Auto. pre-load with compact absolute specification, this signal is OFF. ・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external input signal by the parameters「P740-P741」, if it is ON, the corresponding signal allocated by 「CN10」of『Diagnosis display mode』 becomes "1".		

Zero return run mode signals

Forward jog	ＦＪ[CN1-3pin/X0018/M9168/Ymn30]	Inp.	Circuit No.：I-1
Fun.	・When ON status is continued for more than 10 [ｍｓ] , Forward zero return is conducted. ・When this signal is ON, [ＤＲ／ＦＪ] of LCD module is lit.		
Ref.	・Zero return method, speed, etc. , are determined by parameters [P402] ～ [P410] .		

Reverse jog	ＲＪ[CN1-5pin/X0019/M9169/Ymn31]	Inp.	Circuit No.：I-1
Fun.	・When ON status is continued for more than 10 [ｍｓ] , Reverse zero return is conducted. ・When this signal is ON, [ＴＬ／ＲＪ] of LCD module is lit.		
Ref.	・Zero return method, speed, etc. , are determined by parameters [P402] ～ [P410] .		

Zero return decel.	ＺＬＳ[CN1-43pin/--/--/--]	Inp.	Circuit No.：I-2
Func.	・When this signal is ON in Zero return, Zero return decel. is started. In standard Zero return, this signal shall be ON from Zero return decel. start and completion (On status is retained at Zero position.) . ・If this signal is already ON when Zero return motion starts, a motor once runs opposite to Zero return direction, and after confirming OFF condition of this signal, runs forward. ・When this signal is ON, [ＺＬＳ] of LCD module is lit.		

Hold	ＨＬＤ[CN1-41pin/X0004/M9148/Ymn04]	Inp.	Circuit No.：I-1
Fun.	・Run motion is held when ON signal of this signal is inputted for more than 10 [ｍｓ]. ・At Hold status, [ＨＬＤ] of LCD module is lit.		
Ref.	・To cancel Hold status, turn this signal OFF and turn Forward jog signal (FJ) or Reverse jog signal (RJ) ON.		

Posi.complete	ＰＮ[CN1-52pin/X0064/M9212/Xmn04]	Out.	Circuit No.：O-2
Func.	・This is ON when Positioning is completed. ・This signal is OFF at { 〔Zero return start〕 , 〔Run mode change〕 , 〔Servo OFF〕 and [Alarm occurrence] , and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } ・When this signal is ON, [ＰＮ] of LCD module is lit.		
Ref.	・This external output signal can be allocated to other external output signal by the parameter「P749」.		

Rough matching	ＰＲＦ[CN1-56pin/X0065/M9213/Xmn05]	Out.	Circuit No.：O-2
Func.	・This is ON when Positioning is completed. ・This signal is OFF at 〔Zero return start〕 , 〔Run mode change〕 , 〔Servo OFF〕 . [Alarm occurrence] , and [ON timing of Emergency stop, Reset, Deviation clear, and Program cancel signals] } ・When this signal is ON, [ＰＲＦ] of LCD module is lit.		
Ref.	・This external output signal can be allocated to other external output signal by the parameter「P740」.		

In Zero return run	HMOD[-----/X006B/M9219/Xmn13]	Out.	Circuit No.：－－
Fun.	・When Run mode is Zero return run mode, this signal is ON.		
Ref.	・Time from Mode selection signal (MD1, MD2) change to this signal output is determined by the parameter [P706] set. (Time lag： [P706] setting value ＋ about 20 [ｍｓ]) 。 ・In executing Auto. pre-load with compact absolute specification, this signal is OFF. ・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external input signal by the parameters「P740-P741」, if it is ON, the corresponding signal allocated by 「ＣＮ１０」of『Diagnosis display mode』 becomes "1".		

○ Speed override signal function is same as the function in Manual run mode.

○ Command pulse input inhibit signal function is same as the function in Manual run mode.

Auto. run mode signals

Auto. start	ＰＳＴ[CN1-39pin/X0003/M9147/Ymn03]	Inp.	Circuit No.：I-1

Func.
- When ON status is continued for more than 10 [ｍｓ] , Auto. run by specified address command starts.
- This signal works as Hold in Auto. run, and re-start signal in Block stop status.
- ［ＰＳＴ］of LCD module is lit when ON of this signal is detected, and lit OFF when Auto. run is completed or stopped.

Ref.
- Auto. start signal thorough CN1-39 pin can be inhibited by External start inhibit signal (EPIH).

Address set	ＳＳ１[CN1-20pin/X0008/M9152/Ymn10] ＳＳ２[CN1-18pin/X0009/M9153/Ymn11] ＳＳ３[CN1-16pin/X000A/M9154/Ymn12] ＰＳ４[CN1-14pin/X000B/M9155/Ymn13] ＰＳ５[CN1-12pin/X000C/M9156/Ymn14] ＰＳ６[CN1-10pin/X000D/M9157/Ymn15] ＰＳ７[CN1-8pin/X000E/M9158/Ymn16] ＰＳ８[CN1-6pin/X000F/M9159/Ymn17]	Inp.	Circuit No.：I-1

Func.

Name	ＰＳ８	ＰＳ７	ＰＳ６	ＰＳ５	ＰＳ４	ＳＳ３	ＳＳ２	ＳＳ１
bit No	bit７	bit６	bit５	bit４	bit３	bit２	bit１	bit０

- This signal specifies start address of Auto. run.
- At the time of inputting Auto. start signal (PST), this is read as executing address data.
- Addresses 0～255 can be set by this signal.
- PS8～SS1 are handled as 8bit data and when this signal is ON, corresponding bit is ‘１’.
- Relation of signals and corresponding bit is in the above tabulation.

Ref.
- Set sample ： PS8=OFF,PS7=ON,PS6=ON,PS5=ON,PS4=ON,SS3=OFF,SS2=ON,SS1=ON
  Address set value is 123
- Current Address setting status can be confirmed by『Diagnosis display mode』.
- This external input signal can be allocated to other external output signal by the parameters (P737-P738).
- In case of a controller which has sequence function in it, address can be set by device data as well as the above method.
  By those methods, any of 0 ～ 279 addresses can be executed (Start) .
  Setting methods can be referred to the separate instruction manual「Volume ＳＱＢ」.

Hold	ＨＬＤ[CN1-41pin/X0004/M9148/Ymn04]	Inp.	Circuit No.：I-1
Fun.	・Run motion is held when ON signal of this signal is inputted for more than 10 [ｍｓ]. ・At Hold status, [ＨＬＤ] of LCD module is lit.		
Ref.	・To cancel Hold status, turn this signal OFF and turn Auto. start signal (PST) ON.		

External trigger	ＴＲＧ[CN1-47pin/--/--/--]	Inp.	Circuit No.：I-2
Fun.c.	・When ON of this signal is inputted in Positioning for more than 200[μｓ], at the time Positioning data in executing are cancelled and Positioning set by External trigger positioning data is conducted. ・[ＴＲＧ] of LCD module is lit when ON of this signal is detected, and lit OFF when Positioning is completed.		
Ref.	・Receipt of signal can be changed to「ＯＮ edge」or「ＯＮ level」by the parameter [P411] . When「ＯＮ level」was selected and ON before executing commands, from start of Auto. run, External trigger positioning is executed.		

M complete	ＭＦＩＮ[J5-A20pin/X0031/M9193/Ymn61]	Inp.	Circuit No.：I-5
Fun.	・When this signal is ON, M strobe output signal (MSTB) is OFF and then next command will be executed. ・If M output command is inputted when this signal is ON, M strobe signal is not turned ON. This signal shall be OFF to turn M strobe signal ON.		
Ref.	・Effective signal width is minimum 10 [ｍｓ] . ・This signal can be allocated to an external input signal of CN1 by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1".		

Block stop	ＢＳＴＰ[-----/X0033/M9195/Ymn63]	Inp.	Circuit No.：－－
Fun.	・When this signal is ON in executing Auto. run command, Auto. run stops at a block end, and becomes in waiting for re-start (Block stop) status. ・If Auto. run is started when this signal is ON, Auto. run stops after executing 1 block and becomes in waiting for re-start status.		
Ref.	・Whether this signal shall be detected or not, and how to conduct processing after this signal is detected depends on a command. ・Effective signal width is minimum 10 [ｍｓ] . ・This signal can be allocated to an external input signal of by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1".		

Program cancel	ＰＣＡＮ[-----/X0034/M9196/Ymn64]	Inp.	Circuit No.：－－
Fun c.	・When this signal is ON in executing Auto. run command, Auto. run is cancelled (Stop of Auto. run / release of Hold status / release of block stop status). ・When this signal is ON in running a motor, the motor conducts decel. stop in accordance with Decel. time selection of individual command. ・In motor stop status or after a motor stops, Auto. run is in waiting for re-start status by Address set.		
Ref.	・Effective signal width is minimum 10 [ｍｓ] . ・This signal can be allocated to an external input signal of by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1".		

Ext.auto start inhibit	ＥＰＩＨ[-----/X0035/M9197/Ymn65]	Inp.	Circuit No.：－－
Fu.	・When this signal is ON, Auto. start signal of the external input (PST signal of CN1-39 pin) is inhibited. (However, Auto. start signals of Serial communication, Sequence control, Remote control device are not inhibited.)		
Ref.	・If External auto. start inhibit signal (EPIH) is OFF when External auto. start signal is ON, Auto. start signal is accepted. ・This signal can be allocated to an external input signal of by parameters「P737-P739」. ・When this signal is allocated to an external input signal by parameters「P737-P739」and ON status, the corresponding signal allocated by「ＰＳＩＮ」or「ＯＲＩＮ」of『Diagnosis display mode』becomes "1".		

BCD data input	D11[J5-B11pin/-/-/-], D12[J5-A12pin/-/-/-], D14[J5-B12pin/-/-/-] D18[J5-A13pin/-/-/-], D21[J5-B13pin/-/-/-], D22[J5-A14pin/-/-/-] D24[J5-B14pin/-/-/-], D28[J5-A15pin/-/-/-], D31[J5-B15pin/-/-/-] D32[J5-A16pin/-/-/-], D34[J5-B16pin/-/-/-], D38[J5-A17pin/-/-/-] D41[J5-B17pin/-/-/-], D42[J5-A18pin/-/-/-], D44[J5-B18pin/-/-/-] D48[J5-A19pin/-/-/-], D51[J5-B3pin /-/-/-], D52[J5-A4pin /-/-/-] D54[J5-B4pin /-/-/-], D58[J5-A5pin /-/-/-], D61[J5-B5pin /-/-/-] D62[J5-A6pin /-/-/-], D64[J5-B6pin /-/-/-], D68[J5-A7pin /-/-/-] D71[J5-B7pin /-/-/-], D72[J5-A8pin /-/-/-], D74[J5-B8pin /-/-/-] D78[J5-A9pin /-/-/-], D81[J5-B9pin /-/-/-], D82[J5-A10pin/-/-/-] D84[J5-B10pin/-/-/-], D88[J5-A11pin/-/-/-], D−[J5-B19pin/-/-/-]	Inp.	Circuit No. ：I-5

Func.	・When “ DIG BCD ” is selected by the parameter [P714] and numeric value data of BCD code is set by an external unit, data can be inputted to Index data No. IX. ・Numeric value data setting range is -99999999～99999999, 8 digits (with ±) . ・When BCD is ON, it means “ 1 ”, and when mark data is ON, it means “ − ”. ・If data other than BCD codes are inputted, they are ignored and last Index data is retained. ・When “ DIG BCD ” is selected by the parameter, by connecting Digital switch unit “ SWU-501B" (Max. 3 lines) or “ SWU-501C ”(1 line), setting value can be stored in Index data area (IX55～IX57).

Posi.complete	PN[CN1-52pin/X0064/M9212/Xmn04]	Out.	Circuit No.：O-2

Func.	・This is ON when difference of current position and positioning data is less than the value set by the parameter [P202] after Positioning command is completed. ・This signal is OFF at 〔Auto. run start〕, 〔Run mode change〕, 〔Servo OFF〕 and 〔Alarm occurrence〕, and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } ・When this signal is ON, [PN] of LCD module is lit.
Ref.	・When Auto. start signal is OFF, this signal can be OFF by the parameter [P719] set. ・This external output signal can be allocated to other external output signal by the parameter [P740] .

Rough matching	PRF[CN1-56pin/X0065/M9213/Xmn05]	Out.	Circuit No.：O-2

Func.	・This is ON when Positioning starts and difference of current position and positioning data is less than the value set by the parameter [P703] . ・This signal is OFF at { 〔Auto. run start〕, 〔Run mode change〕, 〔Servo OFF〕 and 〔Alarm occurrence〕, and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } ・When this signal is ON, [PRF] of LCD module is lit.
Ref.	・This external output signal can be allocated to other external output signal by the parameter [P740] .

Auto.run ready	PRDY[-----/X0069/M9217/Xmn11]	Out.	Circuit No.：−−

Func.	・This signal is ON when Auto. start signal (PST) is「In receivable status」(Waiting for Auto. run start, Hold, waiting for re-start, waiting for re-start in Block stop. ・This signal is OFF at { 〔Auto. run start〕, 〔Run mode change〕, 〔Servo OFF〕 and 〔Alarm occurrence〕, ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] and when 〔Zero return is not completed while Zero return complete condition is set to Auto. run permit condition (409)〕 }
Ref.	・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external output signal by the parameters「P740-P741」, if it is ON, the corresponding signal allocated by 「CN10」of『Diagnosis display mode』 becomes "1".

Program end	PEND[-----/X0068/M9216/Xmn10]	Out.	Circuit No.：−−

Func.	・This signal is ON when PEND command is executed in Auto. run or one of POS / HOME / INDX is executed completely. ・This signal is OFF at { 〔Auto. run start〕, 〔Run mode change〕, 〔Servo OFF〕 and 〔Alarm occurrence〕, and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } .
Ref.	・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external output signal by the parameters「P740-P741」, if it is ON, the corresponding signal allocated by 「CN10」of『Diagnosis display mode』 becomes "1".

In Auto. run	AMOD[-----/X006C/M9220/Xmn14]	Out.	Circuit No.：－－
Fu.	・This signal is ON when Run mode is Auto. run.		
Ref.	・Time from Mode selection signal (MD1, MD2) change to this signal output is determined by the parameter [P706] set. (Time lag： [P706] setting value ＋ about 20 [ｍｓ]) 。 ・In executing Auto. pre-load with compact absolute specification, this signal is OFF. ・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external output signal by the parameters「P740-P741」, if it is ON, the corresponding signal allocated by 「ＣＮ１０」of『Diagnosis display mode』 becomes "1".		

Gen. out.	OUT1[J5-A21pin/X0070/M9224/Xmn20],OUT2[J5-B21pin/X0071/M9225/Xmn21] OUT3[J5-A22pin/X0072/M9226/Xmn22],OUT4[J5-B22pin/X0073/M9227/Xmn23] OUT5[J5-A23pin/X0074/M9228/Xmn24],OUT6[J5-B23pin/X0075/M9229/Xmn25] OUT7[J5-A24pin/X0076/M9230/Xmn26],OUT8[J5-B24pin/X0077/M9231/Xmn27]	Out.	Circuit No.：0-6
Func.	・This is outputted when a command to enable a general output is executed in Auto. run. ・This signal is retained until a command to enable next general output is executed. ・Out 8 ～ OUT 1 are handled as binary data (8 bit) and they are corresponding to bit 7 ～ 0 respectively. When a corresponding bit is “ 1 ”, the output is ON and when“ 0 ”, it is OFF. ・This signal is OFF at { 〔Run mode change〕, 〔Servo OFF〕 and [Alarm occurrence] , and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } .		
Ref.	・This signal output terminal is common to M output signal (M01～ M80) output terminal. ・An output signal is selected by the parameter [P717] . ・This signal can be allocated to an external output signal by parameters「P740-P741」. ・When this signal is allocated to an external output signal by parameters「P740-P741」 and ON status, the corresponding signal allocated by「ＣＮ１０」of『Diagnosis display mode』becomes "1".		

M output	M01[J5-A21pin/X0080/M9240/Xmn40], M02[J5-B21pin/X0081/M9241/Xmn41] M04[J5-A22pin/X0082/M9242/Xmn42], M08[J5-B22pin/X0083/M9243/Xmn43] M10[J5-A23pin/X0084/M9244/Xmn44], M20[J5-B23pin/X0085/M9245/Xmn45] M40[J5-A24pin/X0086/M9246/Xmn46], M80[J5-B24pin/X0087/M9247/Xmn47]	Out.	Circuit No.：0-6
Func.	・This is outputted when a command to enable M output is executed in Auto. run. ・This signal is retained until a command to enable next M output is executed. ・M 80 ～ M 1 are handled as 2 bit BCD code (8 bit) . When a corresponding bit is “ 1 ”, the M output is ON and when“ 0 ”, it is OFF. ・This signal is OFF at { 〔Run mode change〕, 〔Servo OFF〕 and [Alarm occurrence] , and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } .		
Ref.	・This signal output terminal is common to General output signal (Out 01 ～ out 080) output terminal. ・An output signal is selected by the parameter [P717] . ・This signal can be allocated to an external output signal by parameters「P740-P741」. ・When this signal is allocated to an external output signal by parameters「P740-P741」 and ON status, the corresponding signal allocated by「ＣＮ１０」of『Diagnosis display mode』becomes "1".		

M strobe	ＭＳＴＢ[J5-A28pin/X008E/M9254/Xmn56]	Out.	Circuit No.：0-6
Func.	・When a command to enable M output is executed in Auto. run, this is ON as Strobe signal after completion of the command . ・This signal is retained until a command to enable next M output is executed. ・This signal is OFF at { 〔Run mode change〕, 〔Servo OFF〕 and [Alarm occurrence] , and ON timing of [M complete signal, Emergency stop, Reset, Deviation clear, and Program cancel signals] } .		
Ref.	・This signal output terminal is common to Software limit switch A signal (SLSA) output terminal. ・An output signal is selected by the parameter [P718] . ・If Next command is executed completely when M complete signal (MFIN) is ON, this signal is not turned ON. M complete signal shall be OFF to turn this signal ON. ・This signal can be allocated to an external output signal by parameters「P740-P741」. ・When this signal is allocated to an external output signal by parameters「P740-P741」 and ON status, the corresponding signal allocated by「ＣＮ１０」of『Diagnosis display mode』becomes "1".		

Digital switch common output	CM2 [J5-A25pin/-/-/-], CM3 [J5-B25pin/-/-/-] CM4 [J5-A26pin/-/-/-], CM5 [J5-B26pin/-/-/-] CM6 [J5-A27pin/-/-/-], CM7 [J5-B27pin/-/-/-]	Out.	Circuit No. : 0-6

Fun.	・This is a signal to store data when Digital switch unit "SWU-501B" (Max. 3 lines) or "SWU-501C (1 line) is connected to BCD data input signals, and setting value is written to Index data.
Ref.	・When SWU-501 or SWU 501C is connected and setting value is written to Index data, select "DIG COM" by the parameter [P714] .

Speed command	INH [CN1-34pin/--/--]	Inp.	Circuit No. : I-8 Analog signal

Function	・When External speed selection (SEL.0) is executed by Speed control command, a motor runs at the speed proportional to Speed command voltage. ・A motor runs at rated speed when DC ± 10 V is inputted. ・Motor rotating direction is forward by positive voltage and reverse by negative voltage referred to GND terminal voltage. ・Speed command voltage set to motor rated speed can be changed by the parameter (124). ・Offset adjustment of Speed command voltage can be conducted by the parameter (P125). ・Accel./ Decel. time can be set by parameters (P213,P216). ・This signal functions as External speed limit when Torque control command is executed. ・This analog input value is written to Index data No. IX 64.
Ref.	・Speed control command and Torque control command are available for 2 types, NCS-FI/FS1 and NCS-FI/FS2.

Torque command	TQH [CN1-33pin/--/--]	Inp.	Circuit No. : I-9 Analog signal

Function	・When External torque selection (SEL.0) is executed by Torque control command, a motor outputs torque proportional to Torque command voltage. ・A motor outputs 300 % torque when DC ± 10 V is inputted. ・Drive torque direction of a motor is forward by positive voltage and reverse by negative voltage referred to GND terminal voltage. ・Offset adjustment of Torque command voltage can be conducted by the parameter (P126). ・This analog input value is written to Index data No. IX 65.
Ref.	・Torque control command is available for 2 types, NCS-FI/FS1 and NCS-FI/FS2.

○ Speed override signal function is same as the function in Manual run mode.
○ Command pulse input inhibit signal function is same as the function in Manual run mode.
○ Zero return decel. signal function is same as the function in Zero return run mode.

Pulse train run mode signals

Cmmd.pls in.inhibit	ＣＩＨ (＊) [CN1-13pin/X0024/M9180/Ymn44]	Inp.	Circuit No.：I-2

Fun.
- When this signal is ON, Pulse train command is invalid and a motor goes into Servo lock status.
- When this signal is ON in motor running, the motor moves deviation pulse amount in Position deviation counter and stops.
- When this signal is ON, ［ＣＩＨ］of LCD module is lit.

Ref.
- This signal function can be disabled by the parameter P600］.
- This signal logic can be changed by the parameter［P600］.

Pulse train command	ＦＣ[CN1-59pin/--/--/--], ＦＣ＊[CN1-57pin/--/--/--] ＲＣ[CN1-65pin/--/--/--], ＲＣ＊[CN1-63pin/--/--/--]	Inp.	Circuit No.：I-3

Function
- Command pulse types are 90° different phase pulse, Directional pulse, and Directional + feed pulse.
- All the types can be applied to Line driver method and Open collector method.

【Connecting method】
- In case of Line driver method, connect line driver output to FC-FC* and RC-RC*, respectively.
- In case of Open collector method, connect +5V ～ +24V of an external power supply unit to FC and RC, and connect open collector output to FC*,RC* and 0V of an external power supply unit.

【Command pulse method】
- In case of 90° different phase Pulse train command, when a pulse train (B phase) between RC-RC* or RC*-0V is 90° ahead of a pulse train (A phase) between FC-FC* or FC*-0V, a motor runs forward and when 90° behind, the motor runs reverse.
- In case of Directional pulse train command, when Pulse train is inputted to FC-FC* or FC*-0V, a motor runs forward and when to RC-RC* or RC*-0V, the motor runs reverse.
- In case of Directional + feed pulse command, input directional signal to RC-RC* or RC*-0V or input feed pulse to FC-FC* or FC*-0V.
- Directional signal becomes a forward motion command when RC is "L" and RC* is "H" and when RC is "H" and RC* is "L" becomes a reverse motion command in case of Line driver method. And in case of Open collector method, it becomes a forward motion command when RC* and 0V terminals are opened and a reverse motion command when RC* and 0V terminals are short-circuited.

【Parameter 】
- Command pulse type is selected by the parameter［P602］. Multiplication ratio of 90°different phase pulse train command can be selected.
- A motor can run reverse by Forward directional pulse train command by the parameter ［P601］.

【Pulse train command input frequency】
- Max. input frequency of Pulse train command is as below.
  Line driver method
  90°different phase pulse ：２５０kpps (４ times ： １Mpps)
  Directional pulse ：２５０kpps
  Open collector method ：２００kpps
- Command pulse width shall be 2 μs or more.

Ref.
- In the point of noise resistance, Line driver method is recommended.
- This unit can be also used as a position feedback input signal in measuring encoder system.

Pls. train communicat.	ＤＴ[J2-3,7pin/--/--/--], ＤＴ＊[J2-4,8pin/--/--/--] ＣＫ[J2-1,5pin/--/--/--], ＣＫ＊[J2-2,6pin/--/--/--]	I/O	Circuit No.：IO-2

Fun.
- When this signal is connected to other NCS-FI/FS or NPS-FI/FS, Pulse train data command transmission and receipt is conducted.
- When Pulse train is transmitted, Pulse train to be transmitted is selected by the parameter (P608).
- Pulse train run can be conducted by Received pulse train selected by parameters (P602,P608).

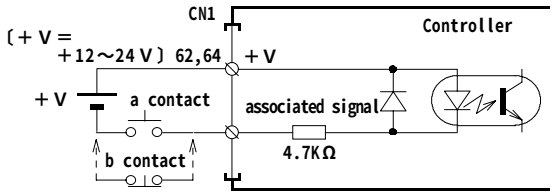
Ref.
- Pulse train communication can be referred to items of parameters (P602,P608).

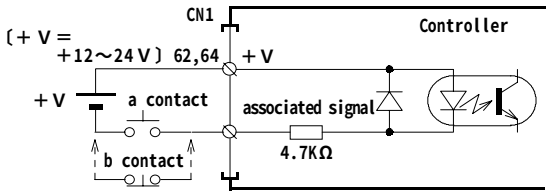
Posi.complete	ＰＮ[CN1-52pin/X0064/M9212/Xmn04]	Out.	Circuit No.：O-2
Func.	・When Deviation counter value is less than parameter [P202] set, this signal is ON. ・This signal is OFF at { 〔Run mode change〕 , 〔Servo OFF〕 and [Alarm occurrence] , and ON timing of [Emergency stop, Reset, Deviation clear, and Program cancel signals] } . ・When this signal is ON, ［ＰＮ］ of LCD module is lit.		
Ref.	・This external output signal can be allocated to other external output signal by parameters「P740」.		

In Pulse train run	ＰＭＯＤ[-----/X006D/M9221/Xmn15]	Inp.	Circuit No.：－－
Func.	・When Run mode is「Pulse train run mode」, this signal is ON.		
Ref.	・Time from Mode selection signal (MD1, MD2) change to this signal output is determined by the parameter [P706] set. (Time lag： [P706] setting value ＋ about 20 [ｍｓ]) 。 ・In executing Auto. pre-load with compact absolute specification, this signal is OFF. ・It can be allocated to an external output signal by the parameters「P740-P741」. ・When it is allocated to an external input signal by the parameters「P740-P741」, if it is ON, the corresponding signal allocated by 「ＣＮ１０」of『Diagnosis display mode』 becomes "1".		

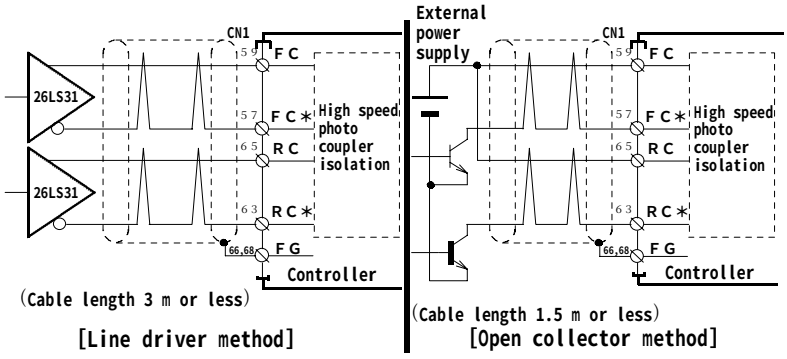
5－2－3 Input and output interface

Input and output signal types and those equivalent circuits are shown in the next list. Individual Input and output signal types are described in Input and output terminal and circuit No. columns of [Tab. 5－1 Input and output signal list].

Circuit No.	Electric specification		Circuit
I－1	Insulat. method	Photo coupler	
	Voltage range	DC10.2～26.4V	
Associa.signal	Ripple ratio	Within 5%	
	Rated input current (/1 pnt.)	Ap.2.5mA/DC12V Ap.5.0mA/DC24V	
PST, CIH EMG＊ FOT＊ ROT＊ SON (＊) RST, CLR HLD, PC SS1～PS8 OR1～OR4 FJ, RJ MD1／2	Input resistor	Apr.4.7kΩ	
	Input filter time constant	Apr.1.5ms	
	Use a micro current switching relay or an Open collector output transistor for the contact. Signals without "＊" symbol are positive-true logic. It is ON when the contact is closed, and OFF when it is opened. Signals with "＊" symbol are negative-true logic. It is ON when the contact is opened, and OFF when it is closed. Logic of signals with "　(＊)　" can be changed by the parameter.		

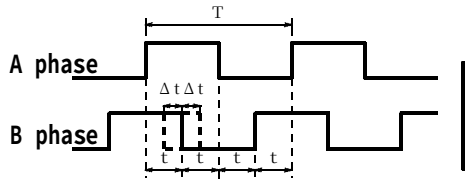
Circuit No.	Electric specification		Circuit
I－2	Insulat. method	Photo coupler	
	Voltage range	DC10.2～26.4V	
Associa.signal	Ripple ratio	Within 5%	
	Rated input current (1/ pnt.)	Ap.2.5mA/DC12V Ap.5.0mA/DC24V	
ZLS, TRG	Input resistor	Apr. 4.7kΩ	
	Input filter time constant	Apro. 120μs	
	Use a micro current switching relay or an Open collector output transistor for the contact. Signals without "＊" symbol are positive-true logic. It is ON when the contact is closed, and OFF when it is opened. Logic of signals with "　(＊)　" can be changed by the parameter.		

Circuit No.				
I－3	Elec. Spec.	Insulat. method	Photo coupler	
		Min.inp. pls.width	1μs	
Associa.signal		Input method	Line driver method	Open collector method
		Max.inp.frequency	250kpps	200kpps
FC, FC＊ RC, RC＊		Line driver	26LS or equivalent	――――――
		Transis.saturat. V	――――	0．9V or less
		Voltage range	――――	DC4.75～26.4V
		Rated inp. current		Apro. 10mA/ 1 point
	Circuit			

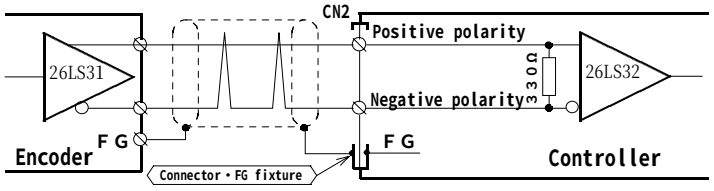


※In some case, it is better to connect Pulse train command output side and each controller GND.

Circuit No.		
I－4	E. S p c.	In forward motor motion, B phase is ahead of A phase.
Associa.signal		
Encoder feedback pulse input (A, A＊ B, B＊ Z, Z＊ SD, SD＊)	C i r c u i t	

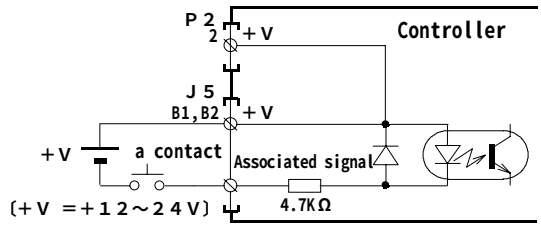


t = T／4
Δt = ±T／8

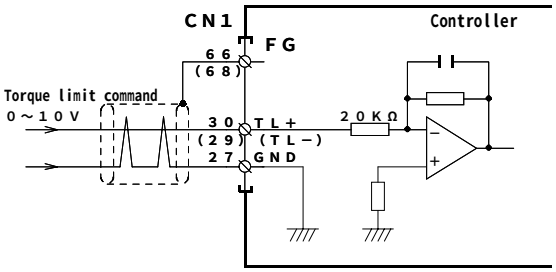


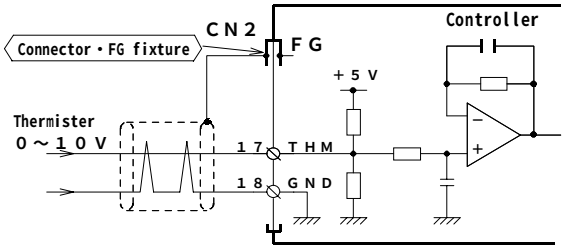
	+ Sign.	- Sig.
A phs.	A	A＊
B phs.	B	B＊
Z phs.	Z	Z＊
	SD	SD＊

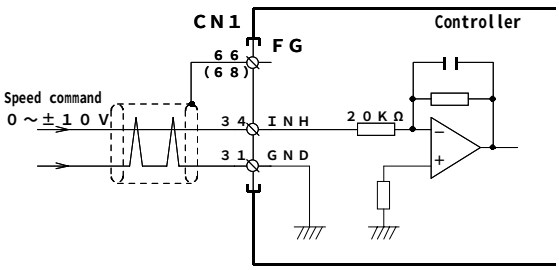
Encoder feedback pulse shall be Line driver (26LS or equivalent) output.

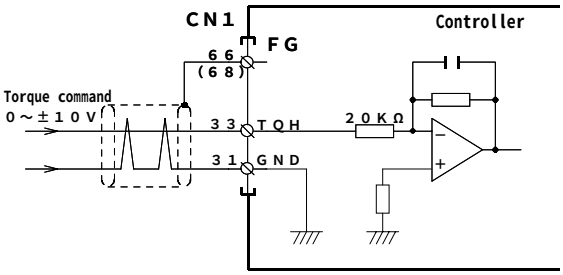
Circuit No.	Electric specification		Circuit
I－5	Insulat. method	Photo coupler	
Associa.signal	Voltage range	DC10.2～26.4V	
MFIN D11～D88 D－	Ripple ratio	Within 5%	
	Rated input current (1 point)	Ap.2.5mA/DC12V Ap.5.0mA/DC24V	
	Input resistor	Apro. 4.7kΩ	
	Input filter time constant	Apro. 2ms	

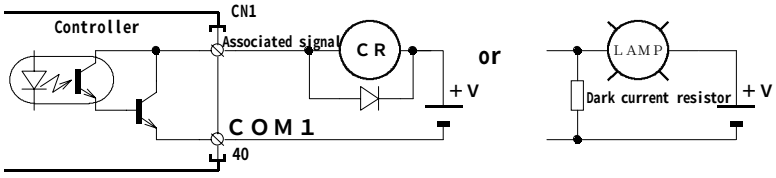
Use a micro current switching relay or an Open collector output transistor for the contact. Signals without "＊" symbol are positive-true logic. It is ON when the contact is closed, and OFF when it is opened.

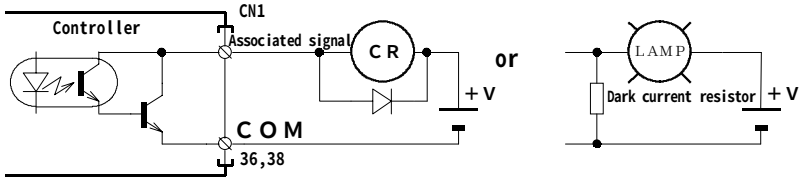
Circuit No.	Electric specification		Circuit
I－6	Voltage range	DC 0～10V	
Associa.signal	Use twist-pair cables and be sure to connect the shield to shield connection terminal (FG).		
TL+ TL－			

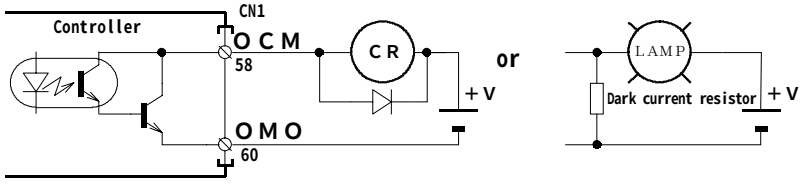
Circuit No.	Electric specification		Circuit
I－7	Voltage range	DC 0～10V	
Associa.signal	Use twist-pair cables and be sure to connect the shield to the connector FG metal fitting. This signal is effective only when a motor equipped with a thermal is used.		
THM			

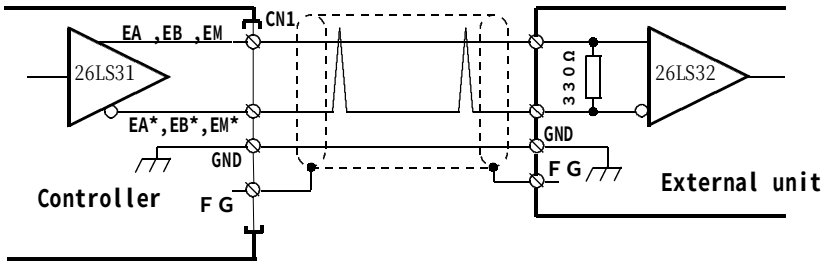
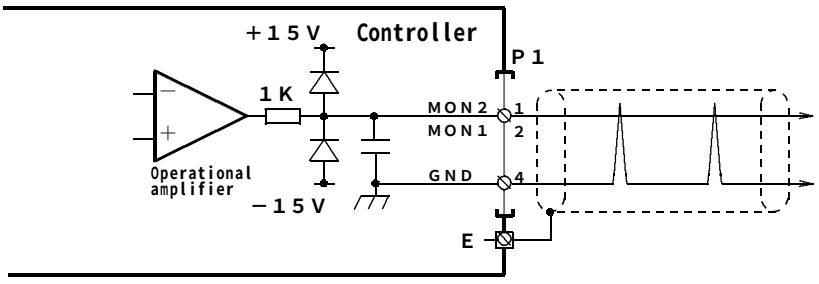
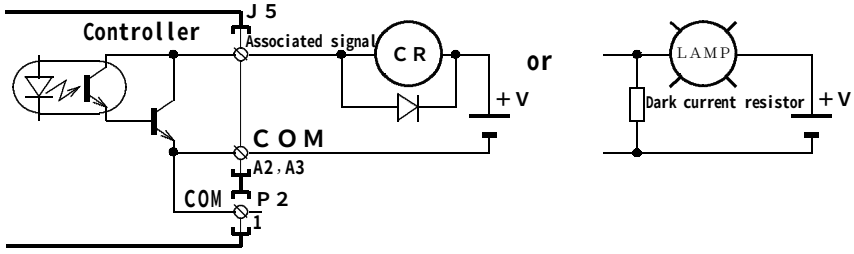
Circuit No.	Electric specification	Circuit
I－8	Voltage range DC -10～10V	
Associa.signal	Use twist-pair cables and be sure to connect the shield to shield connection terminal (FG).	
INH		

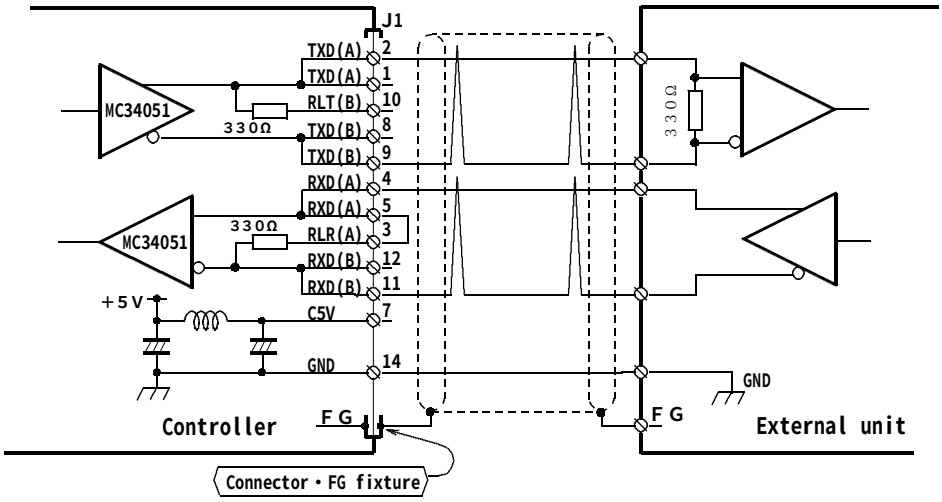
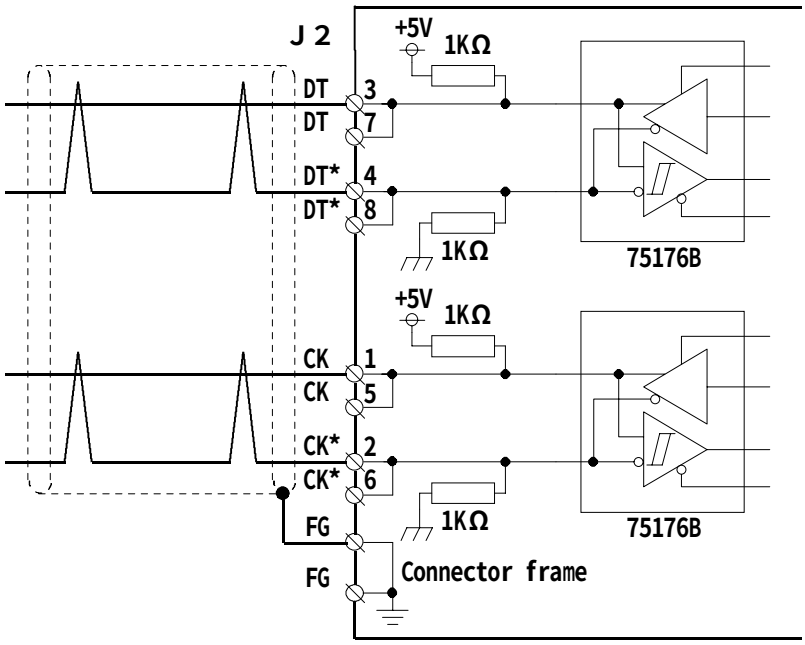
Circuit No.	Electric specification	Circuit
I－9	Voltage range DC -10～10V	
Associa.signal	Use twist-pair cables and be sure to connect the shield to shield connection terminal (FG).	
TQH		

Circuit No.	Electric specification		Signals without "＊" symbol are positive-true logic. When this and COM1 are closed, it is ON. Logic of signals with " (＊) " can be changed by the parameter. COM1 is isolated to COM of circuit No.O-2 and OMD of O-3.
O－1	Insula.method	Photo-coupler	
	Max.load Volt.	DC30V	
	Max.load crnt.	50mA / 1 point	
Associ. signal	Leak current	0.1mA or less	
	Saturated vol.	1.0V or less	
RDY ALM (＊)	Circuit	 When inductive load as a relay, etc. is coneected, be sure to insert a diode, in parallel with the load. In case of lamp load, insert a dark current resistor to keep current (includes rush current) lower than the rated value.	

Circuit No.	Electric specification		Signals without "＊" symbol are positive-true logic. When this and COM are closed, it is ON. Logic of signals with " (＊) " can be changed by the parameter. COM is isolated to COM1 of circuit No.O-1 and OMD of O-3.
O－2	Insula.method	Photo-coupler	
	Max.load Volt.	DC30V	
	Max.load crnt.	50mA / 1 point	
Associ. signal	Leak current	0.1mA or less	
	Saturated vol.	1.0V or less	
WNG (＊) SZ PN PRF LIM BRK	Circuit	 When inductive load as a relay, etc. is coneected, be sure to insert a diode, in parallel with the load. In case of lamp load, insert a dark current resistor to keep current (includes rush current) lower than the rated value.	

Circuit No.	Electric specification		Signals without "＊" symbol are positive-true logic. When this and COM are closed, it is ON. Logic of signals with " (＊) " can be changed by the parameter. OMD is isolated to COM1 of circuit No.O-1 and COM of O-2.
O－3	Insula.method	Photo-coupler	
	Max.load Volt.	DC30V	
	Max.load crnt.	50mA / 1 point	
Associ. signal	Leak current	0.1mA or less	
	Saturated vol.	1.0V or less	
OCM	Circuit	 When inductive load as a relay, etc. is coneected, be dure to insert a diode, in parallel with the load. In case of lamp load, insert a dark current resistor to keep current (includes rysh current) lower than the rated value.	

Circuit No.	Circuit
O－4 Associ. signal Encoder pulse output （EA EA＊ EB EB＊ EM EM＊ AD AD＊）	 Since Line driver (26LS31 or equivalent) is used for outputs, interface it with Line receiver (26LS32 or equivalent). Terminating resistor of receiving side shall be 300Ω (1/2W or more) . In motor CCW rotation, B phase is outputted ahead of A phase. Relation of A and B phases is always corresponding to motor rotating direction and unchanged by rotating direction set of the parameter. This unit is unstable for about max.2 seconds after power is turned ON.
Circuit No. O－5 Associ. signal Analog monitor （MON1 MON2 INH0）	 When 1m or longer cable is used, apply a twist-pair shield cable and connect the shield to the controller ground terminal (E).
Circuit No. O－6 Associ. signal OUT1～OUT8 M01～M80 MSTB SLSA SLSB CM2～CM7	Electric specification Insula.method: Photo-coupler Max.load Volt.: DC30V Max.load crnt.: 50mA / 1 point Leak current: 0.1mA or less Saturated vol.: 1.0V or less Signals without "＊" symbol are positive-true logic. When this and COM are closed, it is ON. Logic of signals with " (＊) " can be changed by the parameter. COM is isolated to COM1 of circuit No.O-1 and COM of O-2.  When inductive load as a relay, etc. is connected, be sure to insert a diode, in parallel with the load. In case of lamp load, insert a dark current resistor to keep current (includes rush current) lower than the rated value.

Circuit No.	Circuit
IO－1 Associ. signal Serial （TXD(A) TXD(B) RXD(A) RXD(B) RLR(A)） communication	 Communication method is RS-422A. RLR(A) and RXD(A) terminals of a communication terminating controller shall be connected to enable an internal terminating resistor. And a terminating resistor shall be connected to an external equipment as well.
Circuit No. IO－2 Associ. signal Pulse train communication （DT DT＊ CK CK＊）	 Communication method is RS-485. Connect a connector for a terminating resistor to a communication terminating controller.

5－3 Connector pin location

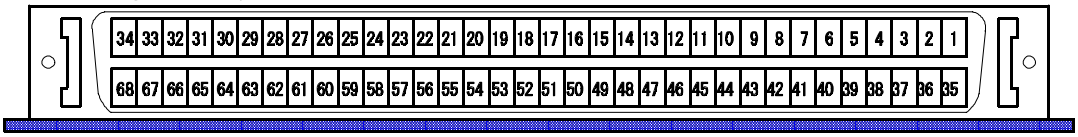
5－3－1 Control I/O signal connector (CN1)

No.	Signal code	Signal name	No.	Signal code	Signal name
1	RST	Reset	35	SON (*)	Servo ON
2	FOT*	Forward over travel	36	COM	Output signal common
3	FJ	Forward jog	37	EMG*	Emergency stop
4	ROT*	Reverse over travel	38	COM	Output signal common
5	RJ	Reverse jog	39	PST	Auto. start
6	PS8	Address set 8	40	COM1	Output signal common 1
7	PC	Remote/ Local change	41	HLD	Hold
8	PS7	Address set 7	42	RDY	Servo ready
9	MD2	Mode selection 2	43	ZLS	Zero point decel.
10	PS6	Address set 6	44	ALM (*)	Alarm
11	MD1	Mode selection 1	45		
12	PS5	Address set 5	46	WNG (*)	Warning
13	CIH (*)	Command pls.inp.inhibit	47	TRG	External trigger
14	PS4	Address set 4	48	LIM	In Torque limit
15	CLR	Deviation clear	49	OR4	Speed override 4
16	SS3	Address set 3	50	SZ	Speed zero
17	EA	Enco.pls.A phase out.(+)	51	OR3	Speed override 3
18	SS2	Address set 2	52	PN	Positioning complete
19	EA*	Enco.pls.A phase out.(-)	53	OR2	Speed override 2
20	SS1	Address set 1	54	BRK	Brake release
21	EB	Enco.pls.B phase out.(+)	55	OR1	Speed override 1
22	EM	Enco.pls.marker out.(+)	56	PRF	Rough matching
23	EB*	Enco.pls.B phase out.(-)	57	FC*	Forward pulse command(-)
24	EM*	Enco.pls.marker out.(-)	58	OCM	Encoder marker output
25	AD	ABS serial data out.(+)	59	FC	Forward pulse command(+)
26	AD*	ABS serial data out. (-)	60	OMO	Encod.marker out. common
27	GND	Int.control power common	61	NC	No connection (Reserved)
28	GND		62	P. 24	External control power
29	TL－	Torque limit－command	63	RC*	Reverse pulse command(-)
30	TL＋	Torque limit＋command	64	P. 24	External control power
31	GND	Int.control power common	65	RC	Reverse pulse command(+)
32	GND		66	FG	Shield earth
33	TQH	Torque command	67	NC	No connection (Reserved)
34	INH	Speed command	68	FG	Shield earth

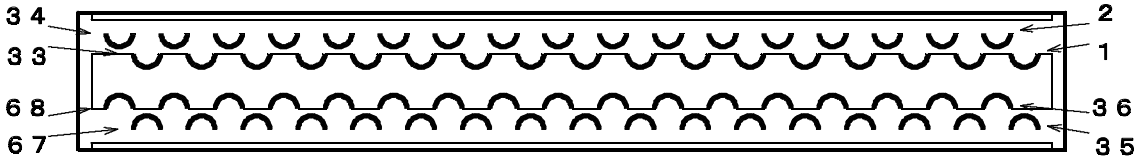
※1 Logic of signal code without "＊" is Positiv-true, logic of signal code with "＊" is Negative-true and logic of signal code with " (*) " can be changed logic by the parameter.

Applied connector : Receptacle ／DX10A－68S (3M product)
Cable side mating connector : Soldered plug ／DX40－68P
: Case (shell) ／DX－68－CV1

※2 Below fig. is layout of the unit connector viewed from the connector side.



※3 Below figure is layout of the cable connector side viewed from soldered terminals.



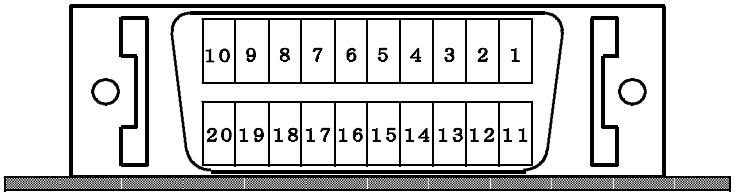
[Tab.5－3] Connector CN1 terminal location

5－3－2 Encoder feedback pulse input connector (CN2)

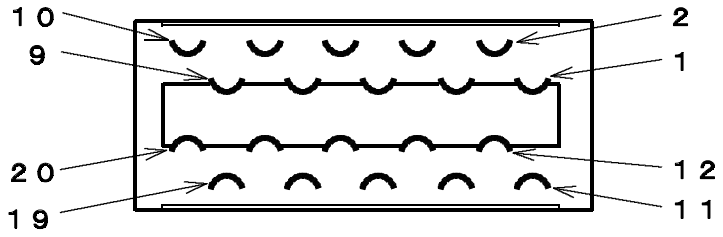
No.	Signal code	Signal name	No.	Signal code	Signal name
1	GND	Encoder power common	11	Z	Enco.marker sig. inp.(+)
2	GND	〃	12	Z＊	〃 (-)
3	EP5	Encoder power (＋5V)	13	NC	No connection (Reserved)
4	EP5	〃	14	NC	No connection (Reserved)
5	SD	ABS position data (+)	15	NC	No connection (Reserved)
6	SD＊	〃 (-)	16	NC	No connection (Reserved)
7	A	Enco.pls.A phase inp.(+)	17	THM	Thermistor input
8	A＊	〃 (-)	18	GND	Thermistor input common
9	B	Enco.pls.B phase out.(+)	19	FG	Shield earth
10	B＊	〃 (-)	20	FG	Shield earth

Applied connector : Receptacle ／10220－52A2JL (3M product)
Cable side mating connector : Soldered plug ／10120－3000VE
: Case (Shell) ／10320－52A0－008

※1 Below fig. is layout of the unit connector viewed from the connector side.



※2 Below figure is layout of the cable connector side viewed from soldered terminals.



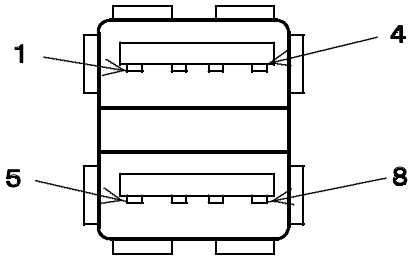
[Tab.5－4] Connector CN2 terminal location

5－3－3 Pulse train communication connector (J2)

No.	Signal code	Signal name	No.	Signal code	Signal name
1	CK	Clock signal(+)	5	CK	Clock signal(+)
2	CK＊	〃 (-)	6	CK＊	〃 (-)
3	DT	Data signal (+)	7	DT	Data signal(+)
4	DT＊	〃 (-)	8	DT＊	〃 (-)

Applied connector : Receptacle ／DUSB-ARB82-T11A(D2) (DDK product)
Cable side mating connector: Plug harness ／DUSB-HAN21-FBm (DDK product)
(m = 05,10,30)

※1 Below fig. is layout of the unit connector viewed from the connector side.



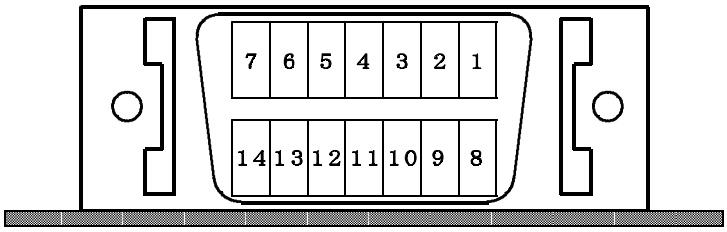
[Tab.5－5] Connector J2 terminal location

5－3－4 Serial communication connector (J1)

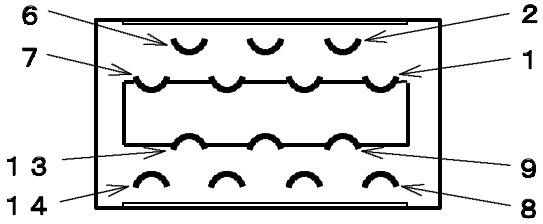
No.	Signal code	Signal name	No.	Signal code	Signal name
1	TXD(A)	Trans.data (pair:TXD(B))	8	TXD(B)	Trans.data (pair:TXD(A))
2	TXD(A)	〃	9	TXD(B)	〃
3	RLR(A)	Receiv.line end resistor	10	RLT(B)	Trans.line end resistor
4	RXD(A)	Receiv.data(pair:RXD(B))	11	RXD(B)	Receiv.data(pair:RXD(A))
5	RXD(A)	〃	12	RXD(B)	〃
6	——	(un-used / reserved)	13	——	(un-used / reserved)
7	C5V	Int. control power + 5	14	GND	Int.control power common

Applied connector : Receptacle ／10214－52A2JL (3M product)
Cable side mating connector : Soldered plug ／10114－3000VE
: Case (shell) ／10314－52A0－008

※1 Below fig. is layout of the unit connector viewed from the connector side.



※2 Below figure is layout of the cable connector side viewed from soldered terminals .



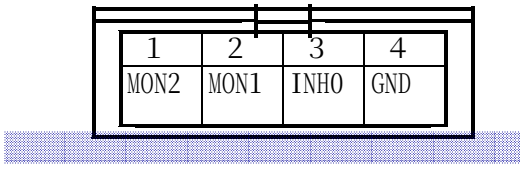
[Tab.5－6] Connector J1 terminal location

5－3－5 Analog monitor connector (P1)

No.	Signal code	Signal name	No.	Signal code	Signal name
1	MON2	Analog monit.out.signal1	3	INH0	Speed command volt. out.
2	MON1	Analog monit.out.signal2	4	GND	Int.control power common

Applied connector : Receptacle ／IL－4P－S3FP2 (JAE product)
Cable side mating connector : Plug (compressive type) ／IL－4S－S3l

※1 Below fig. is layout of the unit connector viewed from the connector side.



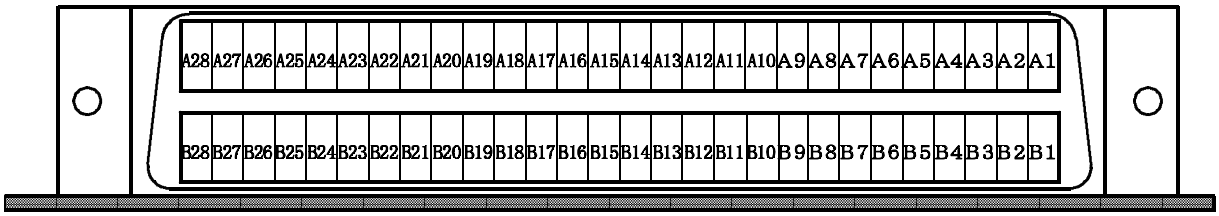
[Tab.5－7] Connector P1 terminal location

5－3－6　BCD data input connector（J５）

No.	Signal code	Signal name	No.	Signal code	Signal name
A１	FG	Shield earth	B１	＋V	Exte. power (DC+12～+24V)
A２	COM	Output signal common	B２	＋V	Exte. power (DC+12～+24V)
A３	COM	Output signal common	B３	D５１	BCD data 1×10^4
A４	D５２	BCD data 2×10^4	B４	D５４	BCD data 4×10^4
A５	D５８	BCD data 8×10^4	B５	D６１	BCD data 1×10^5
A６	D６２	BCD data 2×10^5	B６	D６４	BCD data 4×10^5
A７	D６８	BCD data 8×10^5	B７	D７１	BCD data 1×10^6
A８	D７２	BCD data 2×10^6	B８	D７４	BCD data 4×10^6
A９	D７８	BCD data 8×10^6	B９	D８１	BCD data 1×10^7
A10	D８２	BCD data 2×10^7	B10	D８４	BCD data 4×10^7
A11	D８８	BCD data 8×10^7	B11	D１１	BCD data 1×10^0
A12	D１２	BCD data 2×10^0	B12	D１４	BCD data 4×10^0
A13	D１８	BCD data 8×10^0	B13	D２１	BCD data 1×10^1
A14	D２２	BCD data 2×10^1	B14	D２４	BCD data 4×10^1
A15	D２８	BCD data 8×10^1	B15	D３１	BCD data 1×10^2
A16	D３２	BCD data 2×10^2	B16	D３４	BCD data 4×10^2
A17	D３８	BCD data 8×10^2	B17	D４１	BCD data 1×10^3
A18	D４２	BCD data 2×10^3	B18	D４４	BCD data 4×10^3
A19	D４８	BCD data 8×10^3	B19	D－	Code data
A20	MFIN	M complete	B20	－－－－－	Un-used (never connect)
A21	OUT1/M01	General out.2^0 /M out. 2^0	B21	OUT2/M02	General out.2^1 /M out. 2^1
A22	OUT3/M04	General out.2^2 /M out. 2^2	B22	OUT4/M08	General out.2^3 /M out. 2^3
A23	OUT5/M10	General out.2^4 /M out. 2^4	B23	OUT6/M20	General out.2^5 /M out. 2^5
A24	OUT7/M40	General out.2^6 /M out. 2^6	B24	OUT8/M80	General out.2^7 /M out. 2^7
A25	CM２	Digi.swi. 1 line L select.	B25	CM３	Digi.swi. 1 line H select.
A26	CM４	Digi.swi. 2 line L select.	B26	CM５	Digi.swi. 2 line H select.
A27	CM６	Digi.swi. 3 line L select.	B27	CM７	Digi.swi. 3 line H select.
A28	SLSA/MSTB	Soft. switch A / M strobe	B28	SLSB	Software limit switch B

Applied connector : Receptacle ／FCN－365P056－AU (Fujitsu product)
Cable side mating connector : Soldered plug ／FCN－361J056－AU
: Case (shell) ／FCN－360C056－B

※１　Below fig. is layout of the unit connector viewed from the connector side.



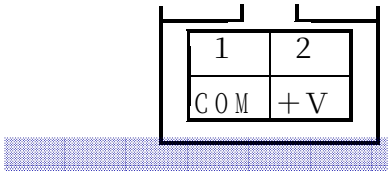
[Tab.５－８]　Connector J5 terminal location

5－3－7　External power connector（P２）

No.	Signal code	Signal name	No.	Signal code	Signal name
1	COM	Output signal common	2	＋V	Exte. power (DC+12～+24V)

※１　Connector for external power connection. COM is connected A2 and A3 pins of J5 connector. +V is connected to B1 and B2 pins of J5 connector.
Applied connector : Receptacle ／IL－2P－S3FP2 (JAE Product)
Cable side mating connector ：Plug (compressive type) ／IL－2S－S3l

※２　Below fig. is layout of the unit connector viewed from the connector side.

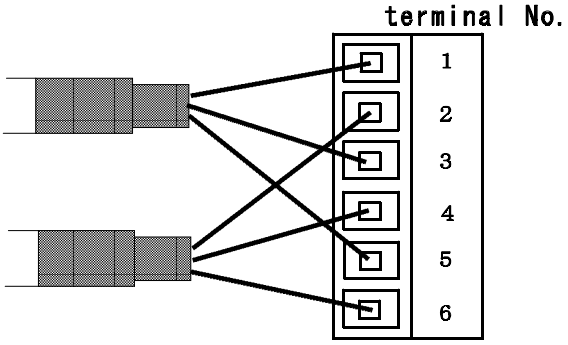


※３ When external power is connected through J5, this external power is not necessary

[Tab.５－９]　Connector P2 terminal location

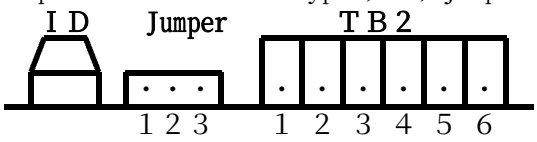
5－3－8 High speed communication connector （ＴＢ２）

No.	Signal code	Signal name		Signal code	Signal name
1	ＬＩＮＥ＋	Data cable +	2	ＬＩＮＥ＋	Data cable +
3	ＬＩＮＥ－	Data cable -	4	ＬＩＮＥ－	Data cable -
5	ＦＧ	Shield earth	6	ＦＧ	Shield earth



Above fig. is layout of the high speed communication terminal block viewed from the unit front face. 1, 3, and 5 terminals are one pair and 2, 4, and 6 are another one pair. The below cable is used when this unit is not a terminating unit but connected to other units with a digital chain.

For high speed communication types, ID, jumpers, and TB2 are attached as below.



1） ＩＤ

This sets node ID No. of high speed communication.

① For Sequence control + high speed communication types, be sure to set "0" to the node ID No.

② For high speed communication types, be sure to set other than "0" to the node ID No. . If "0" is set, high speed communication is not conducted.
And if plural high speed communication types are connected at TB2, set node ID No. from 1 in order and do not duplicate node ID No. .

2） Jumper

This sets a terminating resistor for high speed communication.

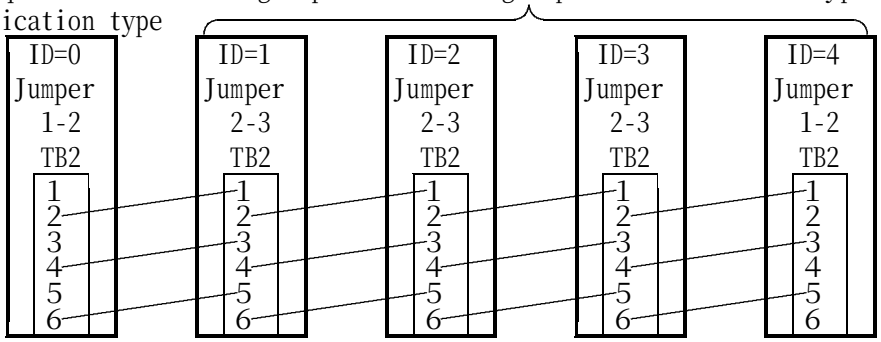
① When this unit is a terminating unit, set it ON (1-2 jumper).

② When this unit is not a terminating unit, set it OFF (2-3 jumper).

3） Setting and connecting sample of ID, jumper, and TB2

The below is sample in case that 5 units are connected by digital chain in high speed communication.

For Sequence control + high speed communication type　　For high speed communication type



［Tab.５－１０］ Connector TB2 terminal location

5－4 Control mode

5－4－1 Control mode selection

In this unit, modes are divided into 3 levels which are ［Control mode level］, ［Run mode level］, and［Operation / Display mode level］. And ［Control mode level］ described in this phrase shall be selected / set first in order to run this unit.
As for mode configuration , please refer to the separate manual 「Volume: Dedicated function」.
And mode selection of Control mode level is conducted by inputting the external input signal, Remote / Local selection (PC).

Local mode

Local mode selects individual Run mode level, starts / stops individual motion basically by control input signals.

Remote mode

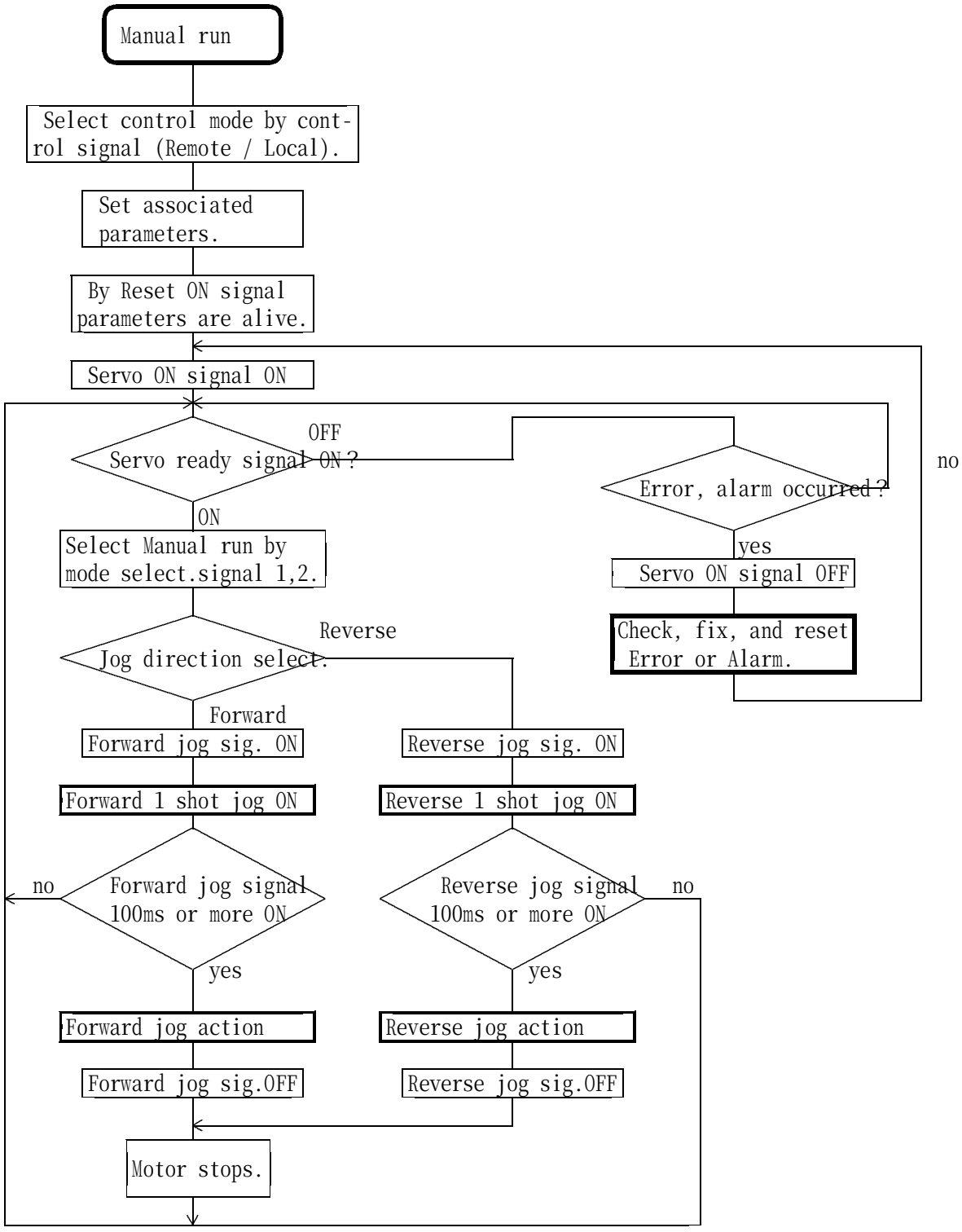
Remote mode selects individual Run mode level, starts / stops individual motion basically by Serial communication or sequence control.
As for communication method, please refer to the separate manual「Volume : Communication protocol」.

5－5 Run mode

5－5－1 Manual run mode

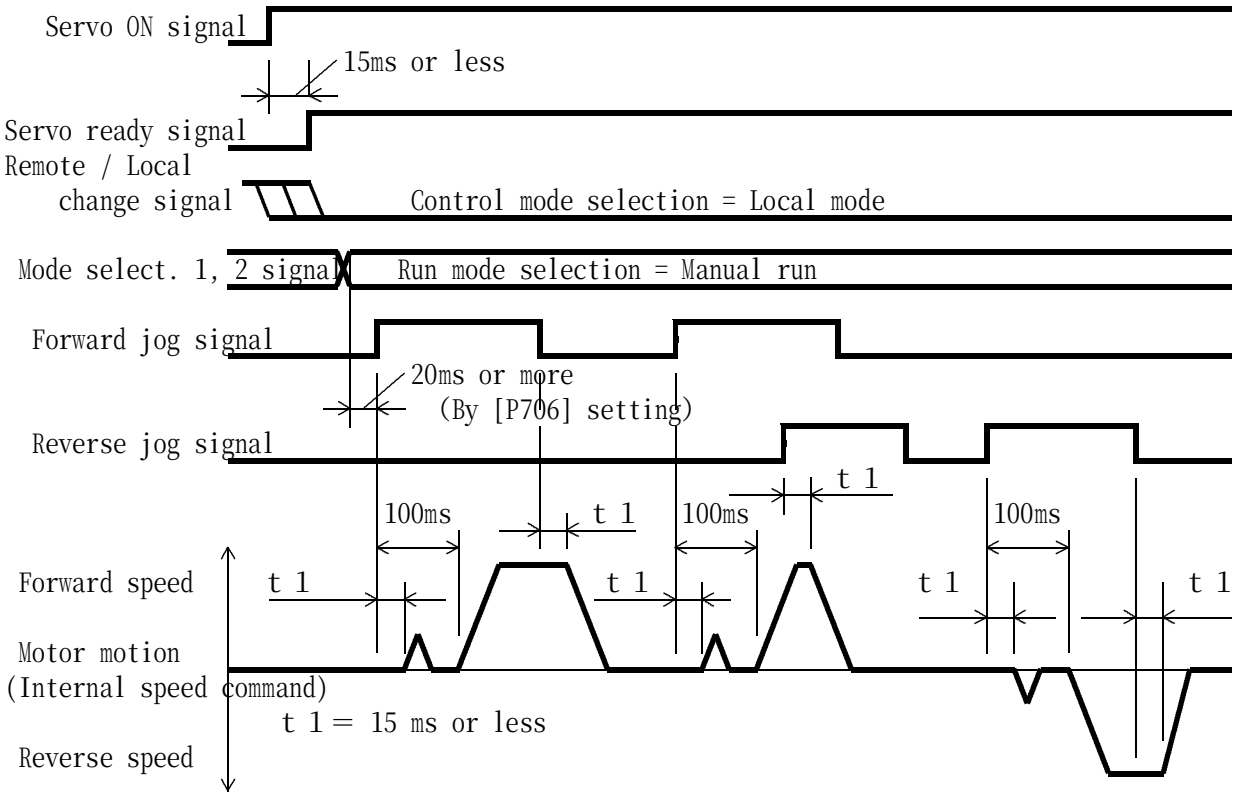
In Manual run mode, when Forward Jog signal (FJ) or Reverse jog signal (RJ) is ON for more than 10ms, one shot Jog is conducted forward or reverse.
And when the ON status continues for more than 100ms, Jog motion is conducted forward or reverse.
One shot Jog is the movement of minimum setting unit (one shot motion).
The value of parameter [P400] or parameter [P401] is selected for Jog motion speed by Jog speed change signal (JOSP).

1) Operation procedure



[Fig. 5－2] Manual run operation procedure

2) Time chart



Caution : When Forward jog signal (FJ) and Reverse jog signal (RJ) are simultaneously inputted, a motor conducts decel. stop. After both signals are once OFF, Forward / reverse jog signals are again inputted, One shot jog is conducted, again. One shot travel amount is fixed minimum setting unit.

[Fig. 5－3] Manual run time chart

5－5－2 Zero return run mode

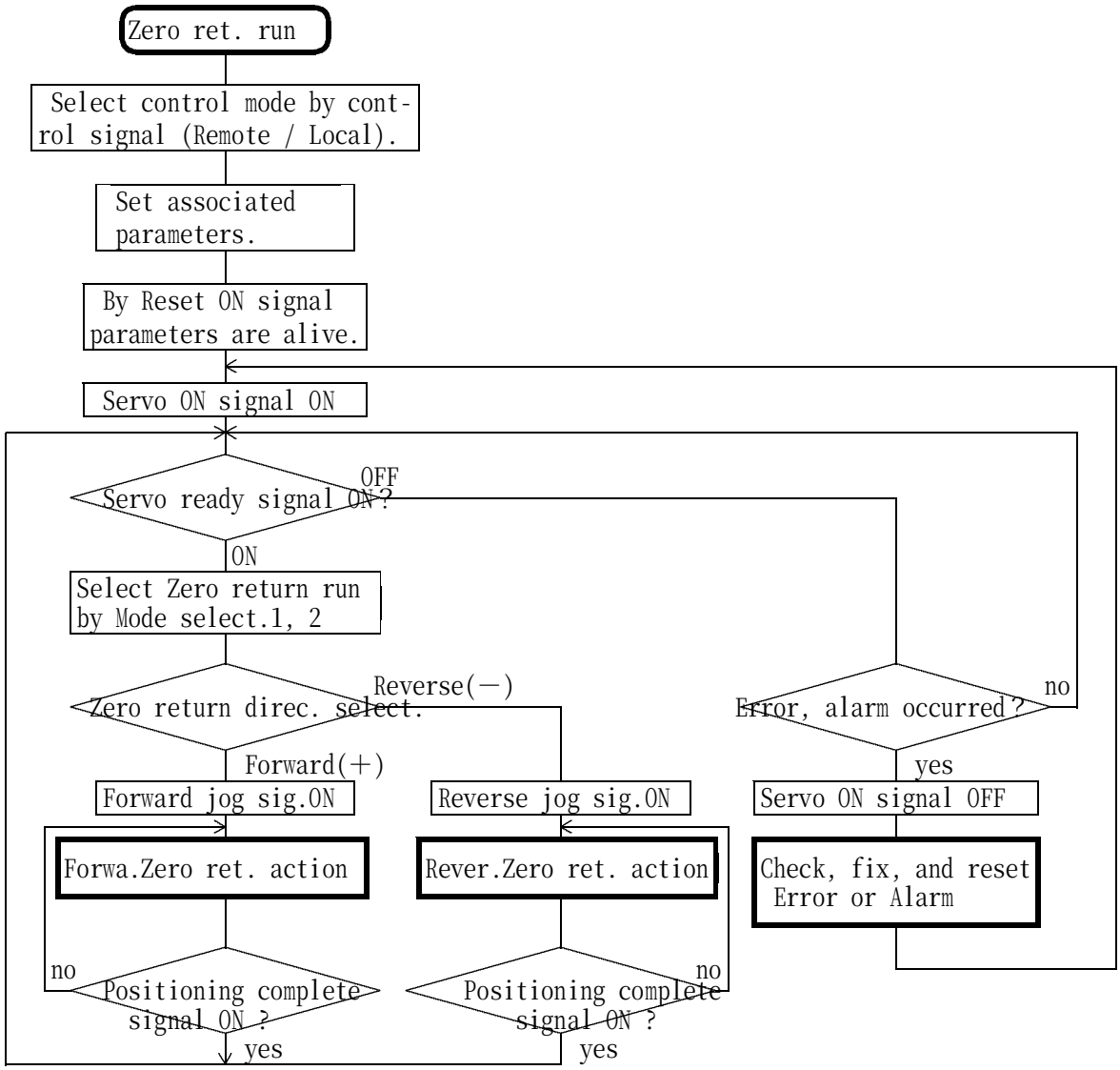
In Zero return run mode, Zero return is conducted by the speed command set by the parameter [P404: Zero return speed] and [P405: Zero return creep speed] .
By 10ms or longer Forward signal (FJ), Forward zero return is conducted.
By 1oms or longer Reverse jog signal (RJ), Reverse zero return is conducted.
Zero return methods are next types.

Zero return method	P402 setting	Motion detail
Standard Zero return	STD.HOME	Zero return by Zero return decel. LS Details can be referred to the time chart.
No LS Zero return	LS LESS	Zero re. by marker or ZLS w/o Z.ret.decel. Details can be referred to the time chart.
On the spot Z.R	STOP HOME	No motion and current posi. is zero point
OT back Zero return	OT HOME	Reverse action when OT is passed in Zero return. Details can be referred to the time chart.

※ parameter [P402: Zero return method selection]

[Tab. 5－1 2] Zero return mode set and motion

1) Operation procedure

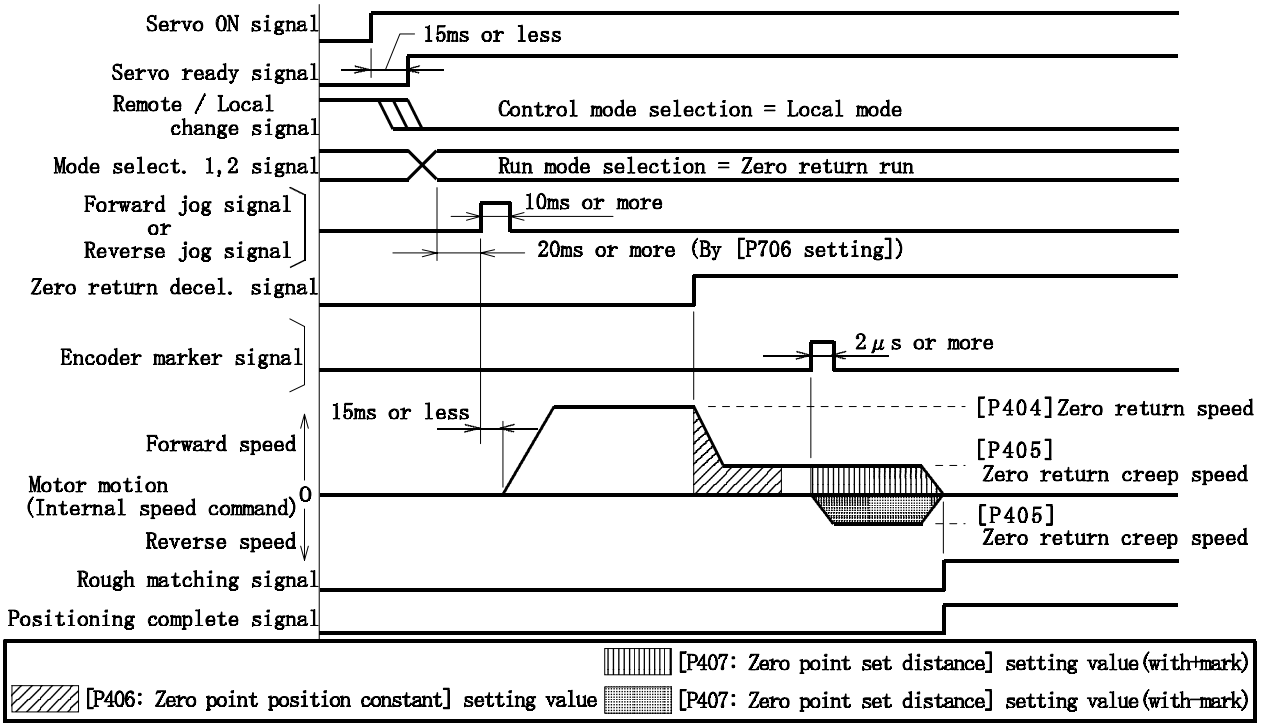


[Fig. 5－4] Zero return run operation procedure

2） Time chart

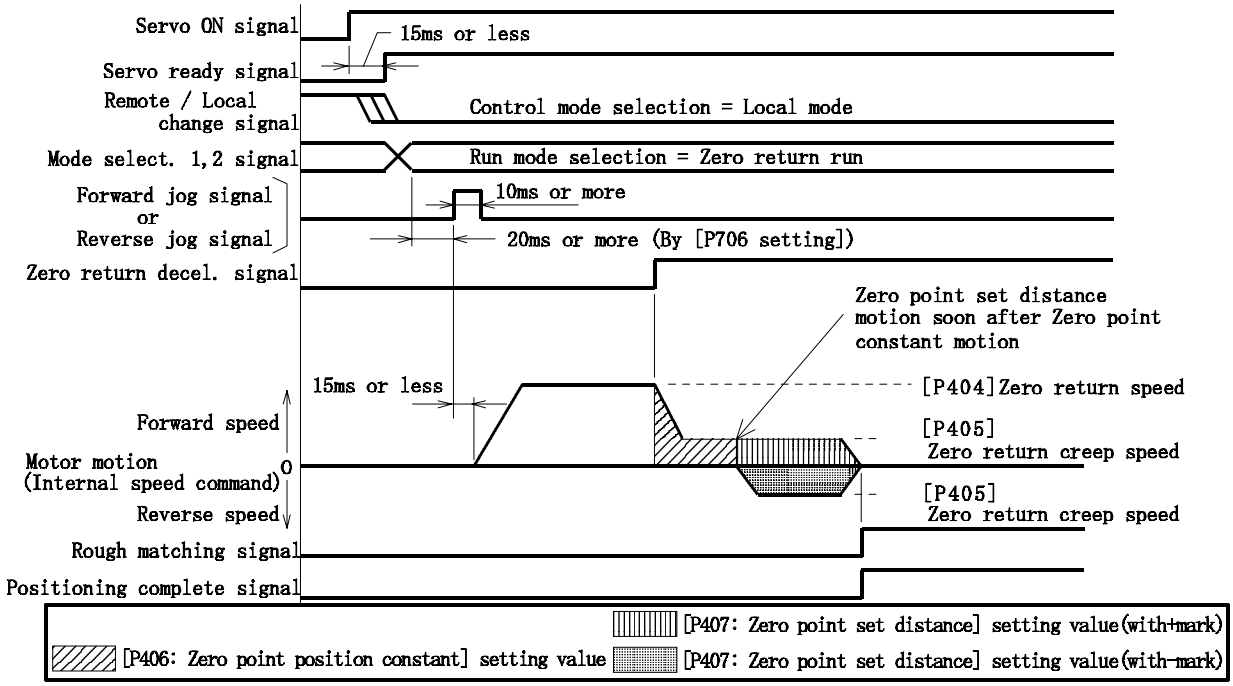
Caution 1 : If Zero return decel.limit signal has been already ON when Zero return starts, a motor once moves reverse against start command direction, and then after the signal is turned OFF, starts Zero return to right direction.
Caution 2 : If hold signal is inputted in Zero return, a motor stops. And it starts to opposite direction to Zero return if Zero return decel.limit signal is ON at re-start, and starts to right Zero return direction after Zero return decel.limit signal is turned 0
Caution 3 : Marker signal selects whether Encoder marker signal shall be used or not by the parameter.
Caution 4 : In Zero return, Software limit is not detected.
Caution 5 : Speed override does not wirk on Zero return creep speed.
Caution 6 : When Zero return is stopped incompletely, preset Forward / Reverse software switches are still effective.

（a）【Standard Zero return】 (Encoder marker is used.)
《At the start of Zero return, when Zero return decel.limit is OFF.》



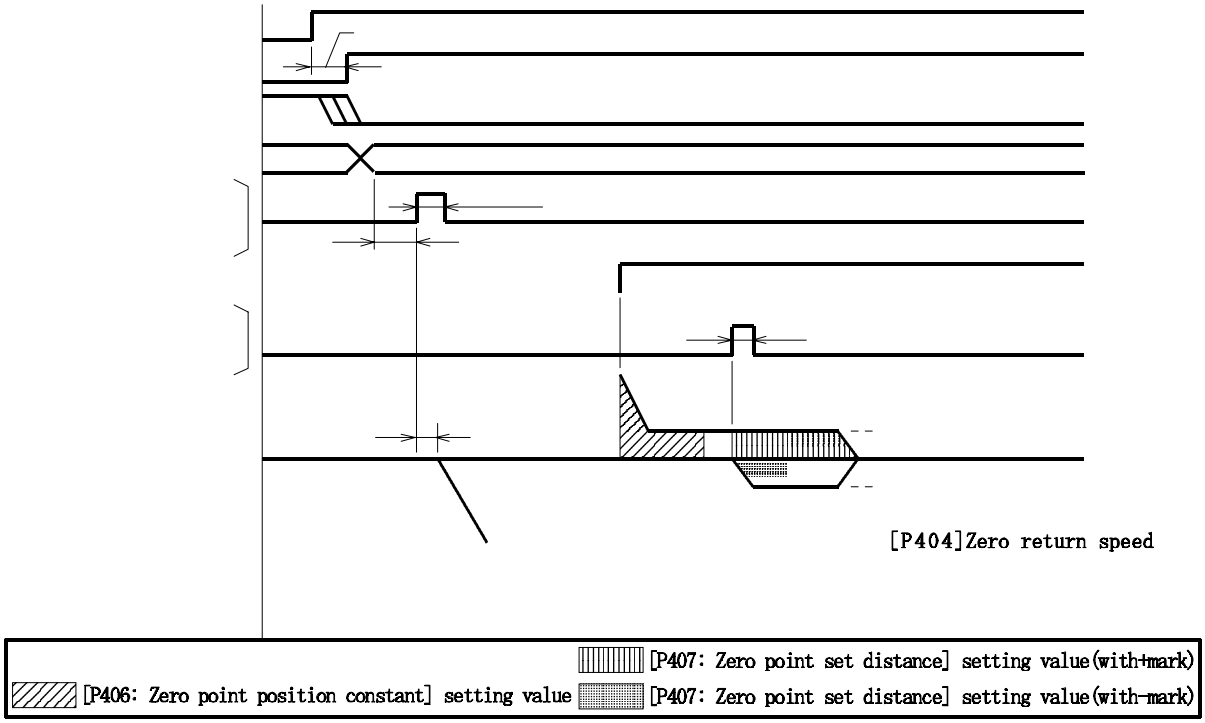
[Fig. 5－5] Standard Zero return run time chart 1 (Encoder marker is used.)

(b) 【Standard Zero return】 (Encoder marker is not used)
《At the start of Zero return, when Zero return decel.limit is OFF.》



[Fig. 5－6] Standard Zero return run time chart 2 (Encoder marker is not used.)

(c) 【Standard Zero return】
《At the start of Zero return, when Zero return decel.limit is ON.》

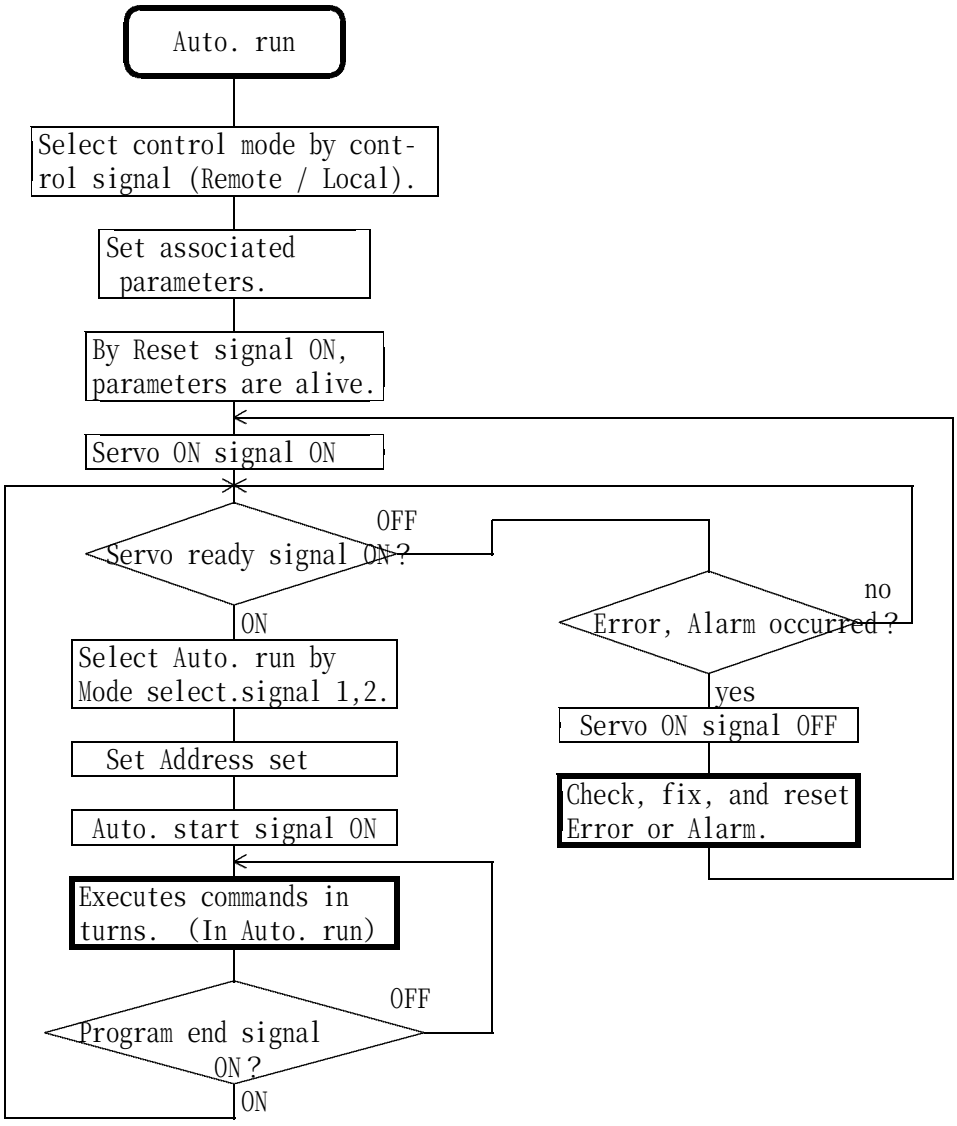


[Fig. 5－7] Standard Zero return run time chart 3

5－5－3 Auto. run mode

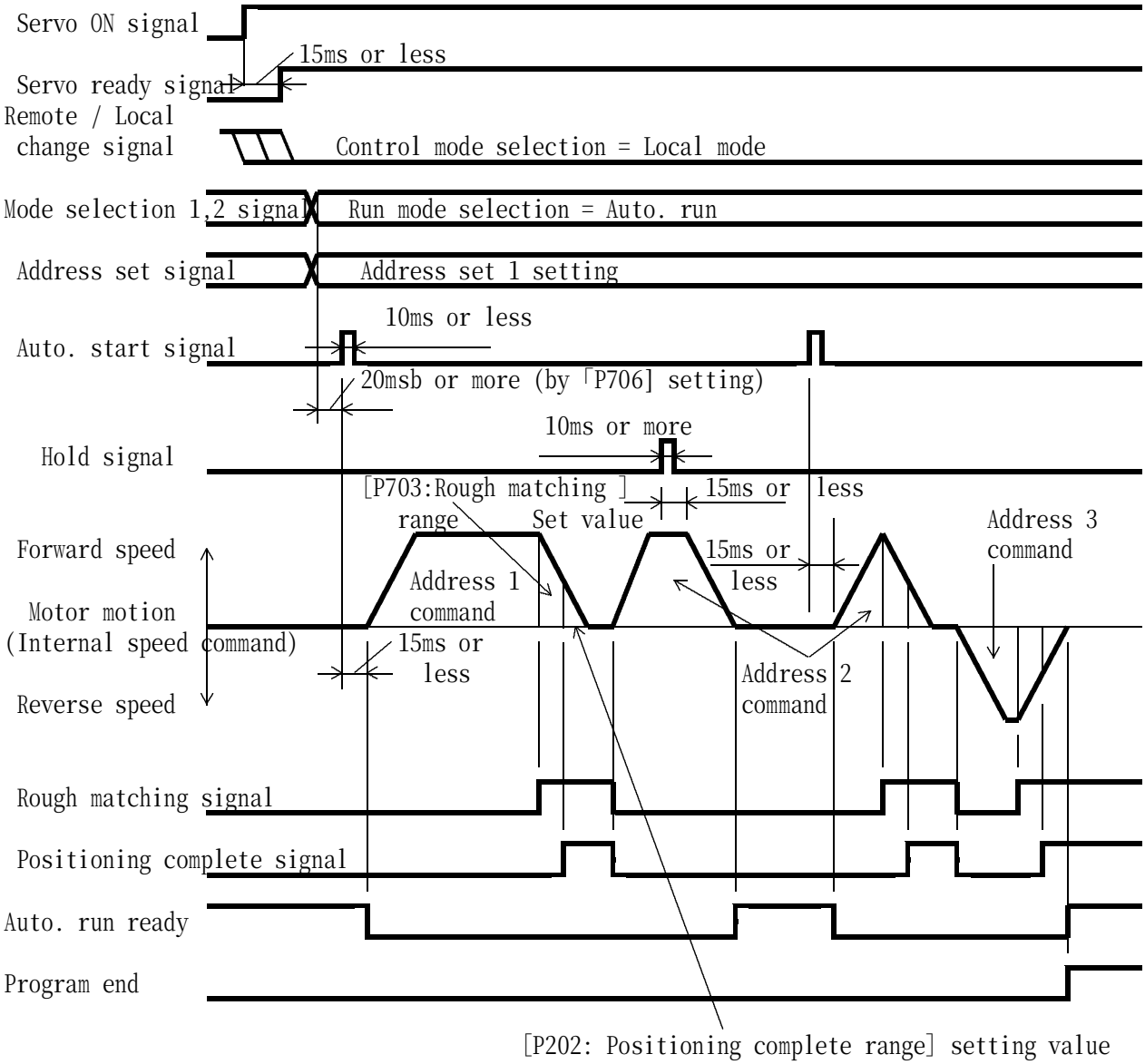
By the parameter [P409: Auto. run permit condition selection] , Auto. run can be disabled before Zero return is completed.
Auto. run executes commands continuously by internal stored commands or external setting data. By turning Auto. start signal (PST) ON, a command of address sets is executed.

1) Operation procedure



[Fig. 5－12] Auto. run operation procedure

2） Time chart



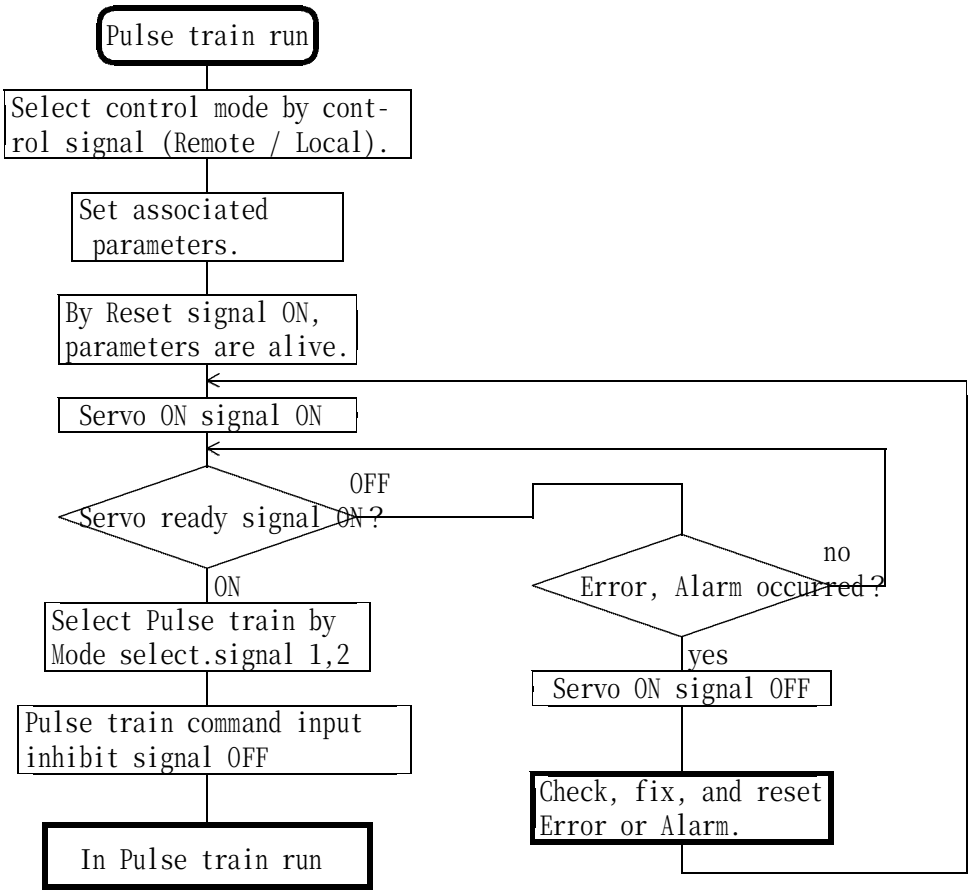
[Fig. 5－13] Auto. run time chart

Caution 1 : When Hold stop was executed in Auto. run or Zero return, Run mode can be changed during in Hold status. When Speed override signal is inputted, actual speed becomes the speed, Speed command × Override ratio.

5－5－4　Pulse train run mode

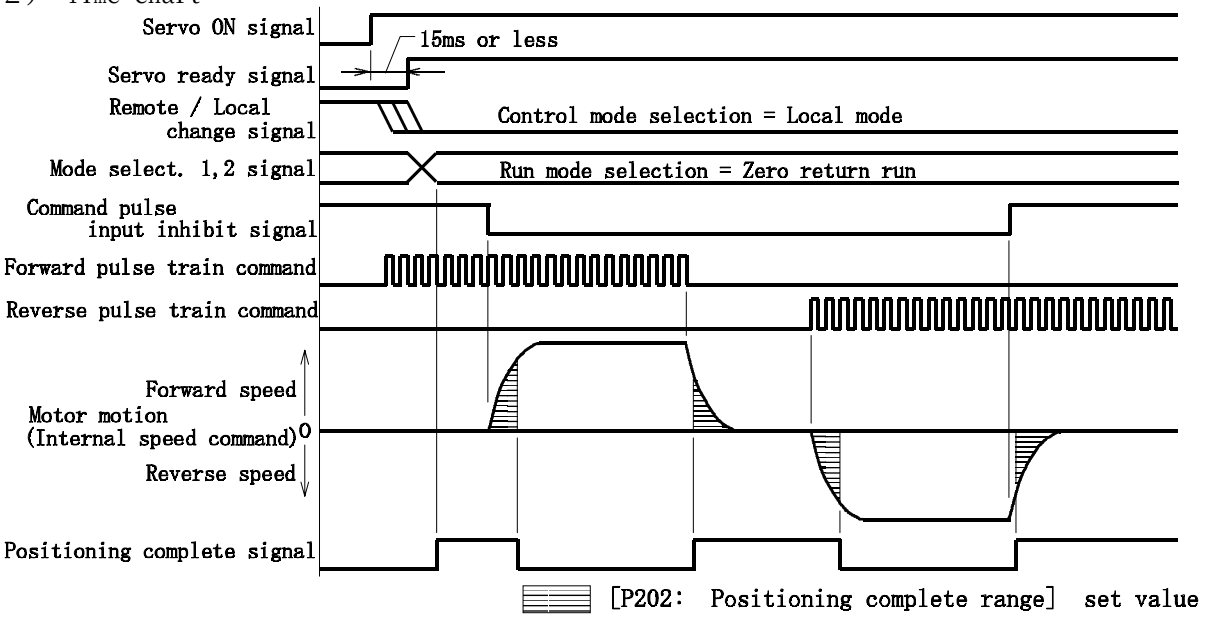
In Pulse train mode, Pulse train run is executed in accordance with Pulse train command (Line driver or Open collector method) or Pulse train communication.

1) Operation procedure



[Fig. 5－1 4] Pulse train run operation procedure

2) Time chart



[Fig. 5－1 5] Pulse train run time chart

Caution 1: Travel amount to a pulse command after 1 command pulse input ([P603: Pulse train command compensation numerator]/[P604: Pulse train command compensation denominator] is minimum setting unit. Output signal condition of 「 Positioning complete signal」 is determined by the parameter [P202: Positioning complete range] setting and deviation amount at the time. In a special case, 「Positioning complete signal」 becomes ON during a motor is running if large value is set to [P202].

5－6 Analog monitor

At the analog monitor connector (P1) terminals MON1, and MON 2, contents selected by the parameters [P700: Monitor 1 selection] and [P701: monitor 2 selection] is outputted by voltage.

Motor motion status (transit, steady state) can be confirmed by an oscilloscope.

Monitor item contents are as follows.

Code	Monitor item	Monitor contents
MON1 and MON2	Speed command [SPD.REF.]	Outputs speed command value. Polarity : Forward rotation;+, Reverse rotation;- voltage Range : 0～±10V ±10% At rated speed : Full range
	Speed Feedback [SPD.FB.]	Outputs motor actual speed. Polarity : Forward rotation; +, Reverse rotation; - volt. Range : 0～±10V ±10% 125% of rated speed : Full range (at rated speed: ±8V)
	Torque command [TRQ.REF.]	Outputs output torque value. Polarity : Forward torque drive ; + voltage Reverse torque drive ; - voltage Range : 0～±10V ±10% At rated torque drive : ＋3．3Ｖ
	External + Torque limit [TRQ.LIM.+] External - Torque limit [TRQ.LIM.-]	Outputs +/- Torque limit value. Polarity : Forward and Reverse torque limit; Both + volt. Range : 0～＋10V ±10% At rated torque limit : ＋3．3Ｖ
	Position deviation 1 [P.RANGE.L] Position deviation 2 [P.RANGE.H]	Outputs Position deviation amount. Polarity : At + deviation; +, deviation; - voltage Range : 0～±10V ±10% Deviation amount 1 : At 255 pulses (4 times); full range Deviation amount 2 : At 4080 pulses (4 times); full range
	NC speed command [SPD.OUT]	Outputs Speed command value in Positioning or Pulse train run. Polarity : Forward command; + , Reverse command ; - volt. Range : 0～±10V ±10% At rated speed : Full range
	NC target speed [SCL.OUT]	Outputs Target speed computed internally in Positioning , Jog or Zero return run. Polarity : Forward command; + , Reverse command ; - volt. Range : 0～±10V ±10% At rated speed : Full range
	Index data 62 [IX62]	Outputs in accordance with the data in Index data 62. Polarity : Positive data ; +, Negative data ; - voltage Range : 0～±10V ±10% At 499 : Full range
	Index data 63 [IX63]	Outputs in accordance with the data in Index data 63. Polarity : Positive data ; +, Negative data ; - voltage Range : 0～±10V ±10% At 499 : Full range
	Reserved [OPT.W]	For our adjustment Never set this.
	Reserved [OPT.L]	For our adjustment Never set this.

[Tab. 5－13] Analog monitor contents

Caution 1 : Since Analog monitor resolution is 1000 within ±10V, transit wave could be like steps. And ripple is generated by ratio 1/ 1000 (1000 resolution case) on the output.

Chapter 6 RUN

6－1 Inspection before start

After installation and wiring, conduct following inspection before start.

① Is there any mis-wiring ? Specially is the power not connected to motor connection terminals U, V, W ?
② Is there no place in short-circuit status by cable chips, etc. ?
③ Is there no part of cable where abnormal force is added on ?
④ Is not there any loose fit screw, terminal, etc. ?
⑤ Is the power source correct ?
⑥ Is not there any short-circuit or line-to-ground fault in the external sequence circuit ?
⑦ Is grounding method correct ? Is the earth ground grade JIS Class 3 or better ?

⚠ Caution

Never conduct insulation test as withstand voltage, megger test, etc. and noise test by a simulator, etc. to this unit.
『Those test may damage the unit.』

6－2 Run procedure

Please operate this unit in accordance with the next procedure.
Be sure to conduct Trial run. In order to avoid a trouble, at first run the unit without any load, and after confirming no fault, connect the unit to your machine. And pay your special attention not to cause an accident.

⚠ Caution

① Do not touch terminals of the controller, carelessly.
『Since there is high voltage, it is very dangerous.』
② Do not use the unit without the terminal box cover.
『It may cause electric shock.』
③ Since some residual voltage is left after power is turned OFF, do no touch terminals and main circuits for 2 to 3 minutes. (For NCS-FI/FS＊＊M-401,402, confirm the front panel LED display 「CHARGE」 is lit OFF.)
④ Power ON/OFF shall be conducted after confirming safety, cautiously.

6－2－1 Confirmation of power source

Please confirm the power source for the controller satisfies the required specification. Power source specification can be referred to [10-1 Specification of controller].

6－2－2 Trial run

1) Separation of a motor and load
① Remove the motor connection from the machine system and make no load status.

2) Servo ON signal (SON(*)) OFF
① Before turning power ON, turn OFF Servo ON signal (SON(*)) .

3) Power ON
① When power is turned ON, initial status is displayed in the LCD module.

4) Parameter set

① Set [P000: Motoe type] and other parameters and Positioning data to meet with your application. (Refer to the separate manual 「Volume: Dedicated function」.)

＊ Required parameters for Trial run are as follows.

Paramet. No.	Name	Reference
P000	Motor type	
P001	Encoder type selection	
P002	Encoder pulse selection	
P005	ABS encoder resolution selection	Only for ABS encoder

[Tab. 6－1] Required parameters for Trial run

② In Trial run, select『Local mode』by the control input signal Remote/ Local change (PC).

5) Power re-input

① In order to reflect parameter values on actual motion, re-input the power.

6) Confirmation of control input signal

① Turn ON/OFF all the control inputs except Servo ON (SON(*)) signal, and by ON/OFF status of individual input display in the front panel LCD module (I/O signal display section), confirm if connection and logic of control inputs are correct.

② As for Speed override signals (OR1～OR4) and Address set signals (SS1～SS3,PS4～PS8) confirm them by Diagnosis display mode.

7) Servo ON signal (SON(*)) ON

① After setting parameters, and confirming control input signals, turn OFF Over travel signals (FOT*, ROT*) , Emergency stop signal (EMG*) , turn On and then OFF Reset signal (RST) . (LCD module [FOT] , [ROT] and [EMG] OFF)
Then turn ON Servo ON signal (SON(*)) . At the time all other control signals shall be OFF.

② When Servo ON signal (SON(*)) is ON, a motor is ready to generate driving torque and resisting torque to external force.

③ If Alarm is displayed or a motor runs at the time when Servo ON signal (SON(*)) is ON, investigate and delete the cause.

8) Run mode selection

① Select Run mode by Mode selection signal 1, 2 (MD1,MD2).

9) Run motion check

① Run a motor by low speed command (as Jog motion, etc.), and confirm if speed is correct, abnormal vibration does not occur, abnormal sound does not exist, etc. .

② Change command speed and confirm that motor speed is proportional changed to the command. (It is recommended to measure the speed with a tachometer on the motor load shaft.)

③ If in the item ② , motor speed can not be increased or not proportional to the speed command and motor vibration or abnormal sound occurs, investigate and delete the cause.

④ In case of Positioning run, confirm if the motor rotating amount is correct to Positioning data. (It is recommended to mark on the motor load shaft to confirm position.)

⑤ If in the item ④, the motor rotating amount is multiplied by constant ratio or fluctuates, investigate and delete the cause.

⑥ Running motion confirmation shall be conducted for both forward and reverse directions.

10) Load run

① After Trial run in no load is over, connect the motor to the machine and conduct Trial run, again.

② Before executing load run, confirm that Emergency stop, Over travel, etc. , surely works.

③ Please inspect if abnormal sound, abnormal vibration, or abnormal heat, etc. , does not occur.

④ If above abnormality occurs, or Alarm is displayed, investigate and delete the cause.

⑤ Motor motion and load status can be confirmed by LCD module (Status and Diagnosis display mode). (Refer to the separate manual 「Volume: Dedicated function」,「2-2 Display mode」.

⑥ If machine system travel amount and NC position command is not equal, confirm the next parameters.

＊ Required parameters for matching NC positioning command with machine system motion.

Paramet. No.	Name	Reference
P301	Setting unit selection	
P302	Command unit	
P303	Electric gear numerator	＊ By this parameter, actual machine system travel amount and NC position command is matched.
P304	Electric gear denominator	
P310	Machine travel amount	

[Tab. 6－2] Required parameters for position matching

Caution: Load inertia ratio to the motor inertia shall be within the standard range. Applied GD^2 value can be referred to the specification.

6－3 Adjustment

6－3－1 Adjustment status at shipment

All the controller adjustment is set by parameters.
Standard adjustment (initial value) at our factory shipment can be referred to the separate manual「Volume: Dedicated function」.
Though a controller has standard adjustment values (initial value set) at our factory shipment, it may be necessary to readjust the controller when a machine system is connected to actual load condition and application.

※1 Auto. tuning can be conducted by Auto. tuning function.
As for Auto. tuning function, refer to「7-4 Auto. tuning」.

※2 In some case, due to actual load status, mechanical play, etc. , Auto. tuning could not be conducted. In the case, referring to the following description, set individual parameter, manually.

6－3－2 Adjustment point for individual phenomenon (parameter)

Phenomenon	Adjustment point (parameter)
A motor vibrates in stop status.	[P105:Speed loop gain /Low speed gain range] [P106:Speed loop integral time con. / L spd. gain range] [P107:Speed loop derivative time con./ L spd. gain range] [P108:Torque command filter freq. / L spd. gain range] Effective in L spd. gain range by P100 set. [P201:Servo lock gain] Effective in Posi.complete range by P202 set.
A motor vibrates in running.	[P101: Speed loop gain] [P102: Speed loop integral time const.] [P103: Speed loop derivative time const.] [P104: Torque command filter freq.] [P200: Position loop gain] [P205: Feed forward ratio] [P605: Pulse train feed forward ratio]
A motor vibrates when GSEL signal is ON.	[P116: Speed loop gain / GSEL signal ON] [P117: Speed loop integral time cons. / GSEL signal ON] [P118: Speed loop derivative time cons. / GSEL signal ON] [P119: Torq. cmmnd. filter freq./ GSEL signal ON]
Over-shoot and under0shoot is large at motor start and stop.	[P210: Add. time to S shape Accel./Decel.] [P101: Speed loop gain] [P102: Speed loop integral time const.] [P103: Speed loop derivative time const.] [P200: Position loop gain] [P205: Feed forward ratio] [P605: Pulse train feed forward ratio] [P211～P213: Accel. time 1～3] [P214～P216: Decel. time 1～3]
Over-speed fault occurs.	
Deviation over-flow occurs.	[P200: Position loop gain] [P207: Over-flow detection pulse] [P205: Feed forward ratio] [P605: Pulse train feed forward ratio] [P211～P213: Accel. time 1～3] [P214～P216: Decel. time 1～3]
Positioning time is long.	[P200: Position loop gain] [P202: Positioning complete range] [P205: Feed forward ratio] [P605: Pulse train feed forward ratio]

※ Individual parameter description and setting method can be referred to the separate manual 「Volume: Dedicated function」.

[Tab.６－３] Adjustment point of individual phenomenon (parameter)

6－3－3 Individual adjustment method

1）《Speed loop gain》

① Speed loop gain [P101] / Low speed gain range [P105] / GSEL signal ON [P116]
- The larger, the setting value is, the quicker the response is.
- Too large set causes vibration.
- Too low set makes response slow and motion unstable.

② Speed loop integral time constant [P102] / Low speed gain range [P106] / GSEL signal ON [P117]
- The smaller, the setting value is, the quicker the response is.
- Too small set causes vibration.
- Too high set makes response slow and motion unstable.

③ Speed loop derivative time constant [P103] / Low speed gain range [P107] / GSEL signal ON [P118]
- When this is set, response becomes quick.
- The smaller, the setting value is, the earlier time it works in motion characteristics. Too large set works all the motion range and causes vibration.

2）《Torque command filter》 (Normally initial value is not changed.)

① Torque command filter freq. [P104] / Low speed gain range [P108] / GSEL signal ON [P119]
- If machine resonance occurs, insert a filter to Torque command to fix it.
- The larger, the setting value is, the quicker the response is.
- Too low set makes response slow and motion unstable.

3）《Position loop gain》

① Position loop gain [P200]
- The larger, the setting value is, the quicker the response is.
- Too large set causes Over-shoot, Under-shoot and vibration.
- Too low set makes Positioning time longer and Positioning accuracy worse.

② Servo lock gain [P201]
- The larger, the setting value is, the quicker the response is in Servo lock.
- Too large set causes vibration.
- Too low set makes Servo lock weaker and shifts stop position by external force.

4）《Feed forward ratio》

① Feed forward ratio [P205]
- The larger, the setting value is, the higher , the compliance is to a command.
- Too large set causes over-shoot, under-shoot and vibration.
- Too low set makes Positioning time longer.

② Pulse train feed forward ratio [P605]
- The larger, the setting value is, the higher , the compliance is to Pulse train command.
- Too large set causes over-shoot, under-shoot and vibration.
- Too low set makes Positioning time longer.

5) 【 Gain adjustment method 】

Gain can be adjusted by using Analog monitor (connector P1) and observing the wave of Speed feedback in an oscilloscope.
Adjust Position loop and Speed loop gain parameters until over-shoot, under-shoot and vibration does not occur.

● Conduct below adjustment in running status

① Set a little bit low value to [P200: Position loop1 gain] and [P201: Servo lock gain] and adjust [P101: Speed loop gain] as high as possible unless a motor vibrates.
② Adjust and set the optimum value to [P102: Speed loop integral time const.] and re-adjust [P101: Speed loop gain] , again to find motor optimum motion.
③ Set [P103: Speed loop derivative time const.] to decrease over-shoot and under-shoot further more. Large value set causes vibration.
④ When machine resonance occurs, adjust [P104: Torque command filter] as high as possible to avoid the resonance.
⑤ Adjust and set [P200: Position loop gain] as high as possible within the range where motor vibration, over-shoot and under-shoot does not occur.

● Conduct below adjustment in stop status

① Copy parameter settings in above running status to the parameters in stop status.
P201 ← P200 [Position loop gain]
P105 ← P101 [Speed loop gain]
P106 ← P102 [Speed loop integral time const.]
P107 ← P103 [Speed loop derivative time const.]
② If a motor vibrates after setting the above, adjust next parameters as the adjustment methods in running status.
[P201: Servo lock gain] ,
[P105: Speed loop gain/ Low speed gain range]
[P106: Speed loop integral time const. / Low speed gain range]
[P107: Speed loop derivative time const. / Low speed gain range]
③ When machine resonance occurs, adjust [P104: Torque command filter] as high as possible to avoid the resonance.

● Conduct below adjustment in GSEL signal ON status.
(Adjustment is not required when Speed gain selection signal (GSEL signal) is not used.)

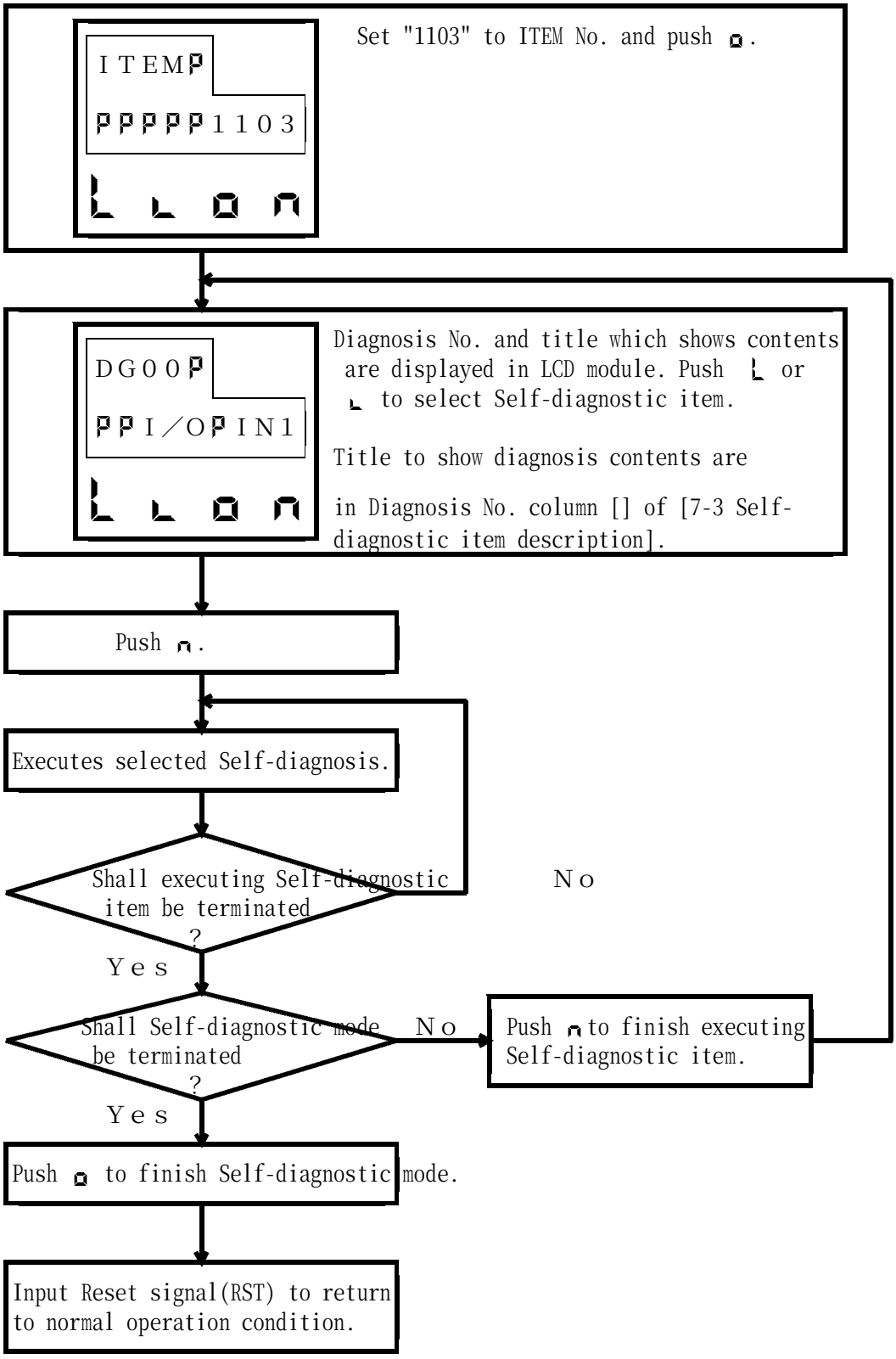
① Adjust and set [P116: Speed loop gain / GSEL signal ON] as high as possible within the range where a motor does not vibrate.
② Adjust and set the optimum value to [P117: Speed loop integral time const. / GSEL signal ON] and re-adjust [P116 : Speed loop gain / GSEL signal ON]] , again to find motor optimum motion.
③ Set [P119: Speed loop derivative time const. / GSEL signal ON] to reduce over-shoot and under-shoot further more. Large value set causes vibration.
④ When machine resonance occurs, adjust [P118: Torque command filter / GSEL signal ON]] as high as possible to avoid the resonance.

※ Please refer to the separate manual 「Volume: Dedicated function」, 「2-3-2 Real time gain set」.

Chapter 7 Self-diagnosis and forced jog mode

7－1 Self-diagnostic mode execution procedure

This unit is equipped with Self-diagnostic function to check external I/0 and internal circuits.
Self-diagnostic mode can be selected by key input of LCD module.
Self-diagnostic mode execution procedure is as below.



[Fig. 7－1] Self-diagnostic mode executing procedure

7－2 Self－diagnosis

Diag.No.	Diagnostic item	Diagnostic contents
DG00 DG01	Control input signal Check 1	Control input signal status is displayed in LCD module.
DG02	Pulse train command counter Check	Internal command counter status (command value) by Pulse train command input is displayed in LCD module.
DG03	Feedback pulse position counter Check	Internal feedback pulse counter status (feedback pulse counter value) by Encoder feedback pulse is displayed in LCD module.
DG04	Feedback pulse speed detection counter Check	Internal speed detecting counter (encoder feedback pulse frequency) by Encoder feedback pulse is displayed in LCD module.
DG05	Speed command input voltage Check	Input voltage of External speed command (analog voltage) is displayed in LCD module.
DG06	Torque command input voltage Check	Input voltage of External torque command (analog voltage) is displayed in LCD module.
DG07	Torque limit+command input voltage Check	Input voltage of External torque limit + command (analog voltage) is displayed in LCD module.
DG08	Torque limit-command input voltage Check	Input voltage of External torque limit - command (analog voltage) is displayed in LCD module.
DG09	Analog monitor ０Ｖ output Check	0V is outputted to Analog monitor terminal (MON1, MON2).
DG10	Analog monitor ＋10Ｖ output Check	+10v is outputted to Analog monitor terminal (MON 1, MON2).
DG11	Analog monitor －10Ｖ output Check	-10V is outputted to Analog monitor terminal (MON 1, MON2).
DG12	Analog monitor ＋５Ｖ output Check	+5V is outputted to Analog monitor terminal (MON 1, MON2).
DG13	Analog monitor －５Ｖ output Check	-5V is outputted to Analog monitor terminal (MON 1, MON2).
DG14	Control input signal Check 2	Control input status of connector J5 is displayed in LCD module.
DG15～ DG18	Individual signal Check	This item is for adjustment at our factory shipment.
DG19～ DG22	ＢＣＤ data input signal Check	Read value of BCD data input of connector J5 is displayed in LCD module.
DG30	Thermistor input Check	This item is for adjustment at our factory shipment.
DG50	ＲＡＭ Check	Confirms if internal RAM is normal by executing READ / WRITE. Results are displayed in LCD module.
DG51	Control output signal Check 1	Outputs control output signal of connector CN1 in turns. Output status is displayed in LCD module.
DG52	Serial communication I/F Check	Short-circuits TXD(A)－RXD(A),TXD(B)－RXD(B), and RXD (A)－RLR(A) of connector J1 to confirm if Transmission / Receipt is properly conducted. Results are displayed in LCD module.
DG53	Control output signal Check 2	Outputs control output signal of connector J5 in turns. Output status is displayed in LCD module.
DG55	Display unit output Check	This item is for adjustment at our factory shipment.
DG56	ＥＥＰＲＯＭ Check	Confirms if internal EEPROM (non-volatile memory) is normal by executing READ /WRITE. Results are displayed in LCD module.

[Tab.７－１（ａ）] Self-diagnostic item (1/2)

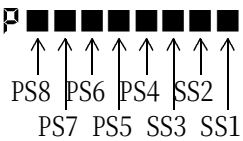
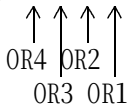
Diag.No.	Diagnostic item	Diagnostic contents
ＤＧ５７	Pulse train communication transmission Check	Conducts Transmission data check by Pulse train communication through connector J2. This and DG 58 is a pair for the check.
ＤＧ５８	Pulse train communication receipt Check	Conducts Receipt data check by Pulse train communication through connector J2. This and DG 57 is a pair for the check.
ＤＧ９０	Test run	This item is for adjustment at our factory shipment. Never execute this.
DG９１～ DG９５	ＤＣＣＴ offset adjustment	This item was adjusted at our factory shipment. Never change the setting.
ＤＧ９７	Auto. tuning at GSEL signal ON	Automatically sets Speed loop gain when GSEL signal is ON.
ＤＧ９８	Auto. tuning	Automatically sets Speed loop gain when GSEL signal is OFF.

[Tab. 7－1 (b)] Self-diagnostic item (2/2)

⚠ Caution

① Self-diagnostic items DG90 ～ 95 are for adjustment at our factory shipment. Never execute them.

7－3 Self-diagnostic item description

Diagnosis No.	Actual LCD display	Diagnostic contents
Control input signal check 1		When Control input signal of connector CN1 is ON, input signal name is lit in signal display section of LCD module. When Diagnosis No.is DG00, individual signal of [PS8]～[PS4],[SS3]～[SS1] is displayed by bit in data display section. When Diagnosis No.is DG01,individual signal of [OR4]～[OR1] is displayed by bit in data display section. Each bit display is「1」when the signal is ON, and「0」when OFF. ON and OFF rule can be referred to [5-2-3 Input and output interface] .
DG00 [__I/O_IN1]	DG00 	
DG01 [__I/O_IN2]	DG01 	
Pulse train comma counter check		Displays internal counter value of Pulse train command. When 90° different phase is inputted, 4 times value of the pulse is displayed. Display range: 0～65535 (increases for forward command.)
DG02 [_PLS.REF.]	DG02	
Feedback pulse position counter check		Displays internal position counter value of Encoder feedback pulse. 4 times value of the input pulse is displayed. Display range : 0～65535 (increases for forward command.)
DG03 [__ENC.FB.]	DG03	
Feedback pulse speed detection counter check		Displays internal speed detection counter value of Encoder feedback pulse. 4 times value of the input pulse is displayed. In「★」of the left figure, code (in reverse「－」) is displayed.
DG04 [SPD.COUNT]	DG04★	
Speed command input voltage check		Displays input voltage of External speed command. In「★」of the left figure, code (in negative voltage「－」) is displayed.
DG05 [_SPD.REF.]	DG05★ ■■. ■■	
Torque command input voltage check		Displays input voltage of External torque command. In「★」of the left figure, code (in negative voltage「－」) is displayed.
DG06 [_TRQ.REF.]	DG06★ ■■. ■■	
Torq.limit +cmmnd.input volt.check		Displays input voltage of External torque limit + command voltage. In「★」of the left figure, code (in negative voltage「－」) is displayed.
DG07 [_TRQ.LIM+]	DG07★ ■■. ■■	
Torq.limit -cmmnd.input volt.check		Displays input voltage of External torque limit -+ command voltage. In「★」of the left figure, code (in negative voltage「－」) is displayed.
DG08 [_TRQ.LIM-]	DG08★ ■■. ■■	

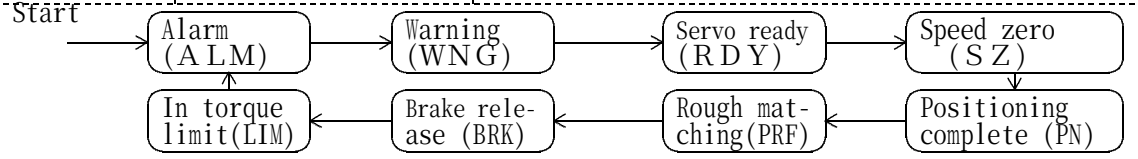
Diagnosis No.	Actual LCD display	Diagnostic contents
Analog monitor 0V output check		Outputs 0[V] to Analog monitor output terminals (MON1, MON2) .
DG09 [_A.MON.0V]	DG09P PPPPP0.00	
Analog monitor +10V output check		Outputs +10[V] to Analog monitor output terminals (MON1, MON2) .
DG10 [A.MON+10V]	DG10P PPPP10.00	
Analog monitor -10V output check		Outputs -10[V] to Analog monitor output terminals (MON1, MON2) .
DG11 [A.MON-10V]	DG11− PPPP10.00	
Analog monitor +5V output check		Outputs +5[V] to Analog monitor output terminals (MON1, MON2) .
DG12 [A.MON.+5V]	DG12P PPPPP5.00	
Analog monitor -5V output check		Outputs -5[V] to Analog monitor output terminals (MON1, MON2) .
DG13 [A.MON.-5V]	DG13− PPPPP5.00	
Control input signal check 2		Displays Control input signal status of connecter J5. M complete signal (MFIN) is corresponding to 2^1 bit of 10^0 bit position.When the signal changes from OFF to ON, 2 is added to value of 10^0 bit position.
DG14 [___EXT.IN]	DG14P P00000002	

Diagnosis No.	Actual LCD display	Diagnostic contents
Individual signal check		This item is for adjustment at our factory shipment.
DG15 ～DG18 [*********]	DG15P～18P ■■■■■■■■	
BCD data input signal check		
DG19 [__DIG.SW5]	DG19★ P■■■■■■■■	Displays read BCD data value[BCD 8 digit (collective input)] inputted to connector J5.
DG20 [__DIG.SW6]	DG20★ P■■■■■■■■	Displays read setting data value of Digital switch unit SWU-501B (first line) or SWU-501C connected to connector J5.
DG21 [__DIG.SW7]	DG21★ P■■■■■■■■	Displays read setting data value of Digital switch SWU-501B (second line) connected to connector J5.
DG22 [__DIG.SW8]	DG22★ P■■■■■■■■	Displays read setting data value of Digital switch SWU-501B (third line) connected to connector J5.
Caution 1: DG19～DG22 display of types which have no J5 connector is「- FFFFFFFF」. Caution 2: DG19 display becomes setting data when parameter [P714] is「DIG BCD」, and「- FFFFFFFF」when the parameter is「DIG COM」. Caution 3: DG20～22 display becomes setting data when parameter [P714] is「DIG COM」, and「- FFFFFFFF」when the parameter is「DIG BCD」. And it becomes「00000000」when Digital switch unit is not connected. Caution 4: When read setting data value of DG19～DG22 is displayed by letters「A～F」, it indicates setting value error, wrong connection, etc. exists.		
Thermistor input check		This item is for adjustment at our factory shipment.
DG30 [THERMIST]	DG30P ■■■■■■■■	

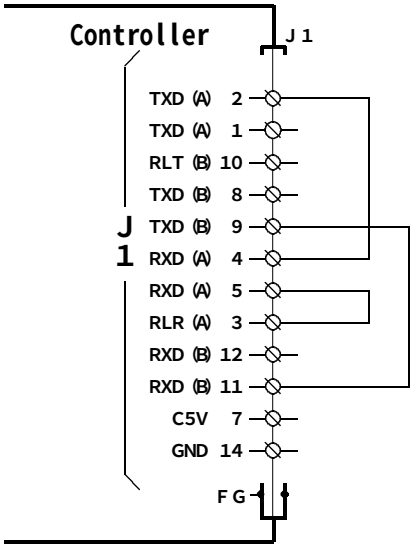
Diagnosis No.	Actual LCD display	Diagnostic contents
RAM check		Checks internal RAM and displays Diagnostic results as below tabulation.
DG50 [_____RAM] Extended memory installed [_____*RAM]	DG50P PPRUNNING	

Display	Results	Error description
[_____OK!!]	Normal end	
[_ERROR1!!]	Err.NO.1	Data「0000」Read/Writ.err.
[_ERROR2!!]	Err.No.2	Data「5555」Read/Writ.err.
[_ERROR3!!]	Err.No.3	Data「AAAA」Read/Writ.err.
[_ERROR4!!]	Err.No.4	Data「FFFF」Read/Writ.err.

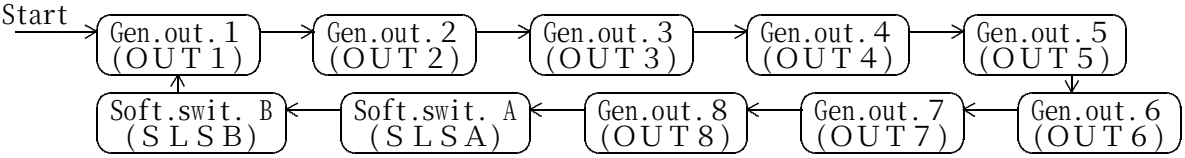
Control output signal check1		Control output signal of connector J1 is ON in turns every 1 second as below. (Alarm signal, Warning signal output logic is set by [P715] .) During output signal is ON, output signal name is lit in signal display section of LCD module. And in「■■■」of left figure, output signal name is displayed.
DG51 [__I/O_OUT]	DG51P P■■■PON!!	



Serial communication I/F check		At normal end,「PPPPPOK!!」, and at abnormal end,「PPERROR!!」is displayed. Short-circuit TXD(A)-RXD(A), TXD(B)-RXD(B), and RXD (A)-RLA(A) of connector J1. connection is as below.
DG52 [__S.COMM.]	DG52P PPRUNNING	



Control output signal check2		Control output signal of connector J5 is ON in turns every 1 second as below. During output signal is ON, output signal name is displayed in「■■■■」of left figure. Types which have no j5 connector display「NOPI/F」.
DG53 [__EXT.OUT]	DG53P P■■■■PON!	



<table>
<tr><th>Diagnosis No.</th><th>Actual LCD display</th><th>Diagnostic contents</th></tr>
<tr><td colspan="2">Display unit output check
DG55
[EXT.DISP.]</td><td>This item is for adjustment at our factory.
Never execute this.

DG55P
■■■■■■■■■</td></tr>
<tr><td colspan="2">EEPROM check
DG56
[__ EEPROM]</td><td>Checks internal EEPROM and displays Diagnostic results as below tabulation.

DG56P
PPRUNNING

<table>
<tr><th>Display</th><th>Results</th><th>Error description</th></tr>
<tr><td>[_____OK!!]</td><td>Normal end</td><td></td></tr>
<tr><td>[_ERROR1!!]</td><td>Err.NO.1</td><td>Data「0000」Read/Writ.err.</td></tr>
<tr><td>[_ERROR2!!]</td><td>Err.No.2</td><td>Data「5555」Read/Writ.err.</td></tr>
<tr><td>[_ERROR3!!]</td><td>Err.No.3</td><td>Data「AAAA」Read/Writ.err.</td></tr>
<tr><td>[_ERROR4!!]</td><td>Err.No.4</td><td>Data「FFFF」Read/Writ.err.</td></tr>
<tr><td>[_ERROR5!!]</td><td>Err.No.5</td><td>Retn. to original data err.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Diagnosis No.</th><th>Actual LCD display</th><th>Diagnostic contents</th></tr>
<tr><td>Pls.train commun.transmis. check
DG57
[_PLS.TRS.]</td><td>DG57P
PPPP■■■■■</td><td>Transmits data by Pulse train communication through connector J2 in turns every 0.5 second as below. And in「■■■■■」of left figure, Transmission data No. is displayed.
Start → 00000 → 11111 → 22222 →
55555 ← 44444 ← 33333 ←</td></tr>
<tr><td>Pulse train commun. receipt check
DG58
[_PLS.RCV.]</td><td>DG58P
PPRUNNING</td><td>Receives data by Pulse train communication through connector J2. For this check, connection of J2 to NCS-FI/FS or other NPS-FI/FS which transmits by DG57 is required. Received data are transmitted data by DG57 from NCS-FI/FS or other NPS-FI/FS. Diagnostic results of Received data are as follows.
<table>
<tr><th>Display</th><th>Results</th><th>Error description</th></tr>
<tr><td>[_____OK!!]</td><td>Normal end</td><td></td></tr>
<tr><td>[_SUM.ERROR]</td><td>Abnormal end</td><td>Sum check error of communication data</td></tr>
<tr><td>[_TIME.OVER]</td><td>Abnormal end</td><td>No communication data was received.</td></tr>
</table></td></tr>
<tr><td>Test run
DG90
[TST.DRIVE]</td><td>DG90P
■■■■■■■■■</td><td>This item is for adjustment at our factory.
Never execute this.
If it is executed, a motor runs and it is dangerous.</td></tr>
<tr><td>DCCT offset adjustment
DG91 ～ DG95</td><td></td><td>This item is for adjustment at our factory.</td></tr>
<tr><td>Auto. tuning
DG97
[_GSELTUNE]</td><td>DG97P
PPRUNNING
↓ displayed in Test run.
DG97P
CALCULATE
displayed in computing parameter</td><td>This item is the function to automatically measure load characteristics (machine system) and set adequate servo system parameters when GSEL signal is ON. Please refer to [7-4 Auto. tuning] for the operation.</td></tr>
<tr><td>Auto. tuning
DG98
[_AUTOTUNE]</td><td>DG98P
PPRUNNING
↓ displayed in Test run
DG98P
CALCULATE
displayed in computing parameter</td><td>This item is the function to automatically measure load characteristics (machine system) and set adequate servo system parameters. Please refer to [7-4 Auto. tuning] for the operation.</td></tr>
</table>

7－4 Auto. tuning

Auto. tuning is the function that the unit itself sets or supports setting of adequate Servo control parameters for a machine (motor load). Auto. tuning consists of 2 functions, 「Auto.tuning function」 and「Tuning level adjustment function」.
Auto. tuning function sets adequate Servo control parameters in accordance with the machine action when a motor is rotated in Trial run (internal run motion pattern).
Tuning level adjustment function supports setting of more adequate Servo control parameters by increasing or decreasing gain in accordance with machine characteristics measured by Auto. tuning function.
And this unit has Servo control parameter change function (selection by GSE) and to the change command, Auto. tuning at 2 types of motor load status is assigned.

⚠ Caution

① Since in Auto. tuning function, a motor runs in accordance with the setting of parameters [P113] and [p114] , please confirm that the load machine stays in the movable range. If Over travel signal (FOT＊/ ROT＊) is not connected, this function is error. However FOT＊and ROT＊ can be disabled by the parameter [P705] setting.
② In Auto. tuning function, input signals except FOT＊and ROT＊ are invalid. Reset signal (RST) , Emergeny stop signal (EMG*) , etc. can not hold (or stop) the tuning.
③ If abnormality occurs such as vibration, etc. in Auto. tuning function, stop the tuning immediately by ↵ key. in the case, a motor goes into Torque free status and moves by its inertia.
④ In the below cases, Auto. tuning function may not tune correct gain and oscillation or runaway could happen. in the case, please set gain, manually.
(1) Big un-equal load
(2) Big friction
(3) Fluctuation of load inertia.
(4) Low rigidity of a load machine
(5) Play or backlash in a load machine
(6) Load inertia is 3 times less of motor inertia.

❗ Compulsion

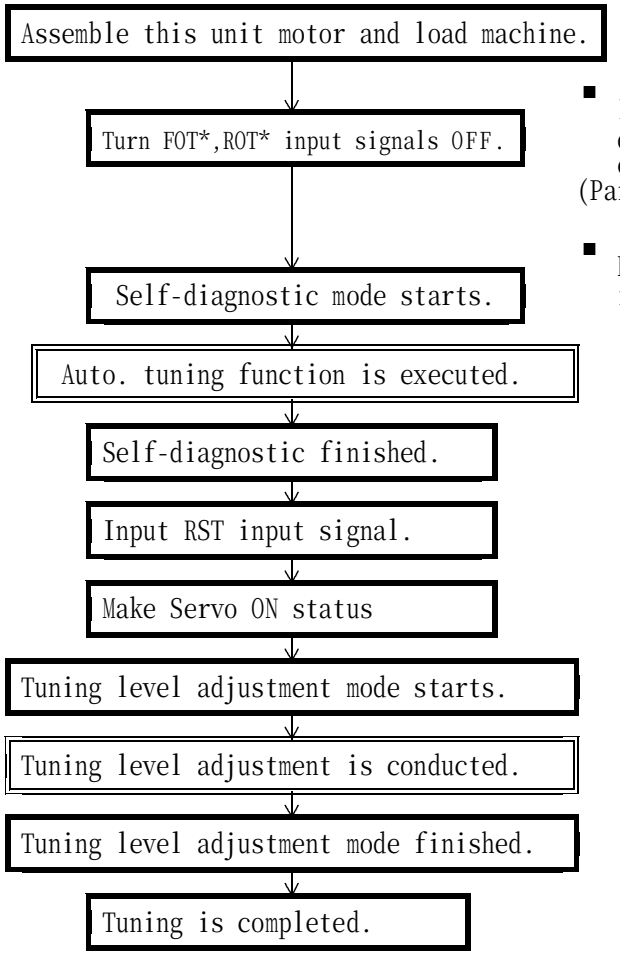
① Auto. tuning function and Tuning level adjustment function computes optimum speed loop gain based on measured load characteristics. If load changes due to fine adjustment of the load machine, etc. after Auto. tuning function and Tuning level adjustment function are over, be sure to again conduct Auto. tuning function by measuring new load characteristics. If Auto. tuning function was not reaajusted against load change, oscillation or runaway of the load machine may occur.

⃠ Prohibition

① Do not conduct Auto.tuning to the motor with a vertical shaft, etc. where external torque is loaded. When Self-diagnosis is selected for conducting Auto. tuning function, a motor becomes Torque free and is moved by external torque.

7－4－1 Auto. tuning execution procedure

Auto. tuning execution procedure is as follows.



■ In Auto. tuning function, as input signal only FOT* and ROT* are valid. RST and EMG*, can not hold (or stop).
(Parameters [P705] can disable FOT* and ROT*.)

■ Do not carelessly start Self-diagnostic function other than Auto. tuning function.

※ [7-4-2 Auto. tuning function] Reference

※ [7-4-3 Tuning level adjustment fun] Reference

[Fig. 7－2] Auto. tuning execution procedure

7－4－2 Auto. tuning function

Auto. tuning function is operated by Diagnosis No. DG97 and DG98 of Self-diagnostic mode.

● DG 98 measures machine characteristics in Trial run and sets adequate values to the following Control servo parameter.
Therefore, **be sure to connect a motor and load, and execute DG98.**

No.	Parameter name	Reference
P101	Speed loop gain	Sets adequate value.
P102	Speed loop integral time coast.	Sets adequate value.
P103	Speed loop derivative time coast.	Set 0.(Normally 0 is adequate.)
P105	Speed loop gain / Low speed gain range	Same set value as P101
P106	Spd.lp.intg.time cons./L.spd.gain rng.	Same set value as P102
P107	Spd.lp.deriv.time cons./L.spd.gain rng.	Same set value as p103
P139	Speed loop Prop. gain division ratio	Set 0.(Normally 0 is adequate.)
P140	Inertia	Set adequate value.
P141	Viscosity friction	Set adequate value.
P142	Speed loop FF2 compensation ratio	Set 0.(Normally 0 is adequate.)

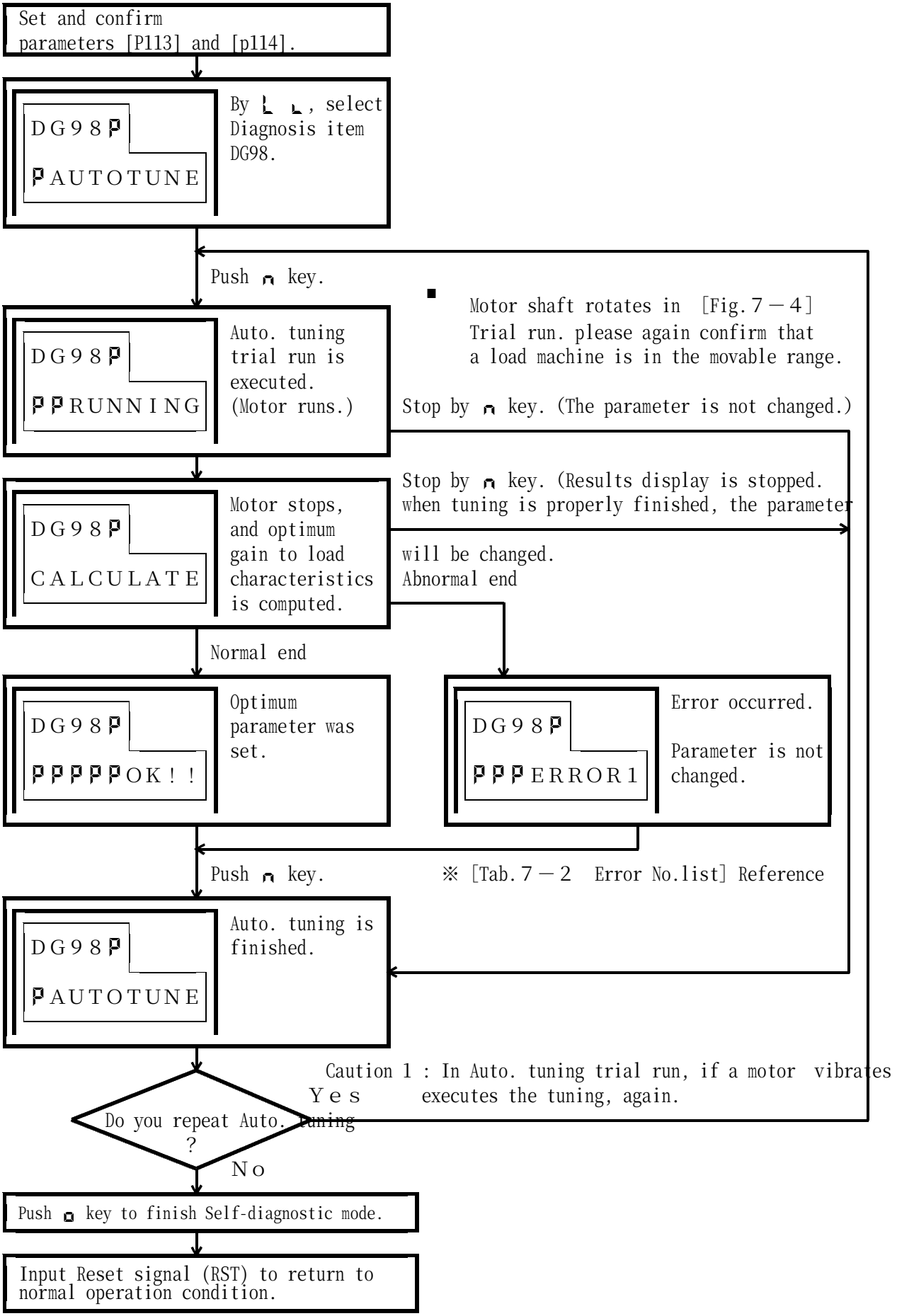
● DG97 sets following Servo control parameters when GSEL is ON.
Since machine characteristics are measured in Trial run, **be sure to connect a motor and load for GSEL signal ON, and execute DG97.**

No.	parameter name	Reference
P116	Speed loop gain / at GSEL signal ON	Set adequate value.
P117	Spd.lp.intg.time cons./ at GSEL sig.ON	Set adequate value.
P118	Spd.lp.deriv.time cons./at GSEL sig.ON	Set 0.(Normally 0 is adequate.)

And when machine load or other load characteristics are changed, **Be sure to again measure load characteristics by Auto. tuning function.**
Auto. tuning function can set adequate gain when load inertia is in the range of 3 ～ 30 times of motor inertia. If load inertia exceeds 30 times, since gain is set a little bit low, please confirm safety and then re-adjust by Tuning level adjustment function.

1) Auto. tuning function execution procedure

Operation in Auto. tuning function is as follows. (D97 operation is same.)



[Fig. 7－3] Auto. tuning function execution procedure

2）Parameter setting

In order to execute Auto. tuning function, please set and confirm parameters [P113] and [P114].

[Ｐ１１３]　Auto. tuning trial run direction selection

1．Function

This sets trial run direction of a motor in Auto. tuning function.

●ＢＯＴＨ： The motor rotates forward and then reverse direction.

●＋ＯＮＬＹ： The motor rotates only forward direction.

●－ＯＮＬＹ： The motor rotates only reverse direction.

Normally, select“ＢＯＴＨ”. Only when a load machine can move one direction either forward or reverse, change this parameter.

And since the parameter [P300 Rotating direction selection] set can reverse rotating direction, please note it.

2．Unit, setting range

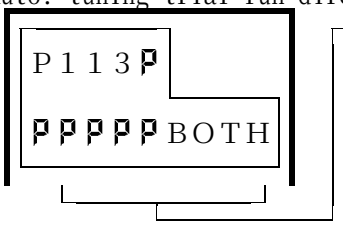
(1) Unit　: Menu selection

(2) Setting range　:ＢＯＴＨ／＋ＯＮＬＹ／－ＯＮＬＹ

(3) Initial value　:ＢＯＴＨ

3．Display

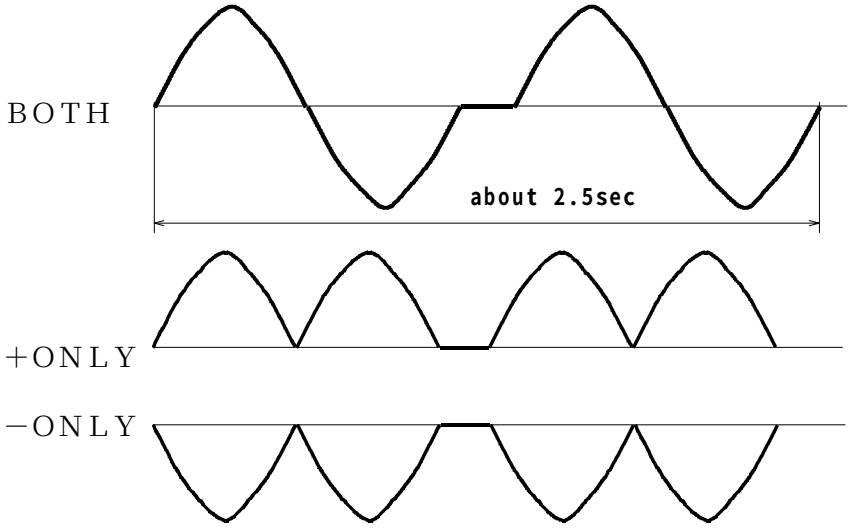
【Auto. tuning trial run direction selection】



Auto. tuning trial run direction is displayed in turns. (BOTH/+ONLY/-ONLY)

Left sample Fig. shows both direction is selected.

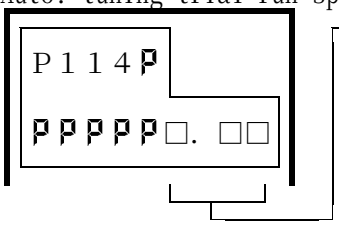
Motor motion pattern in Auto. tuning trial run is shown as follows.



[Fig.７－４]　Auto. tuning trial run

［Ｐ１１４］ Auto. tuning trial run speed ratio

1. Function
   In Auto. tuning function, Trial run speed of a motor is set by some ratio of rated speed.
   When ０．００ is set, a motor does not run and Error occurs.
   When １．００ is set, a motor runs at rated speed.
   Normally, set the initial value. Since this parameter set can change motor speed, please note it.
2. Unit, setting range
   (1) Unit : None
   (2) Setting range：０．００～１．００
   (3) Initial value ：０．３０
3. Display
   【Auto. tuning trial run speed ratio】



Auto. tuning trial run speed ratio is displayed.

▪ Caution

By parameter [P113] and [P114] values, motor speed is determined as below.
Before executing Auto. tuning function, be sure to confirm if a load machine is in the movable range.

(1) When P113 is“ＢＯＴＨ”.
   (Motor shaft rotating amount [turns])=(P114 set value)×(Rated speed)×0.005
   [Sample] P114 is 0.30 and rated speed is 3000rpm.
   (Motor shaft rotating amount [turns])=0.30×3000×0.005=4.5[turns]
   The motor runs forward about 4.5 turns and then, about 4.5 turns reverse.

(2) When P113 is“＋ＯＮＬＹ”or“－ＯＮＬＹ”.
   Motor shaft rotating amount [turns])=(P114 set value)×(Rated speed) ×0.020
   [Sample] P114 is 0.30 and rated speed 3000rpm.
   (Motor shaft rotating amount [turns])=0.30×3000×0.020=18[turns]
   The motor runs either forward or reverse about 18 turns.

(3) Reference sample
   Reference sample when P114 is 0.30 (initial value) is shown as below.

Rated speed	P113 setting		
	ＢＯＴＨ	＋ＯＮＬＹ	－ＯＮＬＹ
2000	Both of F/R: 3 turns	Frd.: 12 turns	Rvs.: 12 turns
3000	Both of F/R: 4.5 turns	Frd.: 18 turns	Rvs.: 18 turns
4000	Both of F/R: 6 turns	Frd.: 24 turns	Rvs.: 24 turns

3）Auto. tuning error
   Error in Auto. tuning function is as follows.

Error No.	Contents
ERROR1	Measured data were 0. Confirm P114 is not 0.00 and execute again.
ERROR2	Speed loop integral time const. P102 or P117 is out of the range. Since Auto. tuning can not be executed, set the parameter, manually.
ERROR3	Measured data was abnormal. Confirm if play, etc. does not exist in a load machine.
ERROR4	Either FOT＊ or ROT＊ is the cause of the stop.

［Tab.７－２］ Error No. list

7－4－3 Tuning level adjustment function

Tuning level adjustment function is executed in ＜Tuning level adjustment mode＞.
＜Tuning level adjustment mode ＞ can be conducted after Auto. tuning function is completed.
And after Auto. tuning function is completed, if load changes please execute **Auto. tuning function again.**
Tuning level adjustment mode is selected by next ITEM No. .

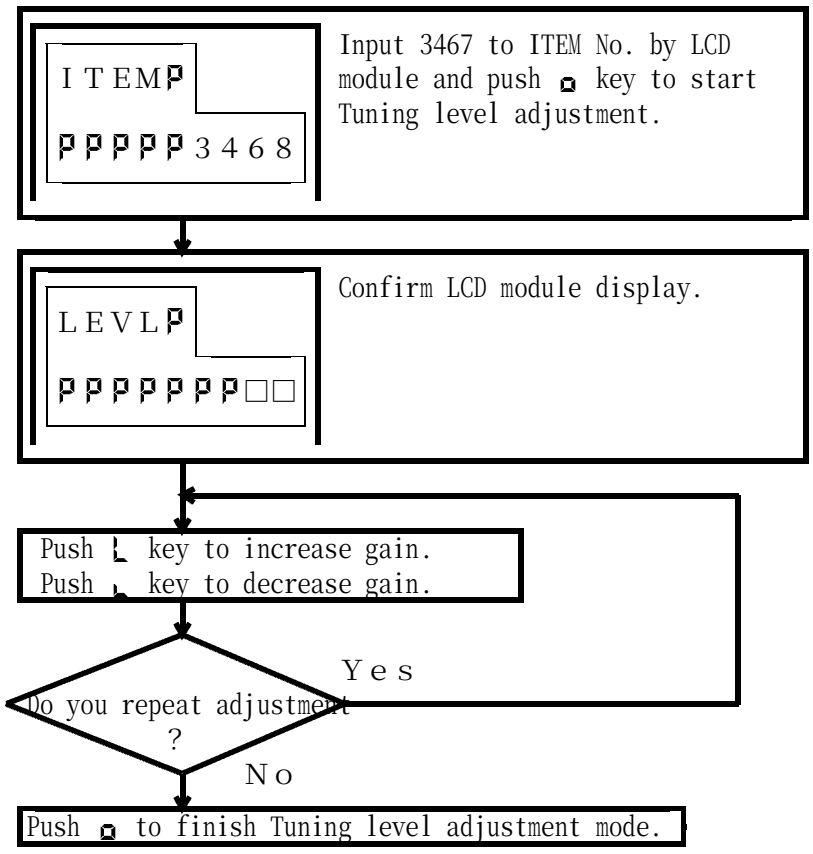
- By ITEM NO.「3468」, to adjust lower or higher gain, set adequate value to Servo control parameters. At the time, adjust gain by watching machine action.

No.	parameter name	Reference
P101	Speed loop gain	Set adequate value.
P102	Speed loop integral time const.	Set adequate value.
P105	Speed loop gain / Low speed gain range	Same set value as P101
P106	Spd.lp.intg.time cons./ L.spd.gain rng.	Same set value as P102

- By ITEM NO.「3467」, to adjust lower or higher gain when GSEL is ON, set adequate value to Servo control parameters. At the time, turn GSEL signal ON and adjust gain by watching machine action.

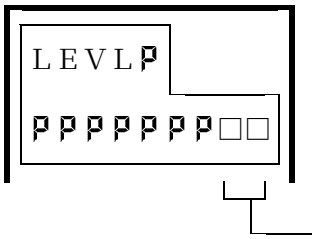
No.	parameter name	Reference
P116	Speed loop gain / at GSEL signal ON	Set adequate value.
P117	Spd.lp.intg.time cons./at GSEL sig.ON	Set adequate value.

1）Tuning level adjustment function execution procedure
Operation in Tuning level adjustment function is as follows.
(ITEM 「3467」 operation is same.)



[Fig. 7－5] Tuning level adjustment function execution procedure

2) Display in Tuning level adjustment mode



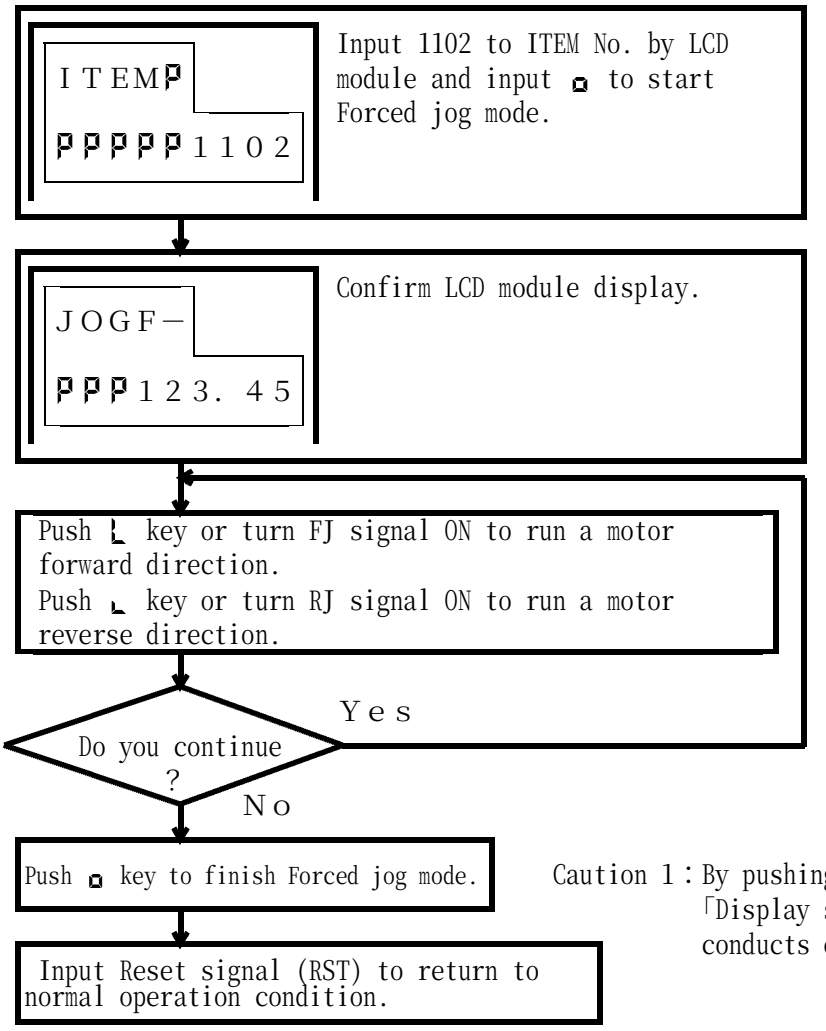
Current gain value is displayed.
Range is 48 steps, 3 ～ 50.
Smaller numeric value indicates lower gain.
Larger numeric value indicates higher gain.

By pushing ▶ key level numeric value becomes large, i.e. high gain.
By pushing ◀ key level numeric value becomes small, i.e. low gain.

7－5 Forced jog mode

Forced jog mode conducts Jog motion of a motor in Test run, recovers from error, etc. .
Motor speed is setting value of the parameter [P400: JOg speed 1] .
In Forced jog mode, control signals other than FJ, RJ, FOT*, and ROT* are ignored.

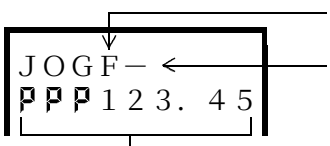
1) Forced jog execution procedure
Operation in Forced jog is as follows.



Caution 1：By pushing ◘ key, display becomes 「Display status mode」 and the unit conducts emergency stop.

[Fig. 7－6] Forced jog execution procedure

2) Display in Forced jog mode



Motor direction F：Forward / R：Reverse
Current position code (P／－)
Current position (Display is machine position and decimal point depends on [P302: Command unit].)

By ↳／↲ keys, a motor can run.
When ↳ key is pushed or FJ signal is ON, a motor runs forward and when ↲ key is pushed or RJ signal is ON, the motor runs reverse.
When a motor runs by ↳／↲ keys and FJ and RJ signals, same display is used.

⚠ Caution

① In case of changing motor speed, once finish Forced jog mode and change the value of [P400: Jog speed 1] .
② If Forced jog mode starts when FJ or RJ is ON, a motor immediately starts. Please note it.

Chapter 8 Maintenance

Though the controller and a motor are maintenance free, to prevent them from un-expected troubles caused by unit circumference change, etc. periodic inspection is recommended.

⚠ Caution

① During maintenance, the worker in charge should confirm the power ON/OFF by him.
② Since high voltage remains in the main circuit capacitors after power is turned OFF, start maintenance after 2～3 minutes or more passes (As for NCS-FI/FS**M-401～402, after front LED display「CHARGE」is lit OFf.)
③ Never conduct insulation test of the controller with a megger tester.
『The controller may be damaged.』 And in case of measuring motor insulation, disconnect cables (U,V,W) between the motor and the controller , perfectly and measure it.

8－1 Daily inspection

Conduct daily inspection on the following items.

【Inspection items】
(1) If the motor runs correctly.
(2) If the installation environment is normal. (power source, temperature, humidity, dust, etc. .
(3) Inspect if the cooling system is normal.
(4) Inspect if terminals and connectors are not loose.
(5) Inspect if there is no abnormal sound or vibration.
(6) Inspect if there is no over-heat or discoloration.
(7) Inspect if Regenerative resistors, etc. are normal.

8－2 Periodic inspection

Periodically inspect the following items after a routine operation, or certain period (every 5 months, 1 year).

【Inspection items】
(1) Inspect if there is no loose load connection, loose belt, shaft key play, or abnormal motor bearing sound.
(2) If the installation environment is normal. (power source, temperature, humidity, dust, etc. .
(3) Inspect if the cooling system is normal.
(4) Inspect if terminals and connectors are not loose.
(5) Inspect if there is no abnormal sound or vibration.
(6) Inspect if there is no over-heat or discoloration.
(7) Inspect if there is no alien substance or dust lump in the controller.
(8) Inspect if cables are free from flaws and fatigue.
(9) Inspect if Regenerative resistors, etc. are normal.
(10) Inspect the control cabinet radiation fans, clean air filters, and inspect or replace relays, etc. .

8－3　Other inspection

8－3－1　Gear

It is necessary to supply and replace lubricating oil for gears of geared motors.
Replace lubricating oil every 3,000 hours.
Since lubricating oil has very important role in functioning, use only designated lubricationg oil.(Never use machine oil, engine oil, etc. .)
If designated lubricating oil name is not indicated, ask our sales man.
In case of supplying or replacing oil to or from lubricating system, be careful not to mix different oils or cause oil leakage.
Please supply oil to the specified level.
And confirm if bolts for gears are not loose.

8－3－2　Oil seal

Replace the oil seal every 5,000 hours.
Since any oil seal is not attached to a standard motor, if required, describe 「With oil seal」 on your order sheet.

8－3－3　Motor bearing

Motor bearings are special types only for motors.
Bearing life depends on working conditions but is generally about 20,000 hours.
Motor cooling blower life is identical as the above.

8－3－4　Controller

Controller part replacement guidance is described, here.
Though used parts of the controller are mainly electric parts, some of them have own life
Part replacement guidance is described in the below tabulation.

Part name	Stand. life	Replacement method, others
Smoothing capacitor and other aluminum electrolytic capacitor (on PC board)	5 years	Replace with new PCB (Decide after inspection.).
Breaker, relays, etc.	—	(Decide after inspection.)
Cooling fan	2～3 years	Replace with new one.
Fuse	10 years	Replace with new one.

[Tab.８－１]　Part replacement guidance 1

Working conditions
- Ambient temperature ： Mean temperature in a year ３０℃
- Load ratio　： ８０% or less
- Availability　： ２０ hours or less / day

Caution 1： They are based on the "Recommendation of periodic inspection of general inverter" issued by the corporate juridial party Nippon Denki Kyokai. However, above replacement period is just guidance and in general, our products were designed with heavy duty parts.

Replacement guidance of other parts which have life is described in [Tab. 8-2] .

Part name	Stand. life	Replace. method	Condition
LCD	7 years	Replace with new.	25±10°C, 65% RH or less
EEPROM	10 years	Replace with new PCB (Determine after inspection.)	Change frequency of parameter, Index data, command, etc. 3 times / day
LIthium cell	10 years	Replace with new PCB (Determine after inspection.)	25±10°C, 65% RH or less Availability : 2,000h / year

[Tab. 8－ 2] Part replacement guidance 2

Since part life largely varies depending on temperature and humidity condition, do not use our products in high temperature and high humidity.

Chapter 9　Error diagnosis and corrective measures

When any error occurs, conduct the following inspections or error diagnosis in order to investigate the cause and take proper corrective measures.
When inspection and confirmation item in ［9-1 Inspection and confirmation items］ is found, or a part or a controller is supposed out of order or broken, immediately inform our sales man.
When Corrective measures are conducted, a worker in charge should check power ON/OFF by himself.
Since high voltage remains in the main circuit condensers after power is turned OFF, start corrective measures after 2～3 minutes or more passes (As for NCS-FI/FS＊＊M-401～402, after front LED「CHARGE」is lit OFF.).
When it is necessary to touch inside of the unit, be careful not to cause damage by static electricity.
Never conduct insulation test with a megger tester as it may damage the controller.
In case of measuring motor insulation, disconnect cables (U,V,W) between the motor and the controller. perfectly and measure it.

9－1 Inspection and confirmation items

When an error occurs, inspection and confirm the following items.
If a spare motor or a controller is available, replace suspicious one and run it to judge whether the controller or the motor is damaged or any external factor exists.

【Inspection and confirmation items】
(1) Inspect what Alarm display is.
(2) Inspect if no error is found by visual check.
(3) Inspect if the error reproducible, or occurs only in a particular motion.
(4) Inspect how often the error occurs.
(5) Inspect how long the unit has been used.
(6) Inspect if the power source is normal and if it fluctuates largely in particular time band.
(7) Inspect if power black out occurred.
(8) Inspect if motor and controller temperature is normal as well as atmosphere temperature.
(9) Inspect if installation environment of the motor and the controller is normal. (water, oil, metal powder, paper fragments, corrosive gas, etc.)
(10) Inspect when the error occurs, during acceleration, deceleration, or at constant speed run of the motor.
(11) Inspect if the error occurs at load fluctuation. (at load increase or decrease).
(12) Inspect if there is no difference between forward and reverse motion of the motor.
(13) Inspect if there is no error in no load run.

9－2　Protective function

9－2－1　Protective function and error treatment

The controller has various Protective function to prevent a controller or a motor from damage, and Error treatment function to inform operation error, etc. .
Protective function consists of 「Alarm treatment」and 「Warning treatment」
And Error treatment function has 「Error display」.

① Alarm treatment
when an error is detected, a motor stops (sudden stop or Torque free based on an error type) and Alarm signal output and Alarm message display are conducted, simultaneously.

② Warning treatment
If it is supposed to probably become error if current operation is continued, Warning of error notice will be made.
The controller outputs Warning signal when Warning occurs and display Warning message but does not stop motor motion.

③ Error display
When operation error, input error, etc. occurs, Error message is displayed on the spot.

	Treatment description when Error occurs (detected).		
	Motor motion status	Control out. signal	LCD display
Alarm treat	Sudden stop or Torque free	Alarm signal ON	Alarm message
Warning treat.	Current motion continues.	Warning signal ON	Warning message
Error display	Current motion continues.	Un-changed	Error message

［Tab. 9－1］　Error occurrence and treatment

9－2－2 Cautions when Protective function works.

When Protective function works, it indicates some error occurred.
Before releasing Alarm, be sure to investigate the cause and delete it.

▪ Caution
If Reset is repeated when「IPM error」or 「Over load error」occurs, a controller could be damaged or a motor burns. Be sure to delete the cause and resume them.

① I PM error

When following errors are detected in the power element (IPM) of the unit main circuit (power section), IPM error occurs.

- Over-current flew.
- The power element is over-heated.

Be sure to delete error cause, release Alarm, and then resume Run. If Alarm is reset before deleting error cause completely, and IPM error is repeated, the unit will be damaged.

② Control / Main power source under voltage error

If voltage drops due to in-sufficient power source capacity or black out (10ms or longer) occurs, Under voltage error occurs.
If Start signal, Jog signal, Positioning start signal and Pulse train command, etc. have been inputted when power source recovers, a motor runs. Please make sequence to turn OFF individual signal and commands at the time Protective function works.

③ Over-voltage error

If load inertia is large, generative energy becomes huge when a motor decelerates or stops, and over-voltage error occurs.
Be sure to delete the error, release Alarm, and then resume Run.

④ Radiator over-heat error

If a heat sink of a power element is over-heated, Radiator over-heat error occurs.
Be sure to delete the error, release Alarm, wait for about 30 minute until the heat sink is cooled down, and then resume Run.

⑤ Motor over-heat error / breaking of thermister cable

When Enable (ALM.OH2.Y) is selected to the parameter [P736: Motor over-heat error detection Enable / Disable selection] , if motor temperature is 150 ℃ or more, or a thermister cable in disconnected or broken, this error occurs.
Be sure to delete the error, release Alarm, wait until motor temperature is down, and then resume Run.

⑥ Encoder fault

In case of disconnection or broke of an encoder cable, loose fit of a connecter loose, mis-setting of the parameters (P000～P002), etc. , Encoder fault occurs.
If the encoder itself is faulty, Encoder fault could not be detected. In the case, Over-load error occurs when a motor runs.

⑦ Over-speed error

When speed over-shoot is too large at motor start due to large inertia, etc. , Over- speed error occurs. Be sure to delete the error, release Alarm, and then resume Run.

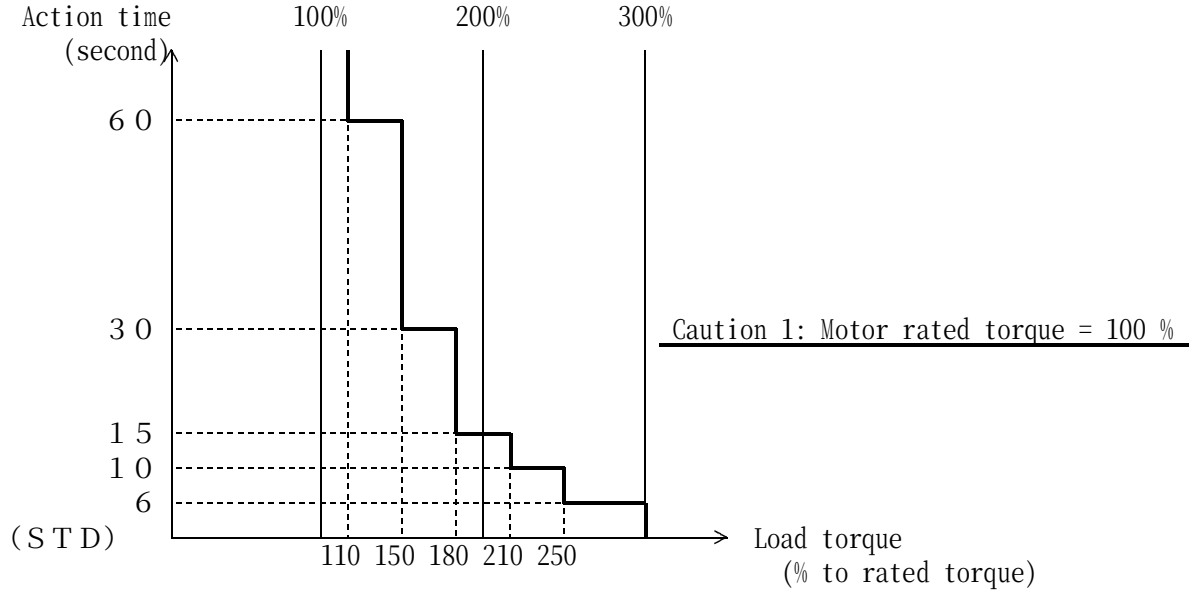
⑧ Over-load error

When an internal electric thermal relay is activated due to over-load or too frequent ON/OFF operation than stipulated times, Over-load error occurs.

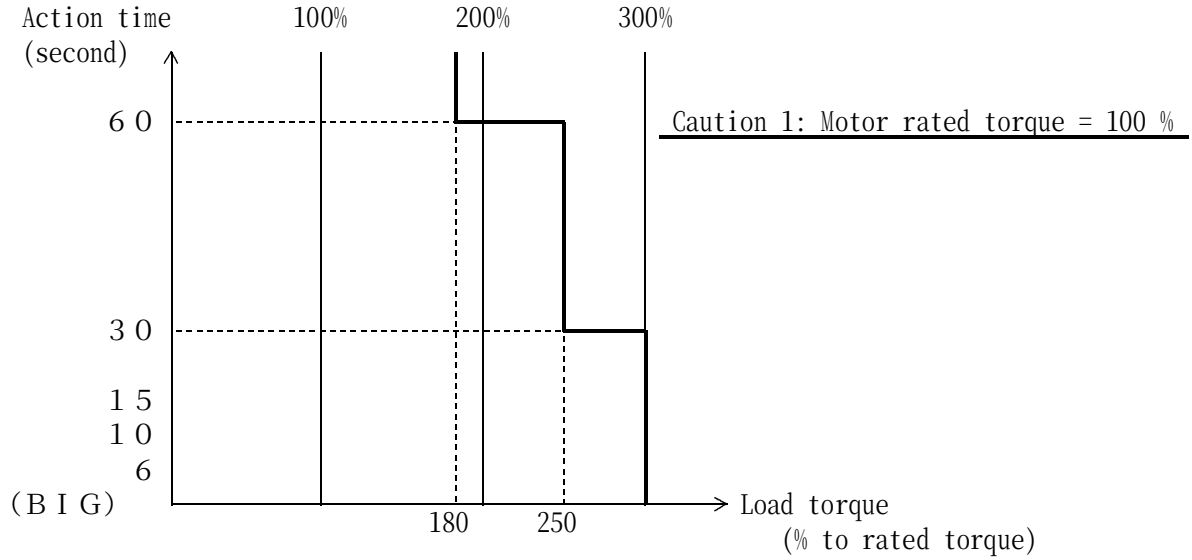
Be sure to delete the error, release Alarm, wait for about 30 minute until the heat sink is cooled down, and then resume Run.

And two types of an internal electric thermal, standard (STD) and large capacity (BIG) can be selected by the parameter [P121: Electric thermal detection selection] .

Relation of action time of internal electric thermal and load torque is described in [Fig. 9－1 (a)] Standard (STD) and [Fig. 9－1 (b)] Large capacity (BIG).



[Fig. 9－1 (a)] Standard (STD) internal electric thermal action time



[Fig. 9－1 (b)] Large capacity (BIG) internal electric thermal action time

Caution of internal electric thermal :

Since torque current (%) = torque (%) under motor rated speed, the latitude unit could be「Load torque (% to rated torque)」.

In case of field control, under motor rated speed (Magnet flux control base speed), torque / torque current is smaller in inverse ratio to speed.

Foe example, at 200 % speed of motor rated speed, to generate rated torque, 200 % torque current of rated torque current is flown.

9－2－3 Protective function list

1） Alarm list

Name / Display	Contents	Motion and output signal status	Way to release
I PM error ALM. P I PM ERR.	Due to line-to-ground of motor or same and short-circuit of U,V,W cables between controller and motor over-current flows in main circuit transister or cooling heat sink for power element is over-heated.	Motor torque free. Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Control power under voltage error ALM. P UNDRVOLT1	Control power (+5V、+15 V) voltage dropped. DC+5V ：About +4.75V or less DC+15V：About +13.5V or less	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Main power source under voltage error ALM. P UNDRVOLT2	Main circuit DC bus voltage dropped less than 180[370]V. In [ ], value of 400V type (In case of controller combined with main power type detects Alarm.)	Motor stops and torq. free by〔P713〕. Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Over-voltage error ALM. P OVERPVOLT	Due to excess load inertia, etc.at motor stop or decel. regenerative energy is beyond capacity and DC power voltage of main circuit exceeds about 400 [820]V. In [ ], value of 400V type	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Motor over-heat error ALM. P OVERHEAT2	Motor temp. detection thermister is 150°C or more.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Wait until motor becomes cool, then ①Power reinput ②Reset signal (RST) input
Disconnection of thermister ALM. P THERMIST.	Cable of motor temp. detection thermister is broken or disconnected.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Confirm wiring, then ①Power reinput ②Reset signal (RST) input
Encoder fault ALM. P PPENCODER	①Encoder fault ②Disconnect. or break of encoder cable or loose fitness of connector. ③Wrong encoder selection by parameter, etc. occurred.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Confirm encoder, encoder cable and parameter「P001」, then ①Power reinput

〔Tab. 9－2 (a)〕 Alarm list 1/9

Name Display	Contents	Motion and output signal status	Way to release
Motor shaft error at power input ALM. P PW. ONPENC	Motor shaft has been rotated or vibrated when power is turned ON. In the case, encoder can not be initialized. 【Detection only for NCS-FS type】	Motor torque free Alarm ON Warning OFF Servo ready OFF	Power reinput.
Overspeed error ALM. P OVERSPEED	Motor speed is more than about 130 % of rated speed.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Over-load error ALM. P OVERPLOAD	Due to over-load, or too frequent ON/OFF than allowable times, internal electric thermal is activated.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
AC loss detection error ALM. P PPACPDOWN	AC power voltage dropped ress than about 145[290] V for 50ms or more. (Black out occurred.) In [ ], value of 400V type	Motor stops and torque free by[P713]. Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Deviation over-flow ALM. P POVERFLOW	Position deviation exceeds setting value of 〔P207：Over-flow detection pulse〕.	Sudden motor stop and torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Deviation error ALM. P VARI. OVER	Position deviation exceeds setting of 〔P208 ： Deviation error detection pulse〕. ※ But it is applied when「STOP :Alarm stop」is selected by 〔P209：Motion selection at Deviation error〕.	Sudden motor stop and Servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Power reinput ②Reset signal (RST) input

*1：Status when「RDY1」is selected by [P716: RDY signal spec. selection].
If other is selected, status could be different.

[Tab. 9－2 (b)]　Alarm list 2/9

Name Display	Contents	Motion and output signal status	Way to release
Forward over travel ALM. P +HARD P OT.	Forward over travel signal (FOT) is detected.	Sudden motor stop and Servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Motor moves to reverse by Jog motion and release forward over-travel.
Reverse over travel ALM. P −HARD P OT.	Reverse over travel signal (ROT) is detected.	Sudden motor stop and Servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Motor moves to forward by Jog motion and release reverse over-travel.
Forward software over travel ALM. P +SOFT P OT.	Current position exceeds setting value of 〔P306 : Forward software OT limit〕.	Sudden motor stop and Servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Motor moves to reverse travel limit by Jog motion.
Reverse software over travel ALM. P −SOFT P OT.	Current position exceeds setting value of 〔P307 : Reverse software OT limit〕.	Sudden motor stop and Servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Motor moves to forward travel limit by Jog motion.

*1 : Status when 「RDY1」 is selected by [P716: RDY signal spec. selection] .
If other is selected, status could be different.

[Tab. 9 − 2 (c)] Alarm list 3/9

Name / Display	Contents	Motion and output signal status	Way to release
No set of motor type ALM. P MOTRTYPE1	Setting of〔P000：Motor type〕is「000」.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Set motor type, then ①Power reinput
Motor type error ALM. P MOTRTYPE2	Combination of motor and controller selected by〔P000：Motor type〕is wrong.	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Set motor type correctly, then ①Power reinput
Extended memory cell under voltage error ALM. P RAM BATT.	Voltage of data hold cell for extended memory (option) dropped. (Only once, Alarm is outputted in power ON status.)	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Reset signal (RST) input. Immediate replacement of extended memory by us is required.
EEPROM (nan-volatile) write error ALM. P WR. EEPROM	Write of data to EEPROM (in controller) was failed.	Sudden motor stop and Servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Power reinput ②Reset signal (RST) input
Rated speed command error 1 ALM. P STD. SPD. 1	Speed at motor rated speed set by〔P303,P304: Electric gear ratio〕and〔P310：Machine travel amount〕exceeds 2M (setting unit / sec) .	Motor torque free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Correct〔P303, P304： Electric gear ratio〕and〔P310： Machine travel amount〕, then ①Power reinput ②Reset signal (RST) input
Rated speed command error 2 ALM. P STD. SPD. 2	Speed at motor rated speed set by〔P303,P304: Electric gear ratio〕and〔P310：Machine travel amount〕is less than 100mm (setting unit / sec) .		
Address set error ALM. P ADDRP ERR.	Command out of 0～279 range was specified and tried.	Motor servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Correct to right address, then ①Power reinput ②Reset signal (RST) input

*1：Status when「RDY1」is selected by［P716: RDY signal spec. selection］.
If other is selected, status could be different.

［Tab. 9－2 (d)］ Alarm list 4/9

Name / Display	Contents	Motion and output signal status	Way to release
Positioning time over ALM. P PTIMEPOUT	Positioning is not completed after set time [P203 : Positioning time over] passed.	A motor sudden stops and in servo lock. Alarm ON Warning OFF Servo ready ON *1 Brake release ON	①Power reinput ②Reset signal (RST) input
Positioning data over-flow ALM. P DATAPOVER	Simple continuous positioning is tried to execute continuous travel distance out of range 2147483647～ -2147483647.	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Set continuous travel distance in the range. ①Power reinput ②Reset signal (RST) input
No 1 rotation data set error ALM. P P305PERR.	Without setting of [P305 : Index positioning range] , i.e.「0」, Index positioning or Spin command is tried to execute.	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Set [P305 : Index positioning range] correctly, then, ①Power reinput ②Reset signal (RST) input
No program end ommand set error ALM. P PEND. ERR.	In executing command other than 0, address becomes 280 due to no PEND command set.	A motor sudden stops and in servo lock. Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct program, then, ①Power reinput ②Reset signal (RST) input
Subroutine call esting over ALM. P CALLPOVER	Subroutine call is tried to execute 9 times without executing Subroutine return.	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct program, then, ①Power reinput ②Reset signal (RST) input
Subroutine return error ALM. P PRETPERR.	Subroutine call is tried to execute without executing Subroutine return.	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct program, then, ①Power reinput ②Reset signal (RST) input

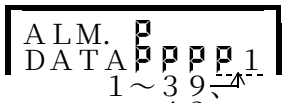
*1 : Status when 「RDY1」 is selected by [P716: RDY signal spec. selection].
If other is selected, status could be different.

[Tab. 9－2 (e)] Alarm list 5/9

Name / Display	Contents	Motion and output signal status	Way to release
Jump address error ALM. P JUMP P ERR.	Jump to address or Subroutine addresses is set other than range 0 ～278 and was tried to execute the command.	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct address, then, ①Power reinput ②Reset signal (RST) input
Spin command error ALM. P P SPN. ERR.	Without executing SPNS command, SPNT or SPNP is tried to execute. Or in Spinning, command other than SPNS, SPNT,SPNP is tried to execute. Or, SPNS or SPNT is executed by Address 279.	A motor sudden stops and in servo lock. Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct program, then program, then, ①Power reinput ②Reset signal (RST) input
Division error ALM. P 0 DIV. ERR.	「0」is tried to execute as divisor.	Motor in serv lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct divisor, then ①Power reinput ②Reset signal (RST) input
Positioning amount error ALM. P P POS P OVER	Positioning command is tried to execute by the setting over Parameter 〔P308: Max. Forward positioning amount〕 or 〔P309：Max. Reverse positioning amount〕.	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct data, then, ①Power reinput ②Reset signal (RST) input
Error command ALM. P CMND. ERR.	Command which can not be identified is tried to execute. (It occurs when an error command is registered by communication)	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct data, then, ①Power reinput ②Reset signal (RST) input
Index data № error ALM. P IXNO. ERR.	Command specified Index data No. out of 0～999 is tried to execute.(It occurs when Index data offset No. is used or error index data No.is registered by communication.)	Motor in servo lock Alarm ON Warning OFF Servo ready ON *1 Brake release ON	Input correct data, then, ①Power reinput ②Reset signal (RST) input

*1：Status when 「RDY1」is selected by [P716: RDY signal spec. selection].
If other is selected, status could be different.

[Tab. 9－2(f)] Alarm list 6/9

Name / Display	Contents	Motion and output signal status	Way to release
Stored data error 1～39, 42 	Stored data are broken.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Reset data, then ①Power reinput ②Reset signal (RST) input But since DATA39 error release is impossible, consult us.

Display	Description
DATAPPPP1	Parameter data (Group0／P000～99) were broken.
DATAPPPP2	Parameter data (Group1／P100～199) were broken.
DATAPPPP3	Parameter data (Group2／P200～299) were broken.
DATAPPPP4	Parameter data (Group3／P300～399) were broken.
DATAPPPP5	Parameter data (Group4／P400～499) were broken.
DATAPPPP6	Parameter data (Group5／P500～599) were broken.
DATAPPPP7	Parameter data (Group6／P600～699) were broken.
DATAPPPP8	Parameter data (Group7／P700～799) were broken.
DATAPPPP9	Command data (Address 000～009) were broken.
DATAPPP10	Command data (Address 010～019) were broken.
DATAPPP11	Command data (Address 020～029) were broken.
DATAPPP12	Command data (Address 030～039) were broken.
DATAPPP13	Command data (Address 040～049) were broken.
DATAPPP14	Command data (Address 050～059) were broken.
DATAPPP15	Command data (Address 060～069) were broken.
DATAPPP16	Command data (Address 070～079) were broken.
DATAPPP17	Command data (Address 080～089) were broken.
DATAPPP18	Command data (Address 090～099) were broken.
DATAPPP19	Command data (Address 100～109) were broken.
DATAPPP20	Command data (Address 110～119) were broken.
DATAPPP21	Command data (Address 120～129) were broken.
DATAPPP22	Command data (Address 130～139) were broken.
DATAPPP23	Command data (Address 140～149) were broken.
DATAPPP24	Command data (Address 150～159) were broken.
DATAPPP25	Command data (Address 160～169) were broken.
DATAPPP26	Command data (Address 170～179) were broken.
DATAPPP27	Command data (Address 180～189) were broken.
DATAPPP28	Command data (Address 190～199) were broken.
DATAPPP29	Command data (Address 200～209) were broken.
DATAPPP30	Command data (Address 210～219) were broken.
DATAPPP31	Command data (Address 220～229) were broken.
DATAPPP32	Command data (Address 230～239) were broken.
DATAPPP33	Command data (Address 240～249) were broken.
DATAPPP34	Command data (Address 250～259) were broken.
DATAPPP35	Command data (Address 260～269) were broken.
DATAPPP36	Command data (Address 270～279) were broken.
DATAPPP37	Index data (IX00～IX49) were broken.
DATAPPP39	Adjustment data for unit shipment were broken.
DATAPPP42	Index data (IX100～IX999) were broken. Only units equipped with extended memory can detect.

[Tab. 9－2 (g)] Alarm list 7/9

Name / Display	Contents	Motion and output signal status	Way to release
Absolute encoder preload error ALM. P ABS. PRE. L	Preload is not completed after preload of Absolute encoder works. ※Applied when Absolute encoder is used.	Motor in servo lock Alarm ON Warning OFF Servo ready ON Brake released OFF	①Power reinput ②Reset signal (RST) input
Absolute encoder battery error ALM. P ABS. BATT.	External battery voltage for Absolute encoder data back up dropped. 『Detected when power is turned ON.』 ※Applied when Absolute	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Replace external battery, then, ①Power reinput ②Reset signal (RST) input
Absolute encoder count error ALM. P ABS. COUNT	Counter error of Absolute encoder occurs. ※Applied when Absolute encoder is used.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input
Absolute encoder over-flow error ALM. P PABS. OVER	Rotating amount of Absolute encoder is more than ±4095 turns. ※Applied when Absolute encoder is used.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input Initialize setting of Absolute encoder.
Absolute encoder data back up error ALM. P ABS. BAKUP	Absolute position data backed up in Absolute encoder is gone. ※Applied when Absolute encoder is used.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input Initialize setting of Absolute encoder.
Absolute encoder communication error ALM. P ABS. COMM.	Data Absolute encoder can not be received. ※Applied when Absolute encoder is used.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Reset signal (RST) input

[Tab. 9－2 (h)]　Alarm list　8/9

Name / Display	Contents	Motion and output signal status	Way to release
SQB (Sequence control section) Alarm ALM. P P SQB P ERR.	①Access from SQB has been lost for 10 sec. at power ON, and 1 sec. in normal condition. ②Self-diagnostic or Forced jog mode is changed.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput
Remote sequ.control IC fault ALM. P NET IC ER	IC part to control communication of Remote sequence control is broken.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Repair it by our service sec. .
Remote sequ.cont.commun.error ALM. P NET ERR.	Communication of Remote sequence control can not be used. It occurs when power of a controller using Sequence control is turned OFF first.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	Reinput power to whole system where Sequence control is remotely connected.
CPU fault ALM. P CPU RAM ALM. P EX RAM ALM. P DSP BOOT ALM. P DSP BOOT1 ALM. P DSP PARA	Unit is out of order.	Motor in torq. free Alarm flashes. Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Replace or repair the unit by us.
CPU fault Front LED is lit. HALT 	Due to fault of CPU, memory (ROM,RAM), etc. Watch dog timer alarm is activated.	Motor in torq. free Alarm ON Warning OFF Servo ready OFF Brake release OFF	①Power reinput ②Replace or repair the unit by us.

[Tab. 9－2(i)] Alarm list 9/9

2) Warning list

Name / Display	Contents	Motion and output signal status	Way to release
Over load warning WNG. P OVER. LOAD	If current running conditions are continued, Over-load error will occur.	Current motion continues. Alarm OFF Warning ON Servo ready ON Brake release ON	①Delete cause of Over-load.
Deviation error warning WNG. P VARI. OVER	Position deviation exceeds set of 〔P208：Deviation error detection pulse〕. ※Applied when 『Continuous motion』 is selected by [P209: Motion selection at Deviation abnormal].	Current motion continues. Alarm OFF Warning ON Servo ready ON Brake release ON	①Delete cause of Deviation error. (Load increase, wrong setting of gain, Accel./Decel/ time, etc.)
Main power under voltage detection warning WNG. P UNDRVOLT2	Main circuit DC bus voltage becomes 180[370]V or less. In [ ], value of 400V type (In case of controller not combined with power source, this warning is detected.)	Motor in torq. free Alarm OFF Warning ON Servo ready OFF Brake release OFF	Recover main power source to normal voltage range.
Zero return incomplete auto. start warning告 WNG. P HOME. ERR.	Since Auto. run started in Zero return incomplete status, Start signal is ignored.※ When 〔P409：Auto.run permit codition selection〕 is no condition, this is not detected.	Neglects Auto. start signal. Alarm OFF Warning ON Servo ready ON Brake release ON	①Execute Zero return. (When mode other than Auto. mode is selected, Warning is OFF.)
Absolute encoder battery error warning WNG. P ABS. BATT.	External battery voltage for Absolute encoder data back up dropped. 『Detected,always.』 ※Applied when Absolute encoder is used.	Current motion continues. Alarm OFF Warning ON Servo ready ON Brake release ON	①Replace external battery.
Absolute encoder preload incomplete warning WNG. P ABS. PRE. L	Preload and preset of Absolute encoder is not completed. ※Applied when Absolute encoder is used.	Current motion continues. Alarm OFF Warning ON Servo ready ON Brake release ON	①Execute preload and preset program.
Remote sequence control commun. waiting warning WNG. P NET NORDY	Communication for Remote sequence control is not started.This occurs when controller for Remote sequence control is not functioning.	Current motion Alarm OFF Warning ON Servo ready ON Brake release ON	Turn power of control ON for Remote Sequence control.

[Tab. 9－3] Warning list

3) Error list

Name Display	Contents	Motion and output signal status	Way to release
Data input range error ERR. P PPPEDITP1	Inputted parameter and data value is out of setting range.	In Edit mode, motor continues present motion. Output signal is not changed.	①Release error by input of any key and reset correct data.
Data setting value error ERR. P PPPEDITP2	Computed results with plural associated values are out of setting range.	In Edit mode, motor continues present motion. Output signal is not changed.	①Release error by input of any key and reset correct data.
Duplicate operation error ERR. P PPPEDITP3	Same address command is edited by LCD module and MDI, simultaneously.	In Edit mode, motor continues present motion. Output signal is not changed.	①Release error by input of any key and operate by only either one.

[Tab. 9－4]　Error list

9－2－4 Inspection method and measures when Protective function works.

When an error occurs, please confirm error contents by Alarm display, and take proper measures.
Before releasing Alarm, be sure to delete error cause.
If an error occurs repeatedly, the unit could be damaged.

Description	Cause	Corrective measures
【I PM fault】 ・Due to line-to-ground error of a motor, or the same error, short-circuit or mis-wiring of cables (U,V,W) between a controller and a motor, Overcurrent flows in main circuit transistors. ・AC power source voltage is out of spec. range. And Over-current flows in main circuit transistor	・Line-to-ground of a motor	・Replace the motor.
	・Line-to-ground and short-circuit between a controller and a motor	・Correct the wiring.
	・Current fluctuation due to unstable motor motion and vibration	・Adjust stability.(Adjust gain , improve machine system play, etc.)
	・Power source voltage is out of spec. range or fluctuates largely .	・Supply correct power.
	・Malfunction due to noise	・Remove noise source and take anti-noise measures.
【I PM fault】 ・Power elements are over-heated.	・High ambient temperature or bad ventilation	・Lower ambient temperature. Improve ventilation.
	・Stop of cooling fan	・Replace the cooling fan.
【Over-load error】 ・Due to over-load or too frequent motor ON / OFF than allowable times, an internal electric thermal is activated. ・Motor value different from the applied type is set to Parameters P000～P002.	・Excess load	・Decrease load.
	・Too frequent start and stop of a motor	・Decrease frequency of motor ON/ OFF.
	・Incorrect wiring (U,V,W) between a controller and a motor	・Correct wiring.
	・Encoder feedback signal is influenced by noise.	・Remove noise source and take anti-noise measures.
	・Encoder failure	・Replace the encoder.
	・Mechanical locking with a brake, etc.	・Release the brake. If there is a problem in machine system, fix it.
	・Current fluctuation due to unstable motor motion and vibration	・Adjust stability. (Adjust gain and improve play of machine system, looseness ofconnecting section, weak machinerigidity, etc. .)
	・ High ambient temperature or bad ventilation	・Lower ambient temperature. Improve ventilation.
	・ Wrong set of P000～P002	・Set correct value to P000～P002.

Description	Cause	Corrective measures
【Control power source under voltage error】 ・Control power source (+5V,+15V) voltage dropped. DC+5V : About+4.75V or less DC+15V : About+13.5V or less	・Power source voltage is low (Includes insufficient capacity) . ・Power black out occurred for more than 10ms. ・Power cables are thin. ・Loose screw in power source terminals	・Supply power source, or reconsider power supply system, capacity and cable diameter.
	・Malfunction due to noise	・Delete noise source and take anti-noise measures.
【Main power source under voltage error】 ・Main circuit DC bus voltage becomes 180[370] V or less. In [ ], value of 400V type	・Power source voltage is low (Includes insufficient capacity) . ・Power black out occurred for more than 10ms. ・Power cables are thin. ・Loose screw in power source terminals	・Supply correct power source, or reconsider power supply system, capacity and cable diameter.
	・Malfunction due to noise	・Delete noise source and take anti-noise measures.
【Over-voltage error】 ・Due to excess load inertia, etc. , at motor stop or decel., regenerative energy is beyond capacity and DC power voltage of main circuit exceeds about 400 [820]V or more. In [ ], value of 400V type	・Power source voltage is high.	・Supply correct power source.
	・Excessive regenerative energy due to too large load inertia	・Reduce load inertia or increase speed or set longer decel. time.
	・Malfunction due to noise	・Delete noise source and take anti-noise measures.
【Over speed error】 ・Motor speed exceeds 130% of rated speed.	・Incorrect wiring (U,V,W) between a controller and a motor. ・Incorrect wiring of Encoder feedback signal	・Correct wiring.
	・Encoder failure	・Replace the encoder.
	・Due to excess load inertia or in-adequate gain setting, Over-shoot is large.	・Reduce load inertia or increase accel. time. ・Adjust stability(Adjust gain and improve play of machine system, looseness of connecting section, weak machine rigidity, etc.)
	・Encoder feedback signal is influenced by noise.	・Delete noise source and take anti-noise measures.
【Encoder error】 ・Encoder is faulty, encoder cable is broken, not connected or a connector came out.	・Breaking, disconnection or incorrect wiring of Encoder cable	・Correct wiring.
	・A connector was inserted incorrectly.	・Insert the connector, securely.
	・Encoder failure	・Replace the encoder.
	・Wrong P001 setting	・Set correct value.

Description	Cause	Corrective measures
【Deviation over-flow】 【Deviation error】 ・Position deviation exceeds set of Parameter 〔P207:Over-flow detection pulse〕. ・Position deviation exceeds set of Parameter 〔P208: Deviation error detection pulse〕.	・Excess load	・Reduce load.
	・Due to excess load inertia or in-adequate gain setting, Over-shoot is large.	・Reduce load inertia or increase accel./decel. time. ・Adjust stability(Adjust gain and improve play of machine system, looseness of connecting section, weak machine rigidity, etc.)
	・Incorrect wiring (U,V,W) between a controller and a motor. ・Incorrect wiring of Encoder feedback signal	・Correct wiring.
	・Encoder failure	・Replace the encoder.
	・Encoder feedback signal or command pulse is influenced by noise.	・Delete noise source and take anti-noise measures.
【Positioning time over】 ・Positioning is not completed even after set time of Parameter 〔P203: Positioning time over〕 has passed.	・Mechanical block by a brake etc.	・Release the brake. If there is a problem in machine system, fix it.
	・Wrong parameter setting ・ Excess load	・Check associated parameters and reset correct values. ・Reduce load.
	・Sticking in machine system	・Fix the trouble in the machine system.
	・Gain setting is too low.	・Increase gain setting.
	・Wrong parameter setting	・Check associated parameters and reset correct values.
【Forward Over-travel】 【Reverse Over-travel】 ・Forward over-travel is detected. ・Reverse Over-travel is detected.	・Breaking, disconnection or incorrect wiring of Control signal cable	・Correct wiring.
	・A connector was inserted incorrectly.	・Insert the connector, securely.
	・Wrong Positioning data setting	・Reset correct value.
	・Wrong external sequence	・Correct the external sequence.
【Forward software limit】 【Reverse software limit】 ・Current position exceeds set of Parameter 〔P306: Forward software limit〕. ・Current position exceeds set of Parameter 〔P307: Reverse software limit〕.	・Wrong Positioning setting	・Reset correct value.
	・Wrong parameter setting	・Check associated parameters and reset correct values.
【EEPROM write error】 ・Write can not be conducted to non-volatile memory(EEPROM).	・Due to noise,Write of data can not be conducted to non-volatile memory (EEPROM).	・Delete noise source and take anti-noise measures.
【Positioning amount error】 ・In Positioning associated command, Positioning amount exceeds 〔P308:Max. Forward positioning amount〕 or 〔P309:Max. Reverse positioning amount〕.	・Wrong Positioning setting	・Reset correct value.
	・Wrong parameter setting	・Check associated parameters and reset correct values.
	・Malfunction due to noise	・Delete noise source and take anti-noise measures.

Description	Cause	Corrective measures
【CPU fault】 ・Due to CPU or memory fault, Watch dog timer is activated.	・Malfunction due to noise	・Delete noise source and take anti-noise measures.
	・Unit failure	・Replace the unit.
【Stored data error】 ・Error occurs in data contents.	・ Data is broken by noise.	・Delete noise source and take anti-noise measures.

[Tab. 9－5] Inspection method and measures when Protective function works

▪ Caution

①If Reset is repeatedly conducted when IPM fault or Over-load error occurs, it may cause controller damage and burning out of a motor.
Be sure to delete the error cause and resume units.

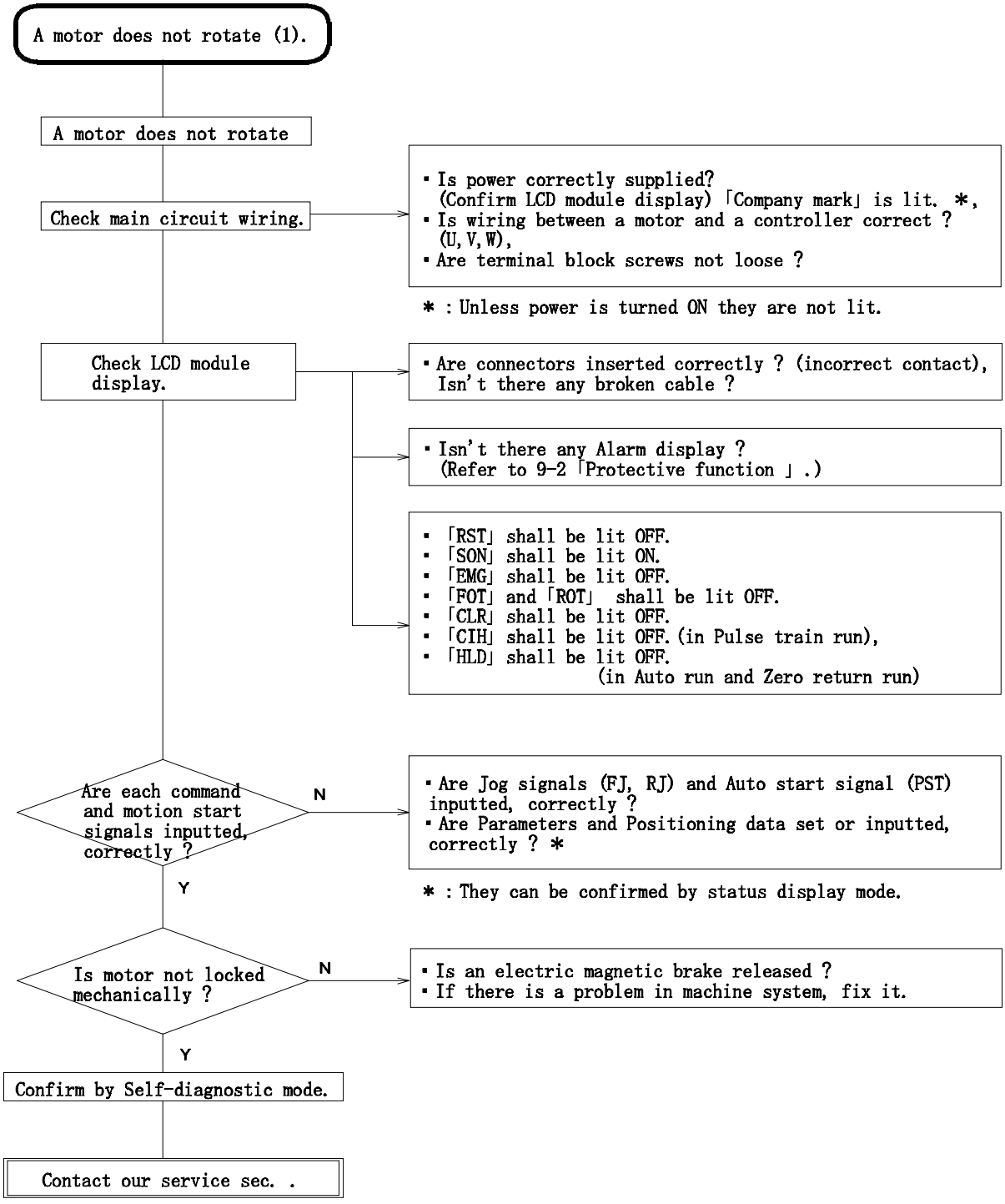
9－3　Trouble shooting

When an error occurs, investigate the cause and take proper corrective measures in accoordance with the following proceedure.

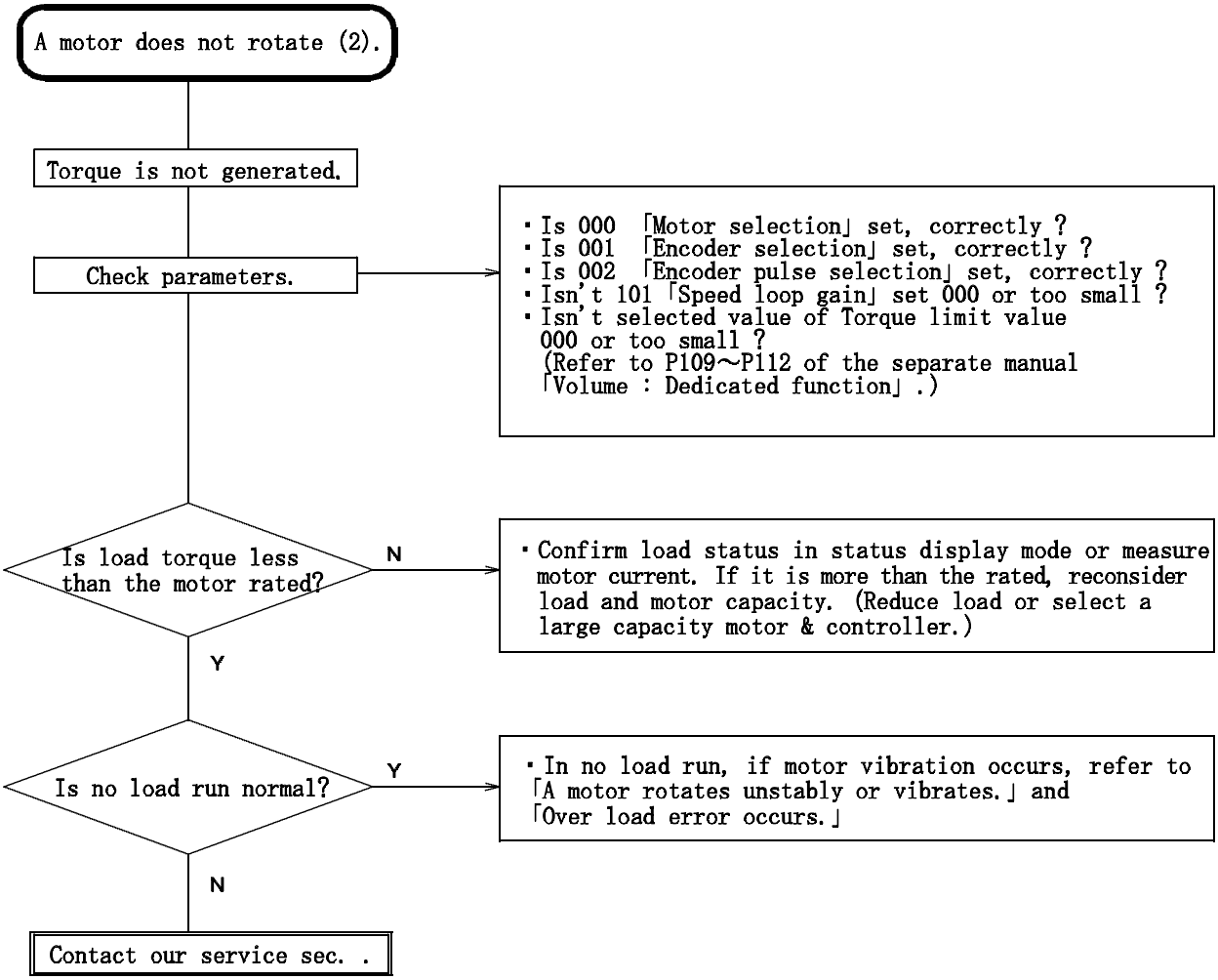
If the cause is none of the following cases, please contact our sales or service section, so on.

⚠ Caution

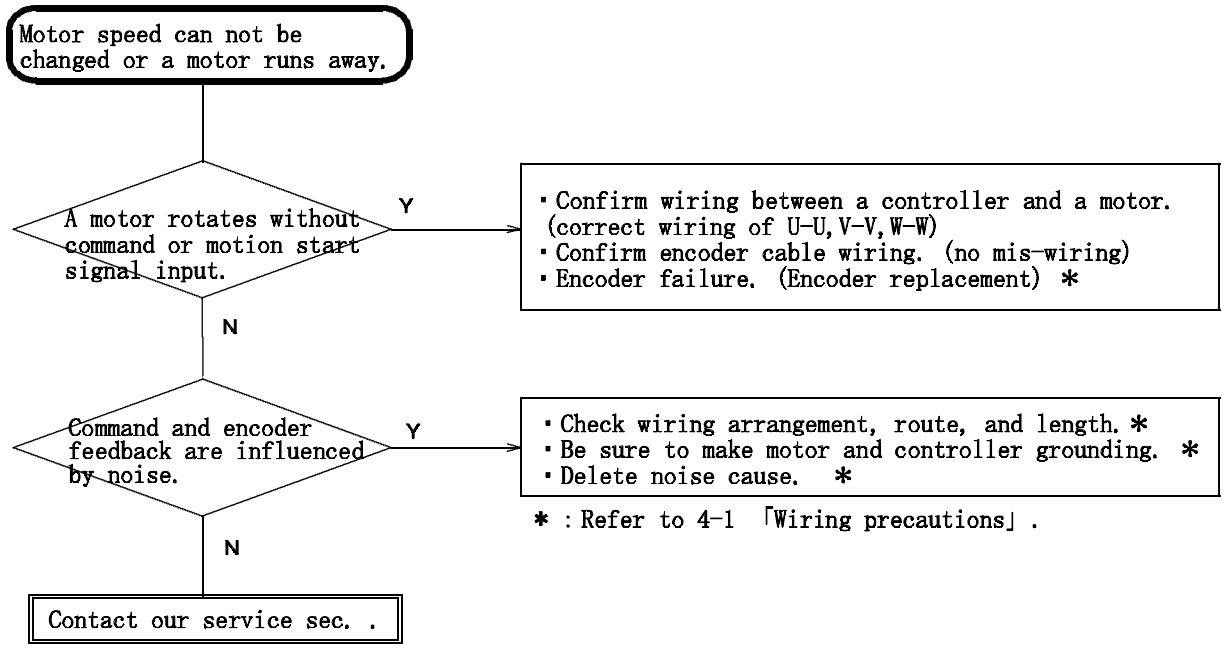
If a controller is coupled with a host control unit, separate the host unit, and inspect the following items only to a motor and the controller.



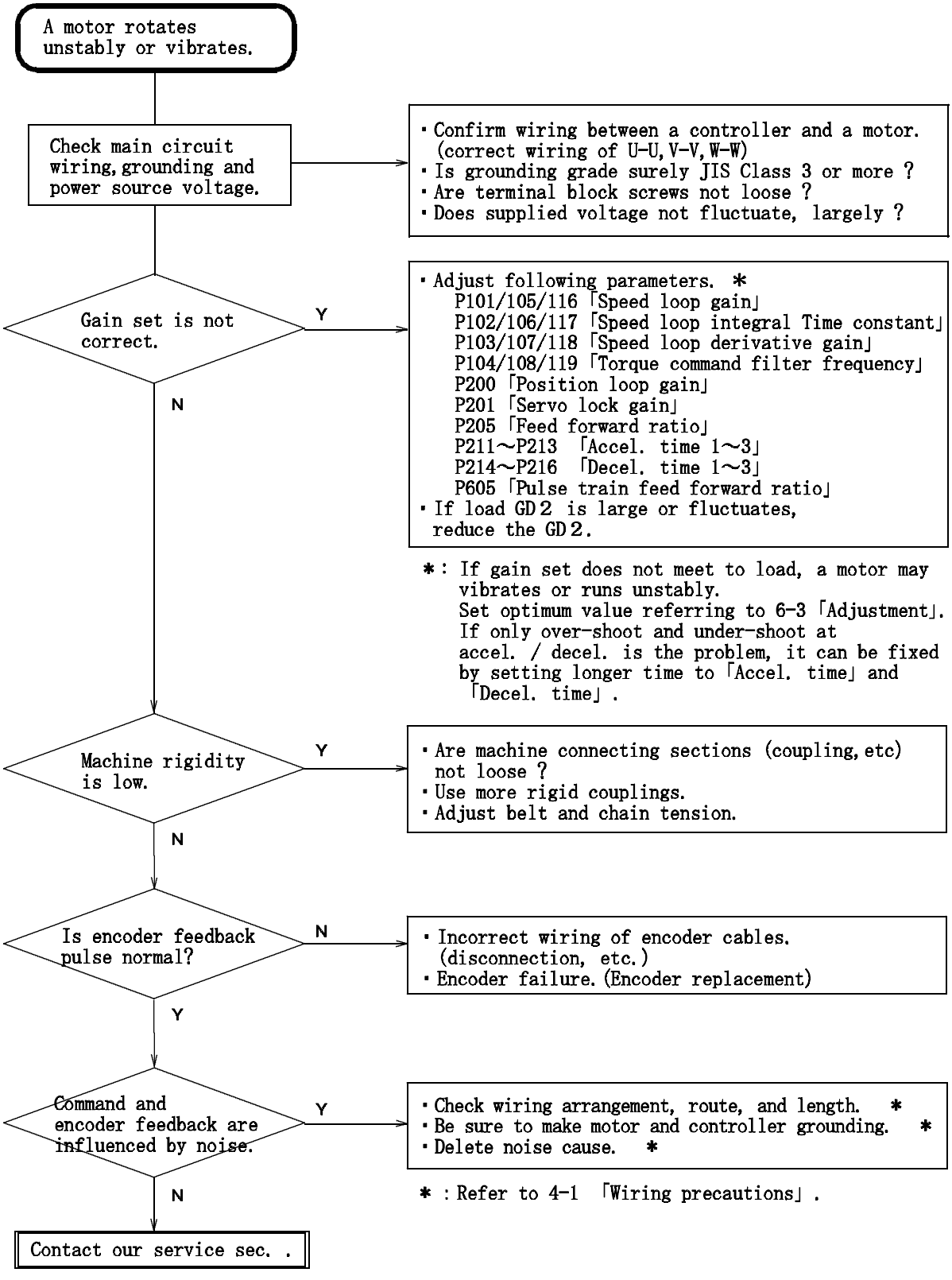
[Fig. 9－2]　A motor does not rotate. (1)



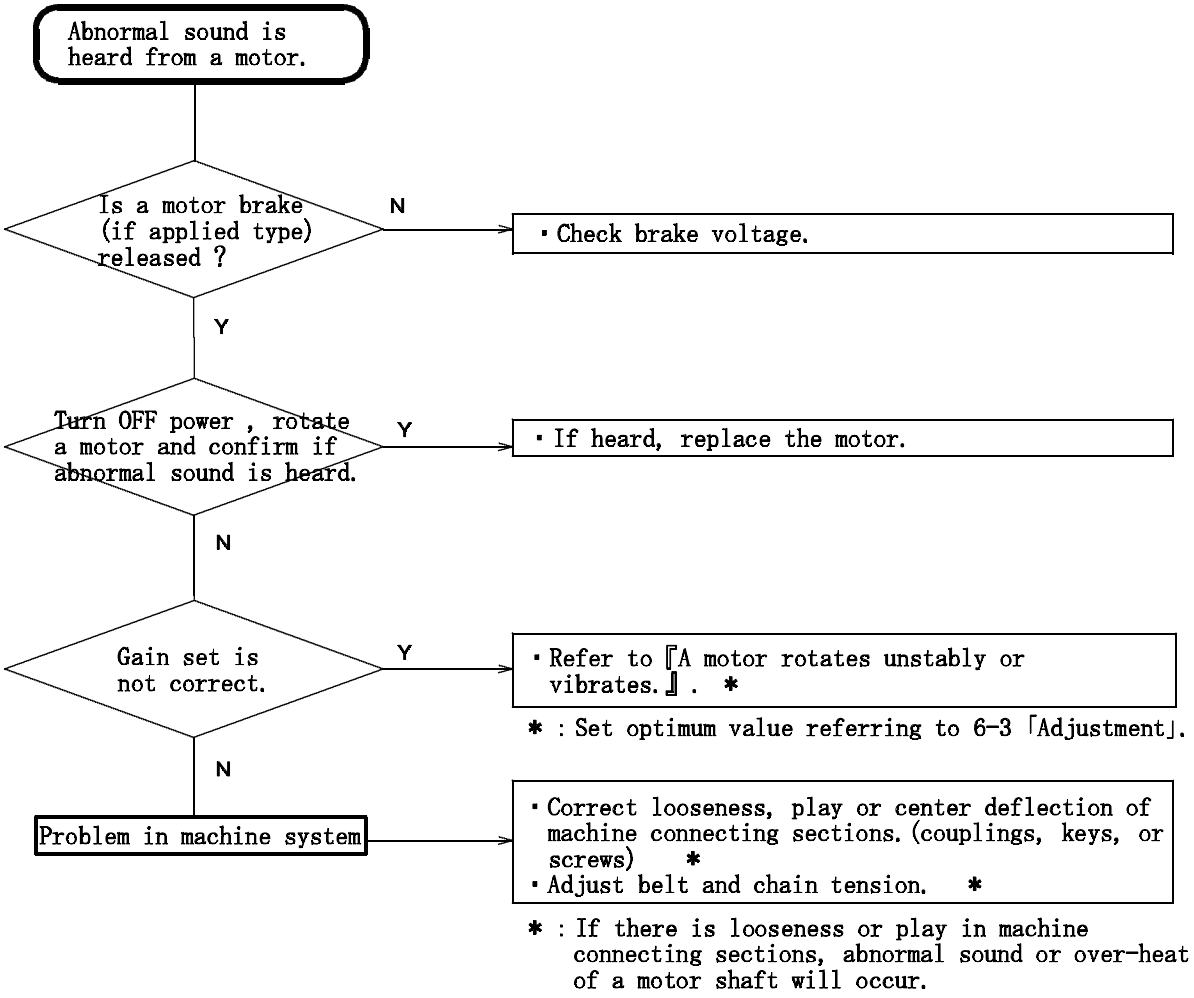
[Fig. 9－3]　A motor does not rotate. (2)



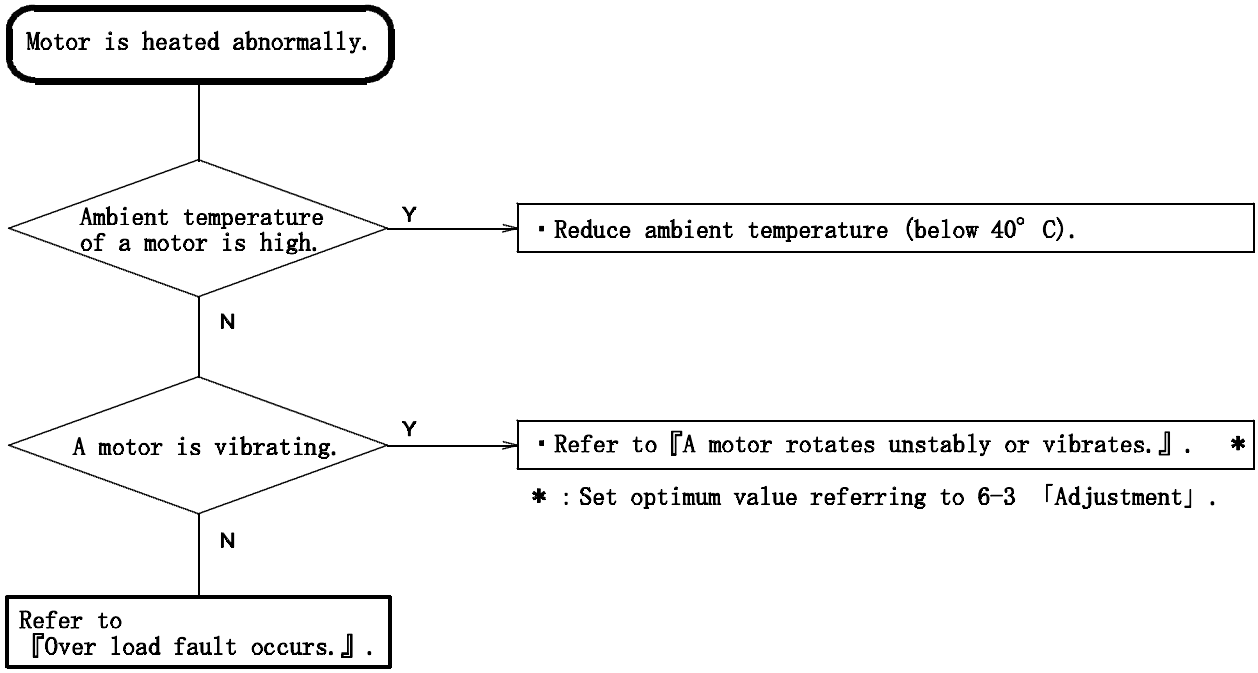
[Fig. 9－4]　Motor speed can not change or a motor runaways.



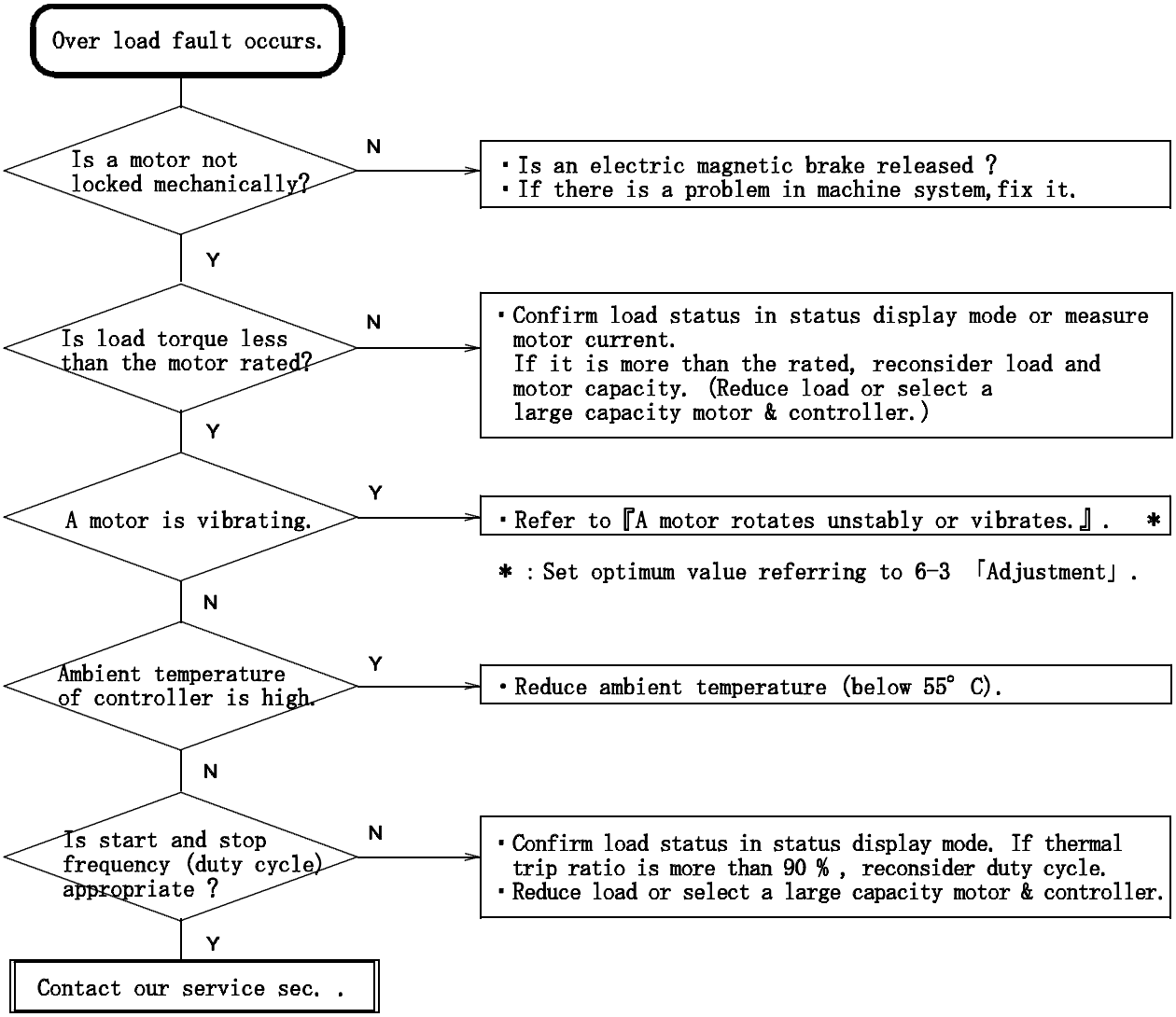
[Fig. 9－5]　A motor rotates unstably or vibrates.



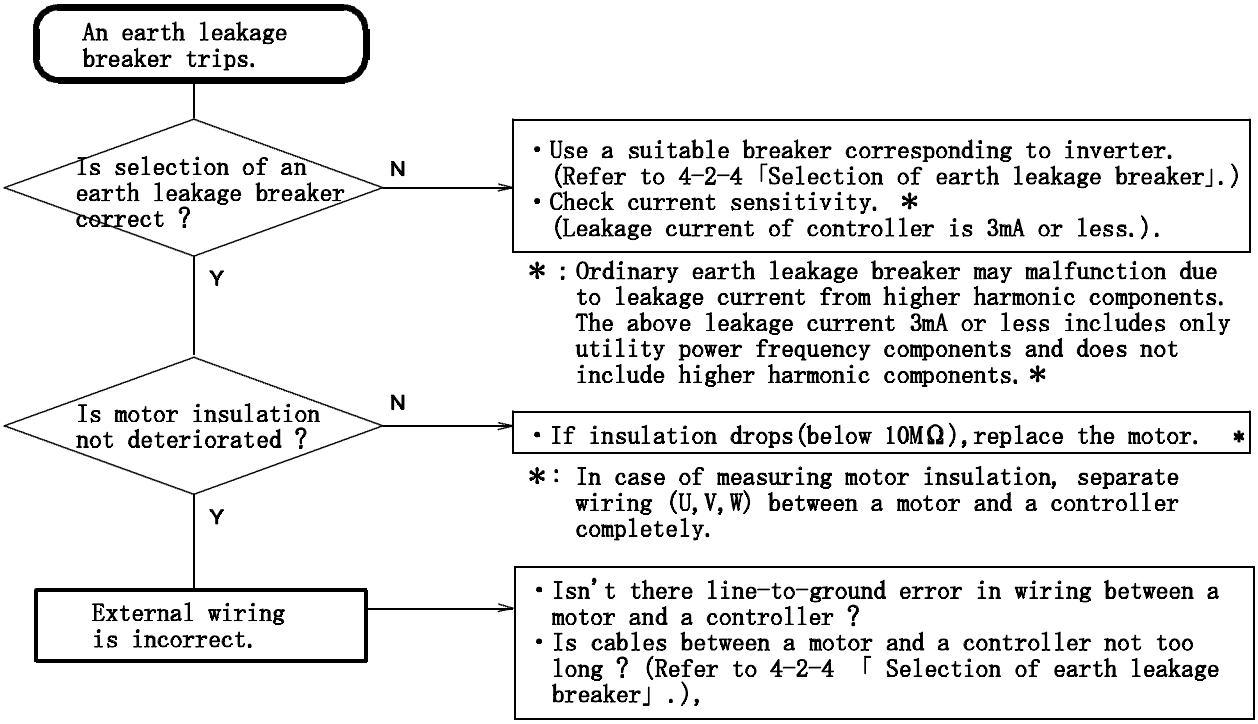
[Fig. 9－6]　Abnormal sound is heard from a motor.



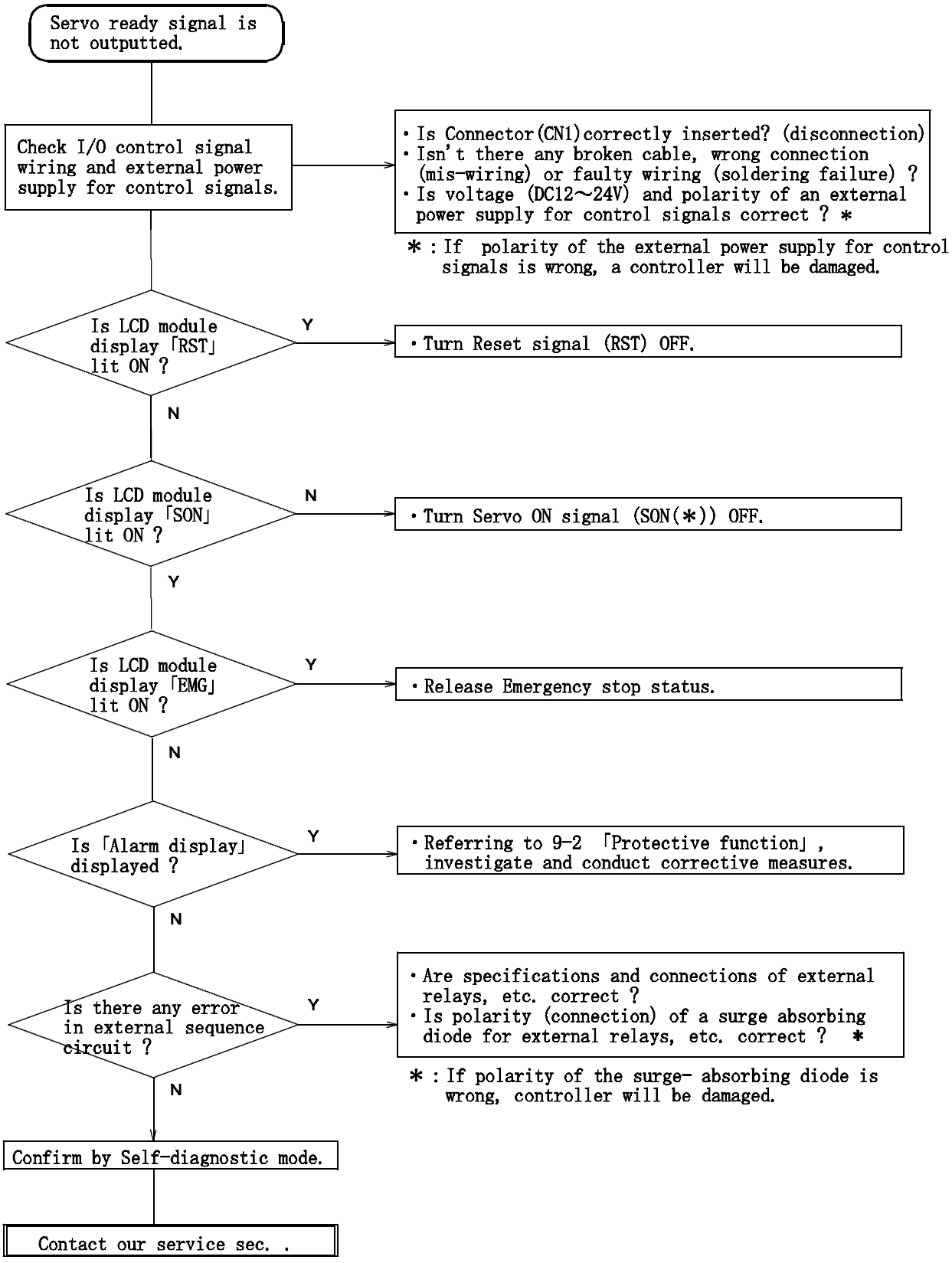
[Fig. 9－7]　A motor is heated, abnormally.



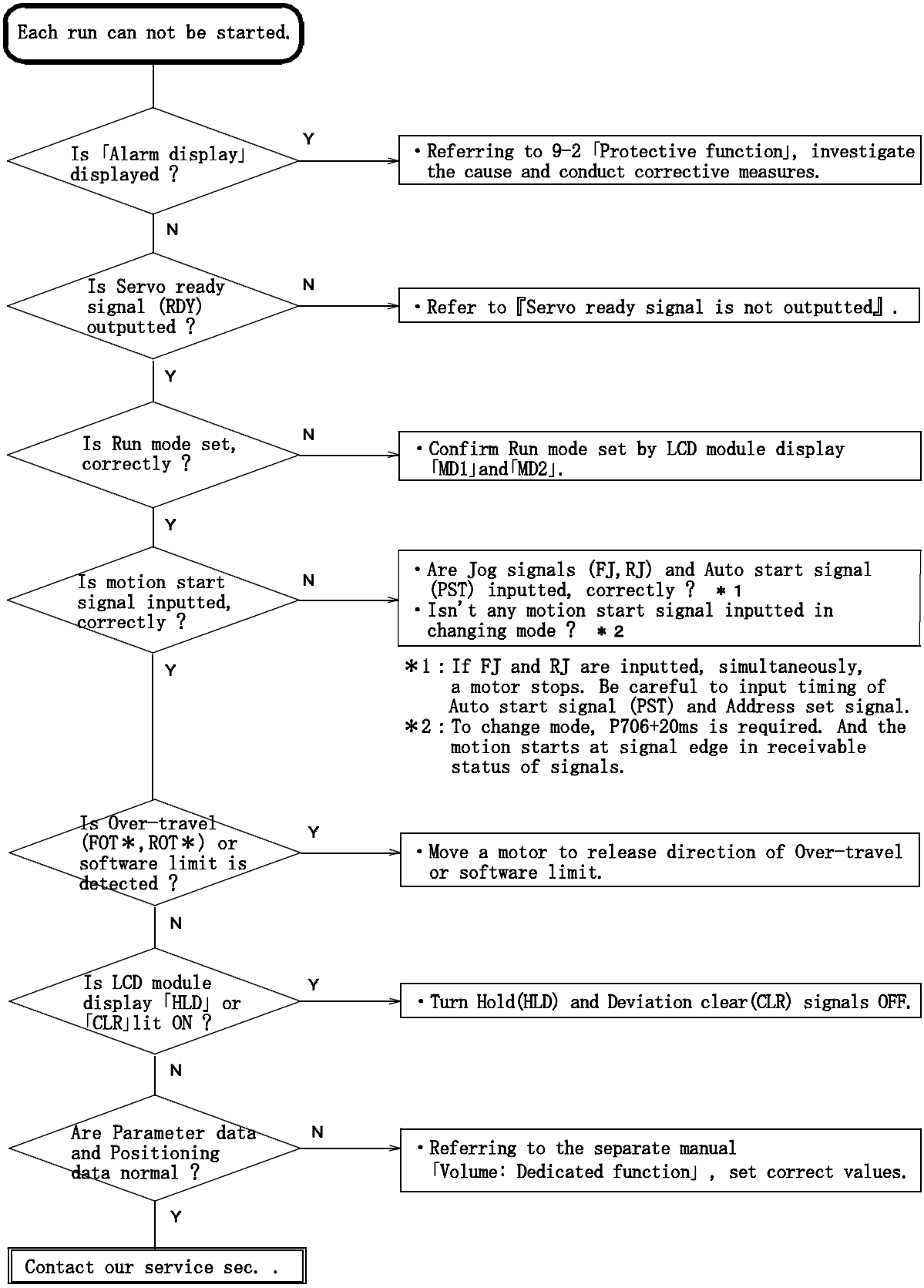
[Fig. 9－8]　Over-heat error occurs.



[Fig. 9－9]　An earth leakage breker trips.



[Fig. 9－10]　Servo ready signal is not outputted.



[Fig. 9－11] Each run start can not be executed.

CHAPTER １０ DATA

１０－１ Electric Specification of Controller

Item	Unit	NCS－FI＊＊M＊					
		－４０１	－８０１	－１２２	－２４２	－４０２	－７５２
Input power source		Integrated control power source type					Separate control power source type
		Main power AC200V/220V, 50/60Hz, 3 phase					
Voltage range		AC180V～AC242V *2					
Main crcit mthd		ＩＰＭ 4 quadrant bridge sine wave PWM control					
Continuous out. current (rms)	A	３．４	６．４	１０．５	１５	２７	５４
Instant.output current (rms)	A	８．８	１７．４	２５．６	３９	５５	９８
Instantaneous output torque	%	200% (Some motor combination 300%, Refer to 10-4「Applicable motor list」)					
Control method		Semi-closed loop by encoder feedback					
Brake method		Regenerative braking (option: power regeneration)					
Carrier frequency	Hz	１０k (7.5k 10k 15k selectable)					
Speed control range		１：５０００ *1					
Field control range		１：３(Max. speed 6000rpm) / rated output (some motor type: reduced rated output)					
Applicable encoder		６０００（２０００）ｐｐｒ (selection by parameter)					
Load inertia		10 times or less of motor rotor inertia					
Power capacity *3	kVA	１．１	１．８	３．０	４．７	７．８	１５．３
No fuse breaker (rated current) *4	A	５	１０	１５	２０	３０	６０
Applicable motor *5		NA30-13F-15 25F-15	NA100-20F 40F 75F-10 NA30-50F-15	NA100-75F 110F-10	NA100-110F 180F-10 NA30-110F-15	NA100-180F 270F-10 370F-10 NA30-180F-15	NA100-180F 270F 370AF 370F-10 550F-10 750F-10
Weight *6	kg	３．８	３．８	７．０	７．０	８．０	１２．５
Dimension		Refer to Section 2 outline drawing.					
Accessories		Regenerative resistor Refer to Section 10-2.					

* 1: A motor may not run smoothly as low speed as 1/5000 of rated speed.
Speed control range is defined that in the range a motor does not stop with 100% load.
In case of combination with NA20 series motor, Speed control range is 1:3000.
* 2: When power source voltage drops, rated output and rated speed is not guaranteed.
* 3: It changes according to power source impedance.
* 4: Please choose sufficient shut down capacity type to conduct protective coordinate with power source capacity.
* 5: As for applicable motor speed and peak torque, please refer to 「10-4 Applicable motor list」.
* 6: The weight for SQB installed models (NCS-FI12*-*, NCS-FI33*-*, NCS-FI34*-*, NCS-FI43*-*, NCS-FI44*-*NCS-FI63*-*, and NCS-FI64*-*), please add 1.2 kg to the stated weight.

［Fig.１０－１－１］ Electric Specification

Item	Unit	NCS－FI＊＊M＊				
		－113	－153	－223	－303	－373
Input power source		Separate control power source type Main power AC200V/220V, 50/60Hz, 3 phase				
Voltage range		AC180V～AC242V *2				
Main crcit mthd		IPM 4 quadrant bridge sine wave PWM control				
Continuous out. current (rms)	A	59	81	117	161	174
Instant.output current (rms)	A	107	143	206	309	329
Instantaneous output torque	%	200% (Some motor combination 300%, Refer to 10-4「Applicable motor list」)				
Control method		Semi-closed loop by encoder feedback				
Brake method		Regenerative braking (option: power regeneration)				
Carrier frequency	Hz	10k			7.5k	
		(7.5k 10k 15k selectable)				
Speed control range		1：5000 *1				
Field control range		1：3 (Max. speed 6000rpm) / rated output (some motor type: reduced rated output)				
Applicable encoder		6000（2000）ppr (selection by parameter)				
Load inertia		10 times or less of motor rotor inertia				
Power capacity *3	kVA	21	30	41	58	70
No fuse breaker (rated current) *4	A	100	125	200	225	250
Applicable motor *5		NA100- 270F 550AF 550F-10 750F-10 1100F-10	NA100- 370F 750AF 550F NA20- 1500-10	NA100- 1100AF 750F NA20- 2200-10	NA100- 1100F NA20- 1500 2700-10	NA20- 1800 3700-10
Weight *6	kg	14.0	26.5	35.5	35.5	63.0
Dimension		Refer to Section 2 outline drawing.				
Accessories		Regenerative resistor Refer to Section 10-2.				

* 1: A motor may not run smoothly as low speed as 1/5000 of rated speed.
Speed control range is defined that in the range a motor does not stop with 100% load.
In case of combination with NA20 series motor, Speed control range is 1:3000.
* 2: When power source voltage drops, rated output and rated speed is not guaranteed.
* 3: It changes according to power source impedance.
* 4: Please choose sufficient shut down capacity type to conduct protective coordinate with power source capacity.
* 5: As for applicable motor speed and peak torque, please refer to 「10-4 Applicable motor list」.
* 6: The weight for SQB installed models (NCS-FI12*-*, NCS-FI33*-*, NCS-FI34*-*, NCS-FI43*-*, NCS-FI44*-*NCS-FI63*-*, and NCS-FI64*-*), please add 1.2 kg to the stated weight.

[Fig.10－1－2] Electric Specification

Item	Unit	NCS－FS＊＊M＊			
		－１２２	－２４２	－４０２	－７５２
Input power source		Integrated control power source type			Separate control powersource type
		Main power AC200V/220V, 50/60Hz, 3 phase			
Voltage range		AC180V～AC242V *2			
Main crcit mthd		ＩＰＭ 4quadrant bridge sine wave ＰＷＭ control			
Continuous out. current (rms)	A	８．３	１５．２	２６	
Instant.output current (rms)	A	２４．９	４５．６	５２	
Instantaneous output torque	%	200% (Some motor combination 300%, Refer to 10-4「Applicable motor list」)			
Control method		Semi-closed loop by encoder feedback			
Brake method		Regenerative braking (option: power regeneration)			
Carrier frequency	Hz	１０k			
		(7.5k 10k 15k selectable)			
Speed control range		１：５０００ *1			
Applicable encoder		６０００（２０００）ｐｐｒ (selection by parameter)			
Load inertia		10 times or less of motor rotor inertia			
Power capacity *3	kVA	２．６	５．０	８．３	１５．７
No fuse breaker (rated current) *4	A	１５	２０	３０	６０
Applicable motor *5		NA720-122	NA720-182 -242	NA720-372 -402	NA720-372 -402 -552 -752
Weight *6	kg	７．０	７．０	８．０	１２．５
Dimension		Refer to Section 2 outline drawing.			
Accessories		Regenerative resistor Refer to Section 10-2.			

* 1: A motor may not run smoothly as low speed as 1/5000 of rated speed.
Speed control range is defined that in the range a motor does not stop with 100% load.
In case of combination with NA20 series motor, Speed control range is 1:3000.
* 2: When power source voltage drops, rated output and rated speed is not guaranteed.
* 3: It changes according to power source impedance.
* 4: Please choose sufficient shut down capacity type to conduct protective coordinate with power source capacity.
* 5: As for applicable motor speed and peak torque, please refer to 「10-4 Applicable motor list」.
* 6: The weight for SQB installed models (NCS-FI12*-*, NCS-FI33*-*, NCS-FI34*-*, NCS-FI43*-*, NCS-FI44*-*NCS-FI63*-*, and NCS-FI64*-*), please add 1.2 kg to the stated weight.

［Fig.１０－１－３］ Electric Specification

Item	Unit	NCS－FS＊＊M＊		
		－１１３	－１５３	－２２３
Input power source		Separate control power source type Main power AC200V/220V, 50/60Hz, 3 phase		
Voltage range		AC180V～AC242V *2		
Main crcit mthd		ＩＰＭ 4 quadrant bridge sine wave PWM control		
Continuous out. current (rms)	A	４５	６２	９４
Instant.output current (rms)	A	８８	１２１	１８３
Instantaneous output torque	%	200% (Some motor combination 300%, Refer to 10-4「Applicable motor list」)		
Control method		Semi-closed loop by encoder feedback		
Brake method		Regenerative braking (option: power regeneration)		
Carrier frequency	Hz	１０k (7.5k 10k 15k selectable)		
Seepd control range		１：５０００ *1		
Applicable encoder		６０００（２０００）ｐｐｒ (selection by parameter)		
Load inertia		10 times or less of motor rotor inertia		
Power capacity *3	kVA	２１	３０	４１
No fuse breaker (rated current) *4	A	１００	１２５	２００
Applicable motor *5		NA720-552 -113	NA720-752 -153	NA720-223
Weight *6	kg	１４．０	２６．５	３５．５
Dimension		Refer to Section 2 outline drawing.		
Accessories		Regenerative resistor Refer to Section 10-2.		

* 1: A motor may not run smoothly as low speed as 1/5000 of rated speed.
Speed control range is defined that in the range a motor does not stop with 100% load.
In case of combination with NA20 series motor, Speed control range is 1:3000.
* 2: When power source voltage drops, rated output and rated speed is not guaranteed.
* 3: It changes according to power source impedance.
* 4: Please choose sufficient shut down capacity type to conduct protective coordinate with power source capacity.
* 5: As for applicable motor speed and peak torque, please refer to 「10-4 Applicable motor list」.
* 6: The weight for SQB installed models (NCS-FI12*-*, NCS-FI33*-*, NCS-FI34*-*, NCS-FI43*-*, NCS-FI44*-*NCS-FI63*-*, and NCS-FI64*-*), please add 1.2 kg to the stated weight.

［Fig.１０－１－４］ Electric Specification

Item	Unit	NCS－FI＊＊H＊				
		－113	－153	－223	－303	－373
Input power source		Separate control power source type Main power AC400V/440V, 50/60Hz, 3 phase				
Voltage range		AC360V～AC484V *2				
Main crcit mthd		IPM 4quadrant bridge sine wave PWM control				
Continuous out. current (rms)	A	34	46	65	89	115
Instant.output current (rms)	A	62	81	112	154	210
Instantaneous output torque	%	200% (Some motor combination 300%, Refer to 10-4「Applicable motor list」)				
Control method		Semi-closed loop by encoder feedback				
Brake method		Regenerative braking (option: power regeneration)				
Carrier frequency	Hz	10k			7.5k	
		(7.5k 10k 15k selectable)				
Seepd control range		1：5000 *1				
Field control range		1：3(Max. speed 6000rpm) / rated output (some motor type: reduced rated output)				
Applicable encoder		6000（2000）ppr (selection by parameter)				
Load inertia		10 times or less of motor rotor inertia				
Power capacity *3	kVA	21	30	41	58	70
No fuse breaker (rated current) *4	A	50	75	100	125	150
Applicable motor *5		NA100-550F-20H 1100F-10H	NA100-750F-20H NA20-1500-10H	NA100-750F-20H 1100F-20H NA20-2200-10H	NA20-1500-20H 2700-10H	NA20-1800-20H 3700-10H
Weight *6	kg	14.0	26.5	35.5	35.5	63.0
Dimension		Refer to Section 2 outline drawing.				
Accessories		Regenerative resistor Refer to Section 10-2.				

* 1: A motor may not run smoothly as low speed as 1/5000 of rated speed.
Speed control range is defined that in the range a motor does not stop with 100% load.
In case of combination with NA20 series motor, Speed control range is 1:3000.
* 2: When power source voltage drops, rated output and rated speed is not guaranteed.
* 3: It changes according to power source impedance.
* 4: Please choose sufficient shut down capacity type to conduct protective coordinate with power source capacity.
* 5: As for applicable motor speed and peak torque, please refer to 「10-4 Applicable motor list」.
* 6: The weight for SQB installed models (NCS-FI12*-*, NCS-FI33*-*, NCS-FI34*-*, NCS-FI43*-*, NCS-FI44*-*NCS-FI63*-*, and NCS-FI64*-*), please add 1.2 kg to the stated weight.

[Fig.10－1－5] Electric Specification

Common specification

Item	Unit	Specification
Torque limit		External analog torque limit command: DC 0～+10V (+3.3V/ rated / torque)　Input resistance about 20kΩ (resolution 10bit), Forward/ reverse each 1 (2ch)　Internal digital torque limit value：Forward/ reverse each 1 (parameter)
Pulse train control		Max. frequency　1　Mpps
Pulse command method		┌Line driver method (directional pulse)　:Max.250Kpps │Line driver method (90°different 2 phase pulse):Max.250Kpps └Open collector method (direction judge. pulse)　:Max.200Kpps
Pulse train compensation		1/100 ≦ A/B ≦ 100　(A,B ： 1～65535)
Encoder pulse output		90°different 2 phase pulse signal, Marker signal ┌Output style：Line driver method └Division ratio　：1/N　(N=1～32)
Serial communication		RS-422A, Start/stop synchro. Multi-drop wiring is possible. (Communication condition parameter set is possible.) 56kbbs
Monitor function		LCD module (installed)：Status display, Diagnostic display, Input/Output signal display Alarm display (last 5 cause history) Analog monitor：Speed, Torque, Deviation, etc. (selection by parameter)
Control function		2 free degree control, FF control, Vibration filter, R2 compensation, Auto. tuning Non-interacting compensation, Dead time compensation
Protective function		IPM error, Under voltage, Over voltage, Over load, Over speed, Encoder failure, Deviation over flow, Communication error Each data and parameter error, etc. (Last 5 cause history is stored.)
Input signal		[36 kinds] Servo ON (SON(*)), Emergency stop (EMG*), Reset (RST), Remote / Local change (PC), Mode selection (MD1,MD2), Auto. start (PST), Address set (SS1～PS8),Forward jog (FJ), Reverse jog (RJ), Hold (HLD), Speed override (OR1～4), Deviation clear (CLR), Command pulse input inhibit (CIH(*)), External trigger (TRG), Zero point decel. (ZLS), Forward over travel (FOT*), Reverse over travel (ROT*) ＜Below signals can be allocated by Remote control or input signal allocation and used.＞ M complete (MFIN), Block stop (BSTP), Program cancel (PCAN), Speed gain selection (GSEL), Forced brake ON (BRON), Torque limit (TL), External auto. stop inhibit (EPIH), Jog speed change (JOSP)
Output signal		[34 kinds] Servo ready (RDY), Alarm (ALM(*)), Warning (WNG(*)), In torque limit (LIM), Speed zero (SZ), Positioning complete (PN), Brake release (BRK), Rough matching (PRF) ＜Below signals can be allocated by Remote control or output signal allocation and used.＞ Program end (PEND), Auto. run ready (PRDY), In Manual run (MMOD), In Auto.run (AMOD), In Remote mode (RMOD), In Zero return run (HMOD), In Pulse train run (PMOD), M strobe (MSTB), Software limit switch(SLSA,SLSB),General output(OUT1～8),M output(M01～M80)
Option		Data input unit (MDI unit), Servo display, Cables , etc.

* 1: It is possible to externally input the MFIN signal in some models.
* 2: In some models, it is possible to externally output the General-purpose output/M output and Soft limit switch/M strobing signal by selecting parameter.

[Fig.１０－２]　Electric Specification

１０－２　Regenerative　Resistor　Combination

１０－２－１　Regenerative　Resistor　Combination

【２００Ｖ system controller Regenerative resistor】

Controller type	Applicable motor	Regenerative resistor (kind)
NCS-FIM*-401	NA30-13F-15 NA30-25F-15	RGH-60-FV-80　60w,80Ω-1pc Cement resistor outline：TYPE 1
NCS-FIM*-801	NA100-20F NA100-40F NA100-75F-10 NA30-50F-15	RGH-60-FV-80　60w,80Ω-1pc Cement resistor outline：TYPE 1
NCS-FIM*-122	NA100-75F NA100-110F-10	RGH-200-FV-40　200w,40Ω-1pc Cement resistor outline：TYPE 2
NCS-FIM*-242	NA100-110F NA100-180F-10 NA30-110F-15	RGH-200-FV-40　200w,40Ω-1pc Cement resistor outline：TYPE 2
NCS-FIM*-402	NA100-180F NA100-270F-10 NA100-370F-10 NA30-180F-15	RGH-400-FV-20　400w,20Ω-1pc Cement resistor outline：TYPE 3
NCS-FIM*-752	NA100-180F NA100-270F NA100-370AF NA100-370F-10 NA100-550F-10 NA100-750F-10	RGH-200G-0S　200w,40Ω-3pcs (Parallel connect.total 600w 13.3Ω) Enamel resistor outline：TYPE 4
NCS-FIM*-113	NA100-550AF NA100-1100F-10 NA100-550F-10 NA100-750F-10 NA100-270F	RGH-500-0S　500w,24Ω-3pcs (Parallel connect.total 1.5 kw 8Ω) Enamel resistor outline：TYPE 5
NCS-FIM*-153	NA100-750AF NA100-550F NA20-1500-10 NA100-370F	RGH-500-0S　500w,24Ω-4pcs (Parallel connect.total 2.0 kw 6Ω) Enamel resistor outline：TYPE 5
NCS-FIM*-223	NA100-1100AF NA100-750F NA20-2200-10	RGH-500-0S　500w,24Ω-6pcs (Parallel connect.total 3.0 kw 4Ω) Enamel resistor outline：TYPE 5
NCS-FIM*-303	NA100-1100F NA20-1500 NA20-2700-10	RGH-500-0S　500w,24Ω-8pcs (Parallel connect.total 4.0 kw 3Ω) Enamel resistor outline：TYPE 5
NCS-FIM*-373	NA20-1800 NA20-3700-10	RGH-500-0S　500w,24Ω-10pcs (Parallel connect.total 5.0kw 2.4Ω) Enamel resistor outline：TYPE 5

【Synchronous type controller Regenerative resistor】

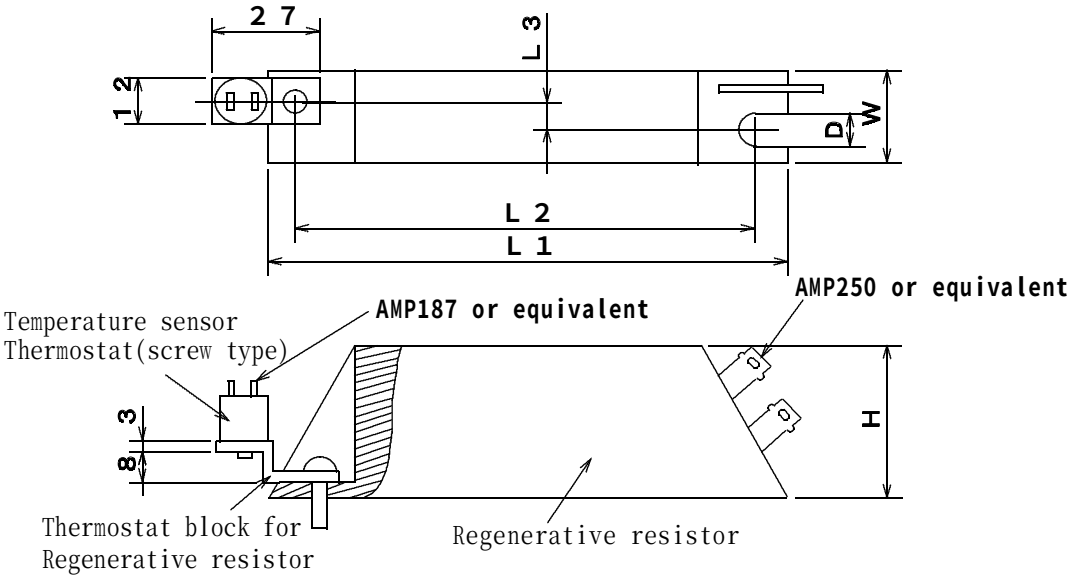
Controller type	Applicable motor	Regenerative resistor (kind)
NCS-FSM*-122	NA720-122	RGH-60-FV-80 60w,80Ω-1pc Sement resistor outline：TYPE 2
NCS-FSM*-242	NA720-182	RGH-200-FV-40 200w,40Ω-1pc
	NA720-242	
		Semet resistor outline：TYPE 2
NCS-FSM*-402	NA720-372	RGH-400-FV-20 400w,20Ω-1pc
	NA720-402	
		Sement resistor outline：TYPE 3
NCS-FSM*-752	NA720-372	RGH-200G-0S 200w,40Ω-3pcs
	NA720-402	(Parallel connect.total 600w 13.3Ω)
	NA720-552	Enamel resistor outline：TYPE 4
	NA720-752	
NCS-FSM*-113	NA720-552	RGH-500-0S 500w,24Ω-3pcs
	NA720-113	(Parallel connect.total 1.5kw 8Ω)
		Enamel resistor outline：TYPE 5
NCS-FSM*-153	NA720-752	RGH-500-0S 500w,24Ω-4pcs
	NA720-153	(Parallel connect.total 2.0 kw 6Ω)
		Enamel resistor outline：TYPE 5
NCS-FSM*-223	NA720-223	RGH-500-0S 500w,24Ω-6pcs
		(Parallel connect.total 3.0 kw 4Ω)
		Enamel resistor outline：TYPE 5

【４００Vsystem Induction type controller Regenerative resistor】

Controller type	Applicable motor	Regenerative resistor (kind)
NCS-FIH*-113	NA100-550F-20H	RGH-500-0S 500w,100Ω-3pcs
	NA100-1100F-10H	(Parallel connect.total 1.5 kw 33Ω)
		Enamel resistor outline：TYPE 5
NCS-FIH*-153	NA100-750F-20H	RGH-500-0S 500w,100Ω-4pcs
	NA20-1500-10H	(Parallel connect.total 2.0 kw 25Ω)
		Enamel resistor outline：TYPE 5
NPS-FIH*-223	NA100-1100F-20H	RGH-500-0S 500w,100Ω-6pcs
	NA20-2200-10H	(Parallel connect.total 3.0kw 16.6Ω)
	NA100-750F-20H	Enamel resistor outline：TYPE 5
NCS-FIH*-303	NA20-1500-20H	RGH-500-0S 500w,100Ω-8pcs
	NA20-2700-10H	(Parallel connect.total 4.0 kw 12.5Ω)
	NA100-1100F-20H	Enamel resistor outline：TYPE 5
NCS-FIH*-373	NA20-1800-20H	RGH-500-0S 500w,100Ω-10pcs
	NA20-3700-10H	(Parallel connect.total 5.0kw 10Ω)
		Enamel resistor outline：TYPE 5

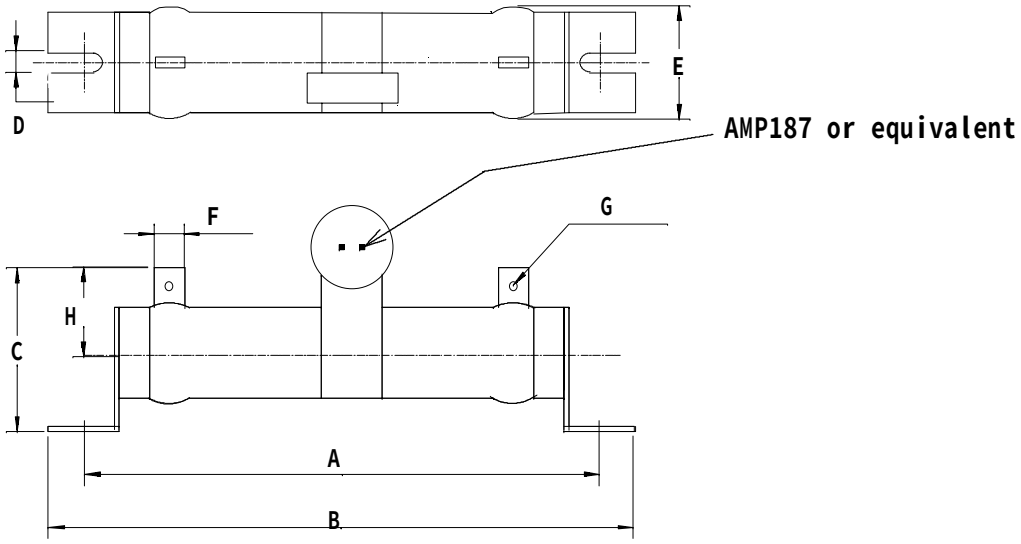
１０－２－２ Regenerative resistor outline drawing

Enamel resistor outline,dimension and thermostat install place si as follows.



(Attach the thermostat and tighten it with a screw common to Regenerative resistor installation.)

Type	Rated power	L 1	L 2	W	H	L 3	D	Outline
RGH60	60W	115	100	20	40	5	4.3	TYPE 1
RGH200	200W	215	200	25	50	8	5.3	TYPE 2
RGH400	400W	265	250	30	60	13	5.3	TYPE 3



Type	Rated power	A	B	C	D	E	F	G	H	Outline
RGH200	200w	282	304	54	6	32	7	2.2	29	TYPE 4
RGH500	500w	350	380	99	10	57	13	5.2	49	TYPE 5

１０－３ Electric Specificaton of Motor cooling Blowers

【ＡＣ２００Ｖ system motor cooling blower】

Motor type	Input power source				Power source poles
	２００Ｖ／５０Ｈｚ		２００Ｖ／６０Ｈｚ		
	Power consump. (W)	Rated current (A)	Power consump. (W)	Pated current (A)	
NA100-110F/-10	２２	０．１８	１８	０．１５	3Φ 2P
NA100-180F/-10	４０	０．３０	５０	０．２５	
NA100-270F/-10	４０	０．３０	５０	０．２５	
NA100-370F/-10	４０	０．３０	５０	０．２５	
NA100-550F/-10 ,-550AF	４５	０．３２	６３	０．３５	
NA100-750F/-10 , -750AF	１０５	０．６５	１４５	０．８	
NA100-1100F/-10, -1100AF	１５０	１．０	１８０	０．８２	
NA20-1500/-10	６２０	２．０	６５０	２．０	
NA20-1800	６２０	２．０	６５０	２．０	
NA20-2200/-10	６２０	２．０	６５０	２．０	
NA20-2700/-10	６２０	２．０	６５０	２．０	
NA20-3700/-10	６２０	２．０	６５０	２．０	

【ＡＣ４００Vsystem motor cooling blower】

Motor type	Input power source				Power source poles
	１００Ｖ／５０Ｈｚ		１００Ｖ／６０Ｈｚ		
	Power consump. (W)	Rated current (A)	Power consump. (W)	Rated current (A)	
NA100-550F-20H	５６	０．９６	５４	０．８６	1Φ 4P

Motor type	Input power source				Power source poles
	４００Ｖ／５０Ｈｚ		４００Ｖ／６０Ｈｚ		
	Power consump. (W)	Rated current (A)	Power consump. (W)	Rated current (A)	
NA100-750F-20H	１５０	１．０	１８０	０．８２	3Φ 2P
NA100-1100F-20H/-10H	１５０	１．０	１８０	０．８２	
NA20-1500-20H/-10H	６２０	１．０	６５０	１．０	
NA20-1800-20H	６２０	１．０	６５０	１．０	
NA20-2200/-10H	６２０	１．０	６５０	１．０	
NA20-2700/-10H	６２０	１．０	６５０	１．０	
NA20-3700/-10H	６２０	１．０	６５０	１．０	

１０－４　Applicable Motor List

１０－４－１　ＮＣＳ－ＦＩ＊＊Ｍ＊－＊＊＊　controller

【２００Ｖ system controller applicable motor selection list】

Controller capasity	Ｐ０００ set value	Applicable motor Motor type	Rate out.	Rated speed	Peak torque
ＮＣＳ－ＦＩ＊＊Ｍ＊	２１１	NA30-13F-15	０．２ Kw	１５００ rpm	３００ %
－４０１	２１２	NA30-25F-15	０．４ Kw	１５００ rpm	３００ %
Capacity：０．４ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｍ＊	２２１	NA100-20F	０．６ Kw	３０００ rpm	３００ %
－８０１	２２２	NA100-40F	０．８ Kw	２０００ rpm	３００ %
Capacity：０．８ｋｗ	２２３	NA100-75F-10	０．８ Kw	１０００ rpm	３００ %
In.voltage：２００Ｖ	２２４	NA30-50F-15	０．８ Kw	１５００ rpm	３００ %
ＮＣＳ－ＦＩ＊＊Ｍ＊	２３１	NA100-75F	１．５ Kw	２０００ rpm	３００ %
－１２２	２３２	NA100-110F-10	１．２ Kw	１０００ rpm	２００ %
Capacity：１．５ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｍ＊	２４１	NA100-110F	２．２ Kw	２０００ rpm	３００ %
－２４２	２４２	NA100-180F-10	１．９ Kw	１０００ rpm	３００ %
Capacity：２．２ｋｗ	２４３	NA30-110F-15	１．６ Kw	１５００ rpm	３００ %
In.voltage：２００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｍ＊	２５１	NA100-180F	３．７ Kw	２０００ rpm	２００ %
－４０２	２５２	NA100-270F-10	２．８ Kw	１０００ rpm	３００ %
Capacity：３．７ｋｗ	２５３	NA100-370F-10	３．７ Kw	１０００ rpm	２００ %
In.voltage：２００Ｖ	２５４	NA30-180F-15	２．８ Kw	１５００ rpm	３００ %
ＮＣＳ－ＦＩ＊＊Ｍ＊	０１１	NA100-180F	３．７ Kw	２０００ rpm	３００ %
－７５２	０１２	NA100-270F	５．５ Kw	２０００ rpm	２００ %
Capacity：７．５ｋｗ	０１３	NA100-370AF	７．５ Kw	２０００ rpm	２００ %
In.voltage：２００Ｖ	０１４	NA100-370F-10	３．７ Kw	１０００ rpm	３００ %
	０１５	NA100-550F-10	５．５ Kw	１０００ rpm	２００ %
	０１６	NA100-750F-10	７．５ Kw	１０００ rpm	２００ %
ＮＣＳ－ＦＩ＊＊Ｍ＊	０２３	NA100-270F	５．５ Kw	２０００ rpm	３００ %
－１１３	０２４	NA100-550F-10	５．５ Kw	１０００ rpm	３００ %
Capacity：１１ｋｗ	０２５	NA100-750F-10	７．５ Kw	１０００ rpm	２９０ %
In.voltage：２００Ｖ	０２１	NA100-550AF	１１ kw	２０００ rpm	２００ %
	０２２	NA100-1100F-10	１１ kw	１０００ rpm	２００ %
ＮＣＳ－ＦＩ＊＊Ｍ＊	０３４	NA100-370F	７．５ Kw	２０００ rpm	３００ %
－１５３	０３１	NA100-750AF	１５ kw	２０００ rpm	２００ %
Capacity：１５ｋｗ	０３２	NA20-1500-10	１５ kw	１０００ rpm	２００ %
In.voltage：２００Ｖ	０３３	NA100-550F	１１ kw	２０００ rpm	３００ %
ＮＣＳ－ＦＩ＊＊Ｍ＊	０４１	NA100-1100AF	２２ kw	２０００ rpm	２００ %
－２２３	０４２	NA20-2200-10	２２ kw	１０００ rpm	２００ %
Capacity：２２ｋｗ	０４３	NA100-750F	１５ kw	２０００ rpm	２９０ %
In.voltage：２００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｍ＊	０５１	NA20-1500	３０ kw	２０００ rpm	２００ %
－３０３	０５２	NA20-2700-10	３０ kw	１０００ rpm	２００ %
Capacity：３０ｋｗ	０５３	NA100-1100F	２２ kw	２０００ rpm	３００ %
In.voltage：２００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｍ＊	０６１	NA20-1800	３７ kw	２０００ rpm	２００ %
－３７３	０６２	NA20-3700-10	３７ kw	１０００ rpm	１９０ %
Capacity：３７ｋｗ					
In.voltage：２００Ｖ					

１０－４－２　ＮＣＳ－ＦＳ＊＊Ｍ＊－＊＊＊　controller

【２００Ｖ system controller applicable motor selection list】

Controller capasity	Ｐ０００ set value	Applicable motor Motor type	Rate out.	Rated speed	Peak torque
ＮＣＳ－ＦＳ＊＊Ｍ＊	５５１	NA720-122	１．２ kw	２０００ rpm	３００ %
－１２２					
Capacity１．２ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＳ＊＊Ｍ＊	５７１	NA720-182	１．８ kw	２０００ rpm	３００ %
－２４２	５７２	NA720-242	２．４ kw	２０００ rpm	３００ %
Capacity：２．４ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＳ＊＊Ｍ＊	５８１	NA720-372	３．７ kw	２０００ rpm	２００ %
－４０２	５８２	NA720-402	４．０ kw	２０００ rpm	２００ %
Capacity：４．０ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＳ＊＊Ｍ＊	７０１	NA720-372	３．７ kw	２０００ rpm	３００ %
－７５２	７０２	NA720-402	４．０ kw	２０００ rpm	３００ %
Capacity：７．５ｋｗ	７０３	NA720-552	５．５ kw	２０００ rpm	２００ %
In.voltage：２００Ｖ	７０４	NA720-752	７．５ kw	２０００ rpm	２００ %
ＮＣＳ－ＦＳ＊＊Ｍ＊	７１１	NA720-552	５．５ kw	２０００ rpm	３００ %
－１１３	７１２	NA720-113	１１ kw	２０００ rpm	２００ %
Capacity：１１ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＳ＊＊Ｍ＊	７２１	NA720-752	７．５ kw	２０００ rpm	３００ %
－１５３	７２２	NA720-153	１５ kw	２０００ rpm	２００ %
Capacity：１５ｋｗ					
In.voltage：２００Ｖ					
ＮＣＳ－ＦＳ＊＊Ｍ＊	７３１	NA720-223	２２ kw	２０００ rpm	２００ %
－２２３					
Capacity：２２ｋｗ					
In.voltage：２００Ｖ					

１０－４－３　ＮＣＳ－ＦＩ＊＊Ｈ＊－＊＊＊ controller

【４００Ｖ system controller applicable motor selection list】

Controller capasity	Ｐ０００ set value	Applicable motor Motor type	Rate out.	Rated speed	Peak torque
ＮＣＳ－ＦＩ＊＊Ｈ＊	１２１	NA100-550F-20H	１１ kw	２０００ rpm	２００ %
－１１３	１２２	NA100-1100F-10H	１１ kw	１０００ rpm	２００ %
Capacity：１１ｋｗ	１２３	NA100-550F-20H	１１ kw	２０００ rpm	３００ %
In.voltage：４００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｈ＊	１３１	NA100-750F-20H	１５ kw	２０００ rpm	２００ %
－１５３	１３２	NA20-1500-10H	１５ kw	１０００ rpm	２００ %
Capacity：１５ｋｗ					
In.voltage：４００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｈ＊	１４１	NA100-1100F-20H	２２ kw	２０００ rpm	２００ %
－２２３	１４２	NA20-2200-10H	２２ kw	１０００ rpm	２００ %
Capacity：２２ｋｗ	１４３	NA100-750F-20H	１５ kw	２０００ rpm	３００ %
In.voltage：４００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｈ＊	１５１	NA20-1500-20H	３０ kw	２０００ rpm	２００ %
－３０３	１５２	NA20-2700-10H	３０ kw	１０００ rpm	２００ %
Capacity ：３０ｋｗ	１５３	NA100-1100F-20H	２２ kw	２０００ rpm	３００ %
In.voltage：４００Ｖ					
ＮＣＳ－ＦＩ＊＊Ｈ＊	１６１	NA20-1800-20H	３７ kw	２０００ rpm	２００ %
－３７３	１６２	NA20-3700-10H	３７ kw	１０００ rpm	２００ %
Capacity：３７ｋｗ					
In.voltage：４００Ｖ					