GE Fanuc Automation

Computer Numerical Control Products

ß-Series Servo Motor

Maintenance Manual

B-65235EN/02 *October 1997*

The export of this product is subject to the authorization of the government of the country from where the product is exported.

In this manual we have tried as much as possible to describe all the various matters.
However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.
Therefore, matters which are not especially described as possible in this manual should be regarded as ''impossible'

Warnings and notices for this publication

GFLE-003

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Notice

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Series Six
Series Three
VuMaster
Workmaster

FANUC SERVO MOTOR series
FANUC SERVO MOTOR AMPLIFIER series
SAFETY PRECAUTIONS

This ”Safety Precautions” section describes the precautions which must be observed to ensure safety when using FANUC servo motors (including spindle motors) and servo amplifiers (including spindle amplifiers). Users of any servo motor or amplifier model are requested to read the ”Safety Precautions” carefully before using the servo motor or amplifier.
The users are also requested to read an applicable specification manual carefully and understand each function of the motor or amplifier for correct use.
The users are basically forbidden to do any behavior or action not mentioned in the ”Safety Precautions.” They are invited to ask FANUC previously about what behavior or action is prohibited.

Contents

DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warning and Caution according to their bearing on safety. Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

WARNING

Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

CAUTION

Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE

The Note is used to indicate supplementary information other than Warning and Caution.

❍ **Read this manual carefully, and store it in a safe place.**

I. FANUC SERVO MOTOR series

1 WARNING

WARNING

● **Be safely dressed when handling a motor.**

Wear safety shoes or gloves when handling a motor as you may get hurt on any edge or protrusion on it or electric shocks.

● **Use a crane or lift to move a motor from one place to another.**

Motors are heavy. When moving them, use a crane or lift as required. (For the weight of motors, refer to their respective specification manuals.)
When moving a motor using a crane or lift, use a hanging bolt if the motor has a corresponding tapped hole, or textile rope if it has no tapped hole. If a motor is attached with a machine or any other heavy stuff, do not use a hanging bolt to move the motor as the hanging bolt and/or motor may get broken. When moving a motor, be careful not to apply excessive force to its windings as the windings may break and/or their insulation may deteriorate.

● **Do not touch a motor with a wet hand.**

A failure to observe this caution is vary dangerous because you may get electric shocks.

● **Before starting to connect a motor to electric wires, make sure they are isolated from an electric power source.**

A failure to observe this caution is vary dangerous because you may get electric shocks.

● **Do not bring any dangerous stuff near a motor.**

Motors are connected to a power line, and may get hot. If a flammable is placed near a motor, it may be ignited, catch fire, or explode.

● **Be sure to ground a motor frame.**

To avoid electric shocks, be sure to connect the grounding terminal in the terminal box to the grounding terminal of the machine.

● **Do not ground a motor power wire terminal or short–circuit it to another power wire terminal.**

A failure to observe this caution may cause electric shocks or a burned wiring.

⁎ Some motors require a special connection such as a winding changeover. Refer to their respective motor specification manuals for details.

WARNING

- **Connect power wires securely so that they will not get loose.**

  A failure to observe this caution may cause a wire to be disconnected, resulting in a ground fault, short circuit, or electric shock.

- **Do not supply the power to the motor while any terminal is exposed.**

  A failure to observe this caution is very dangerous because you may get electric shocks if your body or any conductive stuff touches an exposed terminal.

- **Do not get close to a rotary section of a motor when it is rotating.**

  A rotating part may catch your cloths or fingers. Before starting a motor, ensure that there is no stuff that can fly away (such as a key) on the motor.

- **Before touching a motor, shut off the power to it.**

  Even if a motor is not rotating, there may be a voltage across the terminals of the motor. Especially before touching a power supply connection, take sufficient precautions. Otherwise you may get electric shocks.

- **Do not touch any terminal of a motor for a while (at least 5 minutes) after the power to the motor is shut off.**

  High voltage remains across power line terminals of a motor for a while after the power to the motor is shut off. So, do not touch any terminal or connect it to any other equipment. Otherwise, you may get electric shocks or the motor and/or equipment may get damaged.

- **To drive a motor, use a specified amplifier and parameters.**

  An incorrect combination of a motor, amplifier, and parameters may cause the motor to behave unexpectedly. This is dangerous, and the motor may get damaged.

- **Do not touch a motor when it is running or immediately after it stops.**

  A motor may get hot when it is running. Do not touch the motor before it gets cool enough. Otherwise, you may get burned.

- **Be careful not get your hair or cloths caught in a fan.**

  Be careful especially for a fan used to generate an inward air flow.
  Be careful also for a fan even when the motor is stopped, because it continues to rotate while the amplifier is turned on.

- **Ensure that motors and related components are mounted securely.**

  If a motor or its component slips out of place or comes off when the motor is running, it is very dangerous.

2 CAUTION

CAUTION

- **FANUC motors are designed for use with machines. Do not use them for any other purpose.**

  If a FANUC motor is used for an unintended purpose, it may cause an unexpected symptom or trouble. If you want to use a motor for an unintended purpose, previously consult with FANUC.

- **Ensure that a base or frame on which a motor is mounted is strong enough.**

  Motors are heavy. If a base or frame on which a motor is mounted is not strong enough, it is impossible to achieve the required precision.

- **Be sure to connect motor cables correctly.**

  An incorrect connection of a cable cause abnormal heat generation, equipment malfunction, or failure. Always use a cable with an appropriate current carrying capacity (or thickness). For how to connect cables to motors, refer to their respective specification manuals.

- **Ensure that motors are cooled if they are those that require forcible cooling.**

  If a motor that requires forcible cooling is not cooled normally, it may cause a failure or trouble. For a fan–cooled motor, ensure that it is not clogged or blocked with dust and dirt. For a liquid–cooled motor, ensure that the amount of the liquid is appropriate and that the liquid piping is not clogged. For both types, perform regular cleaning and inspection.

- **When attaching a component having inertia, such as a pulley, to a motor, ensure that any imbalance between the motor and component is minimized.**

  If there is a large imbalance, the motor may vibrates abnormally, resulting in the motor being broken.

- **Be sure to attach a key to a motor with a keyed shaft.**

  If a motor with a keyed shaft runs with no key attached, it may impair torque transmission or cause imbalance, resulting in the motor being broken.

3 NOTE

NOTE

● Do not step or sit on a motor.

If you step or sit on a motor, it may get deformed or broken. Do not put a motor on another unless they are in packages.

● When storing a motor, put it in a dry (non–condensing) place at room temperature (0 to 40 °C).

If a motor is stored in a humid or hot place, its components may get damaged or deteriorated. In addition, keep a motor in such a position that its shaft is held horizontal and its terminal box is at the top.

● Do not remove a nameplate from a motor.

If a nameplate comes off, be careful not to lose it. If the nameplate is lost, the motor becomes unidentifiable, resulting in maintenance becoming impossible. For a nameplate for a built–in spindle motor, keep the nameplate with the spindle.

● Do not apply shocks to a motor or cause scratches to it.

If a motor is subjected to shocks or is scratched, its components may be adversely affected, resulting in normal operation being impaired. Be very careful when handling plastic portions, sensors, and windings, because they are very liable to break. Especially, avoid lifting a motor by pulling its plastic portion, winding, or power cable.

● Do not conduct dielectric strength or insulation test for a detector.

Such a test can damage elements in the detector.

● When testing the winding or insulation resistance of a motor, satisfy the conditions stipulated in IEC34.

Testing a motor under a condition severer than those specified in IEC34 may damage the motor.

● Do not disassemble a motor.

Disassembling a motor may cause a failure or trouble in it.
If disassembly is in need because of maintenance or repair, please contact a service representative of FANUC.

● Do not modify a motor.

Do not modify a motor unless directed by FANUC. Modifying a motor may cause a failure or trouble in it.

NOTE

- **Use a motor under an appropriate environmental condition.**

  Using a motor in an adverse environment may cause a failure or trouble in it. Refer to their respective specification manuals for details of the operating and environmental conditions for motors.

- **Do not apply a commercial power source voltage directly to a motor.**

  Applying a commercial power source voltage directly to a motor may result in its windings being burned. Be sure to use a specified amplifier for supplying voltage to the motor.

- **For a motor with a terminal box, make a conduit hole for the terminal box in a specified position.**

  When making a conduit hole, be careful not to break or damage unspecified portions. Refer to an applicable specification manual.

- **Before using a motor, measure its winding and insulation resistances, and make sure they are normal.**

  Especially for a motor that has been stored for a prolonged period of time, conduct these checks. A motor may deteriorate depending on the condition under which it is stored or the time during which it is stored. For the winding resistances of motors, refer to their respective specification manuals, or ask FANUC. For insulation resistances, see the following table.

- **To use a motor as long as possible, perform periodic maintenance and inspection for it, and check its winding and insulation resistances.**

  Note that extremely severe inspections (such as dielectric strength tests) of a motor may damage its windings. For the winding resistances of motors, refer to their respective specification manuals, or ask FANUC. For insulation resistances, see the following table.

MOTOR INSULATION RESISTANCE MEASUREMENT

Measure an insulation resistance between each winding and motor frame using an insulation resistance meter (500 VDC). Judge the measurements according to the following table.

Insulation resistance	Judgment
100 MΩ or higher	Acceptable
10 to 100 MΩ	The winding has begun deteriorating. There is no problem with the performance at present. Be sure to perform periodic inspection.
1 to 10 MΩ	The winding has considerably deteriorated. Special care is in need. Be sure to perform periodic inspection.
Lower than 1 MΩ	Unacceptable. Replace the motor.

II. FANUC SERVO MOTOR AMPLIFIER series

1 WARNINGS AND CAUTIONS RELATING TO MOUNTING

WARNING

● Check the specification code of the amplifier.

Check that the delivered amplifier is as originally ordered.

● Mount a ground fault interrupter.

To guard against fire and electric shock, fit the factory power supply or machine with a ground fault interrupter (designed for use with an inverter).

● Securely ground the amplifier.

Securely connect the ground terminal and metal frame of the amplifier and motor to a common ground plate of the power magnetics cabinet.

● Be aware of the weight of the amplifier and other components.

Control motor amplifiers and AC reactors are heavy. When transporting them or mounting them in the cabinet, therefore, be careful not to injured yourself or damage the equipment. Be particularly carefull not to jam your fingers between the cabinet and amplifier.

● Never ground or short–circuit either the power supply lines or power lines.

Protect the lines from any stress such as bending. Handle the ends appropriately.

● Ensure that the power supply lines, power lines, and signal lines are securely connected.

A loose screw, loose connection, or the like will cause a motor malfunction or overheating, or a ground fault.

● Insulate all exposed parts that are charged.

● Never touch the regenerative discharge resistor or radiator directly.

The surface of the radiator and regenerative discharge unit become extremely hot. Never touch them directly. An appropriate structure should also be considered.

● Close the amplifier cover after completing the wiring.

Leaving the cover open presents a danger of electric shock.

WARNING

- **Do not disassemble the amplifier.**

- **Ensure that the cables used for the power supply lines and power lines are of the appropriate diameter and temperature ratings.**

- **Do not apply an excessively large force to plastic parts.**

  If a plastic section breaks, it may cause internal damage, thus interfering with normal operation. The edge of a broken section is likely to be sharp and, therefore, presents a risk of injury.

CAUTION

- **Do not step or sit on the amplifier.**

  Also, do not stack unpacked amplifiers on top of each other.

- **Use the amplifier in an appropriate environment.**

  See the allowable ambient temperatures and other requirements, given in the corresponding descriptions.

- **Protect the amplifier from corrosive or conductive mist or drops of water.**

  Use a filter if necessary.

- **Protect the amplifier from impact.**

  Do not place anything on the amplifier.

- **Do not block the air inlet to the radiator.**

  A deposit of coolant, oil mist, or chips on the air inlet will result in a reduction in the cooling efficiency. In some cases, the required efficiency cannot be achieved. The deposit may also lead to a reduction in the useful life of the semiconductors. Especially, when outside air is drawn in, mount filters on both the air inlet and outlet. These filters must be replaced regularly. So, an easy–to–replace type of filter should be used.

- **Before connecting the power supply wiring, check the supply voltage.**

  Check that the supply voltage is within the range specified in this manual, then connect the power supply lines.

- **Ensure that the combination of motor and amplifier is appropriate.**

- **Ensure that valid parameters are specified.**

  Specifying an invalid parameter for the combination of motor and amplifier may not only prevent normal operation of the motor but also result in damage to the amplifier.

- **Ensure that the amplifier and peripheral equipment are securely connected.**

  Check that the magnetic contactor, circuit breaker, and other devices mounted outside the amplifier are securely connected to each other and that those devices are securely connected to the amplifier.

- **Check that the amplifier is securely mounted in the power magnetics cabinet.**

  If any clearance is left between the power magnetics cabinet and the surface on which the amplifier is mounted, dust entering the gap may build up and prevent the normal operation of the amplifier.

CAUTION

● Apply appropriate countermeasures against noise.

Adequate countermeasures against noise are required to maintain normal operation of the amplifier. For example, signal lines must be routed away from power supply lines and power lines.

NOTE

- **Keep the nameplate clearly visible.**
- **Keep the legend on the nameplate clearly visible.**
- **After unpacking the amplifier, carefully check for any damage.**
- **Mount the amplifier in a location where it can be easily accessed to allow periodic inspection and daily maintenance.**
- **Leave sufficient space around the machine to enable maintenance to be performed easily.**

  Do not place any heavy objects such that they would interfere with the opening of the doors.
- **Keep the parameter table and spare parts at hand.**

  Also, keep the specifications at hand. These items must be stored in a location where they can be retrieved immediately.
- **Provide adequate shielding.**

  A cable to be shielded must be securely connected to the ground plate, using a cable clamp or the like.

2 WARNINGS AND CAUTIONS RELATING TO A PILOT RUN

WARNING

- **Before turning on the power, check that the cables connected to the power magnetics cabinet and amplifier, as well as the power lines and power supply lines, are securely connected. Also, check that no lines are slack.**

- **Before turning on the power, ensure that the power magnetics cabinet is securely grounded.**

- **Before turning on the power, check that the door of the power magnetics cabinet and all other doors are closed.**

  Ensure that the door of the power magnetics cabinet containing the amplifier, and all other doors, are securely closed. During operation, all doors must be closed and locked.

- **Apply extreme caution if the door of the power magnetics cabinet or another door must be opened.**

  Only a person trained in the maintenance of the corresponding machine or equipment should open the door, and only after shutting off the power supply to the power magnetics cabinet (by opening both the input circuit breaker of the power magnetics cabinet and the factory switch used to supply power to the cabinet). If the machine must be operated with the door open to enable adjustment or for some other purpose, the operator must keep his or her hands and tools well away from any dangerous voltages. Such work must be done only by a person trained in the maintenance of the machine or equipment.

- **When operating the machine for the first time, check that the machine operates as instructed.**

  To check whether the machine operates as instructed, first specify a small value for the motor, then increase the value gradually. If the motor operates abnormally, perform an emergency stop immediately.

- **After turning on the power, check the operation of the emergency stop circuit.**

  Press the emergency stop button to check that the motor stops immediately, and that the power being supplied to the amplifier is shut off by the magnetic contactor.

- **Before opening a door or protective cover of a machine to enable adjustment of the machine, first place the machine in the emergency stop state and check that the motor has stopped.**

CAUTION

● Note whether an alarm status relative to the amplifier is displayed at power–up or during operation.

If an alarm is displayed, take appropriate action as explained in the maintenance manual. If the work to be done requires that the door of the power magnetics cabinet be left open, the work must be carried out by a person trained in the maintenance of the machine or equipment. Note that if some alarms are forcibly reset to enable operation to continue, the amplifier may be damaged. Take appropriate action according to the contents of the alarm.

● Before operating the motor for the first time, mount and adjust the position and speed detectors.

Following the instructions given in the maintenance manual, adjust the position and speed detectors for the spindle so that an appropriate waveform is obtained. If the detectors are not properly adjusted, the motor may not rotate normally or the spindle may fail to stop as desired.

● If the motor makes any abnormal noise or vibration while operating, stop it immediately.

Note that if operation is continued in spite of there being some abnormal noise or vibration, the amplifier may be damaged. Take appropriate corrective action, then resume operation.

● Observe the ambient temperature and output rating requirements.

The continuous output rating or continuous operation period of some amplifiers may fall as the ambient temperature increases. If the amplifier is used continuously with an excessive load applied, the amplifier may be damaged.

3 WARNINGS AND CAUTIONS RELATING TO MAINTENANCE

WARNING

● Read the maintenance manual carefully and ensure that you are totally familiar with its contents.

This manual describes daily maintenance and the procedures to be followed in the event of an alarm being issued. The operator must be familiar with these descriptions.

● Notes on replacing a fuse or PC board

1) Before starting the replacement work, ensure that the circuit breaker protecting the power magnetics cabinet is open.

2) Check that the red LED that indicates that charging is in progress is not lit. The position of the charging LED on each model of amplifier is given in specification manual. While the LED is lit, hazardous voltages are present inside the unit, and thus there is a danger of electric shock.

3) Some PC board components become extremely hot. Be careful not to touch these components.

4) Ensure that a fuse having an appropriate rating is used.

5) Check the specification code of a PC board to be replaced. If a modification drawing number is indicated, contact FANUC before replacing the PC board. Also, before and after replacing a PC board, check its pin settings.

6) After replacing the fuse, ensure that the screws are firmly tightened. For a socket–type fuse, ensure that the fuse is inserted correctly.

7) After replacing the PC board, ensure that it is securely connected.

8) Ensure that all power lines, power supply lines, and connectors are securely connected.

● Take care not to lose any screws.

When removing the case or PC board, take care not to lose any screws. If a screw is lost inside the nit and the power is turned on, the machine may be damaged.

● Notes on replacing the battery of the absolute pulse coder

Replace the battery only while the power is on. If the battery is replaced while the power is turned off, the stored absolute positioning data will be lost. Some series servo amplifier modules have batteries in their servo amplifiers. To replace the battery of any of those models, observe the following procedure: Open the door of the power magnetics cabinet; Leave the control power of the power supply module on; Place the machine in the emergency stop state so that the power being input to the amplifier is shut off; Then, replace the battery. Replacement work should be done only by a person who is trained in the related maintenance and safety requirements. The power magnetics cabinet in which the servo amplifier is mounted has a high–voltage section. This section presents a severe risk of electric shock.

WARNING

- **Check the number of any alarm.**

  If the machine stops upon an alarm being issued, check the alarm number. Some alarms indicate that a component must be replaced. If the power is reconnected without first replacing the failed component, another component may be damaged, making it difficult to locate the original cause of the alarm.

- **Before resetting an alarm, ensure that the original cause of the alarm has been removed.**

- **Contact FANUC whenever a question relating to maintenance arises.**

- **Notes on removing the amplifier**

  Before removing the amplifier, first ensure that the power is shut off. Be careful not to jam your fingers between the power magnetics cabinet and amplifier.

CAUTION

● Ensure that all required components are mounted.

When replacing a component or PC board, check that all components, including the snubber capacitor, are correctly mounted. If the snubber capacitor is not mounted, for example, the IPM will be damaged.

● Tighten all screws firmly.

● Check the specification code of the fuse, PC board, and other components.

When replacing a fuse or PC board, first check the specification code of the fuse or PC board, then mount it in the correct position. The machine will not operate normally if a fuse or PC board having other than the correct specification code is mounted, or if a fuse or PC board is mounted in the wrong position.

● Mount the correct cover.

The cover on the front of the amplifier carries a label indicating a specification code. When mounting a previously removed front cover, take care to mount it on the unit from which it was removed.

● Notes on cleaning the heat sink and fan

1) A dirty heat sink or fan results in reduced semiconductor cooling efficiency, which degrades reliability. Periodic cleaning is necessary.

2) Using compressed air for cleaning scatters the dust. A deposit of conductive dust on the amplifier or peripheral equipment will result in a failure.

3) To clean the heat sink, do so only after turning the power off and ensuring that the heat sink has cooled to room temperature. The heat sink becomes extremely hot, such that touching it during operation or immediately after power–off is likely to cause a burn. Be extremely careful when touching the heat sink.

NOTE

● Ensure that the battery connector is correctly inserted.

If the power is shut off while the battery connector is not connected correctly, the absolute position data for the machine will be lost.

● Store the manuals in a safe place.

The manuals should be stored in a location where they can be accessed immediately it so required during maintenance work.

● Notes on contacting FANUC

Inform FANUC of the details of an alarm and the specification code of the amplifier so that any components required for maintenance can be quickly secured, and any other necessary action can be taken without delay.

PREFACE

This manual provides information necessary for maintenance of the FANUC Servo Motor Amplifier β series servo amplifier unit.
There is one servo amplifier unit type,as listed below.

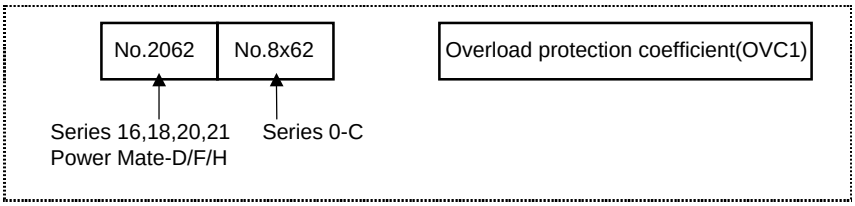
Name	Designation	Remark
SVU	A06B-6093-H***	Conforms to VDE0160, UL and CSA.

Part I describes the procedure to start up the servo amplifier unit. Part II describes the error recovery procedure. Part III describes appendex. Part Ⅳ describes the maintenance of AC servo motors.
This document uses the abbreviations listed below.

Model	Abbreviation
A06B-6093-H***	SVU
FANUC Series □	Series □
FANUC Power Mate -MODEL □	Power Mate-□

In this manual, the servo parameter numbers are arranged as shown below.

(Example)



In addition to this manual, those listed below are provided for the FANUC Servo Motor Amplifier β series (servo amplifier units).

1) FANUC SERVO MOTOR β series DESCRIPTIONS B-65232EN
2) FANUC AC SERVO MOTOR α series DESCRIPTIONS B-65142E

WARNING
When maintaining or inspecting the servo amplifiers, keep the power supply switched off. Also make sure that the "CHANGING" LED (red) on the front panel of the servo amplifier is off. (See Appendix A)

Table of Contents

I. START-UP PROCEDURE

1 OVERVIEW

This part provides information necessary to confirm the system configuration and start up the servo amplifier units:

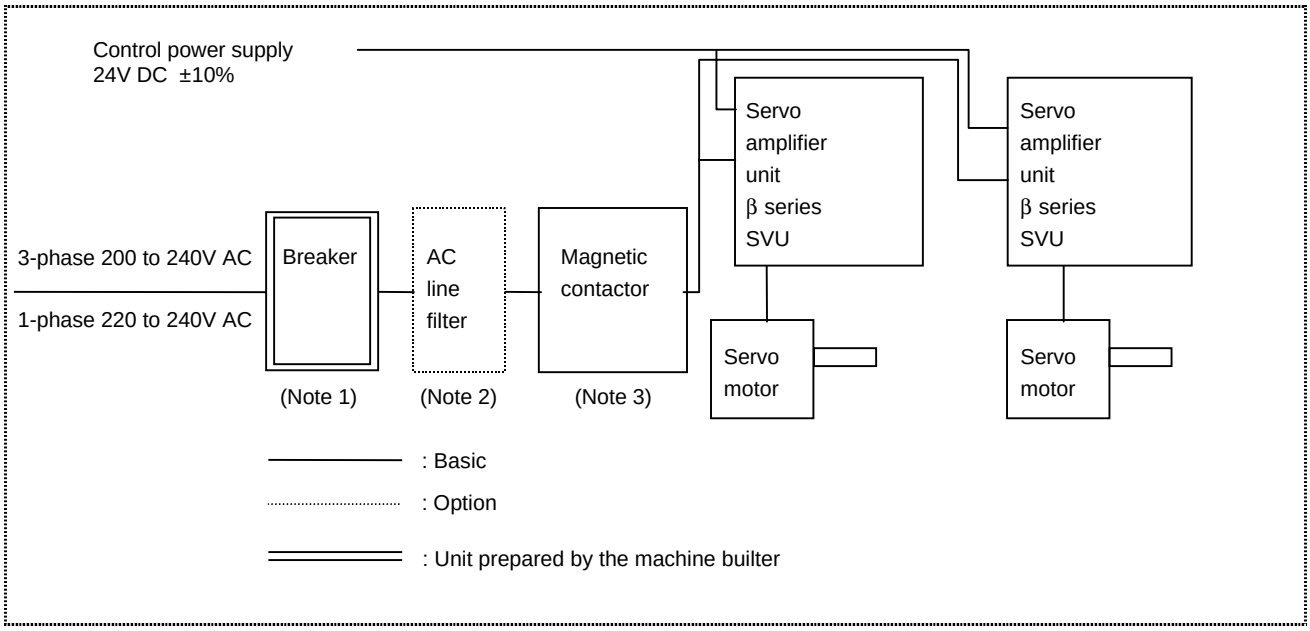
(1) Configuration
(2) Start-up procedure
(3) Operation confirmation procedure

2 CONFIGURATION

2.1 BASIC CONFIGURATION

The basic configuration is shown below.
Refer to "FANUC SERVO MOTOR β series Descriptions" (B-65232EN) for detail.

Ex. Two SVU2s



NOTE
1 This circuit breaker is intended to protect the power cord and servo amplifier unit β series SVU.
2 This AC line filter should always be used, so influence by harmonic noise to the power supply can be reduced. When the line voltage is within specification, and a power transformer (isolation type) is used, the AC line filter can be omitted.
If the AC line filter is ineffective in making the servo amplifier unit satisfy EMC standards, use an appropriate commercial noise filter.
3 The magnetic contactor is required if it is necessary to qualify for European CE marking.
4 Install a surge absorber between the power lines and between a power line and a ground line at the entrance of the power magnetic cabinet in order to protect the equipment from a surge voltage.
Refer to the sector "Installation conditions and notes" of FANUC SERVO β series Description (B-65232EN)

2.2 MAJOR COMPONENTS

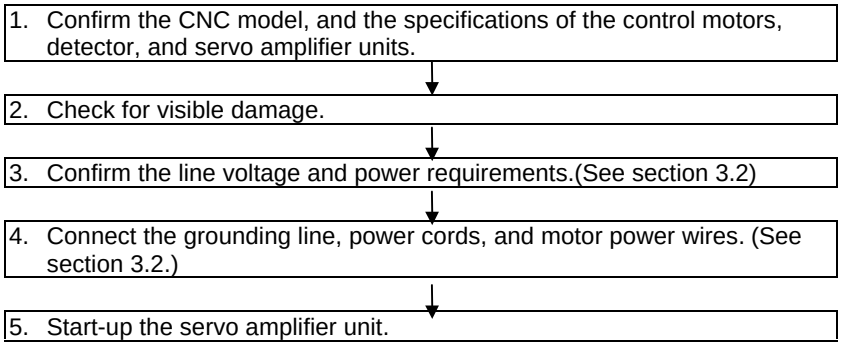
SVU

Model	Oder specification	Power P.C.B.	Control P.C.B.	Remark
SVU-12	A06B-6093-H101	A20B-2100-0130	A20B-2002-0320	
SVU-20	A06B-6093-H102	A20B-2100-0131	A20B-2002-0320	

3 START-UP PROCEDURE

3.1 OVERVIEW OF THE START-UP PROCEDURE

Start-up procedure



3.2 CONNECTING THE POWER SUPPLY

3.2.1 Confirming the Line Voltage and Power Requirements

(1) Line voltage

Before connecting the power source to the machine, check the voltage of the power source.

Item		Specification
Input power	Three-phase	Voltage 200 to 240VAC Allowable deviation voltage+10%, –15% **Note)** Frequency 50 Hz , 60 Hz ±2 Hz Voltage deviation due to load (at maximum output) shall be 7% or less.
	Single-phase	Voltage 220 to 240VAC Allowable deviation voltage+10 %, 15 % **Note)** Frequency 50 Hz , 60 Hz ±2 Hz Voltage deviation due to load (at maximum output) shall be 7% or less.
Control power voltage		24VDC ±10 %

NOTE

Allowable deviation voltage means deviation for a few minutes, not continuous.

(2) Power requirements
- The power requirement of the servo amplifier unit is the sum of the power requirements of individual servo motors.
- When a servo motor accelerates or decelerates rapidly, it may require twice as much power as the continuous rating momentarily. Check on the input voltage required when more than one servo motor accelarates or decelarates simultaneously, and keep the voltage above 170VAC for three-phase input and above 187 VAC for single-phase input.
- Refer to Chapter 5 in Part III of "FANUC SERVO MOTER β series Description" (B-65232EN) for details of the power requirements.

3.2.2 Leakage Current and Selecting a Ground Fault Interrupter

Because the drive circuit for the servo amplifier unit operates by a pulse width modulation control system using IGBTs, high-frequency leakage current flows from the motor windings and power lines to ground through stray capacitance. This leakage current may cause the ground fault interrupter or leakage protection relay installed in the power line on the power supply side to malfunction. So they must accommodate leakage from inverters so that they do not malfunction.

(1) Leakage current from the motor
Determine the leakage current from each motor according to the table below.

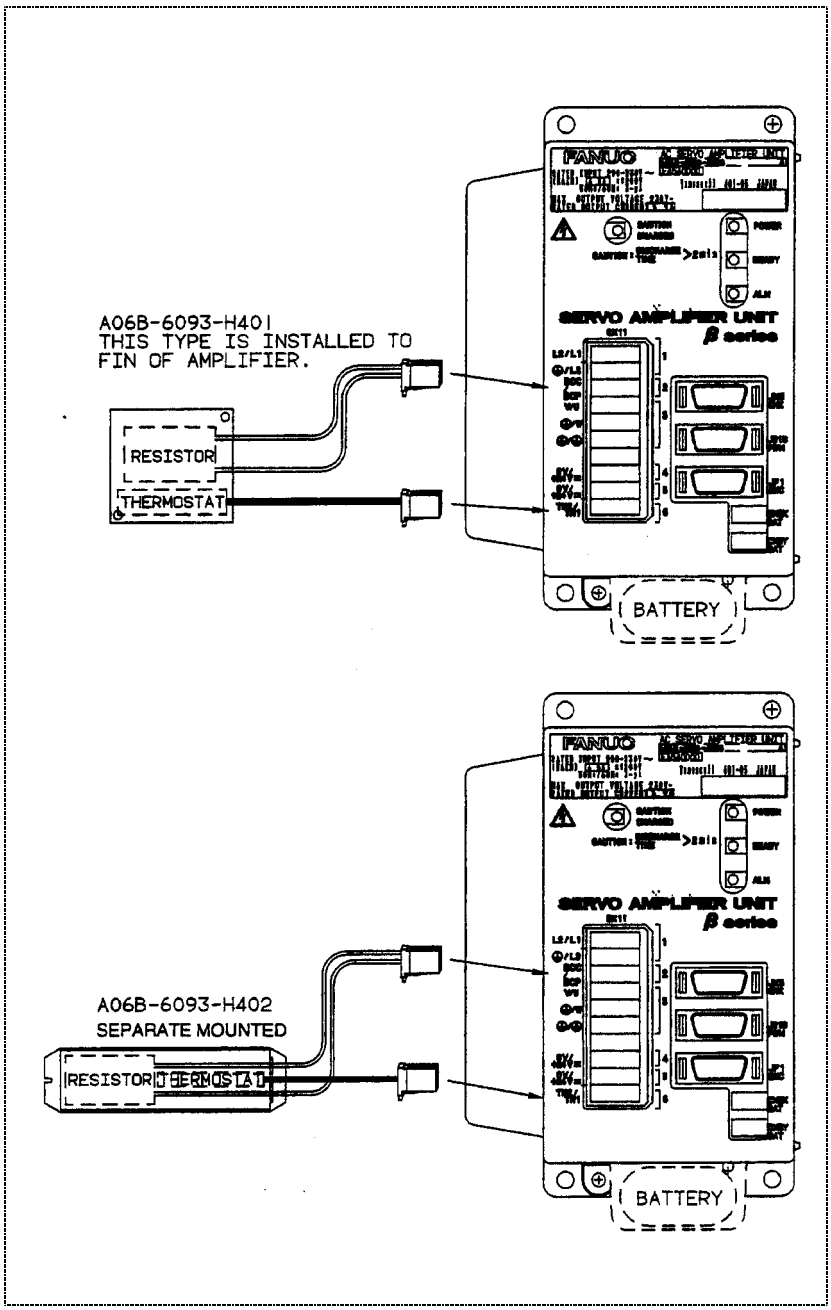
Motor model	Leakage current of commercial power frequency component
β1 to β6, α0.5 (β0.5) to α2, αC3 to αC6	1.8 mA
αC12	2.0 mA

3.3 CONNECTING THE SEPARATE REGENERATIVE DISCHARGE UNIT

(1) Type

A06B-6093-H401	Natural ventilation (30Ω /20W)
A06B-6093-H402	Natural ventilation (30Ω /100W)

(2) Connection



3.4 INITIALIZING SERVO PARAMETERS

3.4.1 Servo Amplifier Unit

(1) Before servo parameter initialization
Before starting servo parameter initialization ,confirm the following:
1) NC model (Example: Series 16-C)
2) Servo motor model (Example: β6/2000)
3) Pulse coder built in a motor
(Example: β pulse coder)
4) Whether a separate position detector is used or not
(Example: Not used)
5) Distance the machine tool moves per revolution of the motor
(Example: 10mm per one revolution)
6) Machine detection unit (Example: 0.001 mm)
7) NC command unit (Example: 0.001 mm)

(2) Servo parameter initialization procedure
1) Switch on the NC in an emergency stop state.
Enable parameter writing (PWE=1)
2) Initialize servo parameters on the servo setting screen.
To display the servo setting screen, follow the procedure below, using the key on the NC.

- **Series 16,18,20,21**

SYSTEM → [SYSTEM] → [▷] → [SV-PRM]
If no servo screen appears, set the following parameter as shown, and switch the NC off and on again.

	#7	#6	#5	#4	#3	#2	#1	#0
3111								SVS

SVS (#0) = 1 (to display the servo screen)

- **Series 0-C**

Press the PARAM key several times, and the servo setting screen will appear.
If no servo screen appears, set the following paramter as shown, and switch the NC off and on again.

	#7	#6	#5	#4	#3	#2	#1	#0
389								SVS

SVS (#0) = 0 (to display the servo screen)

When the following menu appears on the screen, move the cursor to the item you want to set and enter data directly.

Servo set		01000 N0000
	X axis	Z axis
INITIAL SET BITS	00001010	00001011
Motor ID No.	16	16
AMR	00000000	00000000
CMR	2	2
Feed gear	1	1
(N/M)	100	1
Direction Set	111	–111
Volocity Pulse No.	8192	8192
Position Pulse No.	12500	12500
Ref. counter	10000	10000
Value SETTING=		

Servo setting menu

Parameter of Power Mate-E, F, G, H, I

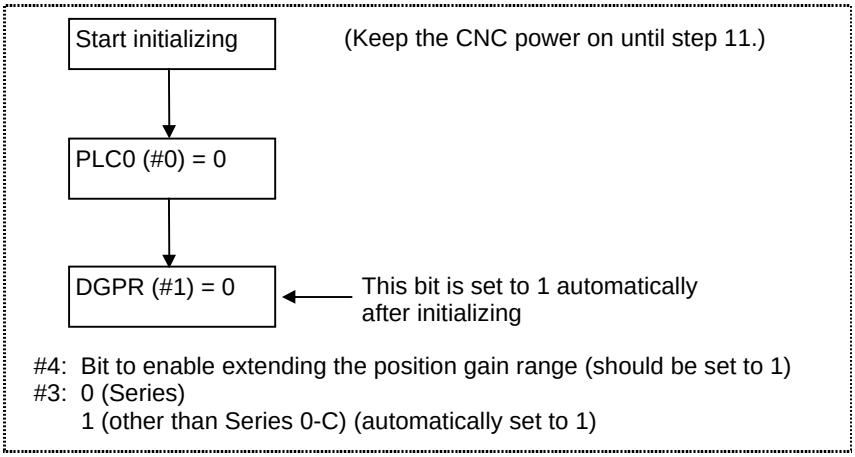
Power Mate-F, G, H, I	Power Mate-E
No.2000	No.1000
No.2020	No.1020
No.2001	No.1001
No.1820	No.100
No.2084	No.1084
No.2085	No.1085
No.2022	No.1022
No.2023	No.1023
No.2024	No.1024
No.1821	No.324

These read to move over so look like headings install a part of previous.

3) Start initializing

	#7	#6	#5	#4	#3	#2	#1	#0
Initial set bits				1	1		DGPR	0

(#3 is set automatically to 1 except for Series 0)



4) Specify the motor Type No. Select the motor Type No. according to the model and specification (four digits in the middle segment of A06B-XXXX-BXXX) of your motor.

Motor model	αC3/2000	αC6/2000	αC12/2000
Motor specification	0121	0126	0141
Motor type No.	7	8	9
Motor model	α1/3000	α2/2000	α2/3000
Motor specification	0371	0372	0373
Motor type No.	61	46	62
Motor model	β0.5/3000	β1/3000	β2/3000
Motor specification	0113	0031	0032
Motor type No.	13	35	36
Motor model	β3/3000	β6/2000	
Motor specification	0033	0034	
Motor type No.	33	34	

5) Set AMR as described below. The setting does not depend on the model of the motor.

α pulse coder	00000000
β pulse coder	00000000

6) Set CMR with the scale of a distance the NC instructs the machine to move.
CMR = Command unit / Detection unit

CMR 1/2 to 48	Setting value = CMR × 2

Usually, CMR = 1, so specify 2.

7) Specify the flexible feed gear (F.FG). This function makes it easy to specify a detection unit for the leads and gear reduction ratios or various ball screws by changing the number of position feedback pulses from the pulse coder or separate detector.

Setting for the α or β pulse coder in the semi-closed mode

$$\frac{\text{F.FG numerator } (\leq 32767)}{\text{F.FG denominator } (\leq 32767)} = \frac{\text{Number of position necessary for each revolution of the motor}}{1000000} \quad \text{(as irreducible fraction)}$$

NOTE 1
For both F.FG numerator and denominator, the maximum setting value (after reduced) is 32767.

(Example of setting)
For detection in 10 μm unit, specify as follows:

Ball screw lead	Number of necessary position pulses	F.FG
10(mm/rev)	1000(pulse/rev)	1/1000
20	2000	2/1000 or 1/500
30	3000	3/1000

(Example of setting)
If the machine is set to detect in 100 degree units with a gear reduction ratio of 10:1 for the rotation axis, the table rotates by 360/10 degrees each time the motor makes one turn. 100 position pulses are necessary for the table to rotate through one degree. The number of position pulses necessary for the motor to make one turn is:
360 / 10 × 100 = 3600 pulse

$$\frac{\text{F.FG numerator}}{\text{F.FG denominator}} = \frac{3600}{1000000} = \frac{36}{10000}$$

Setting for use of a separate detector (full closed)		
$\frac{\text{F.FG numerator } (\leq 32767)}{\text{F.FG denominator } (\leq 32767)} = \frac{\text{Number of position necessary for the motor to make one turn}}{\text{Number of position pulses from the separate detector when the motor makes one turn}}$		(as irreducible fraction)

NOTE 2
DMR can also be used with the separate position detector, provided that F.FG = 0

(Example of setting)
When the separate detector detects 1 μm for 1 μm scale.

Ball screw lead	Number of necessary position pulses	F.FG
1(mm/rev)	1000(pulses/rev)	1/1
5	5000	1/1
10	10000	1/1

8) Specify the direction in which the motor rotates.

111	Clockwise as viewed from the pulse coder
–111	Counterclockwise as viewed from the pulse coder

9) Specify the number of velocity pulses and the number of position pulses.

	Semi-closed	Full-closed
Command unit (μm)	1	1
Initialization bit	#0=0	#0=0
Number of velocity pulses	8192	8192
Number of position pulses	12500	Np

Np: Number of position pulses from the separate detector when the motor makes one turn.

When using a separate detector (full-closed mode), also specify the following parameters:

- **Series 16, 18, 20, 21, Power Mate-D, F, H, I**

	#7	#6	#5	#4	#3	#2	#1	#0
1815							OPTX	

↑
Must be specified for all NCs.

OPTX (#1) The separate position detector is :
1 : used
0 : Not used

NOTE
For Series 16, 18, 20 and 21, setting this parameter causes bit 3 of parameter No.2002 to be set to 1 automatically.

- **Series 0-C**

	#7	#6	#5	#4	#3	#2	#1	#0
0037			STP8	STP7	STP4	STPZ	STPY	STPX

STPX to 8 The separate position detector is :
1 : Used for the X-axis, Y-axis, Z-axis, fourth axis, seventh axis, and eighth axis
0 : Not used for the X-axis, Y-axis, Z-axis, fourth axis, seventh axis, and eighth axis

- **Power Mate-E**

	#7	#6	#5	#4	#3	#2	#1	#0
1002	GRSL				PFSE			

GRSL(#7) The separate position detector is :
1 : Used
0 : Not used
PFSE(#3) Set GRSL,PFSE to same value.

10) Specify the reference counter. The reference counter is used in making a return to the reference position by a grid method. The value to be specified in the number of pulses necessary for the motor to make one turn, or the value obtained by dividing the number by an integer.

α, β pulse coder, semi-closed(detection in 1 μm units)

Ball screw lead	Number of necessary position pulses	Reference counter	Grid width
10mm/rev	10000 pulse/rev	10000	10 mm
20	20000	20000	20
30	30000	30000	30

11) Switch the NC off and on again.
This completes servo parameter initialization.If a servo alarm related to pulse coders occurs for an axis for which a servo motor or amplifier is not connected, specify the following parameter.

		#7	#6	#5	#4	#3	#2	#1	#0
2009	8X09								SERD

SERD (#0) The serial feedback dummy function is:
1 : Used
0 : Not used

12) When you are going to use an α, β pulse coder as an absolute pulse coder, use the following procedure. The procedure for setting absolute position communication using the α pulse coder is somewhat different from the procedure using serial pulse coder A.

1. Set the following parameter, and switch the CNC off.

- **Series 16,18,20,21, Power Mate-D,F,H,I**

	#7	#6	#5	#4	#3	#2	#1	#0
1815			APCX					

APCX (#5)
1 : Performs absolute position as communication pulse coder.
0 : Does not perform as absolute position pulse coder.

- **Series 0-C**

	#7	#6	#5	#4	#3	#2	#1	#0
21			APC8	APC7	APC4	APCZ	APCY	APCX

APCX to 8
1 : Performs absolute position communication for the X-, Y-, Z-, 4-, 7-, or 8- or 8-axis.
0 : Does not perform absolute position communication for the X-, Y-, Z-, 4-, 7-, or 8-axis.

- **Power Mate -E**

	#7	#6	#5	#4	#3	#2	#1	#0
21								APCX

APCX (#0)

1 : Performs absolute position as communication pulse coder.
0 : Does not perform as absolute position pulse coder.

2. After making sure that the battery for the pulse coder is connected,switch the NC on.

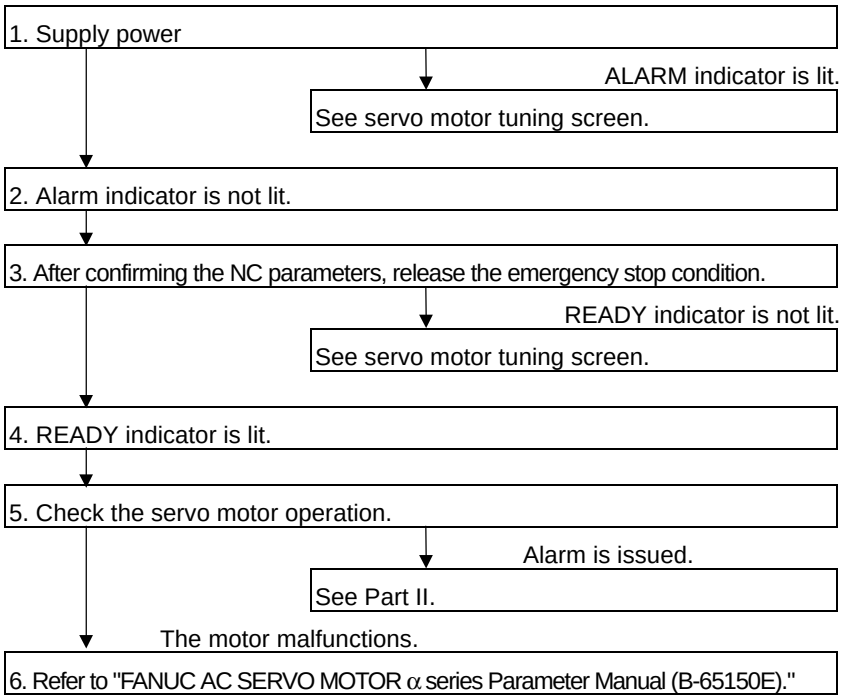
These steps were added for the α and β pulse coders.

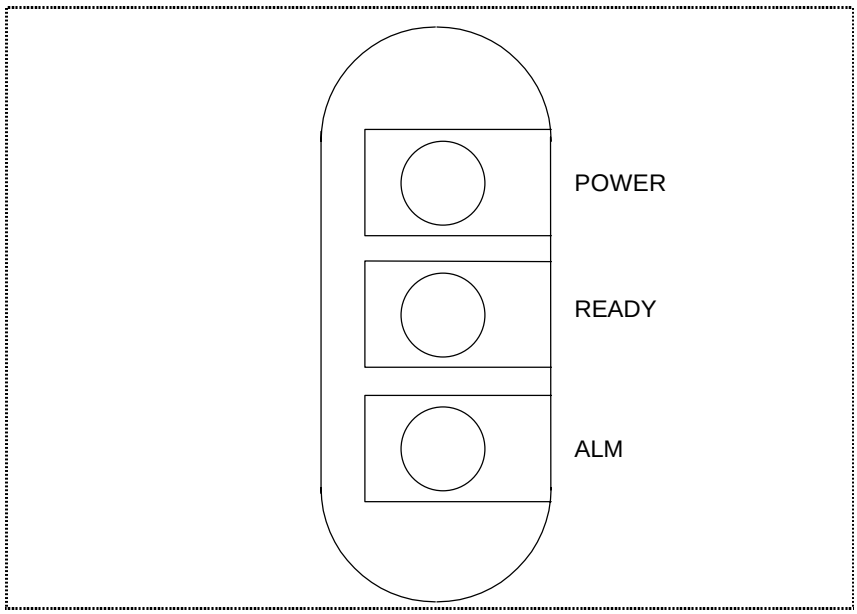
3. **Absolute position communication is performed, and a request to return to the reference position is displayed.**
4. **Move motor more than one revolution by JOG Feed.**
5. **Turn off and on the CNC.**

6. Absolute position communication is performed, and a request to return to the reference position is displayed.
7. Return to the reference position.

4 OPERATION CONFIRMATION METHOD

4.1 CONFIRMATION PROCEDURE



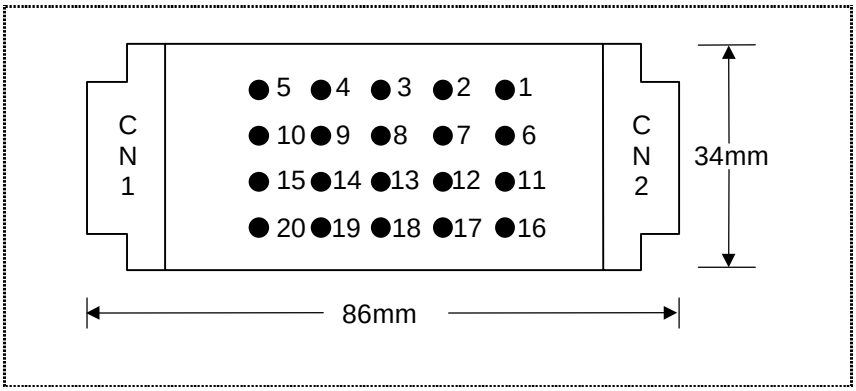


4.2 CHECK PIN BOARD

When you are going to observe the signals inside the amplifier with an oscilloscope,attach the check pin board listed below to the connector.

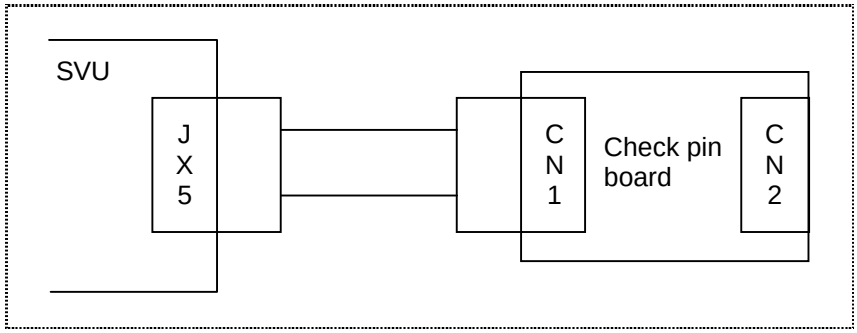
Order No.	Description of the order	
A06B-6071-K290	Printed-circuit board	A20B-1005-0340
	Cable(20m)	A660-2042-T031#L200RO

Pin arrangement on the pin board



NOTE
1. CN1 and CN2 are wired with a one-to-one correspondence.
2. The connector pin numbers correspond to the check pin numbers.

Connection to the servo amplifier unit



Pin No.	Signal name	Description
1)		
2)	0V	Reference voltage
3)	IRC Note)	Phase R motor current signal
4)	ISC Note)	Phase S motor current signal
5)		
6)		
7)		
8)		
9)	0V	Reference voltage
10)	0V	Reference voltage
11)	24VC	+24V power (with tolerance of ±10%)
12)	15VC	+15V power (with tolerance of ±10%)
13)	-15VC	-15V power (with tolerance of ±10%)
14)	5VC	+5V power (with tolerance of ±5%)
15)		
16)		
17)	ESP	Emergency Stop Input
18)		
19)		
20)		

NOTE
The output voltage reflects directly the actual current in the motor. To observe the output voltage, use an oscilloscope. The voltmeter position of a volt-ohm-milliammeter or other voltmeter cannot be used.

4.2.1 Checking the Control Power Supply Voltage

Check pin	Ratings
24V - 0V	24V ±10%
5V - 0V	5V ±5%
15V - 0V	15V ±10%
-15V - 0V	-15V ±10%

4.2.2 Checking the Motor Instantaneous Current

The motor instantaneous current can be measured by observing the voltage across the 0V and IR or IS check pins on an oscilloscope. This measurement cannot be done correctly with a volt-ohm-milliammeter.
The relationships between the motor instantaneous current and the measured voltage are as described below. The servo amplifier name has a number enclosed in a box "□". This number is a limit to the motor instantaneous current. It is determined so that when the motor current reaches the limit, the measured voltage is ± 4V. Therefore, the coefficient to calculate the motor current is obtained as follows.

$$\text{Coefficient to calculate the motor current} = \frac{\text{Limit to Motor instantaneous current}}{4\text{V}} \ [\text{AV}]$$

Then the motor instantaneous current can be obtained by multipling this coefficient by the voltage observed on the check-pin.

For example SVU20

$$\text{Coefficient to calculate the motor current} = \frac{20\text{A}}{4\text{V}} = 5 \ [\text{A/V}]$$

The servo amplifier name

SVU□
└── Limit to Motor instantaneous current

Limit to Motor instantaneous current (A)	Coefficient to caliculate the motor current (A/V)
12	3
20	5

5 SERVO CHECK BOARD

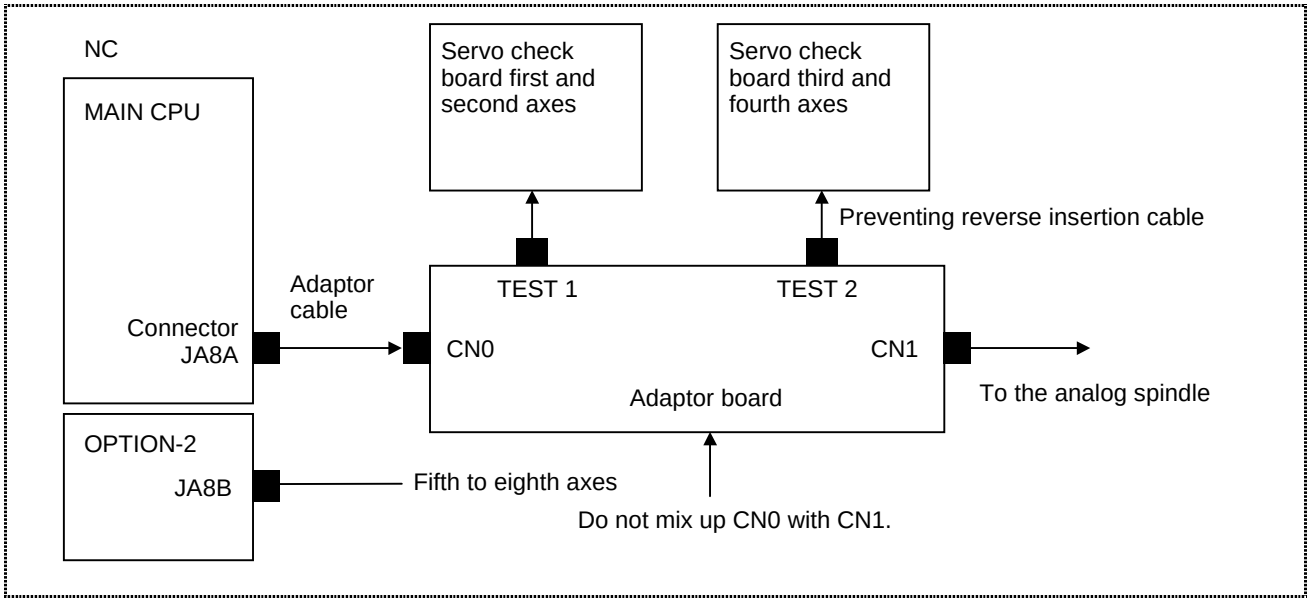
(1) General
The servo check board receives the digital value used for control inside the digital servo as numerical data and converts it to an analog form.

(2) Servo check board specifications

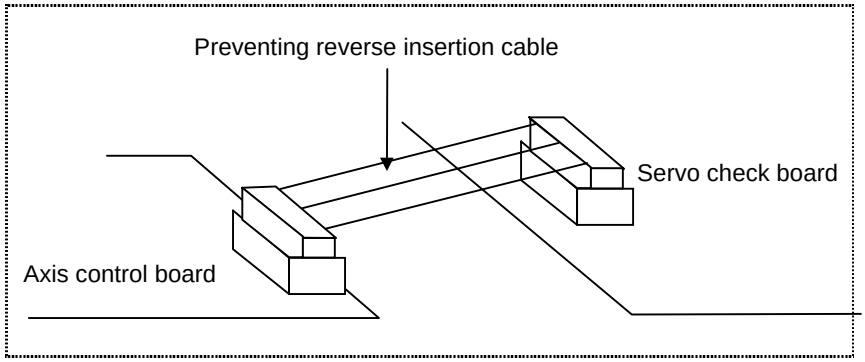
Specification	Name
A06B-6057-H602	Servo check board (with a cable having a provision to prevent incorrect insertion)
A02B-0120-C211	Servo adaptor board (not required for Series 0-C, Power Mate-D, or Power Mate-F)

(3) Connection the servo check board.
When connecting the check board, always keep the NC switched off. If you do not obtain a correct waveform install strapping on the 5 MHz side of clock pin S1 on the check board.

- **Series 16, 18, 20, 21, Power-Mate H, 15B**



- **Series 0-C, Power Mate-D, Power Mate-F**



(4) Location of signal ouput

Check pin	TSAL	TSAM	CH1	CH2	CH3	CH4	CH5	CH6
Signal			L axis VCMD	L axis TCMD	M axis VCMD	M axis TCMD	L axis TSA	M axis TSA

(Check terminal TSAL or TSAM is not used.)

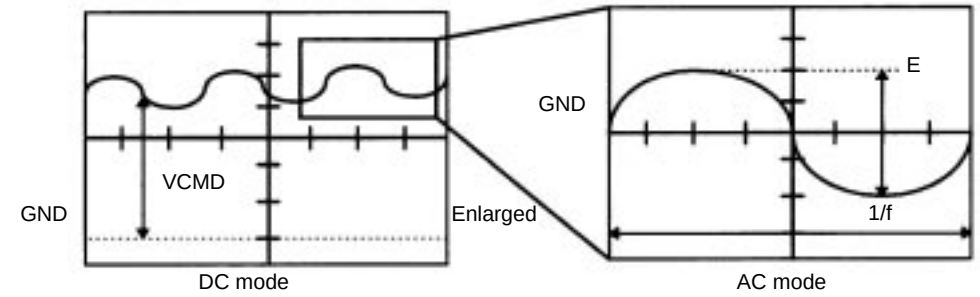
(5) VCMD signal

The VCMD signal is used to output a speed command. It can also be used to measure a very small vibration or uneven movement of the motor. The VCMD signal conversion mode can be switched by a parameter. Because the VCMD signal is clamped at ±5V, the waveform may become difficult observe. In such a case, switch for easier observation .

		#7	#6	#5	#4	#3	#2	#1	#0
2012	8X12			VCM2	VCM1				

VCM2	VCM1	Specified speed/5V
0	0	0.9155 rpm
0	1	14 rpm
1	0	234 rpm
1	1	3750 rpm

To check small vibration monitor the entire vibration on the DC mode of the oscilloscope then enlarge monitor the desired range on the AC mode.



When the signal conversion result for the VCMD waveform is W(rpm/5V), the voltage per positional shift pulse is:

$$\text{Voltage (V) per positional deviation pulse} = \frac{300 \times \text{position gain } (S^{-1})}{\text{Number of positional feedback pulses/motor revolution} \times W}$$

(Example) Assume the conditions: Position gain = 30(S^{-1}), the number of positional feedback pulse/motor revolution = 1000 pulse, and signal conversion result for the VCMD waveform = 14 rpm /5V with 1 μm/pulse)
Under these conditions, if you observe
E = 300mV, 1/f = 20ms and VCM1=1,VCM2=0:
Voltage per positional deviation pulse
= 64 mV/pulse
Therefore, table vibration = 300 × 1/64 = 4.6 μm, with a vibration period of 50 Hz

(6) TCMD signal
The TCMD signal outputs a motor torque command. It may be different from the actual current (IR,IS) of the motor rotating at high speed, because the motor produces a back electromotive force.

Maximum current	Signal output for maximum current	Ap/V	Applicable servo motor
12Ap	4.44V	2.7	β 1/3000, β 2/3000 β 0.5/3000, α 1/3000 α 2/2000, α 2/3000
20Ap	4.44V	4.5	β 3/3000, β 6/2000 α C3/2000, α C6/2000, α C12/2000,

Root mean square value(RMS) =
TCMD signal output(Ap) × 0.71

(7) TSA signal
The TSA signal outputs a motor speed.

Signal conversion	3750 rpm / 5V

If the TSA signal is clamped at 5V, check whether the following parameter is specified.

2115		Not used

Be sure to specify 0.

II. TROUBLESHOOTING AND RECOVERY

1 OVERVIEW

This part describes troubleshooting and recovery procedures. Each item should be carefully followed to find the cause of trouble and take necessary actions.

First, check the alarm No. (Servo tuning screen on the CNC) to find the cause of trouble by referring to Chapter 2.
Second, take appropriate actions according to Chapter 3.

2 ALARM NUMBER AND BRIEF DESCRIPTIONS

2.1 ALARM NUMBER IN Series 0-C (SERVO ALARMS)

Alarm No.	Description	Remark
309 Alarm3	α pulse coder error alarm	3.3.6
309 Alarm4	Pulse coder communication error alarm	3.3.8
400 Alarm1 bit7	Overheat alarm (motor)	3.1.2
414 Alarm1 bit5	Overload alarm (OVC)	3.1.2
414 Alarm1 bit3	DC link over-voltage alarm(HV)	3.1.2
414 Alarm1 bit6	Low DC link voltage(LVDC)	3.1.2
414 Alarm1 bit2	Over-Regenerative discharge alarm (DCOH)	3.1.2
414 Alarm1 bit4	Over-current alarm (HC)	3.1.2
416 Alarm1 bit1	Feedback disconnected alarm	3.3.3
417	Invalid servo parameter setting alarm	3.3.5

To interpret alarms 1 to 4, see Subsec. 3.3.1
Alarm1 Diagnose No. 720 to 723
or diagnose No. listed on the right.
Alarm2 Diagnose No. 730 to 733
Alarm3 Diagnose No. 760 to 763
Alarm4 Diagnose No. 770 to 773

2.2 ALARM NUMBER IN Series 16,18,20,21 (SERVO ALARMS)

Alarm No.	Description	Remark
350 Alarm3	α pulse coder error alarm	3.3.6
350 Alarm3 bit3	Rotation speed data error alarm	3.3.7
351 Alarm4	Pulse coder communication error alarm	3.3.8
400 Alarm1 bit7	Overheat alarm (motor)	3.3.4
414 Alarm5 bit6	Current conversion error alarm	3.2
414 Alarm1 bit5	Overload alarm (OVC)	3.3.2
414 Alarm1 bit3	DC link over-voltage alarm (HV)	3.1.2
414 Alarm1 bit6	Low DC link voltage(LVDC)	3.1.2
414 Alarm5 bit2	FAN stop alarm(FAL)	3.1.2
416 Alarm1 bit2	Over-Regenerative discharge alarm(DCOH)	3.1.2
414 Alarm1 bit4	Over-current alarm(HC)	3.1.2
416 Alarm1 bit1	Feedback disconnected alarm	3.3.3
417	Invalid servo parameter setting alarm	3.3.5

To interpret alarms 1 to 5, see Subsec 3.3.1
Alarm1 Diagnose No. 200
or diagnose No. listed on the right.
Alarm3 Diagnose No. 202
Alarm4 Diagnose No. 203
Alarm5 Diagnose No. 204

3 TROUBLESHOOTING AND RECOVERY PROCEDURES

3.1 SERVO AMPLIFIER UNIT

3.1.1 LED Indications and Meanings

If alarm condition related to the servo amplifier unit occurs, the alarm indicator on the amplifier front panel is lit. Check the description of alarm at servo tuning screen.

Type	Description
Over-voltage alarm (HV)	This alarm occurs if the DC voltage of the main circuit power supply is abnormally high.
Low DC link voltage alarm (LVDC)	This alarm occurs if the DC voltage of the voltage main circuit power supply is abnormally low or the outer circuit breaker trips.
Over-regenerative discharge alarm (DCOH)	This alarm occurs if: The average regenerative discharge energy is too high (too frequent acceleration / deceleration).
Over-heat alarm (OH)	This alarm occurs if the temperature of amplifier is abnormally high.
Fan alarm (FAL)	The fan, built into the servo amplifier unit, has stopped.
Over-current alarm (HC)	This alarm occurs if an abnormally over-current flows in servo amplifier unit.

3.1.2 Actions to be Taken on each Alarm

Type	Action
Over-voltage alarm (HV)	(1) The input voltage is probably higher than the rating. Check the voltage and correct it as required. (2) The connection of the separated regenerative discharge unit is probably incorrect. Check the connection. (3) The resistor of the separate regenerative discharge unit is probably defective. Disconnect the wiring of the regenerative discharge unit and check the resistance. If it is not within +20% of the rating. (described in Section I-3.4), replace the regenerative discharge unit. If any of the above three items does not fit the case, replace the servo amplifier.
Low DC link voltage alarm (LVDC)	(1) The external circuit breaker is probably off. Check the circuit breaker. (2) The input voltage is probably lower than the rating. Check the voltage and correct it as required. (3) The connection of the external setting magnetic contactor is probably incorrect. Check the connection. If any of the above three items does not fit the case, replace the servo amplifier.
Over-regenertive (DCOH)	If not using a separate discharge unit, connector (CX11-6) probably is not shorted. Check the connection. If it is shorted, replace the servo amplifier. If using a separate discharge unit: (1) The average regenerative discharge energy is probably too high. Reduce the frequency of acceleration / deceleration. (2) The connection of the thermostat line to the separated regenerative discharge unit is probably incorrect. Check the connection. (3) The thermostat of the separate regenerative discharge unit is probably defective. Disconnect the wiring of the regenerative discharge unit, and check the thermostat. If the thermostat is open, When the regenerative discharge unit is not hot,replace the regenerative discharge unit. If any of the above three items does not fit the cases, replace the servo amplifier.
Over-heat alarm (OH)	(1) After keeping the amplifier switched off for about ten minutes, replace the emergency stop condition. If the alarm is still issueed, replace the servo amplifier. If the alarm is not issued, the probably cases include high ambient temperature and excessively strict operating condition of the motor. Check these conditions.

<table>
<tr><td>Fan alarm
(FAL)</td><td>Check if the fan,built into the servo amplifier unit, has stopped.
If it is not stopped, replace the servo amplifier.</td></tr>
<tr><td>Over-current alarm
(HC)</td><td>(1) Check that following parameter are set to standard values. If they are not , normal current is impossible.

For digital servo software(9046, 9060, 9070 series)
<table><tr><td>No.2004</td><td>No.8X04</td><td>No.2006</td><td>No.8X06</td><td>No.2011</td><td>No.8X10</td></tr><tr><td>No.2040</td><td>No.8X40</td><td>No.2041</td><td>No.8X41</td><td>No.2074</td><td>No.8X74</td><td>No.2098</td><td>No.8X98</td></tr></table>For digital servo software(9066, 9080 series)
Make sure that besides the parameters for conventional control described above, the following parameters have standard values.
<table><tr><td>No.2057</td><td>–</td><td>No.2058</td><td>–</td><td>No.2110</td><td>–</td></tr><tr><td>No.2111</td><td>–</td><td>No.2127</td><td>–</td><td>No.2128</td><td>–</td><td>No.2129</td><td>–</td></tr></table>(2) Disconnect the power wires from the amplifier connector, and release the emergency stop condition.
If an overcurrent alarm is issued, replace the amplifier.
If an overcurrent alarm is not issued, go to (3).
(3) Disconnect the power wires from the amplifier connector, and check the U,V and W wires for isolation from grounding wire sequentially.
If they are isolated from the grounding wire, go to (4), (5).
If any of the power wires is short-circuited to the grounding wire, disconnect the power wires from the motor connector, amd check the U, V, and W terminals of the motor for isolation from the ground terminal sequentially.
If the U, V, W terminal of the motor is short-circuit to the ground terminal, replace the motor.
If they are isolated from the ground terminal, replace the power wires.
(4) Connect the wires again, and observe the motor current (IR, IS) waveforms when the motor is accelerating or decelerating. (See Subsec. I-4.4.2 for how to measure)
If the motor current waveforms are abnormal, replace the amplifier.
(5) Check if noise is induced on the motor current (IR, IS) waveforms.
If there is noise, shield the wires and ground the shielding. If there is no noise, replace the amplifier.
(6) If any of the above five items does not fit the case, the pulse coder, command cable or the hardware inside the CNC is probably defective.</td></tr>
</table>

3.2 CURRENT CONVERSION FAILURE ALARM

(1) Exchange the command cables as shown in the example below.
Turn on CNC in an emergency stage.

If the alarm is issued on the same axis, go to (2).
If the alarm is issued now on the axis that was normal, go to (3).

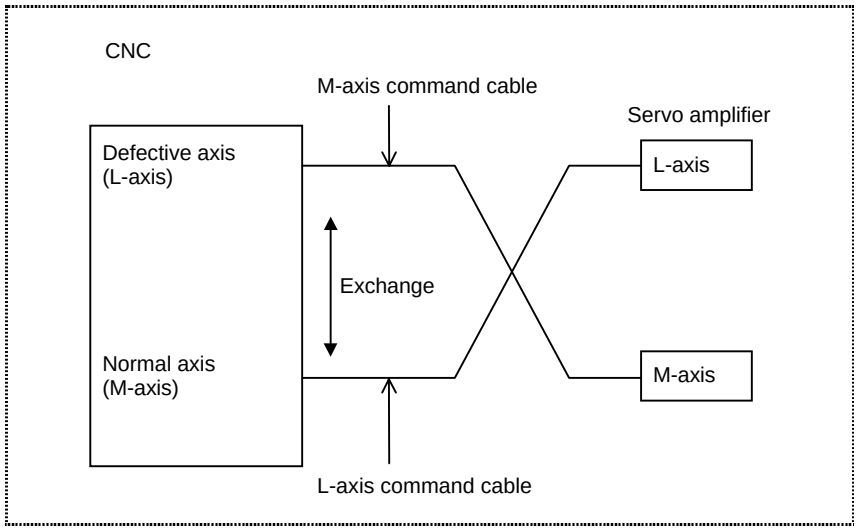
(2) The module for current conversion in the CNC is defective.

(3) Disconnect the command cable from the axis on which the alarm was issued, and connect it to a normal axis.

If the alarm is issued, on the same axis, go to (4).
If the alarm is issued now on the axis that was normal, go to (5).

(4) The servo amplifier is defective.

(5) The command cable is defective. Replace it.



3.3 SERVO SOFTWARE

3.3.1 Servo Adjustment Screen

Cause the servo adjustment screen to appear, and check the position error, actual current, and actual speed it.Using the key on the CNC, enter the required value according to the following procedure.

Series 0-C,16,18,20,21

<SYSTEM> → [SYSTEM] → [▷] → [SV-PRM]

If the servo setting screen does not appear, specify the following parameter, then switch the NC off and on again.

Series 16,18,20,21

	#7	#6	#5	#4	#3	#2	#1	#0
3111								SVS

SVS(#0) = 1 (to display the servo setting screen)

Series 0-C

	#7	#6	#5	#4	#3	#2	#1	#0
389								SVS

SVS(#0) = 0 (to display the servo setting screen)

Servo adjustment			O1000 N0000
X axis			
Func bit	00000000	Alarm1	00000000
Loop gain	3000	Alarm2	00000000
Tuning st	0	Alarm3	10000000
Set period	0	Alarm4	00000000
Int. gain	113	Alarm5	00000000
Prop. gain	-1015	Loop gain	3000
Filter	0	Pos gain	5555
Veloc gain	100	Current(%)	5
		Speed(rpm)	1000

Servo adjustment screen

The cause and detailed information of servo alarms are indicated with alarm 1 to 5.

3.3.2 Overload Alarm

(1) Make sure that the motor is not vibrating.
If a motor vibrates, the current flowing in it becomes more than necessary, resulting in an alarm.

(2) Make sure that the power line to the motor is connected correctly.
If the connection is incorrect, an abnormal current flows in the motor, resulting in an alarm.

(3) Make sure that the following parameters are setted correctly.
An overload alarm is issued based on the result of calculation of these parameters. Be sure to set them to the standard values.

2062	8X62	Overload protection coefficient (OVC1)
2063	8X63	Overload protection coefficient (OVC2)
2065	8X65	Overload protection coefficient (OVCLMT)

(4) Attach the check board (A06B-6071-K290) to connector JX5 to measure the waveform of the actual current (IR and IS) of the servo amplifier unit. Start the motor and measure the actual current (IR and IS).
- If the actual current exceeds 1.4 times the rated current, the constant for the acceleration/ deceleration duration is too small, or the load on the machine is too heavy for the capacity of the motor.
- If the actual current exceeds 1.4 times the rated current during normal operating, the load on the machine is too heavy for the capacity of the motor.

3.3.3 Feedback Disconnected Alarm

This alarm is detailed with alarm 1 and 2 on the servo adjustment screen(⟶ Subsec. 3.3.1).

Alarm 1			Alarm 2	
#7	#2	Alarm details	#7	#4
0	1	CM alarm (α pulse coder)	1	1
0	1	Pulse coder disconnected (soft ware)	0	0
0	1	Separate pulse coder disconnected (hard ware)	1	1

For the CM alarm, go to Subsec 3.3.7.
For soft ware disconnected, go to(1).
For hard ware disconnected, go to(3).

(1) For a full-closed Series 0-C system, make sure that the phase C signal connection is correct, or when the system is not a Series 0-C, go to (2).

(2) If there is a large backlash; or if the number of position feedback pulses divided by the motor one -rotation signal is equal to or less than 640, and a soft ware disconnected alarm is detected when it should not,change the alarm level.

		#7	#6	#5	#4	#3	#2	#1	#0
2003	8X03							TGAL	

TGAL(#1)=1 (the software disconnected alarm level is changed.)

2064	8X64	Soft ware disconnected alarm level(TGALMLV)

Standard value: 4 ⟶ The setting is increased by 4.

(3) If the alarm is a separate detector hardware disconnected alarm, ckeck the specification and wiring of the separate detector.

3.3.4 Motor Overheat Alarm

(1) Check whether the motor has overheated;

WARNING
It is dangerous to touch the motor by the hand or any other part of you body.

If the motor is overheated, use it less frequently.

(2) When the motor is cooled enough, check whether an overheat alarm occurs.
If it occurs, the thermostat is defective.
If not, use the motor less frequently.

3.3.5 Invalid Servo Parameter Setting Parameters

The following table contains actions to be taken for invalid servo parameter setting alarms.

Alarm	Decision criterion	Adjustment item
POA1 overflow	Try resetting POA1 to 0 Parameter: No.8X47-2047=0	Adjustment1
1 pulse suppression level overflow	Disable the pulse suppression function. Function bit:No.8X03-2003, B4=0	Adjustment2
Feed-foward coefficient overflow	Reset the feedfoward coefficient to 0 Parameter: No.8X68-2068=0 No.8X92-2092(advance)=0	Adjustment3
Position gain overflow	Reset the position gain to 0 Parameter: No. 517-1825= 0	Adjustment4
Number of position pulses overflow	The number of position pulses is greater than 13100 (No. 8X00-2000,B0)	Adjustment5
Motor type No.	Check whether the setting is correct. Parameter: No. 8X20-2020	Adjustment6
Invalid axis selection parameter setting	Check whether the axis assignment is correct. Series 0-C: No. 269 to 274 Series 16, 18, 20, 21 Power Mate: No.1023	
Others	Number of position pulses ≤ 0 Number of velocity pulses ≤ 0 Direction of travel = 0 Feed gear numerator ≤ 0, denominator ≤ 0 Numerator > denominator (Serial A, α and semi-closed mode)	

NOTE

The parameter numbers in the table are in the following order:

No. (Series 0-C)-(Series 16, 18, 20, 21)

Survey

If the adjustments described below cannot eliminated overflow, let us work out the setting procedure individually.

Adjustment1: POA1 overflow (No. 8X47-2047)

Use the tenfold POA1 setting function

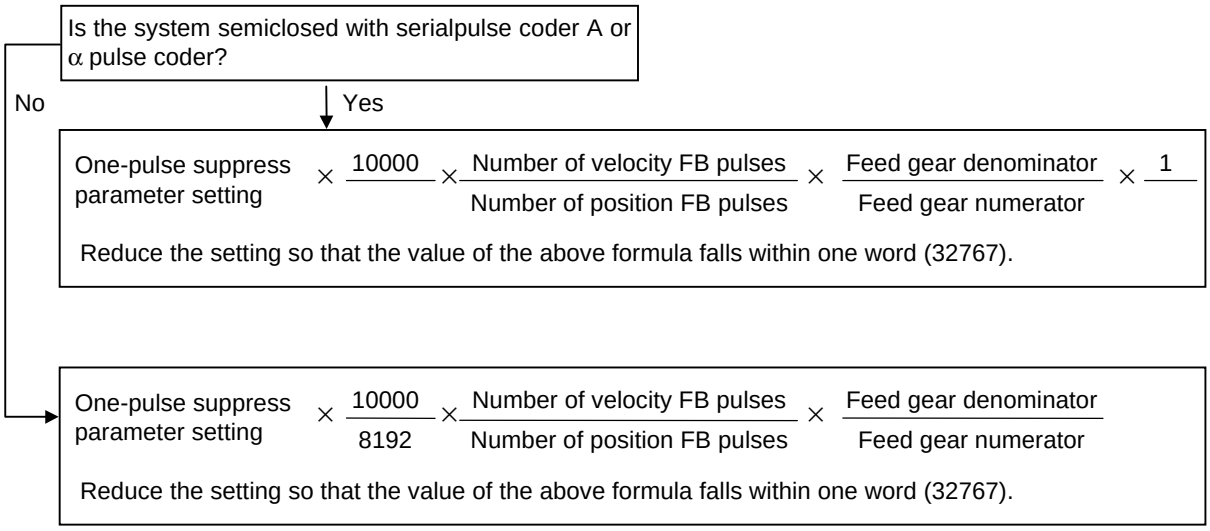
NOTE
This function is available for 9060/L, 9070/C, 9046/A, and later versions.

How to use the tenfold POA1 setting function

If POA1 is specified as a negative value , the absolute value is internally multiplied by 10. If the value you want set is a positive value, specify as follows:
(-1) × the desired setting / 10

Adjustment2: One-pulse suppress (No.2099)

Reduce the setting according to the flowchart shown below. Series 0-C stop using it, because an overflow occurs in the level parameter is fixed at a standard value of 400.



CAUTION
Number of velocity FB pulses (No.8X23-2023)
Number of position FB pulses (No.8X24-2024)
Feed gear numerator (No.8X84-2084)
Feed gear denominator (No.8X85-2085)

Adjustment3: Feed forward coefficient (No.8X68-2068, NO.8X92-2092 (advance))

(9060,9070,9080 Series)

Specify position gain setting range expansion function.
Function bit: No.2000, B4 = 1 (Series 16, 18, 20, 21)

The function also expands the feed-forward coefficient range.

(9046 Series)

If a negative number is specified for the feed-forward coefficient, the internal processing assumes a value ten times the absolute number of the specified number.
If the calculation result obtained during parameter setting exceeds 32767, specify as follows:

(-1) × calculation result / 10

Adjustment4: Position gain

Use the position gain setting range expansion function.

Setting: No.8X11,B5 = 1 (Series 0-C)
Multiply 8X24 by 8 and re-enter it.
No.2000,B4 = 1 (Series 16, 18, 20, 21)

If an overflow still occurs:

1. Multiply the feed gear (or DMR) value by an integer.
2. Increase the following value by the same integer.

Parameter	Series 0-C	Series16, 18, 20, 21
CMR	No.100 to 103	No.1820
Effective area	500 to 503	1826, 1827
Limit to a position error during travel	504 to 507	1828
Limit to a position error at a halt	593 to 596	1829
Backlash	535 to 538	1851, 1852
Reference counter	570 to 573	1821

(Example) To position gain overflows internally under the following conditions:
α pulse coder, Reduction gear ratio: 1/20, Ball screw: 1 mm/rev, Position gain: 30 (with 1μ scale)
In this case, specify the position gain setting range expansion function. For 9046 series, multiply the number of position pulses by 8.

Number of position pulses (No.8X24-1891) 50 → (×8) → 400

Adjustment5: Number of position gain

Make the changes listed below. Value E must satisfy the following:
Number of current position pulses / E < 13100.

Current setting value / E		Current setting value / E	
Series 0-C	Series 16	Series 0-C	Series 16
No.8X23	No.2023	No.8X53	No.2053
8X24	2024	8X74	2074
8X43	2043	8X76	2076
8X44	2044		
8X54	2054		
8X56	2056		
8X57	2057		

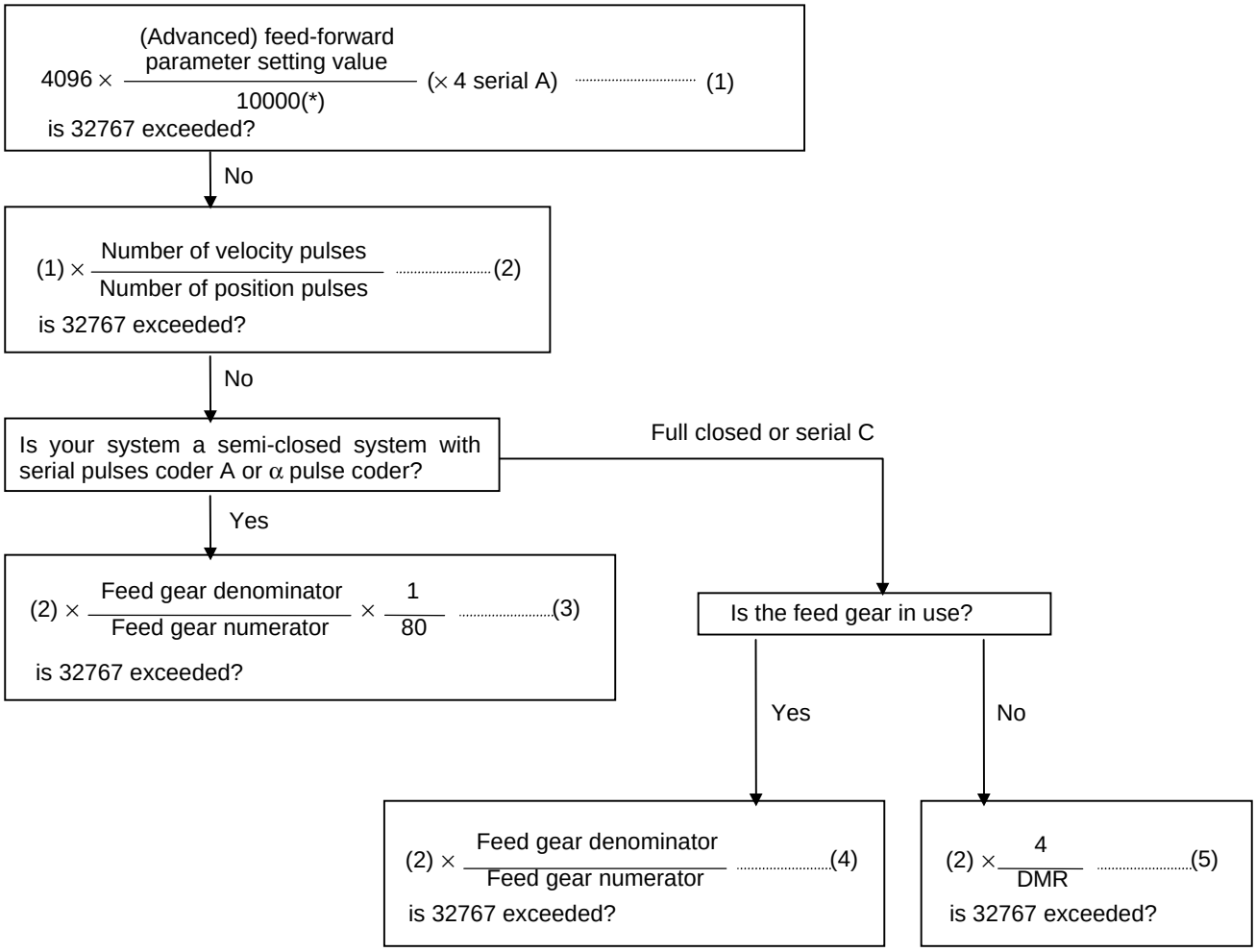
Adjustment6: Motor type No.

The motor type numbers valid for each series of models are listed below.

9046 series	15 to 89 (edition A)
9060 series	15 to 89 (edition K)
	3 to 89 (edition L)
9070 series	3 to 89 (edition C)
9080 series	3 to 93 (edition E)

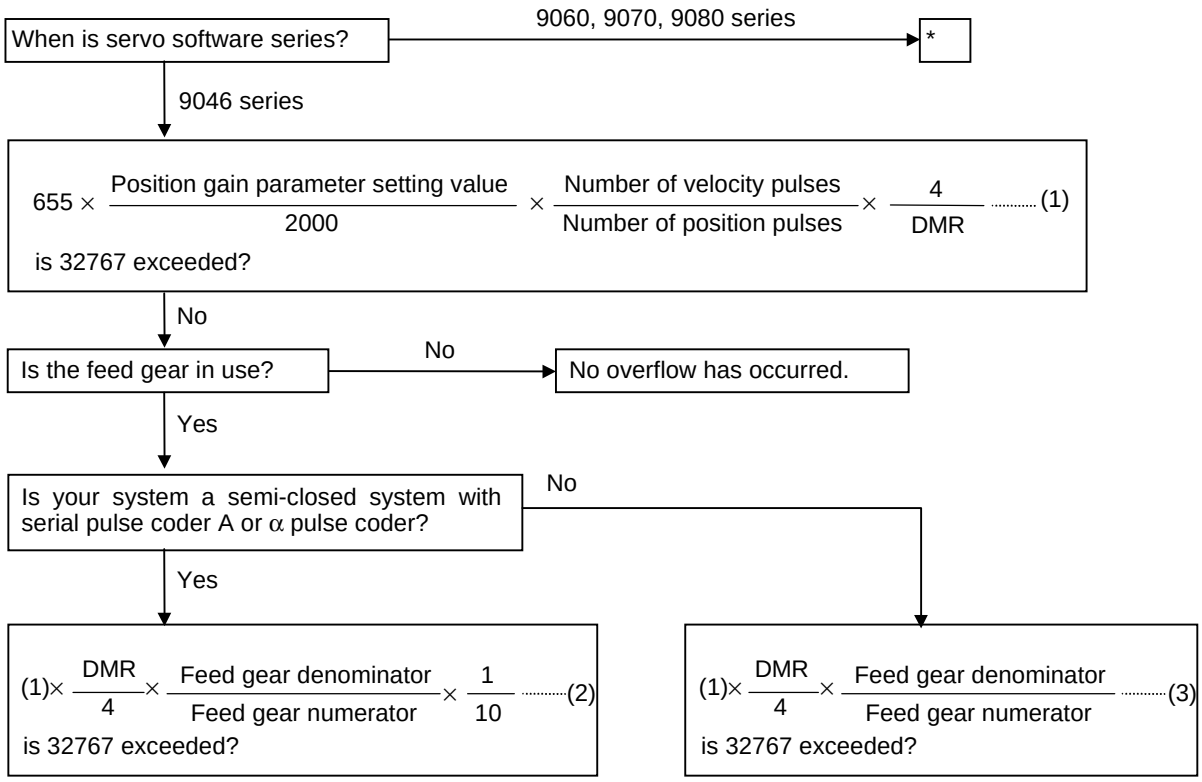
[Reference]
Feed-forward coefficient overflow check (9060, 9070,9080 series)

If the result of any of the following calculations exceed 32767, an overflow occurs.

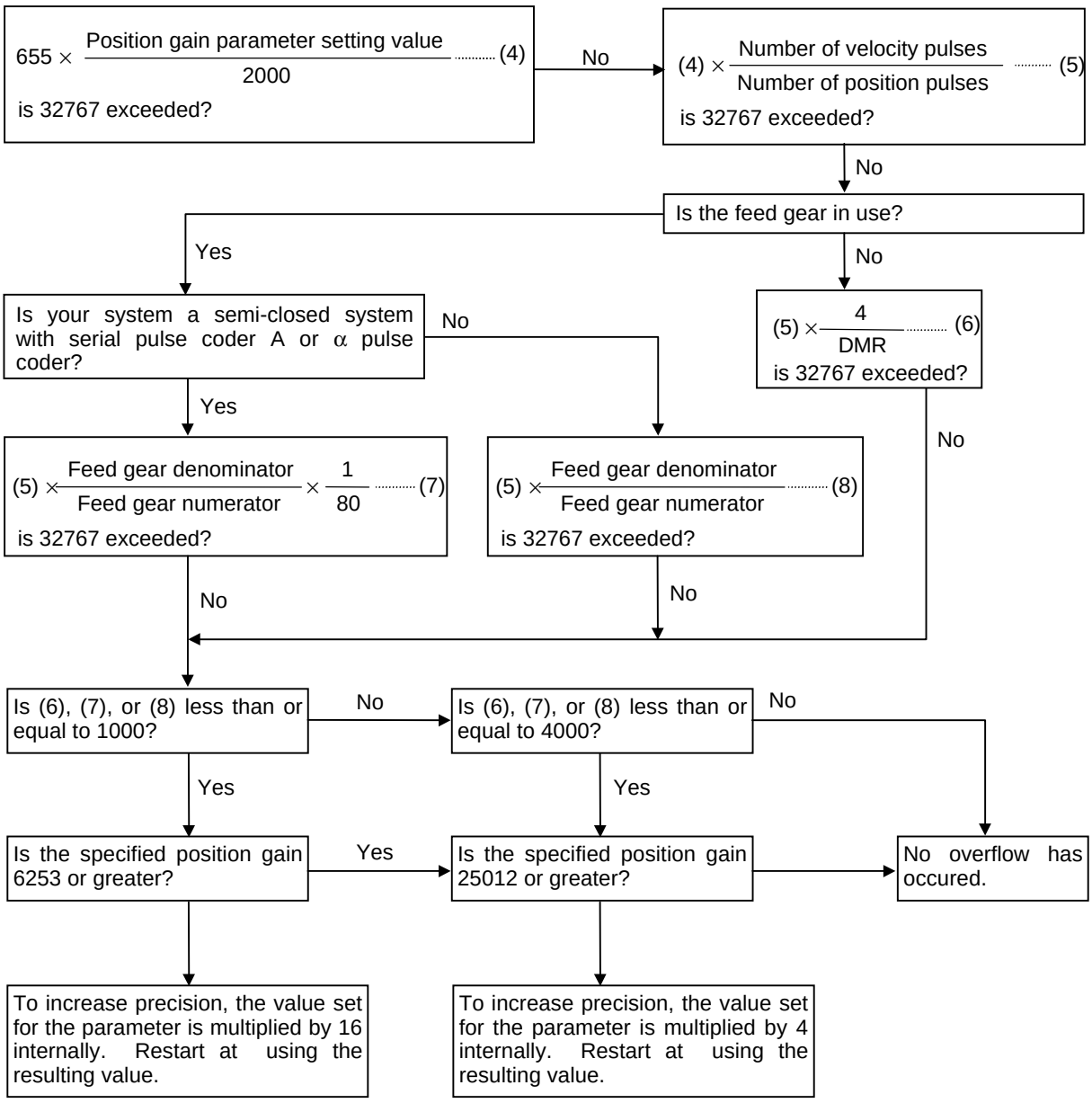


NOTE
If the parameter setting value is 100 or less, use 100 instead of 10000 at a term indicated with *.

Position gain overflow check



* (9060, 9070, 9080 series)



3.3.6 Pulse Coder Error Alarm

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm 3		CSAL	BLAL	PHAL		BZAL	CKAL	SPH

(See Subsec. 3.3.1)

		Whether the alarm occurs in each pulse coder	
		α pulse coder	Serial A
SPH (#0)	Probably, pulse coder or feedback cable is abnormal, or noise	○	○
CKAL (#1)	For serial pulse coder A, a clock alarm has occured. For α pulse coder, the pulse coder or feedback cable is abnormal.	×	○
BZAL (#2)	The voltage of the pulse coder battery is 0V. Replace the battery and cause a return to the reference position.	○	○
PHAL (#4)	Pulse coder or feedback cable is abnormal	×	○
BLAL (#5)	The voltage of the pulse coder battery is dropping. (warning)	○	○
CSAL (#6)	For serial pulse coder A, a check sum alarm has occured. For α pulse coder, an LED error has occured.	×	○
(#7)	This is not an alarm.		

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm 5				LDAL	PMAL			

(See Subsec. 3.3.1)

PMAL (#3)	The pulse coder or feedback cable is abnormal.	○	×
LDAL (#4)	The pulse coder LED is abnormal.	○	×

3.3.7 Rotation Speed Data Error Alarm

Serial pulse coder A

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm 3					RCAL			

(See Subsec. 3.3.1)

RCAL (#3) A rotation speed data error alarm occurred.

α pulse coder

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm 1							FBAL	
Alarm 2	ALDF							
Alarm 3					CMAL			

(See Subsec. 3.3.1)

CMAL (#3) A pulse count error occurred. If the CNC software does not correspond to α series, this bit is not used for a mode other than the APC MODE. If a built-in pulse coder hardware discontinued alarm (#1 of alarm 1 = 1 and #7 of alarm 2 = 1) occurs in a system with an α pulse coder, a pulse count error has occurred.

3.3.8 Pulse Coder Communication Error Alarm

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm 4	DTER	CRC	STB					

(See Subsec. 3.3.1)

STB (#5) A communication error occurred from the pulse coder. The pulse coder or feedback cable is abnormal, or the servo unit is defective.

CRC (#6) A communication error occurred from the pulse coder. The pulse coder or feedback cable is abnormal, or the servo unit is defective.

DTER(#7) The pulse coder does not communicate. The pulse coder or feedback cable is abnormal.

4 REPLACING THE FUSE

WARNING

When replacing the fuse, keep the power supply switched off. Also make sure that the "CHARGING" LED (red) on the servo amplifier front panel is off.

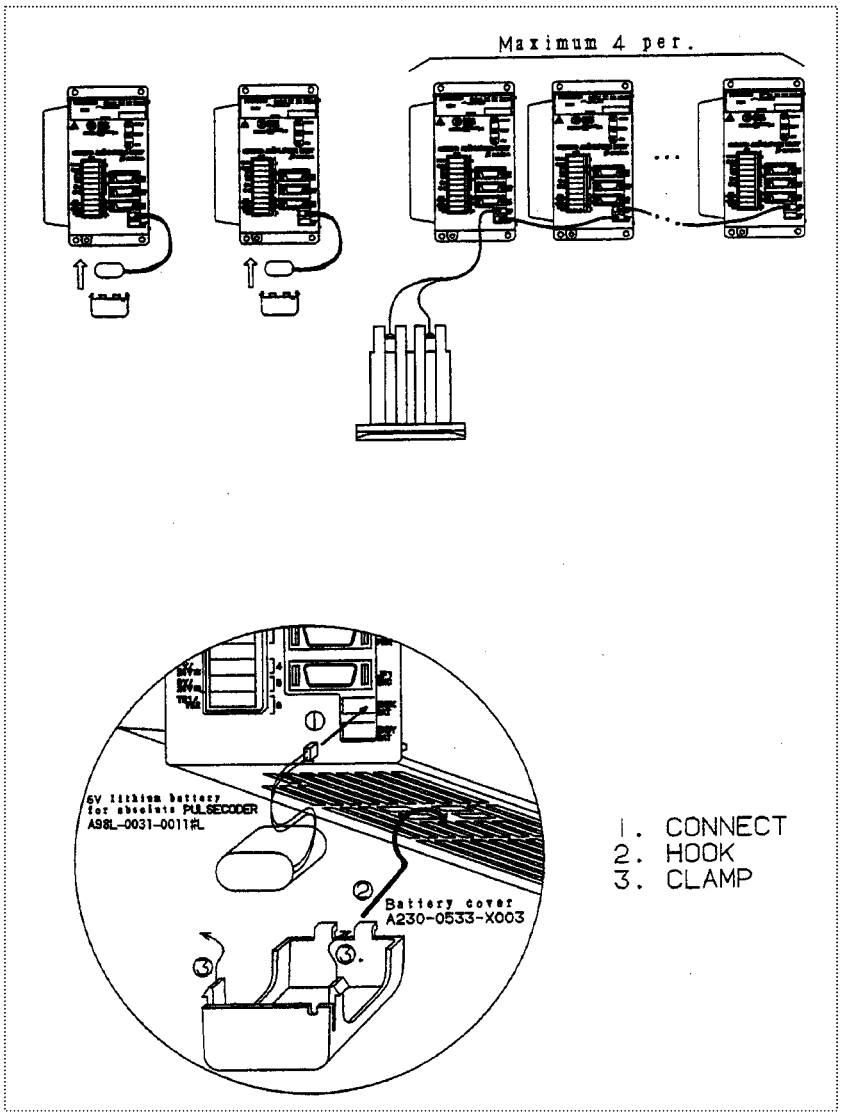
Replacement procedure

1 Remove the plastic cover.
2 Replace the fuse near the connector (CX11) on the P.C.B. (A20B-2100-0130 to -0131). (See Appendix A.)

Use	Name	Qty.	Specification
For control power supply	F600	1	FANUC: A06B-6073-K250 MAKER: LM32, DC48V, F3.2A Daito

5 CONNECTING THE BATTERY FOR AN ABSOLUTE PULSE CODER

Use of an absolute pulse coder requires a battery. The way the battery is connected varies with two types. Refer to FANUC SERVO MOTOR β series Descriptions (B-65232EN) for the details of connecting.



III. MOTOR MAINTENANCE

1 AC SERVO MOTOR MAINTENANCE

Generally, β series servo motors have no parts that wear out or that must be replaced periodically, unlike DC servo motors, which have brushes that must be replaced periodically.
However, you should perform periodic maintenance for servo motors so as to keep their initial performance as long as possible and to prevent breakdowns. Therefore, we recommend that you inspect the servo motors periodically according to the descriptions given below.

1.1 RECEIVING AND KEEPING AC SERVO MOTORS

When you receive an β series servo motor, make sure that:

- The motor is exactly the one you ordered, in terms of model, shaft, and detector specifications.
- No damage has been caused to the motor.
- The shaft can be rotated by the hand normally.
- The brake works normally.
- There are no loose bolts or screws.

The servo motors should be kept indoors as a rule. The storage temperature range is -20 to +60°C.
Do not place or install β series servo motors in the place where:

- It is extremely humid and dew is prone to form.
- There is a steep change in temperature.
- There is constant vibration, which may cause damage to the shaft bearings.
- There is excessive dust or trash.

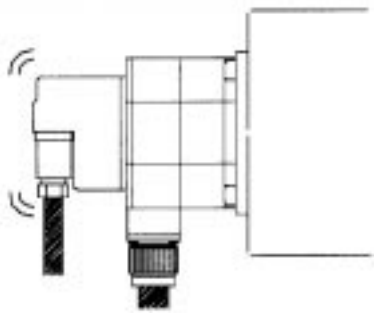
Because FANUC inspects servo motors strictly before shipment, you do not have to inspect them when you receive them.

1.2 DAILY INSPECTION OF AC SERVO MOTORS

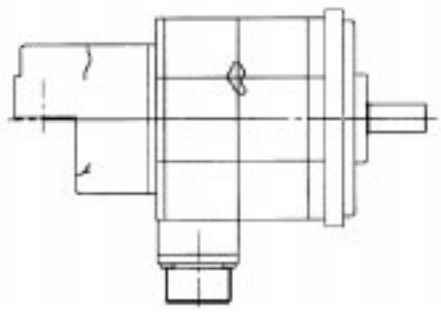
Before starting operation, or periodically (once a week or month), you should inspect the β series servo motors in terms of the following:

(1) Vibration and noise
Check the motor for abnormal vibration and noise when the motor is:
- Not rotating
- Rotating at low speed
- Accelerating or decelerating

If you find anything unusual, contact your FANUC service staff.



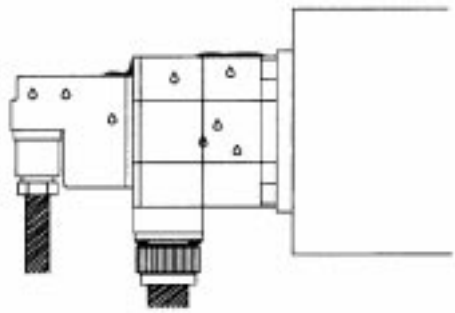
(2) Damage on the outside
Check the motor cover (plastic : red) for crevices and the motor surface (black coating) for scratches and cracks.
If you find crevices, scratches and cracks on the motor, we recommend repair or replace the motors.
If you are not clear about replacing the motor, contact your FANUC service staff.



(3) Stains and smudges

Check the motor surface and bolt holes for oil or cutting fluid. Oil or cutting fluid can damage the coating by chemical reaction, possibly leading to a failure. Therefore, wipe off oil and cutting fluid on the motor surface periodically.

If the motor contains a large quantitius of oil or cutting fluid, check how such a liquid leaks onto the motor, and how the motor is protected from oil or cutting fluid (covering the motor and so on)



(4) Insulation resistance

Check the insulation resistance between motor coil and motor frame with insulation-resistance tester(500VDC). Insulation level is following the below table.

Value of insulation resistance	Judgement
100M Ω or more	Good.
10 to 100M Ω	Caution. Check the insulation level at every morning, or replace the motor.
1 to 10M Ω	Warning. Check the insulation level at every morning, or replace the motor.
less than 1M Ω	No good. Replace the motor.

(5) Observation of torque command (TCMD) and velocity command (VCMD) waveforms

Observe the normal voltage waveforms with an oscilloscope, and keep notes of them. During periodic inspection, check the current waveforms with the records.

The waveforms vary according to the operating conditions such as load and cutting speed.

Note that you should make comparisons under the same condition (during fast traverse to the reference position, low-speed cutting and so on).

See descriptions on the servo check board in Chapter I-5 for detailed inspection procedures.

(6) Overheating
Attach a thermolabel on the motor surface and check it visually to see if the motor becomes too hot during normal operation.

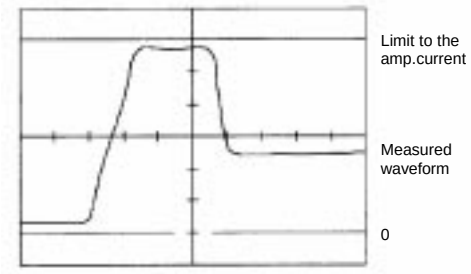
WARNING
Temperature on the motor surface can exceed 80°C under some conditions. Therefore, never touch the motor during operation.

1.3 PERIODIC INSPECTION OF β SERIES MOTOR

We recommend that you inspect the series motor for the following items at least once a year.

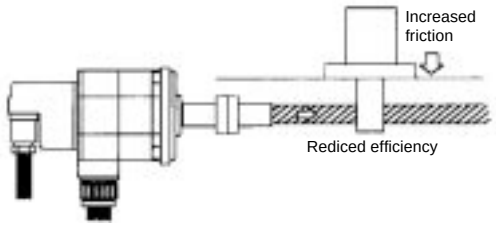
(1) Observation of torque command (TCMD) and velocity command (VCMD) waveforms
Observe the normal voltage waveforms with an oscilloscope, and keep notes of them. During periodic inspection, check the current waveforms with the records.
The waveforms vary according to the operating conditions such as load and cutting speed. Note that you should make comparisons under the same condition (during fast traverse to the reference position, low-speed cutting and so on).
See descriptions on the servo check board in I-5 for detailed inspection procedures.

(2) Diagnosis by waveforms
Check the measured waveforms to see whether:
1) The peak current is within the limit to current in the amplifier.
The reason, if the peak current is increasing, is presumed to be:
– Change the load condition in the machine
– Motor failure



The load condition in the machine is changed to the following reasons.

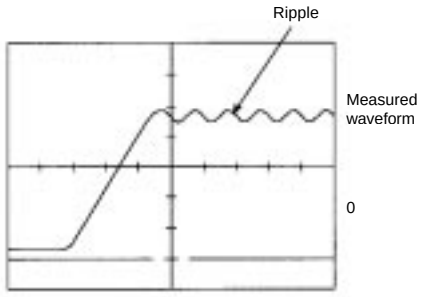
– The machine friction is increased for a long time.
– Reduced efficiency.



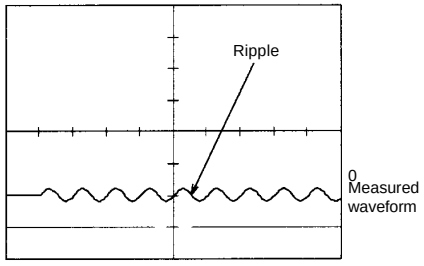
The limit to the amplifier current is listed below.

β1/3000, β2/3000, β0.5/3000, α1/3000, α2/2000, α2/3000	12Apeak
β3/3000, β6/2000, αC3/2000, αC6/2000, αC12/2000	20Apeak

2) The waveforms has ripple during constant - speed feeling.



3) The current waveform has ripple or jumps when the motor is not rotating



If you find anything unusual in relation to the above items, contact your FANUC service staff.

1.4 REPLACING THE PULSE CODER

The pulse coder in the β series servo motor is mounted on the motor shaft directly. Therefore, can not replace the pulse coder. When the pulse coder is detective, replace the motor.

1.5 REPLACEMENT PARTS SPECIFICATION

Listed below are the maintenance arrangement numbers.

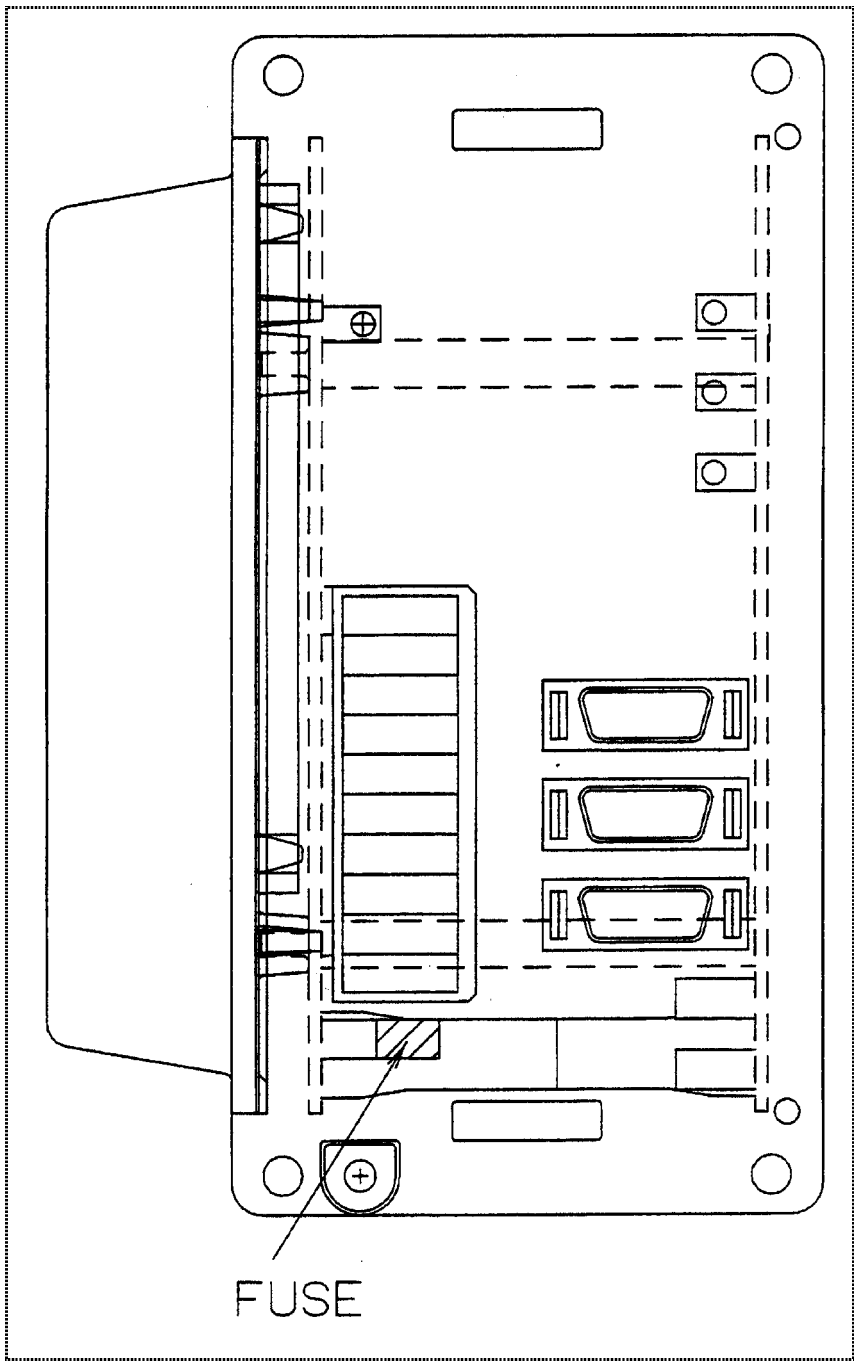
(1) Oil seal (Maker : NOK Corporation)

Motor model	Oil seal specification (Maker specification)
β 0.5/3000	A98L-0001-0135/C0514E5 (AC0514E5 SC type)
β 1/3000, β 2/300 α 1/3000, α 2/2000, α 2/3000	A98L-0001-0135/C0616E2 (AC0616E2 SC type)
β 3/3000, β 6/2000, α C3/2000 α C6/2000	A98L-0004-0249/A1188RX (BC3554E1)
α C12/2000	A98L-0004-0249/A1189RX (BC3555E1)

APPENDIX

A SERVO AMPLIFIER UNIT FRONT PANEL

Identify connector etc.



B MOTOR PARAMETER LIST

9041, 9046 series

	Motor model				2-0SP/3	1-0SP	1-0SP/3	α 0.5	α E1/3	α E2/3	α E3/2	α E6/2
	Motor specification				371	372	373	0113	0101	0102	0105	0106
	Motor model	α C3	α C6	α C12	α 1/3	α 2/2	α 2/3	β 0.5	β 1/3	β 2/3	β 3/3	β 6/2
	Motor specification	0121	0126	0141	0371	0372	0373	0113	0031	0032	0033	0034
	Motor type	7	8	9	61	46	62	13	35	36	33	34
Symbol	Parameter No.											
	FS0-C											
	8□03	00001000	00001000	00001000	00001000	00000000	00001000	00001000	00001100	00001100	00001100	00001100
	8□04	00000110	00000110	00000110	01000110	01000110	01000110	00000110	00000110	00000110	00000110	01000110
	8□05	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000100	00000100	00000100	00000100
	8□06	01000100	01000100	01000000	01000100	00000000	01000100	01000100	01000000	01000000	01000000	01000000
	8□10	00000010	00000010	00000010	00000000	00000000	00000000	00000010	00000000	00000010	00000010	00000010
PK1	8□40	1600	1800	3000	390	1170	450	220	359	704	275	990
PK2	8□41	−5059	−6105	−9750	−1053	−2289	−900	−540	−1129	−2401	−1006	−3544
PK3	8□42	−2608	−2641	−2687	−2480	−2485	−2503	−2556	−2564	−2596	−2622	−2632
PK1V	8□43	107	127	251	111	91	128	9	102	62	144	144
PK2V	8□44	−955	−1140	−2245	−997	−812	−1146	−79	−916	−1111	−2587	−2587
PK3V	8□45	0	0	0	0	0	0	0	0	0	0	0
PK4V	8□46	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235
POA1	8□47	3974	3329	1690	3806	4674	3311	−4789	4141	3415	1467	1467
BLCMP	8□48	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□49	0	0	0	0	0	0	0	0	0	0	0
POK1	8□50	956	956	956	956	956	956	956	956	956	956	956
POK2	8□51	510	510	510	510	510	510	510	510	510	510	510
RESERV	8□52	3843	3844	3842	0	0	0	3844	0	3072	3840	3072
PPMAX	8□53	21	21	21	21	21	21	21	21	21	21	21
PDDP	8□54	1894	1894	1894	3787	3787	3787	1894	1894	1894	1894	3787
PHYST	8□55	319	319	319	319	319	319	319	319	319	319	319
EMFCMP	8□56	3046	4381	4000	2800	2147	2520	1200	2500	3300	3000	3200
PVPA	8□57	2100	1800	2400	2330	1864	2330	2000	2100	2700	3200	2000
PALPH	8□58	42	48	42	57	46	57	77	71	78	80	57
PPBAS	8□59	5	5	5	5	0	5	5	5	5	5	5
TQLIM	8□60	7282	7282	7282	7282	7282	7282	7282	7282	7282	7282	7282
EMFLMT	8□61	120	120	120	120	120	120	120	120	120	120	120
POVC1	8□62	32686	32637	32412	32623	32627	32519	32585	32617	32540	32456	32456
POVC2	8□63	1030	1636	4446	1811	1766	3112	2288	1884	2850	3897	3897
TGALMLV	8□64	4	4	4	4	4	4	4	4	4	4	4
POVCLMT	8□65	3056	4858	13245	5377	5245	9256	6797	5594	8474	11600	11600
PK2VAUX	8□66	0	0	0	0	0	0	0	0	0	0	0
FILTER	8□67	0	0	0	0	0	0	0	0	0	0	0
FALPH	8□68	0	0	0	0	0	0	0	0	0	0	0
VFFLT	8□69	0	0	0	0	0	0	0	0	0	0	0
ERBLM	8□70	0	0	0	0	0	0	0	0	0	0	0
PBLCT	8□71	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□72	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□73	0	0	0	0	0	0	0	0	0	0	0
AALPH	8□74	4000	4000	0	1680	0	2940	1000	0	0	0	0
MODEL	8□75	0	0	0	0	0	0	0	0	0	0	0
WKAC	8□76	0	0	0	0	0	0	0	0	0	0	0
OSCTPL	8□77	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□78	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□79	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□80	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□81	0	0	0	0	0	0	0	0	0	0	0
BLENDL	8□82	0	0	0	0	0	0	0	0	0	0	0
MOFCTL	8□83	0	0	0	0	0	0	0	0	0	0	0
SDMR1	8□84	0	0	0	0	0	0	0	0	0	0	0
SDMR2	8□85	0	0	0	0	0	0	0	0	0	0	0
RTCURR	8□86	1286	1622	2678	1706	1685	2239	1918	1740	2142	2506	2506
TDPLD	8□87	0	0	0	0	0	0	0	0	0	0	0
MCNFB	8□88	0	0	0	0	0	0	0	0	0	0	0
BLBSL	8□89	0	0	0	0	0	0	0	0	0	0	0
ROBSTL	8□90	0	0	0	0	0	0	0	0	0	0	0
ACCSPL	8□91	0	0	0	0	0	0	0	0	0	0	0
ADFF1	8□92	0	0	0	0	0	0	0	0	0	0	0
VMPK3V	8□93	0	0	0	0	0	0	0	12923	14203	12923	12923
BLCMP2	8□94	0	0	0	0	0	0	0	0	0	0	0
AHDRTL	8□95	0	0	0	0	0	0	0	0	0	0	0
RADUSL	8□96	0	0	0	0	0	0	0	0	0	0	0
RESERV	8□97	0	0	0	0	0	0	0	0	0	0	0
DEPVPL	8□98	12800	17920	17920	50	0	0	5160	80	−2786	−1476	30
ONEPSL	8□99	400	400	400	400	400	400	400	400	400	400	400

9060, 9064, 9070 series

	Motor model				2-0SP/3	1-0SP	1-0SP/3	α 0.5	α E1/3	α E2/3	α E3/2	α E6/2
	Motor specification				371	372	373	0113	0101	0102	0105	0106
	Motor model	α C3	α C5	α C12	α 1/3	α 2/2	α 2/3	β 0.5	β 1/3	β 2/3	β 3/3	β 6/2
	Motor specification	0121	0126	0141	0371	0372	0373	0113	0031	0032	0033	0034
	Motor type	7	8	9	61	46	62	13	35	36	33	34
Symbol	Parameter No. FS16,PM,etc											
	2003	00001000	00001000	00001000	00001000	00000000	00001000	00001000	00001100	00001100	00001100	00001100
	2004	00000110	00000110	00000110	01000110	01000110	01000110	00000110	00000110	00000110	00000110	01000110
	2005	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000100	00000100	00000100	00000100
	2006	01000100	01000100	01000000	01000100	00000000	01000100	01000100	01000000	01000000	01000000	01000000
	2011	00100000	00100000	00100000	00000000	00000000	00000000	00100000	00000000	00100000	00100000	00100000
PK1	2040	1600	1800	3000	390	1170	450	220	359	704	275	990
PK2	2041	−5059	−6105	−9750	−1053	−2289	−900	−540	−1129	−2401	−1006	−3544
PK3	2042	−2608	−2641	−2687	−2480	−2485	-2503	−2556	−2564	−2596	−2622	−2632
PK1V	2043	107	127	251	111	91	128	9	102	62	144	144
PK2V	2044	−955	−1140	−2245	−997	−812	−1146	−79	−916	−1111	−2587	−2587
PK3V	2045	0	0	0	0	0	0	0	0	0	0	0
PK4V	2046	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235
POA1	2047	3974	3329	1690	3806	4674	3311	-4789	4141	3415	1467	1467
BLCMP	2048	0	0	0	0	0	0	0	0	0	0	0
RESERV	2049	0	0	0	0	0	0	0	0	0	0	0
POK1	2050	956	956	956	956	956	956	956	956	956	956	956
POK2	2051	510	510	510	510	510	510	510	510	510	510	510
RESERV	2052	0	0	0	0	0	0	0	0	0	0	0
PPMAX	2053	21	21	21	21	21	21	21	21	21	21	21
PDDP	2054	1894	1894	1894	3787	3787	3787	1894	1894	1894	1894	3787
PHYST	2055	319	319	319	319	319	319	319	319	319	319	319
EMFCMP	2056	3046	4381	4000	2800	2147	2520	1200	2500	3300	3000	3200
PVPA	2057	2100	1800	2400	2330	1864	2330	2000	2100	2700	3200	2000
PALPH	2058	42	48	42	57	46	57	77	71	78	80	57
PPBAS	2059	5	5	5	5	0	5	5	5	5	5	5
TQLIM	2060	7282	7282	7282	7282	7282	7282	7282	7282	7282	7282	7282
EMFLMT	2061	120	120	120	120	120	120	120	120	120	120	120
POVC1	2062	32686	32637	32412	32623	32627	32519	32585	32617	32540	32456	32456
POVC2	2063	1030	1636	4446	1811	1766	3112	2288	1884	2850	3897	3897
TGALMLV	2064	4	4	4	4	4	4	4	4	4	4	4
POVCLMT	2065	3056	4858	13245	5377	5245	9256	6797	5594	8474	11600	11600
PK2VAUX	2066	0	0	0	0	0	0	0	0	0	0	0
FILTER	2067	0	0	0	0	0	0	0	0	0	0	0
FALPH	2068	0	0	0	0	0	0	0	0	0	0	0
VFFLT	2069	0	0	0	0	0	0	0	0	0	0	0
ERBLM	2070	0	0	0	0	0	0	0	0	0	0	0
PBLCT	2071	0	0	0	0	0	0	0	0	0	0	0
RESERV	2072	0	0	0	0	0	0	0	0	0	0	0
RESERV	2073	0	0	0	0	0	0	0	0	0	0	0
AALPH	2074	16288	20384	8192	1680	0	2940	17384	0	0	0	0
MODEL	2075	0	0	0	0	0	0	0	0	0	0	0
WKAC	2076	0	0	0	0	0	0	0	0	0	0	0
OSCTPL	2077	0	0	0	0	0	0	0	0	0	0	0
RESERV	2078	0	0	0	0	0	0	0	0	0	0	0
RESERV	2079	0	0	0	0	0	0	0	0	0	0	0
RESERV	2080	0	0	0	0	0	0	0	0	0	0	0
RESERV	2081	0	0	0	0	0	0	0	0	0	0	0
BLENDL	2082	0	0	0	0	0	0	0	0	0	0	0
MOFCTL	2083	0	0	0	0	0	0	0	0	0	0	0
SDMR1	2084	0	0	0	0	0	0	0	0	0	0	0
SDMR2	2085	0	0	0	0	0	0	0	0	0	0	0
RTCURR	2086	1286	1622	2678	1706	1685	2239	1918	1740	2142	2506	2506
TDPLD	2087	0	0	0	0	0	0	0	0	0	0	0
MCNFB	2088	0	0	0	0	0	0	0	0	0	0	0
BLBSL	2089	0	0	0	0	0	0	0	0	0	0	0
ROBSTL	2090	0	0	0	0	0	0	0	0	0	0	0
ACCSPL	2091	0	0	0	0	0	0	0	0	0	0	0
ADFF1	2092	0	0	0	0	0	0	0	0	0	0	0
VMPK3V	2093	0	0	0	0	0	0	0	0	0	0	0
BLCMP2	2094	0	0	0	0	0	0	0	0	0	0	0
AHDRTL	2095	0	0	0	0	0	0	0	0	0	0	0
RADUSL	2096	0	0	0	0	0	0	0	0	0	0	0
RESERV	2097	0	0	0	0	0	0	0	0	0	0	0
DEPVPL	2098	12800	17920	17920	50	0	0	5160	80	−2786	−1476	30
ONEPSL	2099	400	400	400	400	400	400	400	400	400	400	400
INPA1	2100	0	0	0	0	0	0	0	0	0	0	0
INPA2	2101	0	0	0	0	0	0	0	0	0	0	0
DBLIM	2102	15000	15000	15000	0	0	0	15000	0	12000	15000	12000
ABVOF	2103	0	0	0	0	0	0	0	0	0	0	0
ABTSH	2104	0	0	0	0	0	0	0	0	0	0	0
TRQCST	2105	205	326	395	51	104	74	29	51	83	107	215
LP24PA	2106	0	0	0	0	0	0	0	12923	14203	12923	12923

9066, 9080 series

	Motor model				2-0SP/3	1-0SP	1-0SP/3	α 0.5	α E1/3	α E2/3	α E3/2	α E6/2
	Motor specification				371	372	373	0113	0101	0102	0105	0106
	Motor model	α C3	α C6	α C12	α 1/3	α 2/2	α 2/3	β 0.5	β 1/3	β 2/3	β 3/3	β 6/2
	Motor specification	0121	0126	0141	0371	0372	0373	0113	0031	0032	0033	0034
	Motor type	7	8	9	61	46	62	13	35	36	33	34
Symbol	Parameter No. FS16-C, 18-C											
	2003	00001000	00001000	00001000	00001000	00000000	00001000	00001000	00001100	00001100	00001100	00001100
	2004	00000110	00000110	00000110	01000110	01000110	01000110	00000110	00000110	00000110	00000110	01000110
	2005	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000100	00000100	00000100	00000100
	2006	01000100	01000100	01000000	01000100	00000000	01000100	01000100	01000000	01000000	01000000	01000000
	2011	00100000	00000000	00000000	00000000	00000000	00000000	00100000	00000000	00100000	00100000	00100000
PK1	2040	1600	1800	3000	390	1170	450	220	359	704	629	990
PK2	2041	−5059	−6105	−9750	−1053	−2289	−900	−540	−1129	−2401	−2093	−3544
PK3	2042	−2608	−2641	−2687	−2480	−2485	−2503	−2556	−2564	−2596	−2622	−2632
PK1V	2043	107	127	251	111	91	128	9	102	62	144	144
PK2V	2044	−955	−1140	−2245	−997	−812	−1146	-79	−916	−1111	−2587	−2587
PK3V	2045	0	0	0	0	0	0	0	0	0	0	0
PK4V	2046	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235	−8235
POA1	2047	3974	3329	1690	3806	4674	3311	−4789	4141	3415	1467	1467
BLCMP	2048	0	0	0	0	0	0	0	0	0	0	0
RESERV	2049	0	0	0	0	0	0	0	0	0	0	0
POK1	2050	956	956	956	956	956	956	956	956	956	956	956
POK2	2051	510	510	510	510	510	510	510	510	510	510	510
RESERV	2052	0	0	0	0	0	0	0	0	0	0	0
PPMAX	2053	21	21	21	21	21	21	21	21	21	21	21
PDDP	2054	1894	1894	1894	3787	3787	3787	1894	1894	1894	1894	3787
PHYST	2055	319	319	319	319	319	319	319	319	319	319	319
EMFCM	2056	3046	4381	4000	2800	2147	2520	1200	2500	3300	3000	3200
PVPA	2057	−6405	−4630	−3094	2330	1864	2330	2000	2100	−9229	−8208	−5136
PALPH	2058	−250	−2500	−4000	57	46	57	77	71	−1820	−2080	−1600
PPBAS	2059	5	5	5	5	0	5	5	5	5	5	5
TQLIM	2060	7282	7282	7282	7282	7282	7282	7282	7282	7282	7282	7282
EMFLM	2061	120	120	120	120	120	120	120	120	120	120	120
POVC1	2062	32686	32637	32412	32623	32627	32519	32585	32617	32540	32456	32456
POVC2	2063	1030	1636	4446	1811	1766	3112	2288	1884	2850	3897	3897
TGALML	2064	4	4	4	4	4	4	4	4	4	4	4
POVCLM	2065	3056	4858	13245	5377	5245	9256	6797	5594	8474	11600	11600
PK2VAU	2066	0	0	0	0	0	0	0	0	0	0	0
FILTER	2067	0	0	0	0	0	0	0	0	0	0	0
FALPH	2068	0	0	0	0	0	0	0	0	0	0	0
VFFLT	2069	0	0	0	0	0	0	0	0	0	0	0
ERBLM	2070	0	0	0	0	0	0	0	0	0	0	0
PBLCT	2071	0	0	0	0	0	0	0	0	0	0	0
RESERV	2072	0	0	0	0	0	0	0	0	0	0	0
RESERV	2073	0	0	0	0	0	0	0	0	0	0	0
AALPH	2074	16288	20384	8192	1680	0	2940	17384	0	0	0	0
MODEL	2075	0	0	0	0	0	0	0	0	0	0	0
WKAC	2076	0	0	0	0	0	0	0	0	0	0	0
OSCTPL	2077	0	0	0	0	0	0	0	0	0	0	0
RESERV	2078	0	0	0	0	0	0	0	0	0	0	0
RESERV	2079	0	0	0	0	0	0	0	0	0	0	0
RESERV	2080	0	0	0	0	0	0	0	0	0	0	0
RESERV	2081	0	0	0	0	0	0	0	0	0	0	0
BLENDL	2082	0	0	0	0	0	0	0	0	0	0	0
MOFCTL	2083	0	0	0	0	0	0	0	0	0	0	0
SDMR1	2084	0	0	0	0	0	0	0	0	0	0	0
SDMR2	2085	0	0	0	0	0	0	0	0	0	0	0
RTCURR	2086	1286	1622	2678	1706	1685	2239	1918	1740	2142	2506	2506
TDPLD	2087	0	0	0	0	0	0	0	0	0	0	0
MCNFB	2088	0	0	0	0	0	0	0	0	0	0	0
BLBSL	2089	0	0	0	0	0	0	0	0	0	0	0
ROBSTL	2090	0	0	0	0	0	0	0	0	0	0	0
ACCSPL	2091	0	0	0	0	0	0	0	0	0	0	0
ADFF1	2092	0	0	0	0	0	0	0	0	0	0	0
VMPK3V	2093	0	0	0	0	0	0	0	0	0	0	0
BLCMP2	2094	0	0	0	0	0	0	0	0	0	0	0
AHDRTL	2095	0	0	0	0	0	0	0	0	0	0	0
RADUSL	2096	0	0	0	0	0	0	0	0	0	0	0
RESERV	2097	0	0	0	0	0	0	0	0	0	0	0
DEPVPL	2098	12800	17920	17920	50	0	0	5160	80	−2786	−1476	30
ONEPSL	2099	400	400	400	400	400	400	400	400	400	400	400
INPA1	2100	0	0	0	0	0	0	0	0	0	0	0
INPA2	2101	0	0	0	0	0	0	0	0	0	0	0
DBLIM	2102	15000	0	0	0	0	0	15000	0	12000	15000	12000
ABVOF	2103	0	0	0	0	0	0	0	0	0	0	0
ABTSH	2104	0	0	0	0	0	0	0	0	0	0	0
TRQCST	2105	205	326	395	51	104	74	29	51	83	107	215
LP24PA	2106	0	0	0	0	0	0	0	12923	14203	12923	12923
VLGOVR	2107	0	0	0	0	0	0	0	0	0	0	0
RESERV	2108	0	0	0	0	0	0	0	0	0	0	0
BELLTC	2109	0	0	0	0	0	0	0	0	0	0	0
MGSTC	2110	16	24	16	0	0	0	0	0	3867	0	3382
DETQLM	2111	0	5220	0	0	0	0	0	7784	7868	7799	3120
AMRDM	2112	0	0	0	0	0	0	0	0	0	0	0
NFILT	2113	0	0	0	0	0	0	0	0	0	0	0
NINTCT	2127	2729	3326	4520	0	0	0	0	0	0	0	0
MFWKC	2128	4000	6500	6000	0	0	0	0	0	0	0	0
MFWKB	2129	1048	1047	785	0	0	0	0	0	0	0	0
LP2GP	2130	0	0	0	0	0	0	0	0	0	0	0
LP4GP	2131	0	0	0	0	0	0	0	0	0	0	0
LP6GP	2132	0	0	0	0	0	0	0	0	0	0	0

C FSSB

C.1 GENERAL

The β series SERVO AMPLIFIER UNIT with FSSB is used with the new optical interface FSSB.
The specifications of this β series amplifier is same that of the current SVU except for the interface.

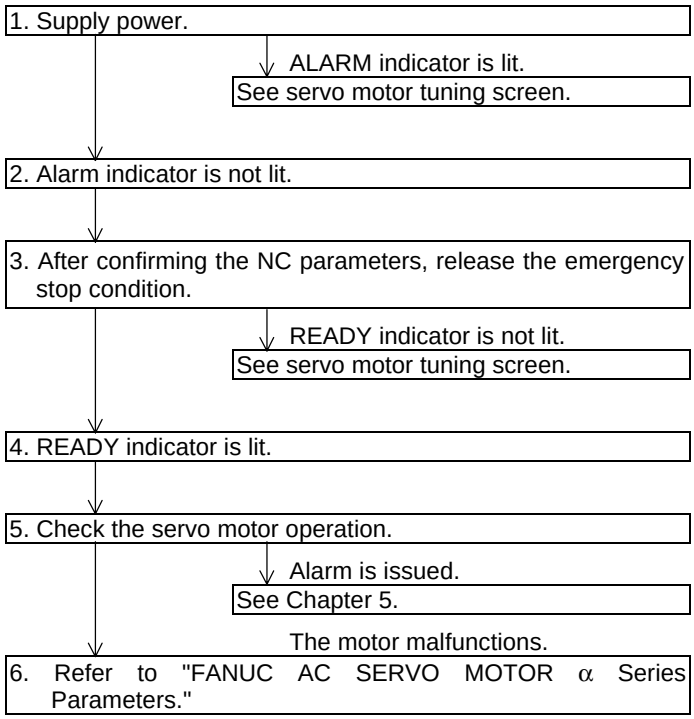
The differences between βseries amplifier with FSSB and the current model are shown below.

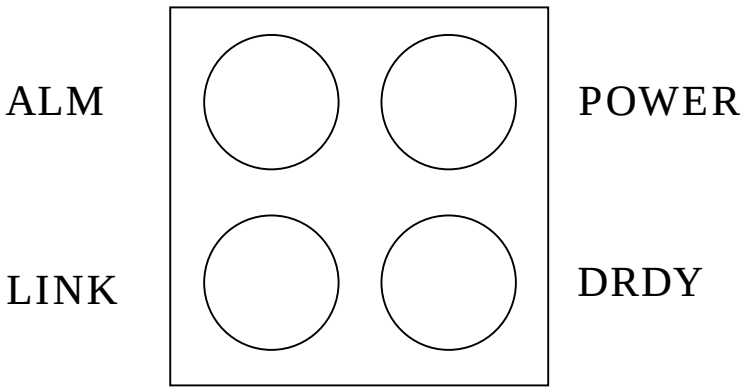
C.2 CONFIGURATION

Model	Oder specification	Power P.C.B.	Control P.C.B.	Remark
SVU-12	A06B-6093-H111	A20B-2100-0130	A20B-2002-0640	
SVU-20	A06B-6093-H112	A20B-2100-0131	A20B-2002-0640	

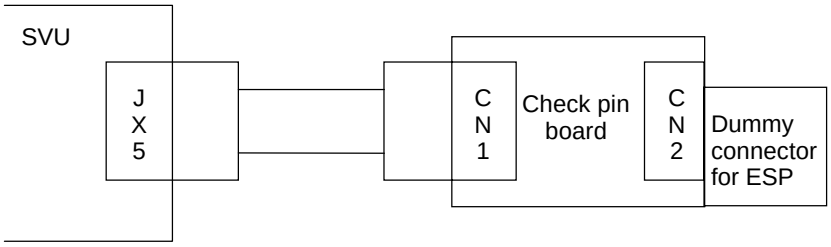
C.3 OPERATION CONFIRMATION METHOD

C.3.1 Check Pin Board





C.3.2 Connection to the servo amplifier unit



Pin No.	Signal name	Description
(1)		
(2)	3.3V	+3.3V power (with tolerance of –2%)
(3)	IRC Note)	Phase R motor current signal
(4)	ISC Note)	Phase S motor current signal
(5)		
(6)		
(7)	0V	Reference voltage
(8)	0V	Reference voltage
(9)	0V	Reference voltage
(10)		
(11)	24VC	+24V power (with tolerance of –10%)
(12)	15VC	+15V power (with tolerance of –10%)
(13)	-15VC	-15V power (with tolerance of –10%)
(14)	5VC	+5.1V power (with tolerance of –2%)
(15)		
(16)		
(17)		
(18)		
(19)		
(20)		

NOTE
The output voltage reflects directly the actual current in the motor. To observe the output voltage, use an oscilloscope. The voltmeter position of a volot-ohm-milliammeter or other voltmeter cannot be used.

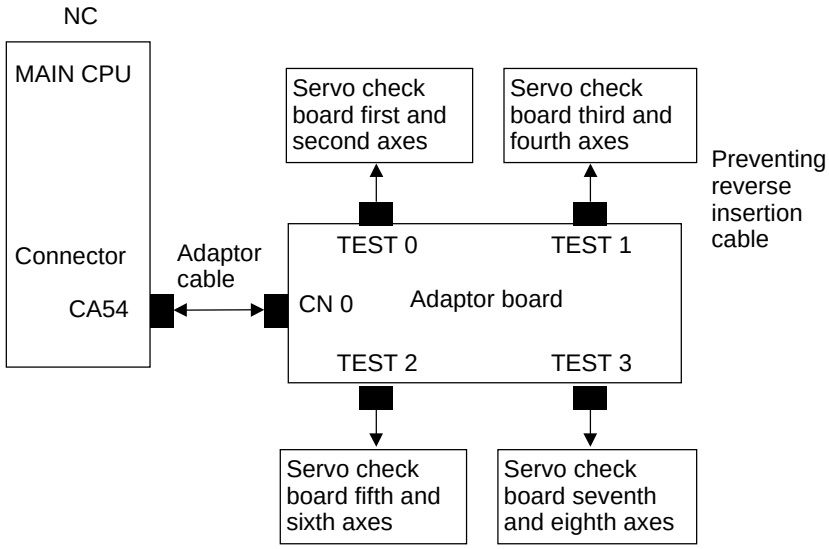
C.4 SERVO CHECK BOARD

(1) General
The servo check board receives the digital value used for contol inside the digital servo as numerical data and converts it to an analog form.

(2) Servo check board specifications

Specification	Name
A06B-6057-H602	Servo check board (with a cable having a provision to prevent incorrect insertion)
A02B-0236-K822	Servo adaptor board (for i series)

(3) Connection the servo check board
When connecting the check board, always keep the NC switched off. obtain a correct Keep on strapping on the 5 MHz side of clock pin S1 on the check board.
Series 16*i*, 18*i*, 21*i*, Power Mate Model D*i*, H*i*



C.5 TROUBLESHOOTING AND RECOVERY

Alarm meaning
Relation to pulsecoder

Number of NC alarms	Message	Meaning
360	n axis : abnormal checksum(int)	Checksum alarmis occurred in pulsecoder (int).
361	n axis : abnormal phase data (int)	Abnormal phase data alarm is occurred in pulsecoder (int).
362	n axis : abnormal rev. data (int)	Abnormal rev. data alarm is occurred in pulsecoder (int).
363	n axis : abnormal clock (int)	Clock alarm is occurred in pulsecoder (int).
364	n axis : soft phase alarm (int)	Internal pulsecoder data is abnormal.
365	n axis : broken LED(int)	LED of pulsecoder is abnormal.
366	n axis : pulse miss (int)	Pulse miss alarm is occurred in pulsecoder (int).
367	n axis : count miss (int)	Count miss alarm is occurred in pulsecoder (int).
368	n axis : serial data error (int)	Serial data is not received from internal pulsecoder.
369	n axis : data trans. error (int)	CRC error or stop bit error is occurred in pulsecoder (int).
380	n axis : broken LED (ext)	LED in external pulsecoder is abnormal.
381	n axis abnormal phase (ext lin)	Abnormal phase data alarm is occrred in external linea scale.
382	n axis : count miss (ext)	Count miss alarm is occurred in external pulsecoder.
383	n axis : pulse miss (ext)	Pulse miss alarm is occurred in external pulsecoder.
384	n axis : soft phase alarm (ext)	External pulsecoder data is abnormal.
385	n axis : serial data error(ext)	Serial data is not received from external pulsecoder.
386	n axis : data trans. error(ext)	External pulsecoder data is CRC error or stop bit error.

Relation to servo amplifier

Number of NC alarms	Message	Meaning
430	n axis : servo motor overheat	Servo motor is overheat.
431	n axis : cnv. overload (OH)	This alarm is occurred if the temperature of amplifier is abnormally high.
432	n axis : cnv. lowvolt con./powfault (LV)	This alarm is occurred if the control circuit power supply is abnormally low.
433	n axis : cnv. low volt DC link (DCLV)	This alarm is occurred if the DC voltage of the voltage main circuit power supply is abnormally low or the outer circuit breakertrips.
436	n axis : softthermal (OVC)	Overheat alarm detected by software
438	n axis : inv. abnormal current (HC)	This alarm is occurred if an abnormally over-current flows in servo amplifier unit.
439	n axis : overvolt power (HV)	This alarm is occurred if the DC voltage of the main circuit power supply is abnormally high.
440	n axis : cnv. ex deceleration pow. (DCOH)	This alarm is occurred if: The average regenerative discharge energy is too high (too frequent acceleration /deceleration).
441	n axis : abnormal current offset	Current feedback is abnormal.
443	n axis : cnv. cooling fan failure (FAL)	The fan, built into the servo amplifier unit, has stopped.
445	n axis : soft disconnection alarm	Disconnection alarm detected by software
446	n axis : hard disconnection alarm	Disconnection alarm detected by hardware **(note1)**
447	n axis : hard disconnection (ext)	External pulsecoder cable is disconnection.
448	n axis : unmatched feedback alarm	Feedback data of pulsecoder is unmatched to it of external pulsecoder.

NOTE

Hard disconnection alarm is not occurred to FS16C, FS16i.
The possibility of FBAL (STATUS1 bit9=1)
External hardware disconnection FBAL (STATUS1 bit9=1, bit7=1, bit4=1)
Software disconnection (STATUS1 bit9=1)
Count miss error (STATUS1 bit9=1, bit7=1, STATUS2 bit11=1)

Relation to servo amplifier

Number of NC alarms	Message	Meaning
460	n axis : FSSB disconnection	FSSB communication is open. 1. Optical fiber cable is open or disconnection. 2. Control power supply is shut down. 3. LV alarm of control power supply is occurred.
461	n axis : illegal amp interface	Both axes are Fast interface in 2-axes amplifier.
462	n axis : send CNC data failed	The slave side amplifier does not receive normal data because of FSSB communication error.
463	n axis : send slave data failed	The servo side amplifier does not receive normal data because of FSSB communication error.
464	n axis : write ID data failed	The amplifier can not be written maintenance information in maintenance screen.
465	n axis : read ID data failed	The amplifier can not read maintenance information in maintenance screen.
466	n axis : motor / amp combination	The value of amplifier maximum current is illegal to it of motor maximum current.
467	n axis : illegal setting of axis	The amplifer is set to 2 axes in axis setting screen, but the following is not possibility. 1. Learning control (PRM2008#5=1) 2. High current loop (PRM2004#0=1) 3. High interface axis (PRM2005#4=1)

Relation to P/S alarm

Number of NC alarms	Message	Meaning
5134	FSSB : open ready time out	FSSB is not ready at the time of power on.
5135	FSSB : error mode	FSSB is abnormal.
5136	FSSB : number of amps is small	The number of amplifier is small to the setting numer.
5137	FSSB : configuration error	FSSB is configuration error.
5138	FSSB : axis setting not complete	The axis is not set in auto mode.
5197	FSSB : open time out	FSSB is not communication.
5198	FSSB : ID data not read	ID data is not read.

C.6 *i* SERIES INITIAL SETTING OF PARAMETER

C.6.1 Outline

In the system using FSSB, we have to set the following parameters for the axis arrangement.
(Please set the parameters as usual except the following ones)

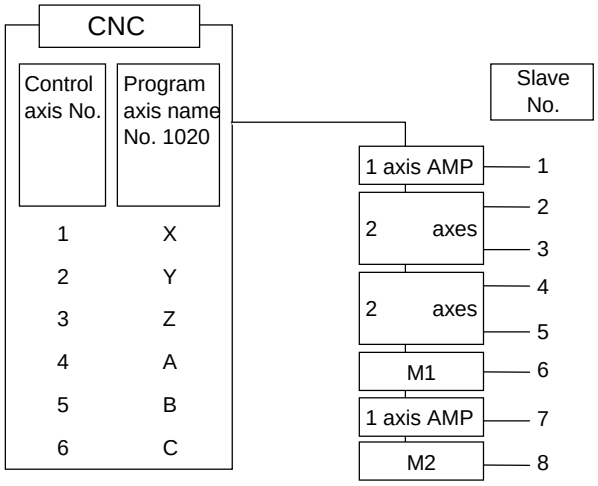
- No.1023
- No.1905
- No.1910 to 1919
- No.1936, 1937

In order to these parameters, there are 3 ways as follows.

1. Manual setting 1
   By setting the parameter in No.1023, the axis arrangement is decided as the default setting. You do not have to need to set the parameter No.1905, 1910 ~ 1919, 1936, 1937. But There is a limitation of function which you can use.
2. Automatic setting
   By using FSSB setting screen, when you input the amplifier and axis informations, CNC set the parameter No.1905, 1910 to 1919, 1936, 1937 automatically.
3. Manual setting 2
   Please input the parameter No.1905, 1910 to 1919, 1936, 1937 by hand after you understand the meaning of each parameter well.

C.6.2 Slave

In the system using FSSB, the Servo Amplifier and Pulse Module are connected to CNC by the optical cable. We call the Servo Amplifier and Pulse Module “Slave”.
Two axes amplifier consists of two slaves and three axes amplifier has three slaves.
Each slave is named 1, 2, 3..., 10 from the near side of CNC to the far side of CNC.



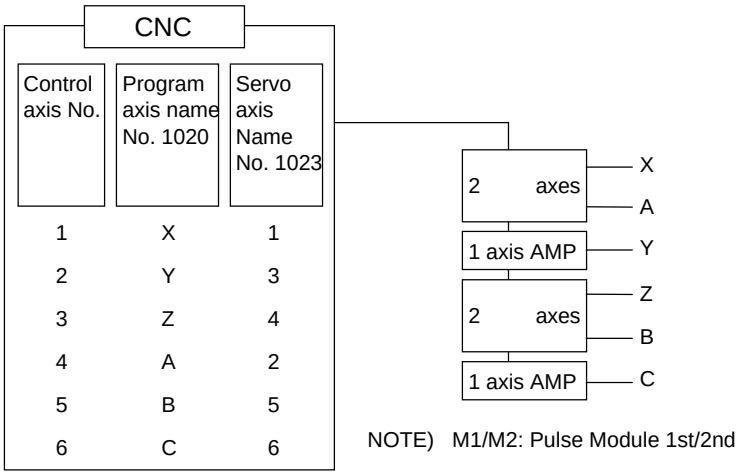
NOTE) M1/M2: Pulse Module 1st/2nd

C.6.3 Manual setting 1

Default setting is available in the following parameter setting.

No.1902#0=0
No.1902#1=0
No.1910 ~ 1919=0 (All 0)

In the manual setting 1, the slave No. has to correspond to the value in No.1023 of each axis. Therefore, the axis which is set No.1023=1 connects to the first amplifier which is the nearest from the CNC and the axis which is set No.1023=2 connects to the second amplifier.



Please be careful for the following things. In the manual setting 1, you can not use the following functions and settings.

- Pulse Module is not available. Therefore, the outer position detector is not available.
- Please set the continuous value in No.1023. For example, you can not set 3 without setting 2 to No.1023.
- The following functions are not available.
  - Learning Control
  - High speed current loop control
  - Electrical Gear Box function

C.6.4 Automatic setting

Under the following conditions, you can set the parameter automatically using the FSSB screen.

No.1902#0=0
No.1902#1=0

Please do the automatic setting by FSSB setting screen in the folloing procedure.

1. Please set the servo axis No. to No.1023.
   Please set the number of the axis to No.1023 to correspond to the total number of amplifier axis.

2. Please initialize the servo parameters on the SERVO INITIAL SETTING screen.

3. Please turn off & on the CNC's power.

4. Please push the function key SYSTEM .

5. [FSSB] appears after pushing ▷ several times.

6. When you push the soft key [FSSB], the screen changes the Amplifier setting (or the screen selected before) and the following soft key appears.
   [AMP][AXIS][MAINTE][ ][(OPRT)]

7. Please input the axis name which should be connected to the each amplifier in AMPLIFIER SETTING screen. In AMPLIFIER SETTING screen, the information of slave lines up one by one from the top to the bottom. Therefore, please set the control axis name to each amplifier not to input 0 or duplicated value.

```
AMPLIFIER SETTING
No.    AMP   SERIES    UNIT  CUR.      [AXIS]   NAME
 1     A1-L     α      SVM   40AL      [ 1 ]      X
 2     A1-M     α      SVM    12A      [ 2 ]      Y
 3     A2-L     β      SVU    20A      [ 3 ]      Z
 4     A3-L     α      SVM    40A      [ 4 ]      A
 5     A3-M     α      SVM    80A      [ 5 ]      B
 7     A4-L     α      SVM   40AS      [ 6 ]      C
No. EXTRA     type      PCB ID
 6     M1       A          0008  DETECTOR(4AXES)
 8     M2       A          0008  DETECTOR(4AXES)
>
MDI ****  ***  ***                  13:11:56
 [ AMP ]  [ AXIS ]  [MAINTE]  [     ]  [ (OPRT)]
```

8. Please push the soft key[SETING].

9. Please push the function key SYSTEM .

10. [FSSB] appears after pushing ▷ several times.

11. When you push the soft key [FSSB], the screen changes the Amplifier setting (or the screen selected before) and the following soft key appears.
    [AMP][AXIS][MAINTE][ ][(OPRT)]

12. Please push the soft key [AXIS].

13. Please set the information of each axis one by one. Please input the setting value in using the following things.
    - In using the outer detector
    - In using 1 DSP/1 axis
      (For example current loop 125 μs, Learning Control etc.)
    - In case of Cs axis
    - In using tandem control

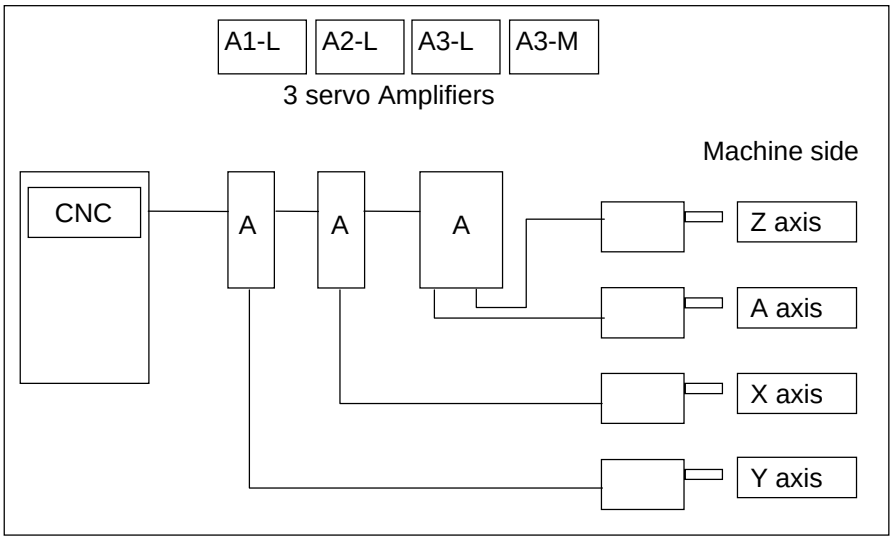
```
 AXIS SETTING
  AXIS  NAME     AMP     M1     M2   1DSP   Cs    TNDM
    1     X      A1-L     1      0      0     0       0
    2     Y      A1-M     0      1      0     0       0
    3     Z      A2-L     0      0      0     0       0
    4     A      A3-L     2      0      0     0       0
    5     B      A3-M     0      2      0     0       0
    6     C      A4-L     0      0      0     0       0
>
MDI  ****  ***  ***                  13:11:56
 [ AMP ]  [ AXIS ]  [MAINTE]  [      ]  [ (OPRT)]
```

14. Please push the soft key [SETING].
    If you input nothing, please push the soft key [SETING] after pushing[(OPRT)].

By these operations, the parameter No.1023, 1905, 1910 ~ 1919, 1936, 1937 is set automatically. At this time,the parameter No.1902 #1 becomes 1.
The setting of axis is finished after CNC power turns off and on.

- Please be careful for using the Electrical Gear Box Function
  In case using the Electrical Gear Box Function, please set the parameter No.7771 at first. After that, please do the automatic setting in the FSSB setting screen. Unless you set the parameter No.7771, the automatic setting is not done correctly.

[EX 1**]** In case of Semi-closed loop



Please set the parameter No.1023.

X : 1 Z : 3

Y : 2 A : 4

Please set the servo initial setting to the each axis.
Please turn off and on the CNC's power line.
Please input "AXIS No." of Amplifier setting screen.

```
AMPLIFIER SETTING
 No.   AMP  SERIES    UNIT   CUR.     [AXIS]    NAME
  1    A1-L    α       SVM    40A      [ 2 ]      Y
  2    A2-L    α       SVM    40A      [ 1 ]      X
  3    A3-L    α       SVM    40A      [ 4 ]      A
  4    A3-M    α       SVM    80A      [ 3 ]      Z
 No. EXTRA     type      PCB ID

>
MDI  ****  ***  ***                 13:11:56
 [ AMP ]  [ AXIS ]  [MAINTE]  [     ]  [(OPRT)]
```

Please push the soft key[SETING]

Please push the function key SYSTEM .

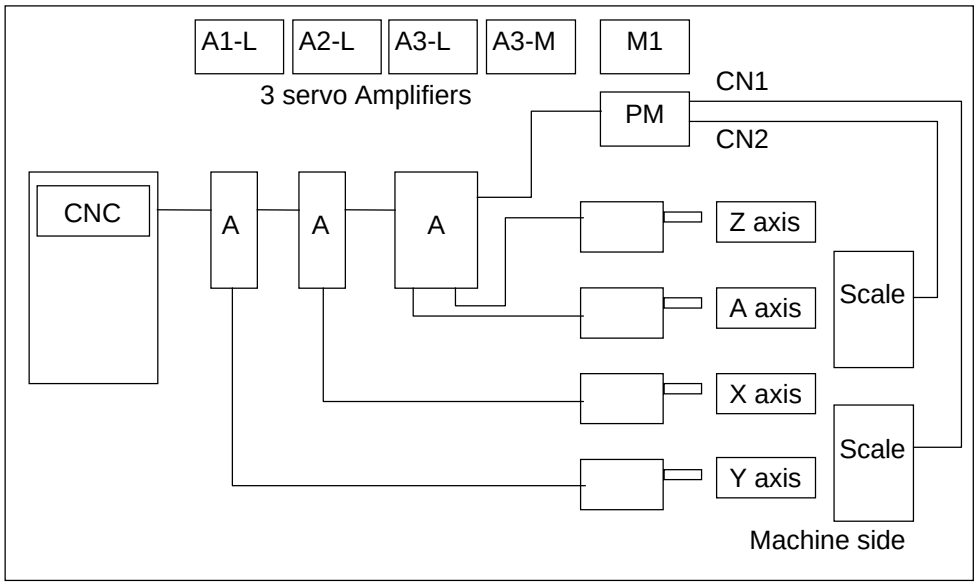
[FSSB] appears after pushing ▷ several times.

When you push the soft key [FSSB], the screen changes the Amplifier setting (or the screen selected before) and the following soft key appears.

[AMP][AXIS][MAINTE][ ][(OPRT)]

Please push the soft key[AXIS].
Please push the soft key[(OPRT)] and please push the soft key [SETING].
Setting is completed after turning off and on CNC.

[EX 2**]** In case of Fully-closed loop



Please set the parameter No.1023.

X : 1 Z : 3
Y : 2 A : 4

Please set the servo initial setting to the each axis.
Please turn off and on the CNC's power line.
Please input "AXIS No." of Amplifier setting screen.

```
AMPLIFIER SETTING
 No.   AMP   SERIES    UNIT  CUR.  [AXIS]    NAME
  1    A1-L     α       SVM   40A   [ 2 ]      Y
  2    A2-L     α       SVM   40A   [ 1 ]      X
  3    A3-L     α       SVM   40A   [ 4 ]      A
  4    A3-M     α       SVM   80A   [ 3 ]      Z
 No. EXTRA  TYPE  PCB  ID
  5    M1      A       0008  DETECTOR (AXES)
>
MDI ****  ***  ***              13:11:56
 [ AMP ] [ AXIS ] [MAINTE] [     ] [ (OPRT)]
```

Please push the soft key[SETING]

Please push the function key SYSTEM .

[FSSB] appears after pushing ▷ several times.

When you push the soft key [FSSB], the screen changes the Amplifier setting (or the screen selected before) and the following soft key appears.

[AMP][AXIS][MAINTE][ ][(OPRT)]

Please push the soft key[AXIS].

```
AXIS SETTING
  AXIS  NAME    AMP     M1    M2    1DSP   Cs   TNDM
    1     X     A2-L    0     0     0      0    0
    2     Y     A1-L    1     0     0      0    0
    3     Z     A3-M    0     0     0      0    0
    4     A     A3-L    2     0     0      0    0


>
MDI  ****  ***  ***                13:11:56
 [ AMP ]  [ AXIS ]  [MAINTE]  [      ]  [ (OPRT)]
```

Please push the soft key[SETING]
Please input No.1815#1=1 for Y axis & A axis.
Setting is completed after turning off and on CNC.

C.6.5 Manual setting 2

When the following parameters are set, you can set the parameter for each axis by hand.
No.1902#0=1, #1=0
In case of manual setting 2, please set the parameter No.1023, 1905, 1910 to 1919, 1936, 1937 after understanding the meaning of these parameters well.

No.	#7	#6	#5	#4	#3	#2	#1	#0
1902							ASIGN	FSBMD

Data type : Bit

FSBMD Setting FSSB mode selection
0 : Automatic setting mode
(By using FSSB setting screen, when the information of axis and amplifier is set, the parameter No.1023, 1905, 1910 to 1919, 1936, 1937 is set automatically.)
1 : Manual setting mode 2
(Please input the parameter No.1023, 1905, 1910 to 1919, 1936, 1937 by hand.)

ASIGN Automatic setting of FSSB
0 : is completed.
1 : is not completed.
(When the automatic setting is done, this bit becomes 1 automatically.)

No.	#7	#6	#5	#4	#3	#2	#1	#0
1905	FSBM2	FSBM1						FSBSL

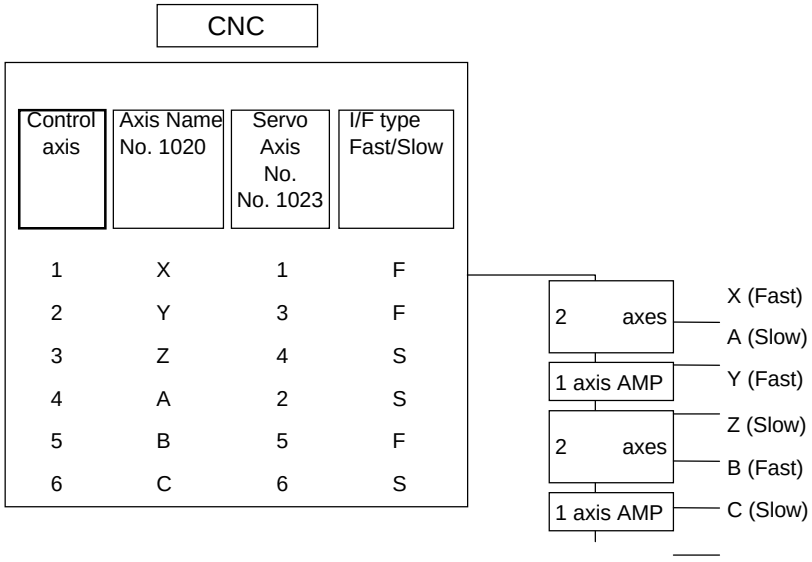
Data type : Bit

FSBSL Select the interface between servo amplifier and servo software
0 : Fast type
1 : Slow type

There are two types interface of servo data transfer.
One is Fast type, the other is Slow type.
Please select the interface to satisfy to the following conditions.

- In case of the single axis amplifier, Fast/Slow type is available.
- In case of 2 axes amplifier, Fast type can be used for only one axis.
  Please do not set Fast type for both axes.
  Slow type can be set for both axes.

- In case of 3 axes amplifier, the first and the second axis are the same as 2 axes amplifier, and the third axis is the same as single axis amplifier.
- Please select Fast type for the axis set the odd to No.1023.
  In case of the axis for EGB, Learning control, high speed currentloop, Slow type is also available as an exception.
- Please select Slow type for the axis set the even to No.1023.



FSBM1 1st Pulse Module

0 : is not used.
1 : is used.

FSBM2 2nd Pulse Module

0 : is not used.
1 : is used.

In case of the Automatic setting mode(No.1902#0=0), these parameters are set automatically.
In case of the Manual setting mode(No.1902#0=1), please set these parameters by hand.
In case of using the Pulse Module, you have to set Connector No.(parameter is No.1936, 1937), too.

No.	
1910	The value of Address Conversion Table for Slave1 (ATR)
1911	The value of Address Conversion Table for Slave2 (ATR)
1912	The value of Address Conversion Table for Slave3 (ATR)
1913	The value of Address Conversion Table for Slave4 (ATR)
1914	The value of Address Conversion Table for Slave5 (ATR)
1915	The value of Address Conversion Table for Slave6 (ATR)
1916	The value of Address Conversion Table for Slave7 (ATR)
1917	The value of Address Conversion Table for Slave8 (ATR)
1918	The value of Address Conversion Table for Slave9 (ATR)
1919	The value of Address Conversion Table for Slave10 (ATR)

Data type : Byte
Data range : 0 to 7, 16, 40, 48

Please set the value of address conversion table for slave 1~10.
The amplifier or pulse module connected to CNC by the optical cable is called “Slave”.
This slave No. is named 1~10 from near side of CNC to the far side of CNC.
Two axes amplifier consists of two slaves and Three axis amplifier has three slaves.
This parameter is set as follows.

- In case of amplifier :
  Please set (the value of No.1023-1).

- In case of Pulse Module :
  Please set 16 for the first Pulse Module(near from CNC) and 48 for the second
  Pulse Module(far from CNC).

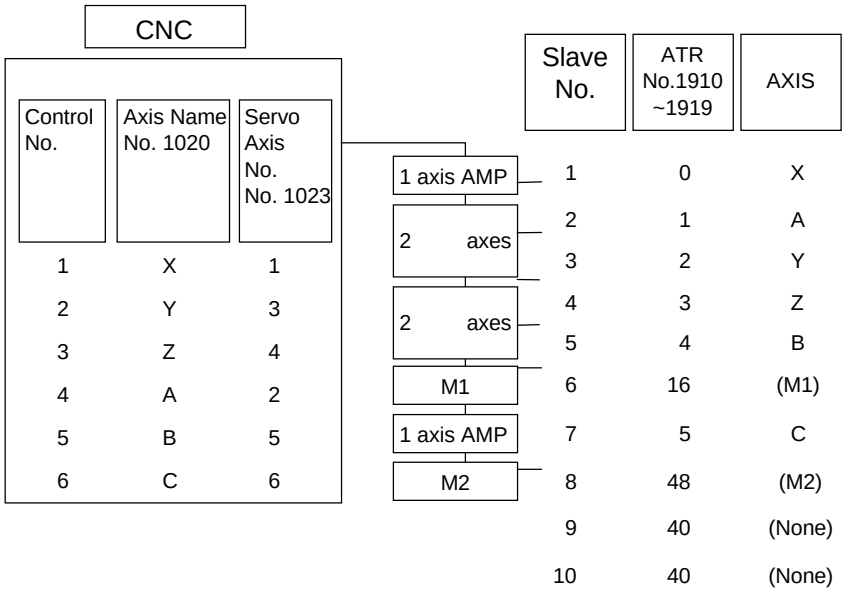
- In case of no slave :
  Please set 40.

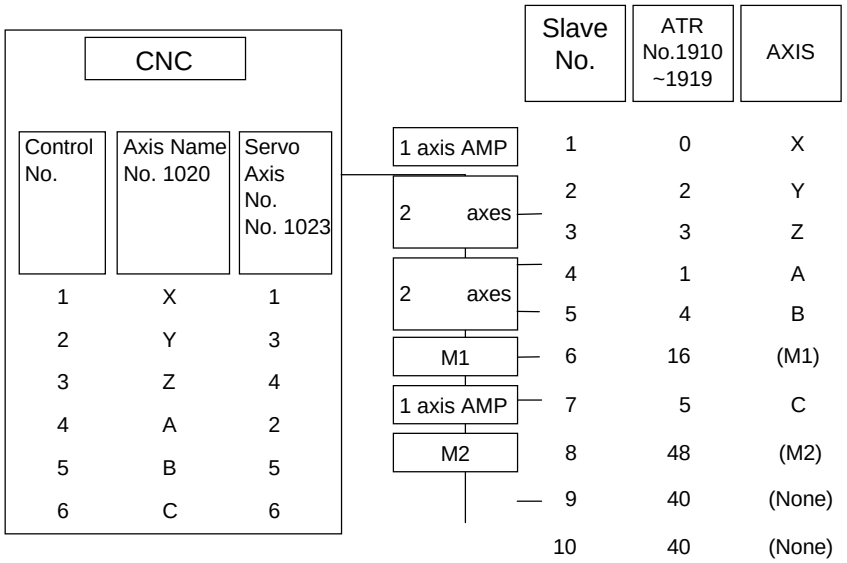
In case using Electrical Gear Box function, please set it as follows.

EGB dummy axis designated in No.7771 does not need the amplifier.
At this time, please do not set 40, but set(the value of No.1023-1) for the EGB dummy axis.

In case of the Automatic setting mode(No.1902#0=0), these parameters are set automatically.
In case of the Manual setting mode(No.1902#0=1), please set these parameters by hand.

- Example of axis configration & parameter setting





M1/M2: Pulse Module 1st/2nd

No.	
1936	Connector number of 1st Pulse Module
1937	Connector number of 2nd Pulse Module

Data type : Byte
Data range : 0 to 7

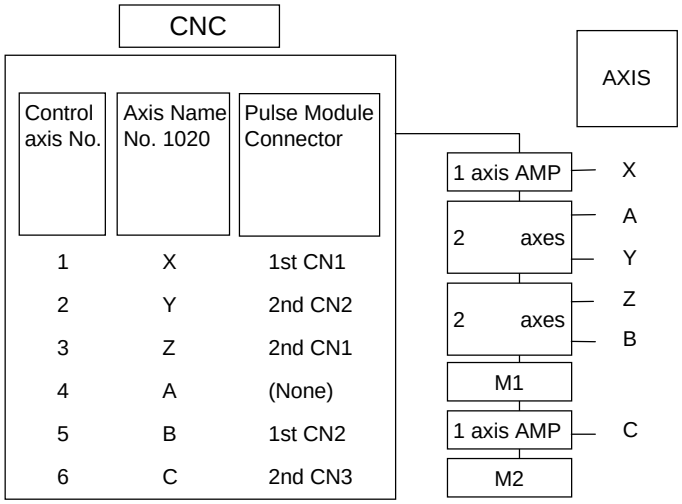
In case using the Pulse module, please set the value which subtracts 1 from the connector No. of each axis.
Therefore, the No. of connector 1-8 coresponds to 0-7.
You have to set the parameter No.1905#6, #7, too. Please set 0 for the axis where the Pulse module is not used.
You can use any connectors, but please use the connector from the small No.
So, please do not use the Connector No.3 without using No.2.

Example)

Control Axis	1st Connector No.	2nd Connector No.	No. 1936	No. 1937	No. 1905 (#7, #6)
X	1	Not used	0	0	0, 1
Y	Not used	2	0	1	1, 0
Z	Not used	1	0	0	1, 0
A	Not used	Not used	0	0	0, 0
B	2	Not used	1	0	0, 1
C	Not used	3	0	2	1, 0

In case of the Automatic setting mode(No.1902#0=0), these parameters are set automatically.
In case of the Manual setting mode(No.1902#0=1), please set these parameters by hand.

- Axis configration & parameter setting by Manual setting 2



M1/M2: Pulse Module 1st/2nd

No.	1902#0 FSBMD
	1

No.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
	0	1	2	3	4	16	5	48	40	40

No.	1023	1905#0 FSBSL	1905#6 FSBM1	1905#7 FSBM2	1936	No. 1905 (#7, #6)
X	1	0	1	0	0	0
Y	3	0	0	1	0	1
Z	4	1	0	1	0	0
A	2	1	0	0	0	0
B	5	0	1	0	1	0
C	6	1	0	1	0	2

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Revision Record

FANUC SERVO MOTOR β series MAINTENANCE MANUAL (B–65235EN)

Edition	Date	Contents
01	Nov., ’96	———
03	Oct., ’97	– SAFETY PRECAUTIONS (FANUC AC SERVO MOTOR series) is modified. – SAFETY PRECAUTIONS (FANUC AC SERVO AMPLIFIER series) is modified. – FANUC SERVO MOTOR AMPLIFIER β series with FSSB MAINTENANCE MANUAL (B–65235EN/01–02 is added.