FANUC AC SERVO MOTOR βi-B/βi series
FANUC AC SPINDLE MOTOR βi series
FANUC SERVO AMPLIFIER βi-B series

MAINTENANCE MANUAL

B-65425EN/02

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- All specifications and designs are subject to change without notice.

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Should you wish to export or re-export these products, please contact FANUC for advice.

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".

- If operation is abnormal, for example, when an alarm is issued or a hardware failure occurs, the operation described in this manual is not guaranteed unless otherwise specifically noted. If operation is abnormal, take action according to the instructions specifically described in this manual if any or contact FANUC when the instructions are not described.
- Generally, a "safety function" means a function that protects the operators from danger posed by the machine.
  The signals and functions described in this manual cannot be used separately for any "safety function" unless otherwise described as being [usable for the safety function]. Their specifications are not assumed to be used as the [safety function] in this case, unexpected danger may be caused. If you have any questions, contact FANUC.
- A device connection error or setting error can lead to unpredictable operation. When starting to operate the machine for the first time after assembling the machine, replacing parts, or changing parameter settings, exercise extreme care.

SAFETY PRECAUTIONS

The "Safety Precautions" section describes the safety precautions relating to the use of FANUC servo motors (β*i*S, β*i*Sc, β*i*F), spindle motors (β*i*I, β*i*Ic, β*i*Ip, β*i*It), and servo amplifiers (β*i*SV-B, β*i*SVSP-B). 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 damage 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.

If a precaution described even as "CAUTION" is not followed, a serious result may be caused depending on the status. Be sure to follow the precautions described as "WARNING" and "CAUTION" since they give important information.

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

FANUC AC SERVO MOTOR βi-B/βi series, FANUC AC SPINDLE MOTOR βi series

Warning

⚠ WARNING

- **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.

- **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 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.

- **When connecting a cord such as a power line to the terminal block, use specified tightening torque to firmly connect the cord.**

If operation is performed with a loose terminal, the terminal block can overheat, resulting in a fire. Moreover, a terminal can be detached, resulting in a ground fault, short circuit, or electric shock.

- **Do not apply current when a terminal of the terminal block or the crimp terminal of a power line is exposed.**

If the hand or a conductive object touches a terminal of the terminal block or the crimp terminal of a power line, you may get electric shocks. Attach an insulation cover (accessory) onto the terminal block. Moreover, cover the crimp terminal at the tip of a power line with an insulation tube.

- **Assemble and install a power connector securely.**

If a power line is detached due to a failure in crimping or soldering, or a conductive area is exposed due to a failure in shell assembly, you may get electric shocks.

- **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 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 20 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.

- **On the machine, install a stop device for securing safety.**

The brake built into the servo motor is not a stop device for securing safety. The machine may not be held if a failure occurs.

⚠ WARNING

- **Do not enter the area under the vertical axis without securing safety.**

If a vertical axis drop occurs unexpectedly, you may be injured.

- **Fasten a motor firmly before driving the motor.**

If a motor is driven when the motor is not fastened firmly or is fastened insufficiently, the motor can tumble or is removed, resulting in a danger. If the motor mounting section is not sufficiently strong, the machine may be damaged or the user may be injured.

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

When a motor is rotating, clothes or fingers can be caught, resulting in an injury.

- **Do not drive a motor with an object such as a key exposed.**

An object such as a key can be thrown away, resulting in an injury. Before rotating a motor, check that there is no object that is thrown away by motor rotation.

- **Do not apply a radial load exceeding the "allowable radial load".**

The shaft can break, and components can be thrown away. When the vertical axis is involved, a vertical axis drop can occur.

- **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 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 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.**

A motor is heavy, so that if you lift a motor by hand, you may be exposed to various risks. For example, the waist can be damaged, and the motor can drop to injure you. Use equipment such as a crane as needed. (For the weight of a motor, see Descriptions.)

Caution

⚠ CAUTION

- **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.

- **Install the components around a motor securely.**

If a component is displaced or removed during motor rotation, a danger can result

⚠ CAUTION

- **Use the eyebolt of a motor to move the motor only.**

When a motor is installed on a machine, do not move the machine by using the eyebolt of the motor. Otherwise, the eyebolt and motor can be damaged.

- **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.
For Pulsecoder replacement, refer to the Subsection, “Maintenance of a Detector”.

- **Do not machine and modify a motor.**

Do not machine and modify a motor in any case except when motor machining or modification is specified by FANUC. Modifying a motor may cause a failure or trouble in it.

- **Do not conduct dielectric strength or insulation test for a sensor.**

Such a test can damage elements in the sensor.

- **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). Refer to the Specification manual of each motor for details of the connection method etc.

- **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. Plastic components and sensors can be damaged easily. So, handle those components very carefully. In particular, do not lift a motor by using a plastic component, connector, terminal block, and so forth.

- **Do not step or sit on a motor, and do not put a heavy object 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 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.

- **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 Descriptions 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.

⚠ CAUTION

- **Do not use the brake built into a motor for braking.**

The brake built into a servo motor is designed for holding. If the brake is used for braking, a failure can occur.

- **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 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.

- **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.

Note

NOTE

- **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.

- **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.

- **When testing the winding or insulation resistance of a motor, satisfy the conditions stipulated in IEC60034.**

Testing a motor under a condition severer than those specified in IEC60034 may damage 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 the Descriptions.

- **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 the Descriptions, or ask FANUC. For insulation resistances, see the following table.

NOTE

- **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 the Descriptions, 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. Make an insulation resistance measurement on a single motor unit after detaching cords such as a power line.

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.

FANUC SERVO AMPLIFIER βi-B series

Warnings and Cautions Relating to Mounting

Warning

⚠ 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.**
  Servo amplifiers, AC reactors, and AC line filters are heavy. When transporting them or mounting them in the cabinet, therefore, be careful not to injured yourself or damage the equipment. Be particularly careful 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.
  Be extremely careful with power supply lines, motor power lines, and DC link connections through which a large amount of current passes, because a loose screw (or poor contact in a connector or poor connection between a connector terminal and a cable) may cause a fire. Securely tighten each target screw with the specified tightening torque.

- **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.

- **Confirm that the input voltage meets the specifications of the amplifier before making connection.**
  If the input voltage exceeds the specified value (for example, if the input voltage for a 200-V input amplifier is 400 V), an internal component may be damaged and burnt out.

⚠ WARNING

- **Do not disassemble the amplifier.**

- **Take appropriate measures to prevent cutting fluid, oil mist, or chips from being adhered to the radiator and fan motors exposed to outside air.**
  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 fan motors or 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.

- **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

⚠ 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 impact.**
  Do not place anything on the amplifier.

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

- **Take appropriate measures to prevent coolant, oil mist, or chips from being adhered to the radiator and fan motors that are exposed to the outside of the power magnetics cabinet.**
  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 fan motors and 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.

- **Connect the power supply lines and power lines to the appropriate terminals and connectors.**

- **Connect the signal lines to the appropriate connectors.**

- **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.**

⚠ CAUTION

- **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.

- **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.

- **Notes relating to this product storage, transportation and environment**
  This servo amplifier uses electronic parts corroded by the halogen (fluorine, chlorine, bromine, iodine, etc.)
  Do not storage or transport or use this servo amplifier in the halogen (fluorine, chlorine, bromine, iodine, etc.) atmosphere.
  Fumigant and industrial cleaning solvent, and pesticide might contain the halogen.

Note

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 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.

- **Note regarding Korean KC mark**
  This equipment is industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home.
  이 기기는 업무용(A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Warnings and Cautions Relating to a Pilot Run

Warning

⚠ 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

⚠ 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.

⚠ CAUTION

- **Before operating the motor for the first time, mount and adjust the position and speed sensors.**
  Following the instructions given in the maintenance manual, adjust the position and speed sensors for the spindle so that an appropriate waveform is obtained.
  If the sensors 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.

Warnings and Cautions Relating to Maintenance

Warning

⚠ WARNING

- **Read the maintenance manual carefully and ensure that you are totally familiar with its contents.**
  The maintenance 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 this 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.

⚠ WARNING

- **Notes on replacing the battery of the absolute Pulsecoder**
  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. If the battery is installed in the β*i*-B series servo amplifier, open the door of the power magnetics cabinet and enter the emergency stop state without turning off the control power. Interrupt the input of the power system of the amplifier and 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.

- **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

⚠ 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.

⚠ CAUTION

- **Note on inserting or removing a connector**
  Unless otherwise specified, do not insert or remove any connector while the power is turned on. Otherwise, the amplifier may fail.

Note

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

Organization of this manual

This manual describes information necessary to maintain FANUC SERVO AMPLIFIER β*i*-B series products, such as a β*i*SV-B and β*i*SVSP-B and FANUC SERVO MOTOR β*i*-B/β*i* series and FANUC SPINDLE MOTOR β*i* series products.
Parts I and II explain the start-up procedure and troubleshooting for the β*i*-B series β*i*SV-B.
Parts III and IV explain the start-up procedure and troubleshooting for the β*i*-B series β*i*SVSP-B.
Parts V and VI explain the maintenance for servo motor β*i*-B/β*i* series and spindle motor β*i* series.

The abbreviations listed below are used in this manual.

Product name	Abbreviations
FANUC Series 30*i*-MODEL B	FS 30*i*-B
FANUC Series 31*i*-MODEL B	FS 31*i*-B
FANUC Series 32*i*-MODEL B	FS 32*i*-B
FANUC Series 35*i*-MODEL B	FS 35*i*-B
FANUC Series Power Motion *i*-MODEL A	FS PM*i*-A
FANUC Series 30*i*-MODEL A	FS 30*i*-A
FANUC Series 31*i*-MODEL A	FS 31*i*-A
FANUC Series 32*i*-MODEL A	FS 32*i*-A
FANUC Series 0*i*-MODEL F	FS 0*i*-F
FANUC Series 0*i*/0*i* Mate-MODEL D	FS 0*i*/0*i* Mate-D
FANUC SERVO AMPLIFIER β*i*SV-B series	β*i*SV-B
FANUC SERVO AMPLIFIER β*i*SVSP-B series	β*i*SVSP-B

* The manuals shown below provide information related to this manual. This manual may refer you to these manuals.

1) FANUC SERVO AMPLFIER β*i*-B series DESCRIPTIONS B-65422EN
2) FANUC AC SERVO MOTOR β*i*-B/β*i* series DESCRIPTIONS B-65302EN
3) FANUC AC SPINDLE MOTOR β*i* series DESCRIPTIONS B-65312EN
4) FANUC AC SERVO MOTOR α*i* series/FANUC AC SERVO MOTOR β*i* series, FANUC LINEAR MOTOR L*i*S series, FANUC SYNCHRONOUS BUILT-IN SERVO MOTOR D*i*S series PARAMETER MANUAL B-65270EN
5) FANUC AC SPINDLE MOTOR α*i*/β*i* series, BUILT-IN SPINDLE MOTOR B*i* series PARAMETER MANUAL B-65280EN

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IV. TROUBLESHOOTING FOR βiSVSP-B

V. MOTOR/DETECTOR/AMPLIFIER PREVENTIVE MAINTENANCE

I. START-UP PROCEDURE FOR βiSV-B

1 OVERVIEW

This part describes the units and components of the servo amplifiers. It also explains the following information necessary to start up the servo amplifier:

- Configurations
- Start-up procedure
- Confirmation of the operation
- Periodic maintenance of servo amplifier

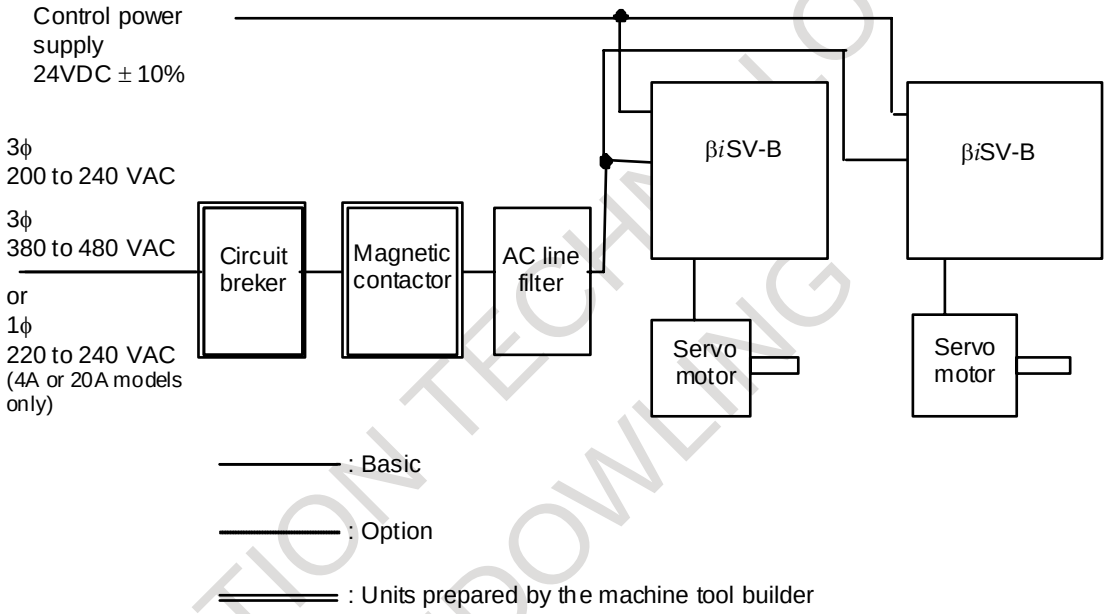
2 CONFIGURATIONS

2.1 CONFIGURATIONS

The servo amplifier βiSV-B consists of the units and components listed below:

(1) Servo amplifier module (βiSV-B) (basic)
(2) AC line filter (basic)
(3) Connectors (for connecting cables) (basic)
(4) Fuses (option)
(5) Power transformer (option)

Constituent (example)



NOTE
1 Be sure to use a stabilized power supply as the 24VDC amplifier power supply. Do not use the 24VDC motor brake power supply as the 24VDC amplifier power supply.
2 A circuit breakers , magnetic contactor, and AC line filter are always required.
3 To protect the unit from surge currents caused by lightning, connect surge absorbers between lines, and between the lines and ground, at the power inlet of the power magnetics cabinet.

⚠ **WARNING**
Take great care to prevent incorrect operation of the motor or a ground fault caused by looseness of a screw, incorrect insertion of a connector, etc.
Take great care to prevent fire caused by looseness of a screw (or incorrect contact with a connector or incorrect connection between a connector terminal and a cable) in a power line or motor power line through which large current flows.

2.2 MAJOR COMPONENTS

2.2.1 Servo Amplifier

(1) 1-axis βiSV-B series (200-V type)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
βiSV4-B	A06B-6160-H001	A06B-6160-C001	A20B-2101-0090	A20B-2102-0081
βiSV20-B	A06B-6160-H002	A06B-6160-C002	A20B-2101-0091	
βiSV40-B	A06B-6160-H003	A06B-6160-C003	A16B-3200-0512	
βiSV80-B	A06B-6160-H004	A06B-6160-C004	A16B-3200-0513	

(2) 1-axis βiSV-B series (400-V type)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
βiSV10HV-B	A06B-6161-H001	A06B-6161-C001	A16B-3200-0515	A20B-2102-0081
βiSV20HV-B	A06B-6161-H002	A06B-6161-C002	A16B-3200-0516	
βiSV40HV-B	A06B-6161-H003	A06B-6161-C003	A16B-3200-0517	

(3) 2-axis βiSV-B series (200-V type)

Model	Order specification	Unit specification	Wiring board specification	Printed circuit board specification
βiSV20/20-B	A06B-6166-H201	A06B-6166-C201	A16B-3200-0642	A20B-2101-0881
βiSV20/20-B	A06B-6166-H201#A	A06B-6166-C201#A	A16B-3200-0644	
βiSV40/40-B	A06B-6166-H203	A06B-6166-C203	A16B-3200-0643	

3 START-UP PROCEDURE

3.1 START-UP PROCEDURE (OVERVIEW)

Make sure that the specifications of the CNC, servo motors, servo amplifiers, and other units you received are exactly what you ordered, and these units are connected correctly. Then, turn on the power.
The items to be checked are described below.

No.	Description	Check method
Checking the installation of the servo amplifier		
1	Specification of the servo amplifier and servo motor	Check the combination of the servo amplifier and the servo motor is correct. Refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
2	Packing of the flange	Check the supplied packing is attached properly and that there is no gap between the control panel and the amplifier flange.
3	Keeping maintenance areas	Keep maintenance areas above and below the amplifier. For details, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
4	Prevention of contact with conductive section	Check a protective plate is attached to the DC link terminal board. For details, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
5	Measure against entry of coolant	Take a measure to prevent electroconductive, flammable, and corrosive material as well as mist and water drop from getting in the unit. For keeping of the effective closeness of the control panel, refer to Appendix G "EXAMPLES OF RECOMMENDED POWER MAGNETICS CABINETS FOR SERVO AMPLIFIER INSTALLATION" in the Servo Amplifier βi-B series Descriptions (B-65422EN).
Checking the wiring for the servo amplifier		
6	Screwing to the terminal block	When connecting wires to the servo amplifier terminal board, be sure to tighten the screws with a proper torque. For the detail of the tightening torque for the terminal board screws, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
7	Connecting protective ground	Use a proper cable for grounding in order to prevent electrical shocks at a ground fault. For details, refer to Subsection 9.3.1.7 of the Servo Amplifier βi-B series Descriptions" (B-65422EN).
8	Installing the lightning serge protector	In order to prevent damage due to a surge voltage applied to the input power supply, install a lightning surge protector. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
9	Measure against noise	Check that ground wires, including feedback cable shielding clamps, are connected to proper places to maintain a stable operation of the machine. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
10	Phase order of motor power lines	If the phase order of motor power lines is incorrect, the motor may operate unexpectedly. Make sure that the motor power lines are connected correctly.
11	Checking the axis to which the motor feedback wire and power wire are connected	If the axis to which the motor feedback wire and power wire are connected is incorrect, the motor may operate unexpectedly. So, make sure that the connection is correct.
12	Connection of batteries	Do not connect the built-in batteries in parallel. Please make sure, if the built-in batteries are used with an amp-to-amp battery connection cable (CXA19A/B or BATL (B3)) attached, they may be connected in parallel. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
Check during startup of operation		
13	Checking the power supply voltage	Before turning on the power, check that the power supply voltage is in its proper range. For details of the power supply voltage specification, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
14	Checking the ground potential	The 400 V servo amplifier supports only neutral grounding. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).

No.	Description	Check method
15	Setting the ground fault breaker	Use a ground fault interrupter that supports inverters. For information about leakage current, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
16	Checking the control power	Check that the voltage of the 24 V power supply for amplifiers is in its proper range and the selected current capacity is proper. For details, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
17	Setting parameters	Set initial parameters with reference to Section 3.4.
18	Handling early failures	To solve start-up problems, such as being impossible to turn on the power, motor failing to rotate, and occurrence of an alarm, see Chapter 5 of this document.

3.2 CONNECTING THE POWER

3.2.1 Checking the Voltage and Capacity of the Power

Before connecting the power, you should measure the AC power voltage.

(1) 1-axis βiSV-B series (200-V type), 2-axis βiSV-B series (200-V type)

Table 3.2.1 (a) Action for the AC power (200-V input type)

Permissible voltage fluctuation width	Nominal voltage	Action
-15%+10%	3-phase 200 to 240VAC	**βiSV4-B, βiSV20-B, βiSV40-B, βiSV80-B, βiSV20/20-B, βiSV40/40-B** Permitted. Note) If the voltage is below the rated value, the rated output may not be obtained.
-15%+10%	1-phase 220 to 240VAC	**βiSV4-B, βiSV20-B** Single-phase input is permitted when the power supply is 380 to 415 VAC to neutral grounding.
Other than the above		**βiSV4-B, βiSV20-B, βiSV40-B, βiSV80-B, βiSV20/20-B, βiSV40/40-B** Not permitted. Use an insulating transformer to adjust the input voltage.

Table 3.2.1 (b) list the input power specification. Use a power source with sufficient capacity so that the system will not malfunction due to a voltage drop even at a time of peak load.

Table 3.2.1 (b) AC power voltage specifications (200-V input type)

Model	βiSV4-B	βiSV20-B	βiSV40-B	βiSV80-B	βiSV20/20-B	βiSV40/40-B
Nominal voltage rating	200 to 240VAC -15%,+10%					
Power source frequency	50/60Hz ±1Hz					
Power source capacity (for the main circuit) [kVA]	0.2	2.8	4.7	6.5	2.7	4.8
Power source capacity (for the control circuit) [kVA]	22				24	

(2) 1-axis βiSV-B series (400-V type)

Table 3.2.2 (a) Action for the AC power (400-V input type)

Permissible voltage fluctuation width	Nominal voltage	Action
-10%+10%	3-phase 380 to 480V	(**βiSV10HV-B, βiSV20HV-B, βiSV40HV-B**) Permitted.
-15%+10%	1-phase 220 to 240V	Not permitted.
Other than the above		Not permitted.

Table 3.2.2 (b) list the input power specification. Use a power source with sufficient capacity so that the system will not malfunction due to a voltage drop even at a time of peak load.

Table 3.2.2 (b) AC power voltage specifications (400-V input type)

Model	βiSV10HV-B	βiSV20HV-B	βiSV40HV-B
Nominal voltage rating	380 to 480VAC -10%,+10%		
Power source frequency	50/60Hz ±1Hz		
Power source capacity (for the main circuit) [kVA]	1.9	3.9	6.2
Power source capacity (for the control circuit) [VA]	22		

3.2.2 Connecting a Protective Ground

Check that a protective ground is connected correctly with reference to individual items in Chapter 6 "INSTALLATION" in the FANUC SERVO AMPLIFIER βi-B series Descriptions (B-65422EN).

3.2.3 Selecting the Ground Fault Interrupter That Matches the Leakage Current

Check that a ground fault breaker is selected correctly with reference to individual items in Chapter 6 "INSTALLATION" in the FANUC SERVO AMPLIFIER βi-B series Descriptions (B-65422EN).

3.3 INITIALIZING PARAMETERS (SWITCHES AND DUMMY CONNECTORS)

(1) βiSV4-B, βiSV20-B

- When no regenerative resistor is used
  Connect connector CXA20 by using a dummy connector.
  See FANUC SERVO AMPLIFIER βi-B series DESCRIPTIONS B-65422EN.

(2) βiSV40-B, βiSV80-B

- Switch (SW) setting
  The regenerative resistor alarm level is set. The setting condition varies depending on the regenerative resistor used (the built-in regenerative resistor or separate regenerative resistor). Perform the setting properly.

> ⚠ **WARNING**
> Incorrect setting can damage the regenerative resistor.

See FANUC SERVO AMPLIFIER βi-B series DESCRIPTIONS B-65422EN.

- When the built-in regenerative resistor is used
  Connect connector CXA20 by using a dummy connector.
  Connect connector CZ6 by using a dummy connector.
  See FANUC SERVO AMPLIFIER βi-B series DESCRIPTIONS B-65422EN.

(3) βiSV20/20-B, βiSV40/40-B

- Switch (SW) setting
  The regenerative resistor alarm level is set. The setting condition varies depending on the regenerative resistor used (when the regenerative resistor is not used or a separate regenerative resistor is used). Perform the setting properly.

> ⚠ **WARNING**
> Incorrect setting can damage the regenerative resistor.

See FANUC SERVO AMPLIFIER βi-B series DESCRIPTIONS B-65422EN.

- When the regenerative resistor is not used
  Connect connector CXA20 by using a dummy connector.
  See FANUC SERVO AMPLIFIER βi-B series DESCRIPTIONS B-65422EN.

3.4 INITIALIZING SETTINGS

For the initialization of servo amplifiers or servo motors, refer to the following manual:
FANUC AC SERVO MOTOR αi series / FANUC AC SERVO MOTOR βi series/ FANUC LINEAR LiS series / FANUC BUILT-IN SERVO MOTOR DiS series Parameter Manual (B-65270EN)

4 CONFIRMATION OF THE OPERATION

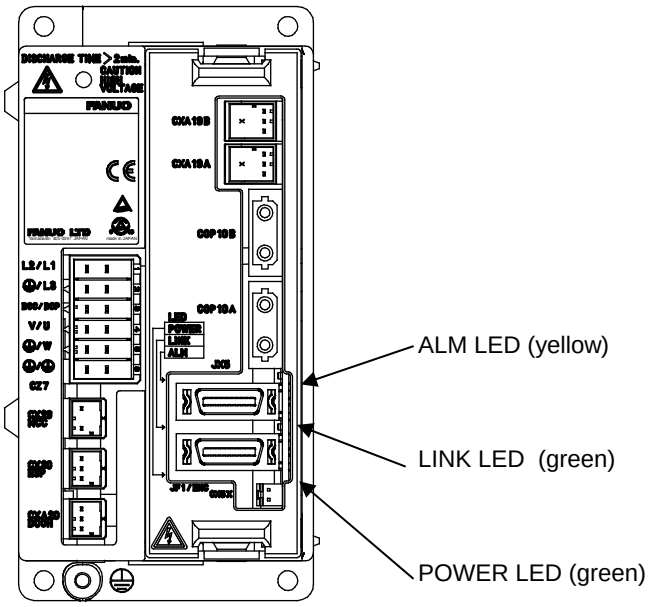
4.1 SERVO AMPLIFIER MODULE

4.1.1 Check Procedure

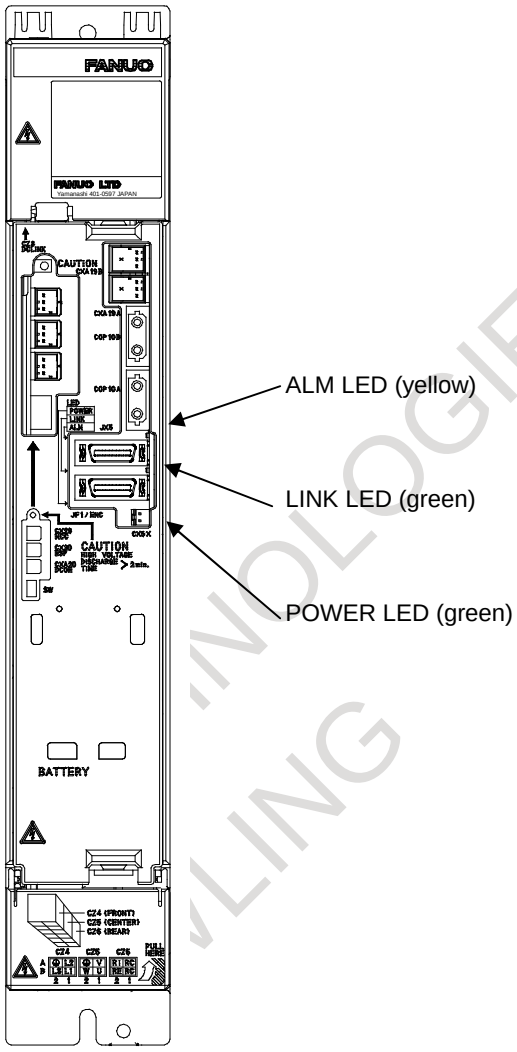
1. Turn on power.
   - ALM LED goes on. → See servo adjustment screen of host (CNC and so on).
2. ALM LED does not go on.
3. Check CNC parameters, then release emergency stop state.
   - READY LED does not go on. → See servo adjustment screen of host (CNC and so on).
4. READY LED goes on.
5. Check servo motor operation.
   - Alarm → See Part II “Troubleshooting”.
   - Abnormal motor operation

See FANUC AC SERVO MOTOR αi series / FANUC AC SERVO MOTOR βi series/ FANUC LINEAR L*i*S series / FANUC BUILT-IN SERVO MOTOR D*i*S series Parameter Manual (B-65270EN).

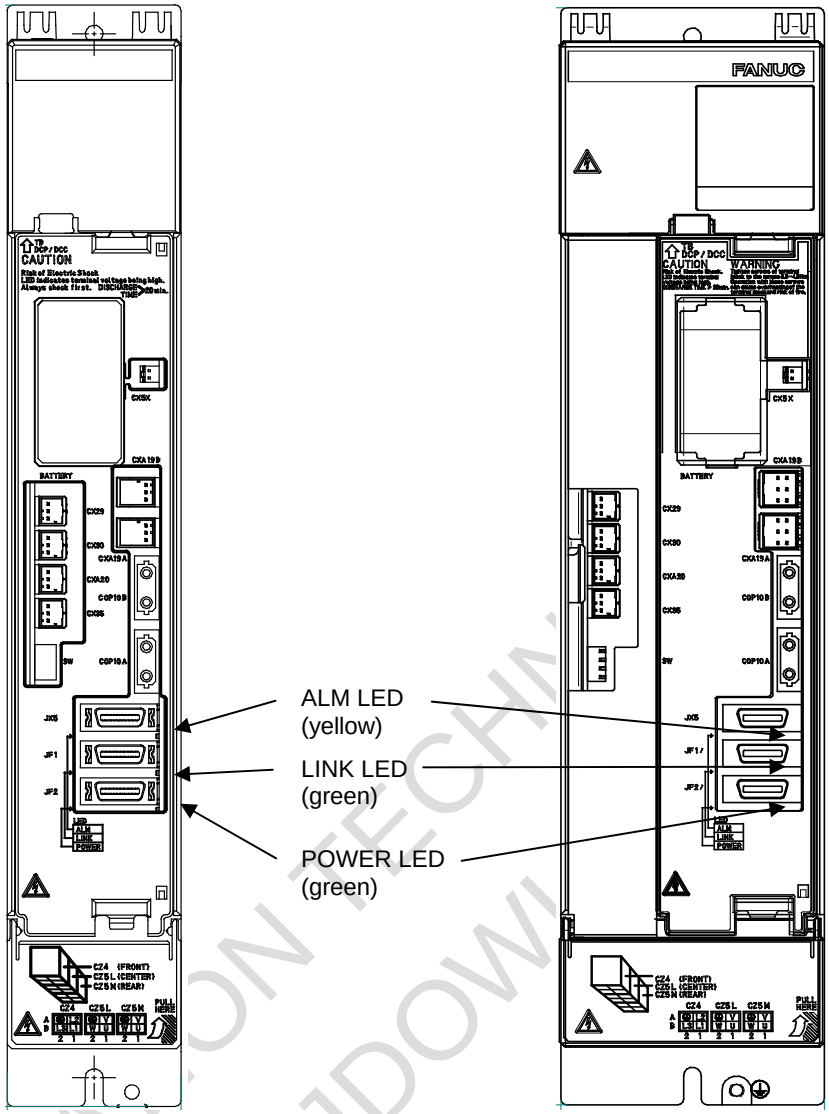
(1) βiSV4-B, βiSV20-B



(2) βiSV40-B, βiSV80-B, βiSV10HV-B, βiSV20HV-B, βiSV40HV-B



(3) βiSV20/20-B, βiSV40/40-B



(a) βiSV20/20-B (b) βiSV40/40-B

4.1.2 V Ready-off Alarm Indicated on the CNC Screen

When the V ready-off alarm is indicated on the CNC, check the items listed below. In addition, V ready-off can occur also for reasons other than listed below. If the following items turn out to have not caused V ready-off, check diagnosis information No. 358 (V ready-off information) on the diagnosis screen and report it to FANUC.

(1) Emergency stop signal (ESP)
Has the emergency stop signal (connector: CX30) applied to the βiSV-B been released? Alternatively, is the signal connected correctly?

(2) MCON signal
Hasn't setting up the axis detach function disabled the transmission of the ready command signal MCON from the CNC to the βiSV-B?

(3) βiSV-B control printed-circuit board
The βiSV-B control printed-circuit board may be poorly installed or faulty. Be sure to push the faceplate as far as it will go. If the problem persist, replace the control printed-circuit board.

Checking diagnosis information (DGN) No. 358 makes it possible to analyze the cause of the V ready-off alarm.

Diagnosis	358	V ready-off information

Convert the displayed value to binary form, and check bits 5 to 14 of the resulting binary number.
When the servo amplifier starts working, these bits become 1 sequentially, starting at bit 5. When the servo amplifier has started normally, all of bits 5 to 14 become 1.
Check bits 5 to 14 sequentially, starting at the lowest-order bit. The first lowest bit that is not 0 corresponds to the processing that caused the V ready-off alarm.

#15	#14	#13	#12	#11	#10	#9	#8
	SRDY	DRDY	INTL	RLY	CRDY	MCOFF	MCONA
#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
MCONS	*ESP	HRDY					

#06(*ESP) : Emergency stop signal
#07,#08,#09 : MCON signal (CNC → amplifier → converter)
#10(CRDY) : Converter preparation completed signal
#11(RLY) : Relay signal (DB relay energized)
#12(INTL) : Interlock signal (DB relay de-energized)
#13(DRDY) : Amplifier preparation completed signal

The following table lists the values of diagnosis information No.358 and the major failure causes. Do not detach or attach any connector while the power is on.

Values of diagnosis information No. 358	Description of failures	Check items
417	Emergency stop has not been released.	(1) Check that an emergency stop signal applied to CX30 of the common power supply has been released. (2) Check that there is no anomaly on the connection for communication between the amplifiers or the related cable. (3) Replace the servo amplifier.
993	The βiSV-B ready signal (CRDY) is not output.	(1) Check that there is no problem with the connection for communication (CXA2A/B) between the amplifiers or the related cable. (2) Check that the input power is supplied. (3) Check that the operation coil of the magnetic contactor is supplied with power and that there is no problem with the connection of CX29 of βiSV-B. (4) Replace the servo amplifier.
4065	The interlock signal is not input.	Replace the servo amplifier.
225	-	Replace the servo amplifier.
481	-	Replace the servo amplifier.
2017	-	Replace the servo amplifier.
8161	-	Replace the servo amplifier.
97	-	Check that the axis detach function has not been set.

4.1.3 Method for Observing Motor Current

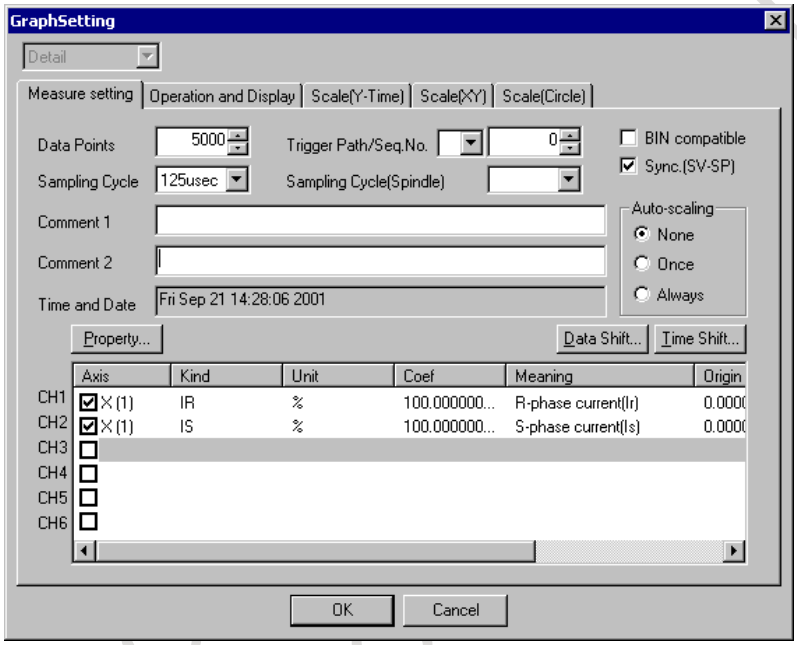
This subsection explains how to observe the current that flows through the servo motor.

(1) Method of using the SERVO GUIDE

Refer to online help for explanations about how to connect to and use the servo adjustment tool "SERVO GUIDE" and applicable CNC systems.

- Setting

Select an axis to be subjected to measurement in graph window channel setting. Also select IR and IS under Kind. Under Coef (conversion coefficient), set the maximum allowable current (Ap) for the amplifier in use.



NOTE
The minimum motor current sampling cycle depends on the current control cycle.

- Display

Select the XTYT mode from the graph window mode (M) menu to display waveforms.

II. TROUBLESHOOTING FOR βiSV-B

1 OVERVIEW

This part describes the troubleshooting procedure. Read the section related to your current trouble to locate it and take an appropriate action.

First, check the alarm number (indicated by the CNC) and the βiSV-B indication in Chapter 2 to find the cause.

Then, take an appropriate action according to the corresponding description in Chapter 3.

2 ALARM NUMBERS AND BRIEF DESCRIPTIONS

2.1 FOR Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F

2.1.1 Servo Alarm

Alarm No.	Description	Reference item
SV0361	Pulsecoder phase error (built-in)	3.2.7 (1)
SV0364	Soft phase alarm (built-in)	3.2.7 (1)
SV0365	LED error (built-in)	3.2.7 (1)
SV0366	Pulse error (built-in)	3.2.7 (1)
SV0367	Count error (built-in)	3.2.7 (1)
SV0368	Serial data error (built-in)	3.2.7 (3)
SV0369	Data transfer error (built-in)	3.2.7 (3)
SV0380	LED error (separate)	3.2.7 (2)
SV0381	Pulsecoder phase error (separate)	3.2.7 (2)
SV0382	Count error (separate)	3.2.7 (2)
SV0383	Pulse error (separate)	3.2.7 (2)
SV0384	Soft phase alarm (separate)	3.2.7 (2)
SV0385	Serial data error (separate)	3.2.7 (3)
SV0386	Data transfer error (separate)	3.2.7 (3)
SV0387	Sensor error (separate)	3.2.7 (2)
SV0417	Invalid parameter	3.2.6
SV0421	Excessive semi-full error	3.2.8
SV0430	Servo motor overheat	3.2.5
SV0432	PS: control undervoltage	3.1.4
SV0433	PS: DC link undervoltage	3.1.1
SV0436	Soft thermal (OVC)	3.2.3
SV0438	SV : current alarm	3.1.9
SV0439	PS : DC link overvoltage	3.1.2
SV0440	PS : Excessive regenerative power 2	3.1.3
SV0441	Current offset error	3.2.8
SV0444	SV: internal cooling fan stopped	3.1.5
SV0445	Soft disconnection alarm	3.2.4
SV0447	Hard disconnection alarm (separate)	3.2.4
SV0448	Feedback mismatch alarm	3.2.8
SV0449	SV: IPM alarm	3.1.7
SV0453	Soft disconnection alarm (α Pulsecoder)	3.2.4
SV0601	SV: cooling fan stopped of the radiator	3.1.6
SV0603	SV: IPM alarm (OH)	3.1.8

2.2 FOR Series 30*i*/31*i*/32*i*-A

2.2.1 Servo Alarm

Alarm No.	Description	Reference item
SV0361	Pulsecoder phase error (built-in)	3.2.7 (1)
SV0364	Soft phase alarm (built-in)	3.2.7 (1)

Alarm No.	Description	Reference item
SV0365	LED error (built-in)	3.2.7 (1)
SV0366	Pulse error (built-in)	3.2.7 (1)
SV0367	Count error (built-in)	3.2.7 (1)
SV0368	Serial data error (built-in)	3.2.7 (3)
SV0369	Data transfer error (built-in)	3.2.7 (3)
SV0380	LED error (separate)	3.2.7 (2)
SV0381	Pulsecoder phase error (separate)	3.2.7 (2)
SV0382	Count error (separate)	3.2.7 (2)
SV0383	Pulse error (separate)	3.2.7 (2)
SV0384	Soft phase alarm (separate)	3.2.7 (2)
SV0385	Serial data error (separate)	3.2.7 (3)
SV0386	Data transfer error (separate)	3.2.7 (3)
SV0387	Sensor error (separate)	3.2.7 (2)
SV0417	Invalid parameter	3.2.6
SV0421	Excessive semi-full error	3.2.8
SV0430	Servo motor overheat	3.2.5
SV0432	Converter: control power supply undervoltage	3.1.4
SV0433	Converter: DC link undervoltage	3.1.1
SV0436	Soft thermal (OVC)	3.2.3
SV0438	Inverter: motor current alarm	3.1.9
SV0439	Converter: DC link overvoltage	3.1.2
SV0440	Converter: Excessive deceleration power	3.1.3
SV0441	Current offset error	3.2.8
SV0444	Inverter: internal cooling fan stopped	3.1.5
SV0445	Soft disconnection alarm	3.2.4
SV0447	Hard disconnection alarm (separate)	3.2.4
SV0448	Feedback mismatch alarm	3.2.8
SV0449	Inverter: IPM alarm	3.1.7
SV0453	Soft disconnection alarm (α Pulsecoder)	3.2.4
SV0601	Inverter: cooling fan stopped of the radiator	3.1.6
SV0603	Inverter: IPM alarm (OH)	3.1.8

2.3 FOR Series 0*i*/0*i* Mate-D

2.3.1 Servo Alarm

Alarm No.	Description	Reference item
SV0361	Pulsecoder phase error (built-in)	3.2.7 (1)
SV0364	Soft phase alarm (built-in)	3.2.7 (1)
SV0365	LED error (built-in)	3.2.7 (1)
SV0366	Pulse error (built-in)	3.2.7 (1)
SV0367	Count error (built-in)	3.2.7 (1)
SV0368	Serial data error (built-in)	3.2.7 (3)
SV0369	Data transfer error (built-in)	3.2.7 (3)
SV0380	LED error (separate)	3.2.7 (2)
SV0381	Pulsecoder phase error (separate)	3.2.7 (2)
SV0382	Count error (separate)	3.2.7 (2)
SV0383	Pulse error (separate)	3.2.7 (2)
SV0384	Soft phase alarm (separate)	3.2.7 (2)
SV0385	Serial data error (separate)	3.2.7 (3)
SV0386	Data transfer error (separate)	3.2.7 (3)
SV0387	Sensor error (separate)	3.2.7 (2)
SV0417	Invalid parameter	3.2.6

Alarm No.	Description	Reference item
SV0421	Excessive semi-full error	3.2.8
SV0430	Servo motor overheat	3.2.5
SV0432	Converter: control power supply undervoltage	3.1.4
SV0433	Converter: DC link undervoltage	3.1.1
SV0436	Soft thermal (OVC)	3.2.3
SV0438	Inverter: motor current alarm	3.1.9
SV0439	Converter: DC link overvoltage	3.1.2
SV0440	Converter: Excessive deceleration power	3.1.3
SV0441	Current offset error	3.2.8
SV0444	Inverter: internal cooling fan stopped	3.1.5
SV0445	Soft disconnection alarm	3.2.4
SV0447	Hard disconnection alarm (separate)	3.2.4
SV0448	Feedback mismatch alarm	3.2.8
SV0449	Inverter: IPM alarm	3.1.7
SV0453	Soft disconnection alarm (α Pulsecoder)	3.2.4
SV0601	Inverter: cooling fan stopped of the radiator	3.1.6
SV0603	Inverter: IPM alarm (OH)	3.1.8

3 TROUBLESHOOTING AND ACTION

3.1 SERVO AMPLIFIER MODULE

The following table lists alarms related to the servo amplifier module.
See this table and the CNC alarm code indicated in Chapter 2, "ALARM NUMBERS AND BRIEF DESCRIPTIONS".

Alarm	LED display	Major cause	Reference item
Converter: DC link undervoltage PS: DC link undervoltage	ON	Voltage drop at the DC link in the main circuit	3.1.1
Converter: DC link overvoltage PS: DC link overvoltage	ON	Voltage rise at the DC link in the main circuit	3.1.2
Converter: excessive deceleration power PS: Excessive regenerative power 2	ON	- Too large regenerative discharge amount - Abnormal regenerative discharge circuit	3.1.3
Converter: control power supply undervoltage PS: control power supply undervoltage	ON	- Drop in external control power supply (24 V) - Connector/cable (CXA19A, CXA19B) defective - βiSV-B failure	3.1.4
Inverter: internal cooling fan stopped SV: internal cooling fan stopped	ON	- Fan not running. - Fan motor connector or cable defective - βiSV-B failure	3.1.5
Inverter: cooling fan stopped of the radiator SV: cooling fan stopped of the radiator	ON	- Fan not running. - Fan motor connector or cable defective - βiSV-B failure	3.1.6
Inverter: IPM alarm SV: IPM alarm	ON	- Short-circuit between power lead phases or ground fault in them - Short-circuit between motor winding phases or ground fault in them - βiSV-B failure	3.1.7
Inverter: IPM alarm (OH) SV: IPM alarm (OH)	ON	- The motor is being used under a harsh condition. - The ambient temperature is high. - βiSV-B failure	3.1.8
Inverter: motor current alarm SV: current alarm	ON	- Short-circuit between power lead phases or ground fault in them - Short-circuit between motor winding phases or ground fault in them - Incorrect motor ID setting - βiSV-B or motor failure	3.1.9
FSSB communication error	ON	- Connector or cable failure - βiSV-B or CNC failure	3.1.10

3.1.1 Converter: DC Link Undervoltage

(1) Meaning
The voltage at the DC link of the converter is low.
(2) Cause and troubleshooting
(a) A small power dip has occurred.
→ Check the power supply.
(b) Low input power supply voltage

→ Check the power supply specification.

(c) Insert the βiSV-B face plate (control printed-circuit board) securely.

(d) Replace the βiSV-B.

3.1.2 Converter: DC Link Overvoltage

(1) Meaning
In the main circuit, the voltage at the DC link is abnormally high.

(2) Cause and troubleshooting

(a) βiSV4-B, βiSV20-B, βiSV20/20-B and βiSV40/40-B
Use a regenerative resistor.

(b) Excessive regenerated power
Increase the acceleration/deceleration time constant. If this alarm occurs less frequently, the regeneration capacity is not sufficient. Set the acceleration/deceleration time constant to such a level that does not cause any alarm.

(c) Insert the βiSV-B face plate (control printed-circuit board) securely.

(d) Replace the βiSV-B.

(e) Check that the regenerative resistor is broken or poorly connected.

3.1.3 Converter: Excessive Deceleration Power

(1) Meaning
The converter deceleration power is too large.

(2) Cause and troubleshooting
For βiSV4-B, βiSV20-B, βiSV20/20-B and βiSV40/40-B

- When a separate regenerative resistor is not used
  (a) Connect CXA20 by using a dummy connector.
  (b) Insert the βiSV-B face plate (control printed-circuit board) securely.
  (c) Replace the βiSV-B.
- When a separate regenerative resistor is used
  (a) Check the resistance at both ends of connector CXA20 on the regenerative resistor side to confirm that the resistance is 0 Ω.
  (b) The average regenerative power may be high. Decrease the frequency of acceleration/deceleration, or review the resistor specification.
  (c) Insert the βiSV-B face plate (control printed-circuit board) securely.
  (d) Replace the βiSV-B.

For βiSV40-B and βiSV80-B

- When the built-in regenerative resistor is used
  (a) Connect CXA20 and CZ6 by using a dummy connector.
  (b) The average regenerative power may be high. Decrease the frequency of acceleration/deceleration, or review the resistor specification.
  (c) Insert the βiSV-B face plate (control printed-circuit board) securely.
  (d) Replace the βiSV-B.

- When a separate regenerative resistor is used
  (a) Check the resistance at both ends of connector CXA20 on the regenerative resistor side to confirm that the resistance is 0 Ω.
  (b) The average regenerative power may be high. Decrease the frequency of acceleration/deceleration, or review the resistor specification.
  (c) Insert the βiSV-B face plate (control printed-circuit board) securely.
  (d) Replace the βiSV-B.

3.1.4 Converter: Control Power Supply Undervoltage

(1) Meaning
The external control power supply (24 VDC) voltage is low.
(2) Cause and troubleshooting
(a) Check the voltage level of the external power supply (24 VDC). (Normal voltage: 21.6 V or higher)
(b) Check the connector and cable (CXA19A, CXA19B).
(c) Replace the βiSV-B.

3.1.5 Inverter: Internal Cooling Fan Stopped

(1) Meaning
Inverter: internal cooling fan stopped
(2) Cause and troubleshooting
(a) Check whether there is any foreign material in the fan.
(b) Be sure to push the faceplate (control printed-circuit board) as far as it will go.
(c) Check that the fan connector is attached correctly.
(d) Replace the fan.
(e) Replace the βiSV-B.

3.1.6 Inverter: Cooling Fan Stopped of the Radiator

(1) Meaning
Inverter: cooling fan stopped of the radiator
(2) Cause and troubleshooting
(a) Check whether there is any foreign material in the fan.
(b) Be sure to push the faceplate (control printed-circuit board) as far as it will go.
(c) Check that the fan connector is attached correctly.
(d) Replace the fan.
(e) Replace the βiSV-B.

3.1.7 Inverter: IPM Alarm

(1) Meaning
Inverter: IPM alarm
(2) Cause and troubleshooting
(a) Be sure to push the faceplate (control printed-circuit board) as far as it will go.
(b) Disconnect the motor power leads from the βiSV-B, and release the βiSV-B from an emergency stop condition.
<1> If no IPM alarm condition has occurred
→ Go to (c).
<2> If an IPM alarm condition has occurred
→ Replace the βiSV-B.
(c) Disconnect the motor power leads from the βiSV-B, and check the insulation between PE and the motor power lead U, V, or W.
<1> If the insulation is deteriorated
→ Go to (d).
<2> If the insulation is normal
→ Replace the βiSV-B.

(d) Disconnect the motor from its power leads, and check whether the insulation of the motor or power leads is deteriorated.
<1> If the insulation of the motor is deteriorated
→ Replace the motor.
<2> If the insulation of any power lead is deteriorated
→ Replace the power lead.

3.1.8 Inverter: IPM Alarm (OH)

(1) Meaning
Inverter: IPM alarm (OH)
(2) Cause and troubleshooting
(a) Be sure to push the faceplate (control printed-circuit board) as far as it will go.
(b) Check that the heat sink cooling fan is running.
(c) Check that the motor is being used at or below its continuous rating.
(d) Check that the cooling capacity of the cabinet is sufficient (inspect the fans and filters).
(e) Check that the ambient temperature is not too high.
(f) Replace the βiSV-B.

3.1.9 Inverter: Motor Current Alarm

(1) Meaning
Inverter: DC link current alarm
(2) Cause and troubleshooting
(a) Checking the servo parameters
Referring to " FANUC AC SERVO MOTOR αi series / FANUC AC SERVO MOTOR βi series/ FANUC LINEAR LiS series / FANUC BUILT-IN SERVO MOTOR DiS series Parameter Manual (B-65270EN)," check whether the following parameters have default values.

No.2004	No.2040	No.2041

Alternatively, if an abnormal motor current alarm condition occurs only on rapid acceleration/deceleration, it is likely that the motor is being used under too harsh a condition. Increase the acceleration/deceleration time constant, and see what will occur.
(b) Be sure to push the faceplate (control printed-circuit board) as far as it will go.
(c) Disconnect the motor power leads from the βiSV-B, and release the βiSV-B from an emergency stop condition.
<1> If no abnormal motor current occurs
→ Go to (d).
<2> If an abnormal motor current occurs
→ Replace the βiSV-B.
(d) Disconnect the motor power leads from the βiSV-B, and check the insulation between PE and the motor power lead U, V, or W.
<1> If the insulation is deteriorated
→ Go to (e).
<2> If the insulation is normal
→ Replace the βiSV-B.
(e) Disconnect the motor from its power leads, and check whether the insulation of the motor or power leads is deteriorated.
<1> If the insulation of the motor is deteriorated
→ Replace the motor.
<2> If the insulation of any power lead is deteriorated
→ Replace the power lead.

3.1.10 FSSB Communication Error

(1) Meaning
Inverter: FSSB communication error

(2) Cause and troubleshooting
(a) Replace the optical cable (COP10A) of the βiSV-B that is nearest to the CNC among the amplifiers on which the ALM LED is lit (in Fig. 3.1.10, the cable between UNIT2 and UNIT3).
(b) Replace the βiSV-B that is the second nearest to the CNC among the amplifiers on which the ALM LED is lit (in Fig. 3.1.10, UNIT3).
(c) Replace the βiSV-B that is nearest to the CNC among the amplifiers on which the ALM LED is lit (in Fig. 3.1.10, UNIT2).
(d) Replace the servo card in the CNC.

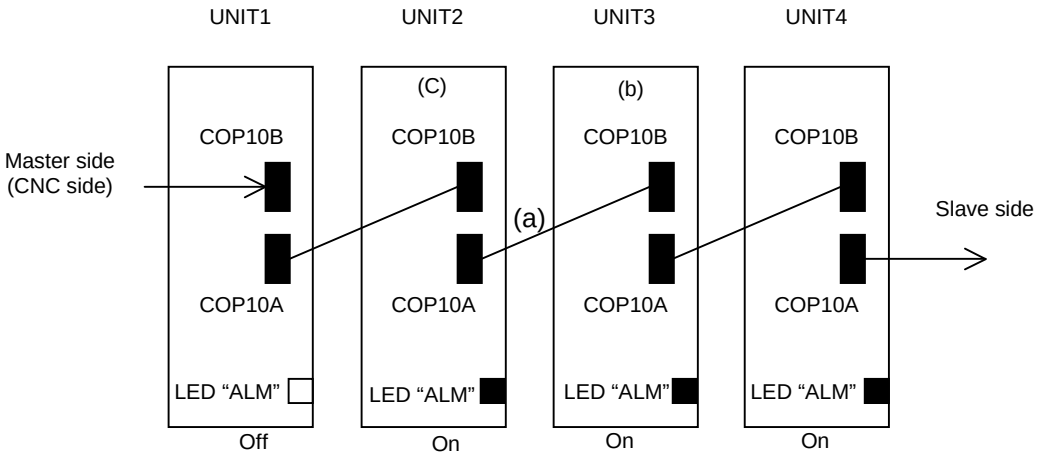


Fig. 3.1.10

3.2 SERVO CONTROL SOFTWARE

If a servo alarm is issued, an alarm message is output, and details of the alarm are also displayed on the servo adjustment screen or the diagnosis screen. Using the alarm identification table given in this section, determine the alarm, and take a proper action.

3.2.1 Servo Adjustment Screen

The following procedure can be used to display the servo adjustment screen.

SYSTEM → [SYSTEM] → [▷] → [SV-PRM] → [SV-TUN]

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

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

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

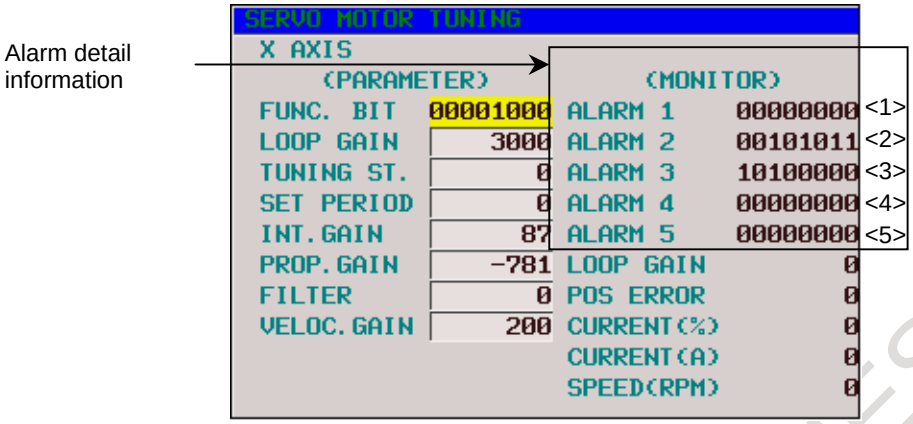


Fig. 3.2.1(a) Servo adjustment screen

The table below indicates the names of the alarm bits.

Table 3.2.1 List of alarm bit names

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				
<3> Alarm 3		CSA	BLA	PHA	RCA	BZA	CKA	SPH
<4> Alarm 4	DTE	CRC	STB	PRM				
<5> Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF
<6> Alarm 6					SFA			
<7> Alarm 7	OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH
<8> Alarm 8	DTE	CRC	STB	SPD				
<9> Alarm 9		FSD			SVE	IDW	NCE	IFE

NOTE
The empty fields do not represent alarm codes.

3.2.2 Diagnosis Screen

The alarm items of the servo adjustment screen correspond to the diagnosis screen numbers indicated in the table below.

Table 3.2.2 Correspondence between the servo adjustment screen and diagnosis screen

Alarm No.	Parameter
<1> Alarm 1	No 200
<2> Alarm 2	201
<3> Alarm 3	202
<4> Alarm 4	203
<5> Alarm 5	204
<6> Alarm 6	——
<7> Alarm 7	205
<8> Alarm 8	206
<9> Alarm 9	——

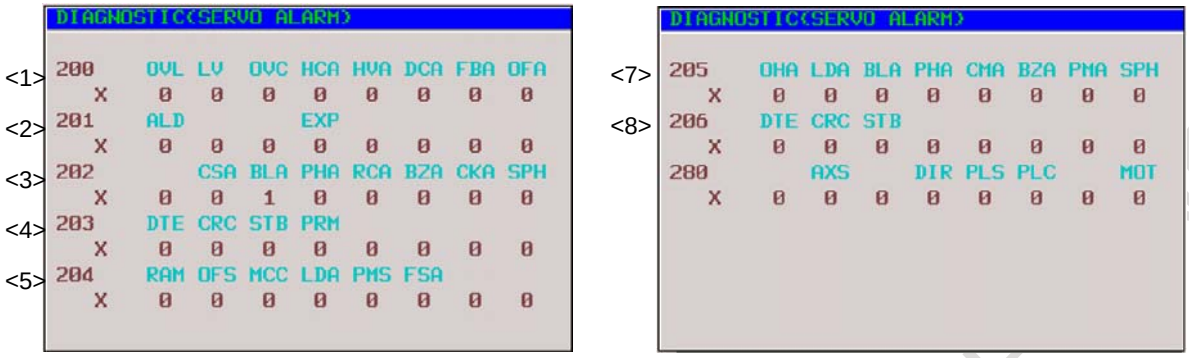


Fig. 3.2.2 Diagnosis screen

3.2.3 Overload Alarm (Soft Thermal, OVC)

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA

(Action)

(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 lead 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 set correctly.
⇒ An overload alarm is issued based on the result of calculation of these parameters. Be sure to set them to the standard values. For details of the standard values, refer to the FANUC AC SERVO MOTOR α*i* series / FANUC AC SERVO MOTOR β*i* series/ FANUC LINEAR L*i*S series / FANUC BUILT-IN SERVO MOTOR D*i*S series Parameter Manual (B-65270EN).

No. 2062	Overload protection coefficient (OVC1)
No. 2063	Overload protection coefficient (OVC2)
No. 2065	Overload protection coefficient (OVCLMT)
No. 2162	Overload protection coefficient (OVC21)
No. 2163	Overload protection coefficient (OVC22)
No. 2164	Overload protection coefficient (OVCLMT2)

(4) Attach the check board to connector JX5 to measure the waveform of the actual current (IR and IS) of the servo amplifier module. (This check pin board differs from that for the α series.)
Run the motor and measure its actual currents (IR and IS). Then compare the measurement results with the overload duty curve shown in "FANUC AC SERVO MOTOR β*i*-B/β*i* series Descriptions (B-65302EN)," and see whether the machine load is too heavy compared with the motor capacity. If the actual current is high on acceleration/deceleration, it is likely that the time constant is too small.

3.2.4 Feedback Disconnected Alarm

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				
<6> Alarm 6					SFA			

FBA	ALD	EXP	SFA	Alarm description	Action
1	1	1	0	Hard disconnection (separate phase A/B)	1
1	0	0	0	Soft disconnection (closed loop)	2
1	0	0	1	Soft disconnection (αi Pulsecoder)	3

(Action)

Action 1:

This alarm is issued when a separate phase A/B scale is used. Check if the phase A/B detector is connected correctly.

Action 2:

This alarm is issued when the position feedback pulse variation is small relative to the velocity feedback pulse variation. This means that this alarm is not issued when a semi-full is used. Check if the separate detector outputs position feedback pulses correctly. If position feedback pulses are output correctly, it is considered that the motor alone is rotating in the reverse direction at the start of machine operation because of a large backlash between the motor position and scale position.

	#7	#6	#5	#4	#3	#2	#1	#0
No. 2003							TGAL	

TGAL (#1) 1: Uses the parameter for the soft disconnection alarm detection level.

No. 2064	Soft disconnection alarm level

Standard setting 4: Alarm issued for a 1/8 rotation of the motor.
Increase this value.

Action 3:

This alarm is issued when synchronization between the absolute position data sent from the built-in Pulsecoder and phase data is lost. Turn off the power to the CNC, then detach the Pulsecoder cable then attach it again. If this alarm is still issued, replace the Pulsecoder.

3.2.5 Overheat Alarm

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				

OVL	ALD	EXP	Alarm description	Action
1	1	0	Motor overheat	1
1	0	0	Amplifier overheat	1

(Action)

Action 1:

If this alarm is issued after a long-time of continuous operation, it is considered that the motor and amplifier are overheated. Stop operation for a while, then make a check. If this alarm is still issued after the power is off for about 10 minutes then is turned on again, the thermostat is considered to be faulty. If this alarm is issued intermittently, increase the time constant or increase stop time in the program to suppress the rise in temperature.

3.2.6 Invalid Servo Parameter Setting Alarm

The invalid servo parameter setting alarm is issued when a setting out of the specifiable range is specified, or an overflow has occurred in an internal calculation. When an invalid parameter is detected on the servo side, alarm 4#4(PRM)=1 results.

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<4> Alarm 4	DTE	CRC	STB	PRM				

For details and action required when the invalid servo parameter setting alarm is issued on the servo side, refer to the FANUC AC SERVO MOTOR α*i* series / FANUC AC SERVO MOTOR β*i* series/ FANUC LINEAR L*i*S series / FANUC BUILT-IN SERVO MOTOR D*i*S series Parameter Manual (B-65270EN).

(Reference information)

Method of checking details of an invalid parameter detected on the servo side

3.2.7 Alarms Related to Pulsecoder and Separate Serial Detector

(Bits for alarm identification)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				
<3> Alarm 3		CSA	BLA	PHA	RCA	BZA	CKA	SPH
<4> Alarm 4	DTE	CRC	STB	PRM				
<5> Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF
<6> Alarm 6					SFA			
<7> Alarm 7	OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH
<8> Alarm 8	DTE	CRC	STB	SPD				
<9> Alarm 9		FSD			SVE	IDW	NCE	IFE

(1) For a built-in Pulsecoder

An alarm is determined from the bits of alarms 1, 2, 3, and 5. The table below indicates the meaning of each bit.

Alarm 3							Alarm 5		1	Alarm 2		Alarm description	Action
CSA	BLA	PHA	RCA	BZA	CKA	SPH	LDM	PMA	FBA	ALD	EXP		
						1						Soft phase alarm	2
				1								Zero battery voltage	1
			1						1	1	0	Count error alarm	2
		1										Phase alarm	2
	1											Battery voltage decrease (Caution)	1
								1				Pulse error alarm	
							1					LED error alarm	

> ⚠ **CAUTION**
> An alarm for which no action number is given is considered to be caused by a Pulsecoder failure. Replace the Pulsecoder.

(2) For a separate serial detector
An alarm is determined from the bits of alarm 7. The table below indicates the meaning of each bit.

Alarm 7								Alarm description	Action
OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH		
							1	Soft phase alarm	2
						1		Pulse error alarm	
					1			Zero battery voltage	1
				1				Count error alarm	2
			1					Phase alarm	2
		1						Battery voltage decrease (Caution)	1
	1							LED error alarm	
1								Separate detector alarm	3

⚠ CAUTION
An alarm for which no action number is given is considered to be caused by a detector failure. Replace the detector.

(Action)
Action 1: Battery-related alarms
Check if a battery is connected. When the power is turned on for the first time after a battery is connected, the zero battery voltage alarm is issued. In such a case, turn off the power, then turn on the power again. If the alarm is still issued, check the battery voltage. If the battery voltage decrease alarm is issued, check the voltage, and replace the battery as required.

Action 2: Alarms that may be issued for noise
If an alarm is issued intermittently or after emergency stop cancellation, noise is probably the cause. So, provide noise protection. If the same alarm is still issued after noise protection is provided, replace the detector.

Action 3: Alarm condition detected by the separate detector
If the separate detector detects an alarm condition, contact the manufacturer of the detector for information on troubleshooting.

(3) Alarms related to serial communication
An alarm is determined from the bits of alarms 4 and 8.

Alarm 4			Alarm 8			Alarm description
DTE	CRC	STB	DTE	CRC	STB	
1						Serial Pulsecoder communication alarm
	1					
		1				
			1			Separate serial Pulsecoder communication alarm
				1		
					1	

Action:
Serial communication is not performed correctly. Check if the cable is connected correctly and is not broken. If CRC or STB is issued, noise may be the cause. So, provide noise protection. If CRC or STB is always issued after the power is turned on, the Pulsecoder or amplifier control board or the pulse module may be faulty.

3.2.8 Other Alarms

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<5> Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF

OFS	DAL	ABF	Alarm description	Action
		1	Feedback mismatch alarm	1
	1		Excessive semi-full error alarm	2
1			Current offset error alarm	3

(Action)

Action 1:

This alarm is issued when the move direction of the position detector is opposite to the move direction of the speed detector. Check the rotation direction of the separate detector. If the rotation direction of the separate detector is opposite to the rotation direction of the motor, take the following action:

For a phase A/B detector: Reverse the connections of A and XA.

For a serial detector: Reverse the setting of the signal direction of the separate detector.

In the Series 90B0/G(07) and subsequent editions, the following settings enable signal directions in the A/B phase detector to be inverted.

	#7	#6	#5	#4	#3	#2	#1	#0
No. 2018								RVRSE

RVRSE (#0) Reverses the signal direction of the separate detector.

0: Does not reverse the signal direction of the separate detector.

1: Reverses the signal direction of the separate detector.

If a large distortion exists between the motor and separate detector, this alarm may be issued in the case of abrupt acceleration/deceleration. In such a case, modify the detection level.

	#7	#6	#5	#4	#3	#2	#1	#0
No. 2201							RNLV	

RNLV (#1) Modifies the feedback mismatch alarm detection level.

1: Detected with 1000 min^{-1} or more

0: Detected with 600 min^{-1} or more

Action 2:

This alarm is issued when the difference between the motor position and separate detector position exceeds the excessive semi-full error level. Check if the conversion efficient for dual position feedback is set correctly. If the conversion efficient is set correctly, increase the alarm level. If this alarm is still issued after the level is modified, check the connection direction of the scale.

No. 2078	Dual position feedback conversion coefficient (numerator)

No. 2079	Dual position feedback conversion coefficient (denominator)

$$\text{Conversion coefficient} = \frac{\left(\text{Number of feedback pulses per motor revolution (detection unit)}\right)}{1{,}000{,}000}$$

No. 2118	Dual position feedback semi-full error level

[Setting] Detection unit. When 0 is set, no detection is made.

Action 3:

The current offset value of the current detector (equivalent to the current value in the emergency stop state) is abnormally high. If this alarm is still issued after the power is turned off then back on, the current detector is faulty. For the β*i* series, replace the amplifier.

4 REPLACING SERVO AMPLIFIER COMPONENTS

This chapter describes how to replace a fan motor, absolute Pulsecoder battery, fuses, and printed-circuit board.

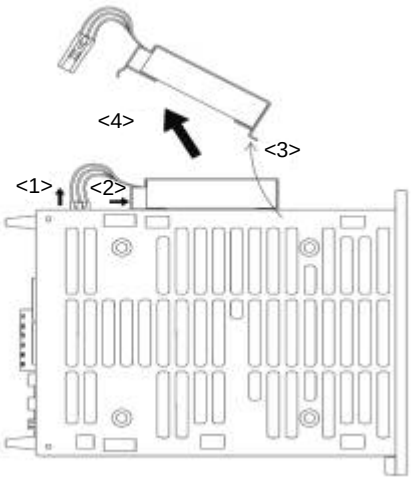
> ⚠ **WARNING**
> Because the Servo Amplifier uses a large-capacitance electrolytic capacitor internally, the Servo Amplifier remains charged for a while even after the power is turned off. Before touching the Servo Amplifier for maintenance or other purposes, ensure your safety by measuring the residual voltage in the DC link with a tester and confirming that the charge indication LED (red) is off.

> ⚠ **CAUTION**
> Install a fan motor when the control power supply does not supply power to the βiSV-B.

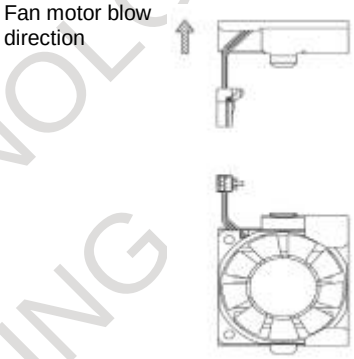
4.1 REPLACEMENT OF A FAN MOTOR

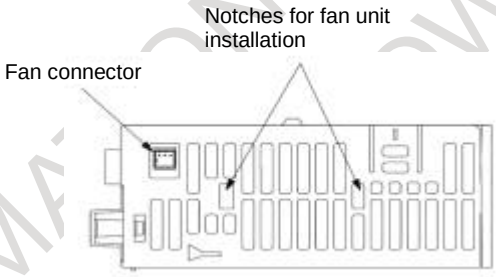
4.1.1 Removing the Fan Unit of βiSV4-B or βiSV20-B

<1> Pull out the fan connector upward.
<2> Push the front of the fan unit to disengage the lug.
<3> Disengage the rear of the fan unit.
<4> Lift the fan unit in a slant direction.



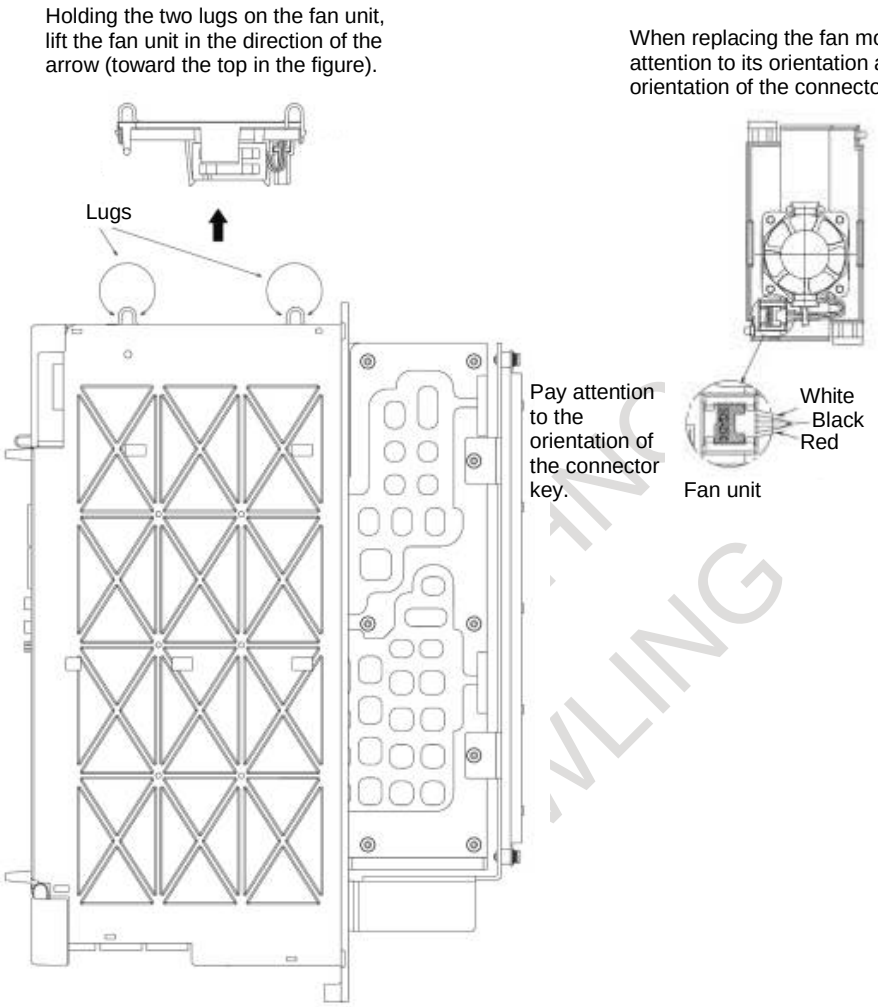
When replacing the fan motor, pay attention to its orientation and the cable drawing position.





4.1.2 Removing the Internal Cooling Fan Unit of βiSV40-B, βiSV80-B, βiSV10HV-B, βiSV20HV-B, βiSV40HV-B, or βiSV20/20-B

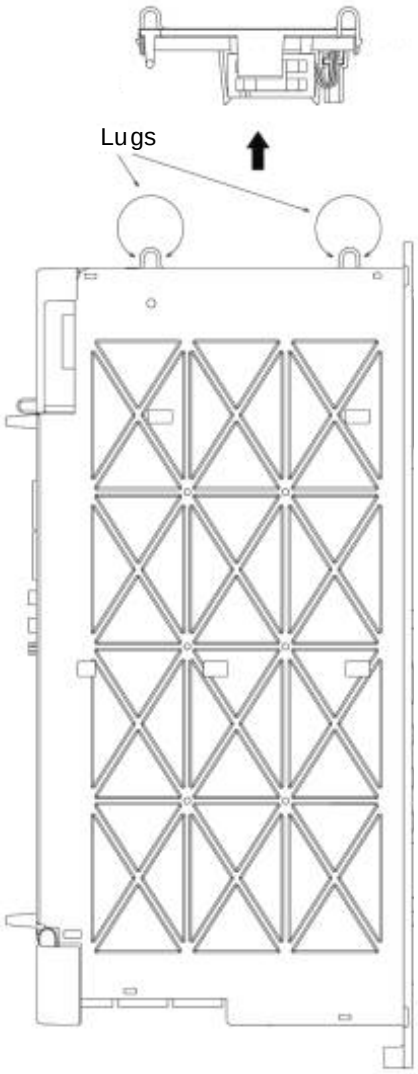
1 Hold the two handles of the fan unit and pull up them in the direction (the upward direction of the figure) of the arrow.



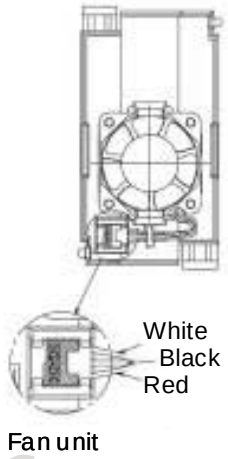
4.1.3 Removing the Fan Unit of βiSV40/40-B

1 Hold the two handles of the fan unit and pull up them in the direction (the upward direction of the figure) of the arrow.

Holding the two lugs on the fan unit, lift the fan unit in the direction of the arrow (toward the top in the figure).

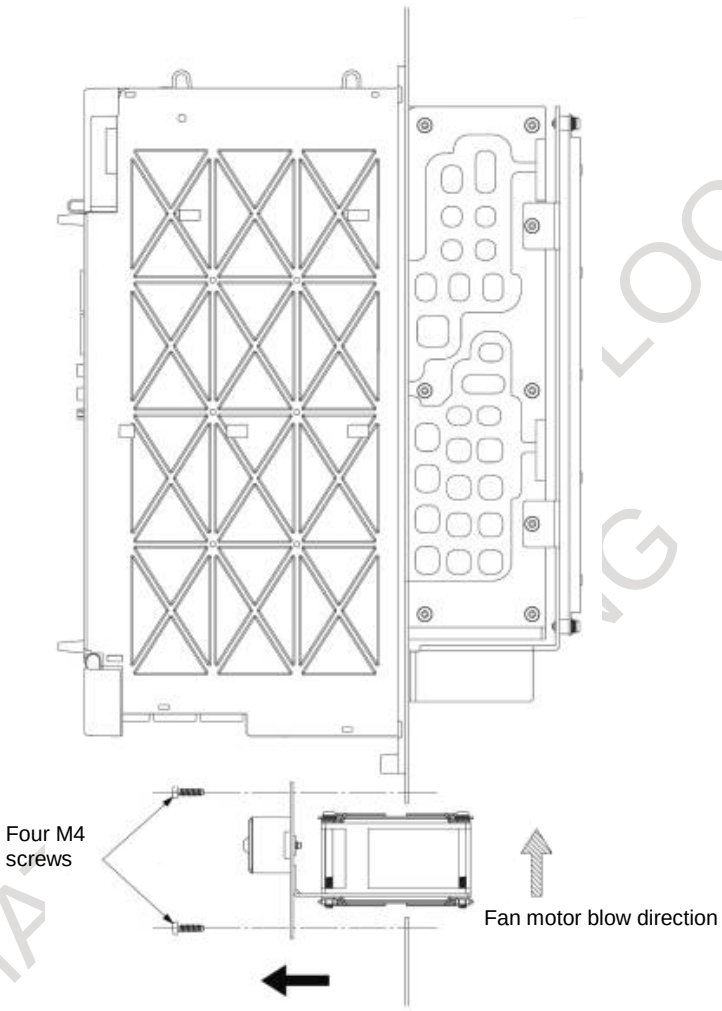


When replacing the fan motor, pay attention to its orientation and the orientation of the connector.



4.1.4 Removing the Radiator Cooling Fan Unit of βiSV80-B or βiSV40HV-B

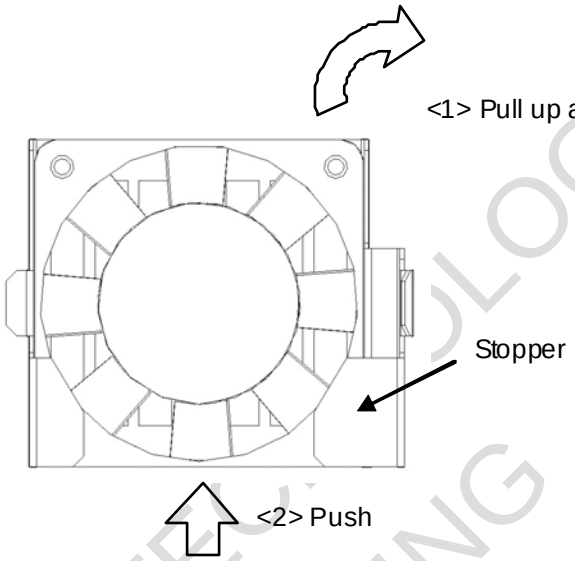
1 Holding the two lugs on the fan unit, lift the fan unit in the direction of the arrow (upward in the figure).



4.1.5 Removing the Fan Motor from the Fan Unit (βiSV4-B, βiSV20-B)

(a) A06B-6134-K003

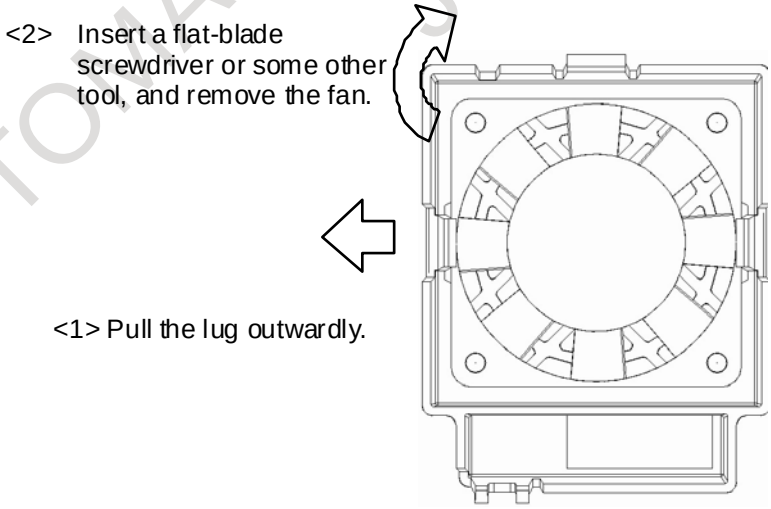
(1) Remove the fan motor from the case.
<1> Pull up the side of the fan motor (the side without the case stoppers) away from the case.
<2> While pulling up the fan motor, push it toward its center from the side where the case stoppers are located.



When replacing the fan motor, pay attention to its orientation (when the fan motor is mounted in an amplifier, its label is facing upward).

(b) A06B-6134-K005

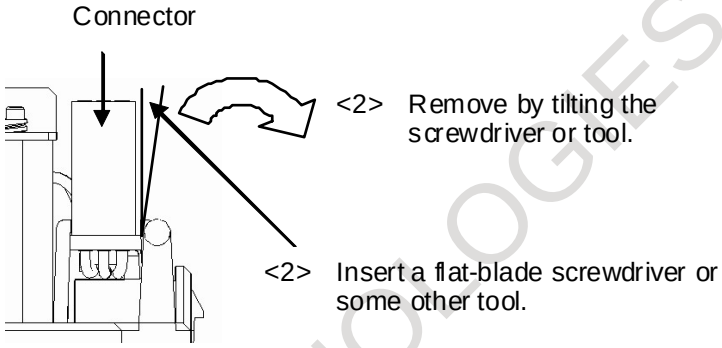
(1) Remove the fan motor from the case.
<1> Pull one of the lugs on the case.
<2> While pulling the lug, remove the fan using a flat-blade screwdriver or some other tool.



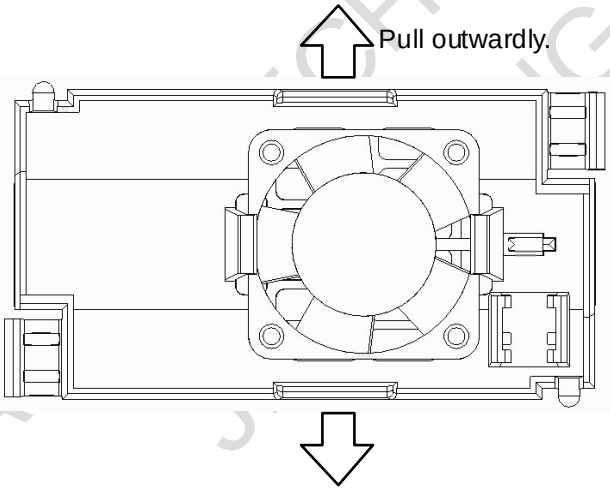
When replacing the fan motor, pay attention to its orientation (when the fan motor is mounted in an amplifier, its label is facing upward).

4.1.6 Removing the Fan Motor from the Fan Unit (βiSV40-B, βiSV80-B, βiSV10HV-B, βiSV20HV-B, βiSV40HV-B, βiSV20/20-B)

(1) Remove the connector from the case.
<1> Insert a flat-blade screwdriver or some other tool between the case and the connector.
<2> Tilt the inserted screwdriver or tool.



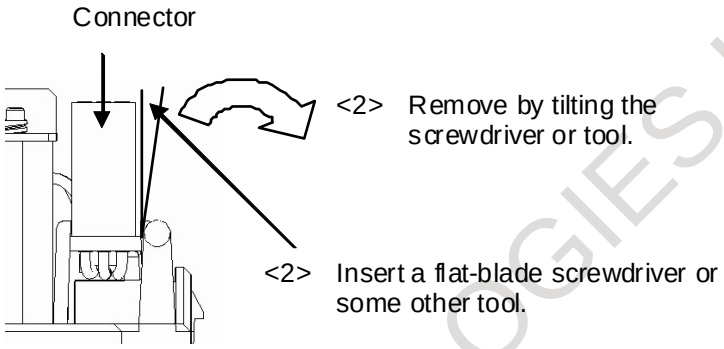
(2) Pull the lugs on the case outwardly, and remove the fan motor.



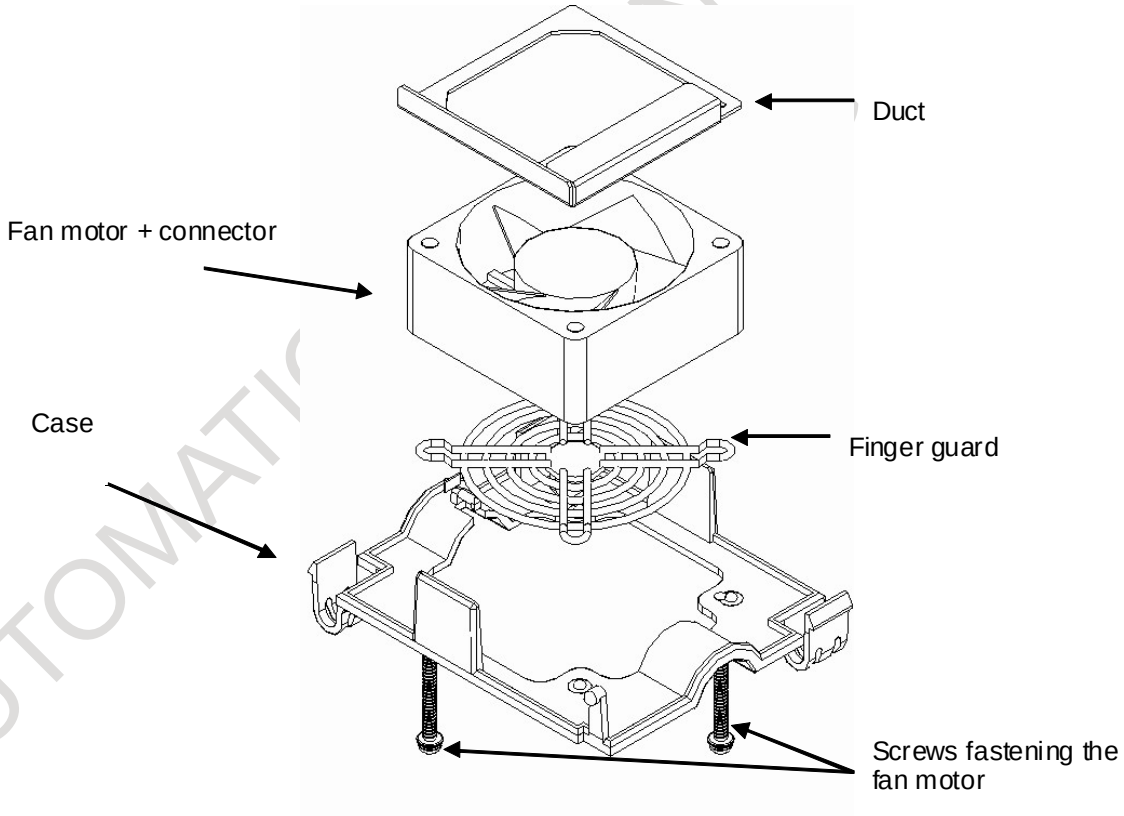
When replacing the fan motor, pay attention to its orientation (when the fan motor is mounted in an amplifier, its label is facing upward) as well as to the orientation of the connector.

4.1.7 Removing the Fan Motor from the Fan Unit (βiSV40/40-B)

(1) Remove the connector from the case.
<1> Insert a flat-blade screwdriver or some other tool between the case and the connector.
<2> Tilt the inserted screwdriver or tool.



(2) Remove the two screws fastening the fan motor.



When replacing the fan motor, pay attention to its orientation (when the fan motor is mounted in an amplifier, its label is facing upward), the orientation of the connector, and the orientation of the duct (its turned edge is facing the opposite direction of the connector).

4.1.8 Specifications of Fan Units for Maintenance

(1) 1-axis

Model name	Internal cooling fan		Radiator cooling fan	
	Fan unit	Fan motor	Fan unit	Fan motor
βiSV4-B βiSV20-B	A06B-6134-K003 (Sheet-metal type) A06B-6134-K005 (Resin type)	A90L-0001-0423#50	-	-
βiSV40-B	A06B-6110-C605	A90L-0001-0510	-	-
βiSV80-B	A06B-6110-C605	A90L-0001-0510	A06B-6134-K002	A90L-0001-0445#B
βiSV10HV-B βiSV20HV-B	A06B-6110-C605	A90L-0001-0510	-	-
βiSV40HV-B	A06B-6110-C605	A90L-0001-0510	A06B-6134-K002	A90L-0001-0445#B

(2) 2-axis

Model name	Internal cooling fan		Radiator cooling fan	
	Fan unit	Fan motor	Fan unit	Fan motor
βiSV20/20-B (A06B-6166-H201)	A06B-6110-C605	A90L-0001-0510	-	-
βiSV20/20-B (A06B-6166-H201#A)	-	-	-	-
βiSV40/40-B	A06B-6110-C641	A90L-0001-0569	-	-

4.2 REPLACING BATTERY FOR ABSOLUTE PULSECODERS

4.2.1 Overview

- When the voltage of the batteries for absolute Pulsecoders becomes low, alarm 307 or 306 occurs, with the following indication in the CNC state display at the bottom of the CNC screen.
  Alarm 307 (alarm indicating the voltage of the battery becomes low) :
  The indication "APC" blinks in reversed display.
  Alarm 306 (battery zero alarm) :
  The indication "ALM" blinks in reversed display.
- When alarm 307 (alarm indicating the voltage of the battery becomes low) occurs, replace the battery as soon as possible. In general, the battery should be replaced within one or two weeks, however, this depends on the number of Pulsecoders used.
- When alarm 306 (battery zero alarm) occurs, Pulsecoders are reset to the initial state, in which absolute positions are not held. Alarm 300 (reference position return request alarm) also occurs, indicating that reference position return is required.
- In general, replace the batteries periodically within the service life listed below.
  - A06B-6050-K061 or D-size alkaline dry cells (LR20): Two years (for each six-axis configuration)
  - A06B-6093-K001 : Two years (for each one-axis configuration)
  - A06B-6114-K504 : One year (for each three-axis configuration)

NOTE
The above values indicate the estimated service life of batteries used with FANUC absolute Pulsecoders. The actual battery service life depends on the machine configuration based on, for example, detector types. For details, contact the machine tool builder.

4.2.2 Replacing Batteries

To prevent absolute position information in absolute Pulsecoders from being lost, turn on the machine power before replacing the battery. The replacement procedure is described below.
<1> Ensure that the power to the servo amplifier is turned on.
<2> Ensure that the machine is in the emergency stop state (the motor is inactive).
<3> Ensure that the DC link charge LED of the servo amplifier is off.
<4> Detach the old batteries and attach new ones.
The replacement of the batteries in a separate battery case and the replacement of the battery built into the servo amplifier are described below in detail.

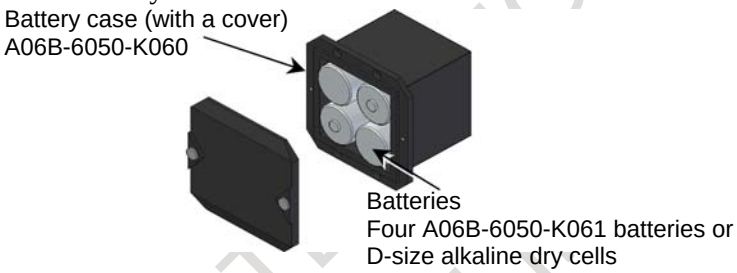
⚠ WARNING
1 The absolute Pulsecoder of each of the αi series servo motors or βi series servo motors (βiS0.4 to βiS40, βiSc, and βiF) has a built-in backup capacitor. Therefore, even when the power to the servo amplifier is off and the batteries are replaced, reference position return is not required if the replacement completes within less than 10 minutes. Turn the power on and replace the batteries if the replacement will take 10 minutes or more.
2 To prevent electric shock, be careful not to touch metal parts in the power magnetics cabinet when replacing the batteries.

⚠ WARNING

3 Because the servo amplifier uses a large-capacitance electrolytic capacitor internally, the servo amplifier remains charged for a while even after the power is turned off. Before touching the servo amplifier for maintenance or other purposes, ensure your safety by measuring the residual voltage in the DC link with a tester and confirming that the charge indication LED (red) is off.
4 Be sure to replace the batteries with specified ones. Pay attention to the battery polarity. If a wrong type of battery is used or a battery is installed with incorrect polarity, the battery may overheat, blow out, or catch fire, or the absolute position information in the absolute Pulsecoders may be lost.
5 Ensure that the battery connector is inserted in the correct position.

4.2.3 Replacing the Batteries in a Separate Battery Case

Use the following procedure to replace the batteries in the battery case.
<1> Loosen the screws on the battery case and detach the cover.
<2> Replace the batteries in the case (pay attention to the polarity).
<3> Attach the cover to the battery case.



⚠ CAUTION

1 Four D-size alkaline dry cells (LR20) that are commercially available can be used as batteries. A set of four A06B-6050-K061 batteries is optionally available from FANUC.
2 Replace all the four batteries with new ones. If old and new batteries are mixed, the absolute position information in the absolute Pulsecoders may be lost.

4.2.4 Replacing the Battery Built into the Servo Amplifier

Use the following procedure to replace the special lithium battery.
<1> Detach the battery case.
<2> Replace the special lithium battery.
<3> Attach the battery case.

⚠ CAUTION

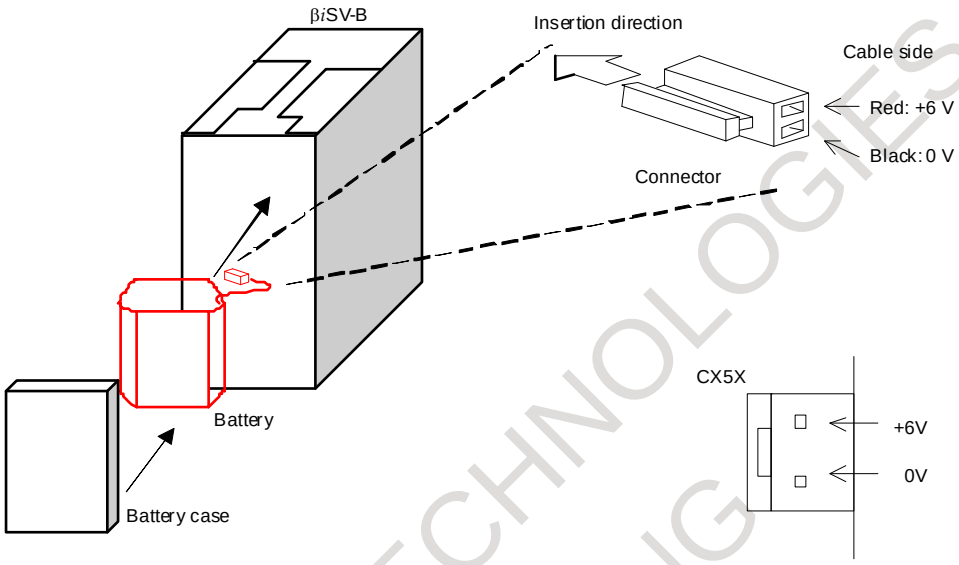
1 Purchase the battery from FANUC because it is not commercially available. It is therefore recommended that you have a backup battery.
2 When the built-in battery is used, do not connect BATL (B3) of connector CXA19B/CXA19A. Also, do not connect two or more batteries to the same BATL (B3) line. These connections are dangerous because battery output voltages may be short-circuited, causing the batteries to overheat.
3 Install the battery in the servo amplifier in a direction that allows slack in the cable. If the battery cable is under tension, a bad connection may occur.

⚠ CAUTION

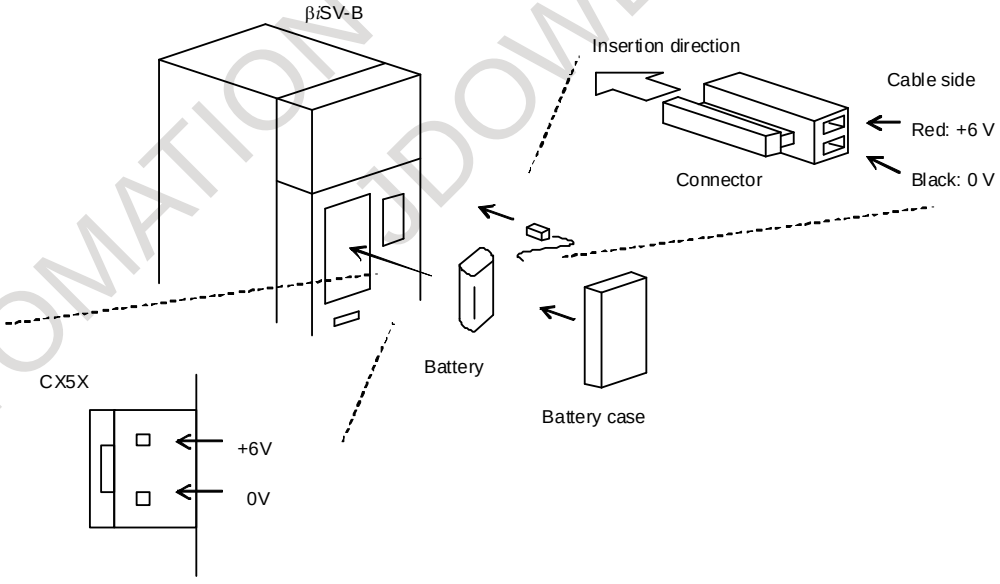
4 If the +6 V pin and 0 V pin of CX5X are short-circuited, the battery may overheat, blow out, or catch fire, or the absolute position information in the absolute Pulsecoders may be lost.

5 When inserting the connector, align it to the connector pins.

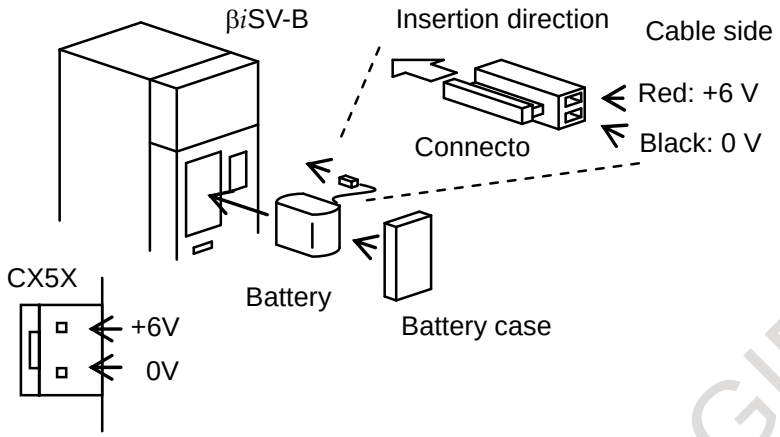
(1) For βiSV4-B and βiSV20-B



(2) For βiSV40-B, βiSV80-B, βiSV10HV-B, βiSV20HV-B, and βiSV40HV-B



(3) For βiSV20/20-B and βiSV40/40-B



Used batteries

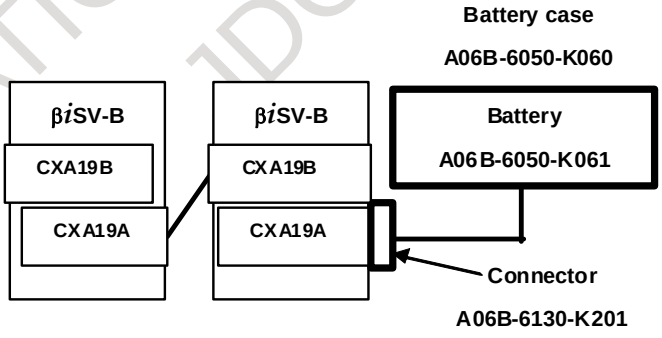
Old batteries should be disposed as "INDUSTRIAL WASTES" according to the regulations of the country or autonomy where your machine has been installed.

4.2.5 Notes on Replacing a Battery (Supplementary Explanation)

4.2.5.1 Battery connection modes

The battery for the absolute Pulsecoder can be connected using [Connection method 1] and [Connection method 2] explained below.
For details, refer to "Connecting the Battery" in the FANUC SERVO AMPLIFIER βi-B Series Descriptions (B-65422EN).

[Connection method 1] Method of supplying battery power from one battery to multiple βiSV-B amplifiers

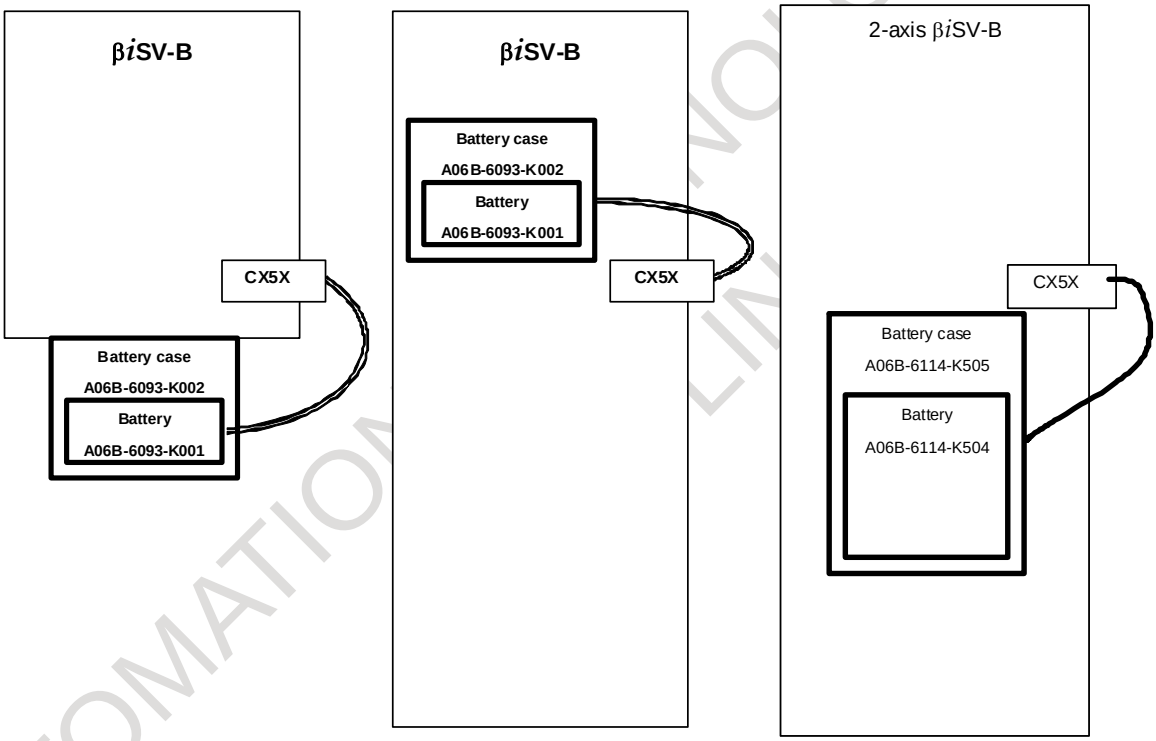


- If a low battery voltage or a battery voltage of 0 V is indicated by an APC (absolute Pulsecoder) alarm, replace the battery. If a battery voltage of 0 V is indicated, you need to make a zero point return.
- The absolute Pulsecoder of the αi series servo motor and the βi series servo motor (βiS 0.4 to βiS 40, βiSc, βiF) is incorporated with a backup capacitor as standard. This backup capacitor enables an absolute position detection to be continued for about 10 minutes. Therefore, no zero point return need be performed if the time during which servo amplifier power is kept off for battery replacement is within 10 minutes.
  The Pulsecoder of some of the βiS series servo motors (βiS 0.2 to βiS0.3) does not include a backup capacitor. Be careful when replacing the battery for this Pulsecoder. See Subsection 4.2.5.2, “Connecting the battery for the βiS 0.2 to βiS 0.3” for details.

- The battery service life is about two years for the αi series servo motor and the βi series servo motors (βiS 0.4~βiS 40, βiSc, βiF) if servo motors for six axes are connected. For some of the βiS series servo motors (βiS 0.2 to βiS0.3), the battery service life is about one year.
  FANUC recommends that you replace the batteries periodically according to the battery service life.
- The battery unit consists of four LR20 alkaline batteries. Commercial batteries can be used in the battery unit. The optional battery offered by FANUC is A06B-6050-K061.

> ⚠ **WARNING**
> 1 Do not connect more than one battery to the same BAT (B3) line. If the output voltage is different between the batteries, they may be short-circuited, resulting in the batteries becoming very hot.
> 2 Install the battery with correct polarity. If the battery is installed with incorrect polarity, it may overheat, blow out, or catch fire.

[Connection method 2] Method of building a built-in battery into each βiSV-B



- If a low battery voltage or a battery voltage of 0 V is indicated by an APC (absolute Pulsecoder) alarm, replace the battery (A06B-6093-K001 or A06B-6114-K504). If a battery voltage of 0 V is indicated, you need to make a zero point return.
- The absolute Pulsecoder of the αi series servo motor and the βi series servo motor (βiS 0.4 to βiS 40, βiSc, and βiF) is incorporated with a backup capacitor as standard. This backup capacitor enables an absolute position detection to be continued for about 10 minutes. Therefore, no zero point return need be performed if the time during which servo amplifier power is kept off for battery replacement is within 10 minutes.
  The Pulsecoder of some of the βiS series servo motors (βiS 0.2 to βiS0.3) does not include a backup capacitor. Be careful when replacing the battery for this Pulsecoder. See Subsection 4.2.5.2, “Connecting the battery for the βiS 0.2 to βiS 0.3” for details.
- The battery service life is about two years for the αi series servo motor and the βi series servo motors (βiS 0.4 to βiS 40, βiSc, and βiF). For some of the βiS series servo motors (βiS 0.2 to βiS0.3), the battery service life is about one year.
  FANUC recommends that you replace the batteries periodically according to the battery service life.

- The built-in batteries are not commercially available. They must be purchased from FANUC. So, FANUC recommends that you keep spares.

⚠ WARNING
1 When using the built-in batteries (A06B-6073-K001 or A06B-6114-K504), do not connect them to the BAT (B3) of connector CXA19B/CXA19A.
The output voltages from different batteries may be short-circuited, resulting in the batteries becoming very hot.
2 Do not connect more than one battery to the same BAT (B3) line. If the output voltage is different between the batteries, they may be short-circuited, resulting in the batteries becoming very hot.
3 Install the battery with correct polarity. If the battery is installed with incorrect polarity, it may overheat, blow out, or catch fire.

4.2.5.2 Replacing βiS 0.2 to βiS 0.3 batteries

Some servo motors of the βi series (βiS 0.2 to βiS 0.3) do not have a backup capacitor in the Pulsecoder as a standard feature. Therefore, to avoid losing the absolute position data of the absolute Pulsecoder, you need to have the control power on when replacing the battery. The replacement procedure is described below.

[Replacement procedure]
1 Check that the power of βiSV-B is on (that the "POWER" LED on the front side of βiSV-B is on).
2 Check that the emergency stop button of the system has been pressed.
3 Check that the motor is not excited.
4 Check that the DC link charge LED of βiSV-B is off.
5 Remove the old battery, and attach the new one.
6 The replacement procedure is complete. You are ready to turn off the power of the system.

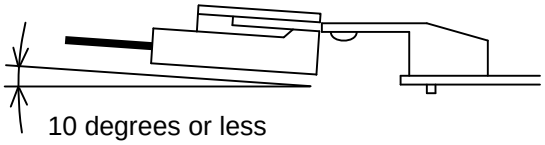
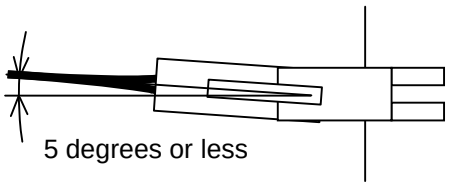
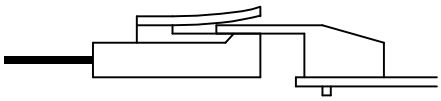
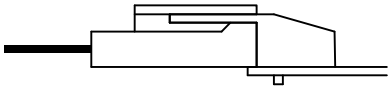
⚠ WARNING
1 When replacing the battery, be careful not to touch bare metal parts in the power magnetics cabinet. Particularly, touching a high voltage part may cause electric shock.
2 Before replacing the battery, check that the DC link charge LED on the front side of the servo amplifier is off. Replacing the battery when this LED is on may cause electric shock.
3 When connecting the battery, pay attention to its polarity. If connected with the wrong polarity, the battery may overheat, burst, or catch fire.
4 Be careful not to short-circuit '+6V' and '0V' of the battery. If short-circuited, the battery may overheat, burst, or catch fire.

4.2.5.3 Notes on attaching connectors

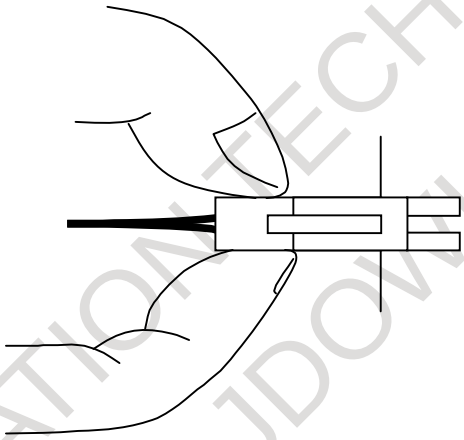
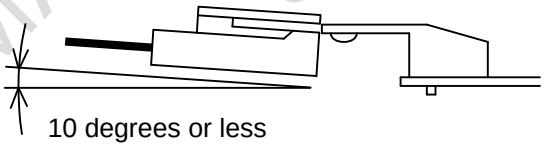
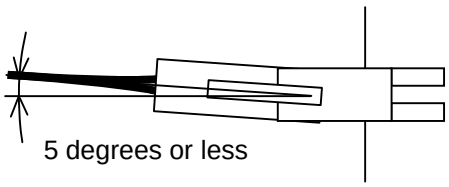
If an excessive strain is applied to a connector when it is inserted or removed, a poor contact may result. When inserting and removing the battery connector, therefore, be careful not to apply an excessive wrenching force to it; just follow the instructions given in the following table.

(1) Attaching connectors

<1>		Check the attachment position.

<2>		Plug the cable connector while raising it slightly.
<3>		Here, the angle of the cable connector to the horizontal must be 5 degrees or less.
<4>		After passing the lock pin, insert the connector straight.
<5>		The attachment of the connector is completed.

(2) Detaching the connector

<1>		Hold both the sides of the cable insulator and the cable, and pull them horizontally.
<2>		Pull out the cable side while raising it slightly.
<3>		Here, the angle of the cable to the horizontal must be 5 degrees or less.

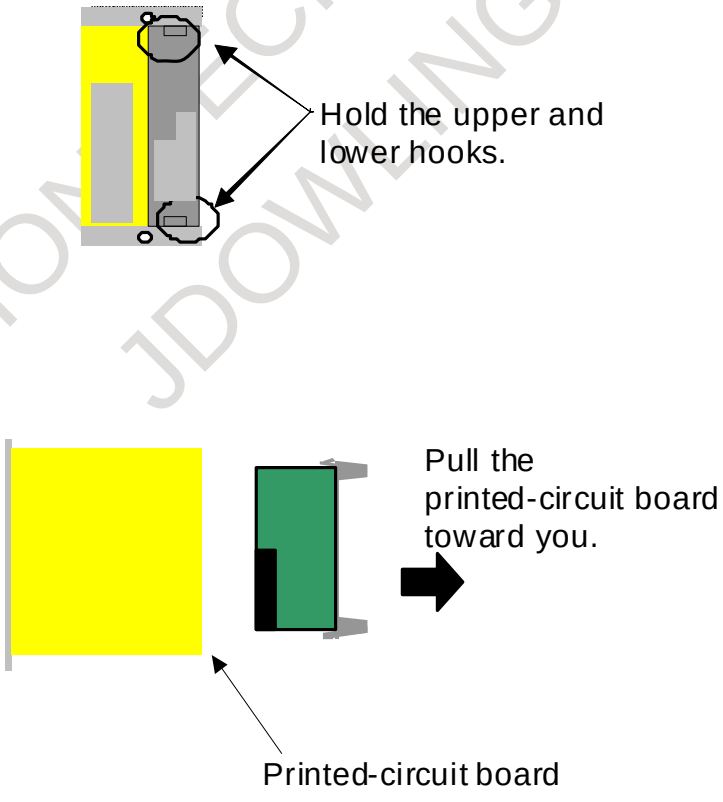
4.3 HOW TO REPLACE THE FUSES AND PRINTED CIRCUIT BOARDS

4.3.1 How to Replace the Fuses and Printed Circuit Boards

In the βiSV-B series, a printed-circuit board can be removed and inserted from the front of the servo amplifier.

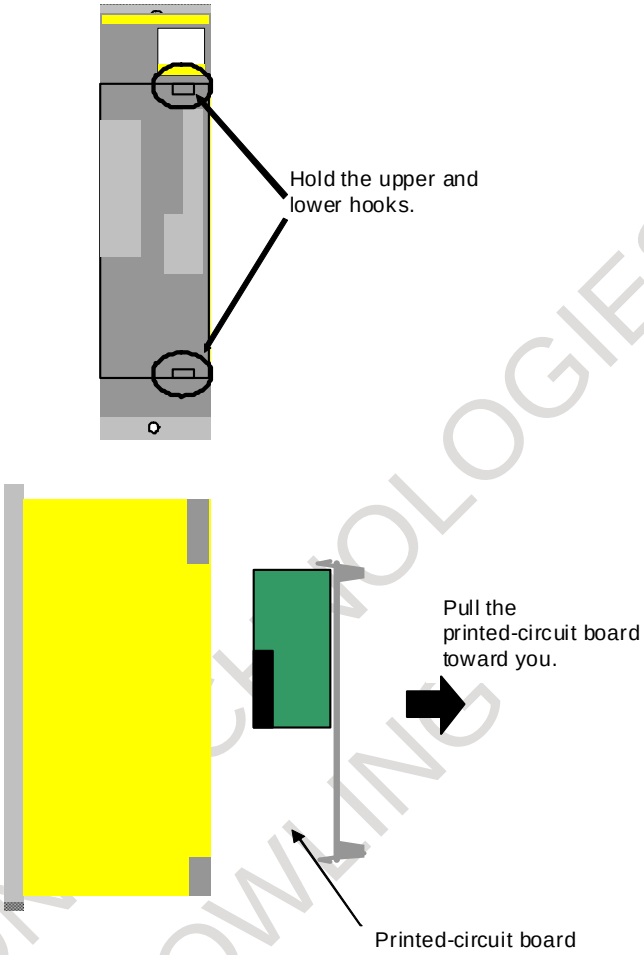
NOTE
1 If a fuse blows, it is likely that there is a short-circuit in the power supply for a device (such as a sensor) connected to the Servo Amplifier.
After checking that all devices connected to the Servo Amplifier are normal, replace the fuse.
If you do not remove the cause, it is very much likely that the fuse will blow again.
2 Do not use any fuse not supplied from FANUC.
3 Before replacing a fuse, check a marking on it with that on the printed-circuit board. Be careful not to mount a fuse with an incorrect rating.

(1) For βiSV4-B and βiSV20-B



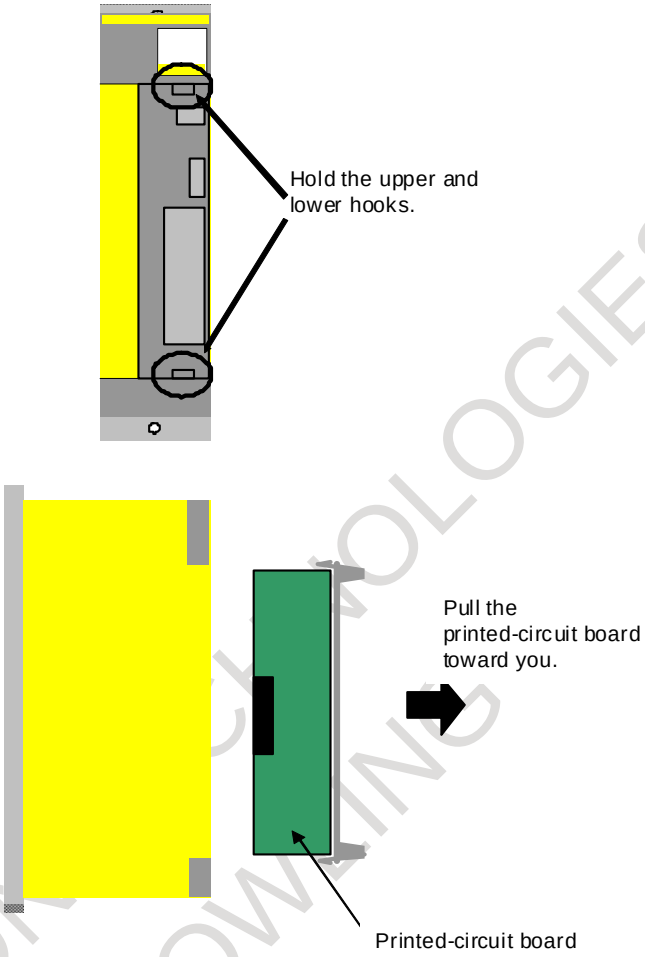
To insert the printed-circuit board, reverse the above procedure.
Ensure that the upper and lower hooks snap into the housing.
If the printed-circuit board is not inserted completely, the housing remains lifted. Pull out the printed-circuit board and insert it again.

(2) For βiSV40-B, βiSV80-B, βiSV10HV-B, βiSV20HV-B, and βiSV40HV-B



To insert the printed-circuit board, reverse the above procedure.
Ensure that the upper and lower hooks snap into the housing.
If the printed-circuit board is not inserted completely, the housing remains lifted. Pull out the printed-circuit board and insert it again.

(3) For βiSV20/20-B, and βiSV40/40-B

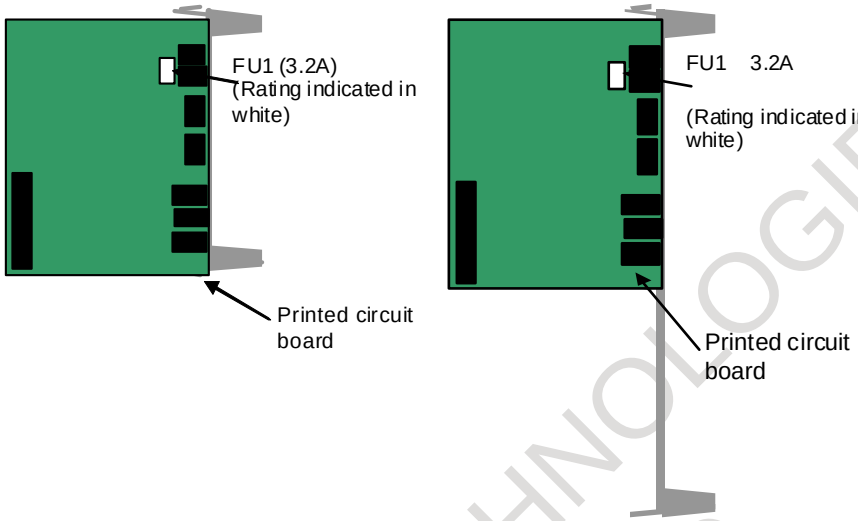


To insert the printed-circuit board, reverse the above procedure.
Ensure that the upper and lower hooks snap into the housing.
If the printed-circuit board is not inserted completely, the housing remains lifted. Pull out the printed-circuit board and insert it again.

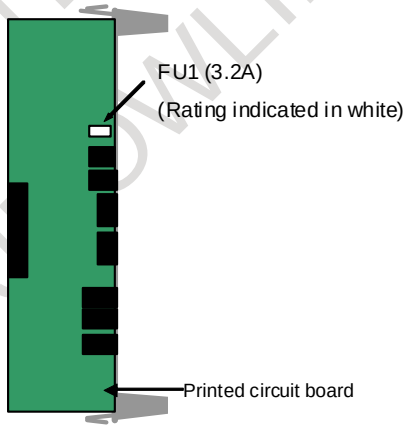
4.3.2 Fuse Locations

There is one fuse on the βiSV-B printed-circuit board.

(1) A20B-2102-0081



(2) A20B-2101-0881



Fuse specification

Symbol	Ordering number
FU1	A60L-0001-0290#LM32C

III. START-UP PROCEDURE FOR βiSVSP-B

1 OVERVIEW

This part describes the units and components of the FANUC Servo Amplifier βi-B series. It also explains the following information necessary to start up the servo amplifier:

- Configurations
- Start-up procedure
- Confirmation of the operation
- Periodic maintenance of servo amplifier

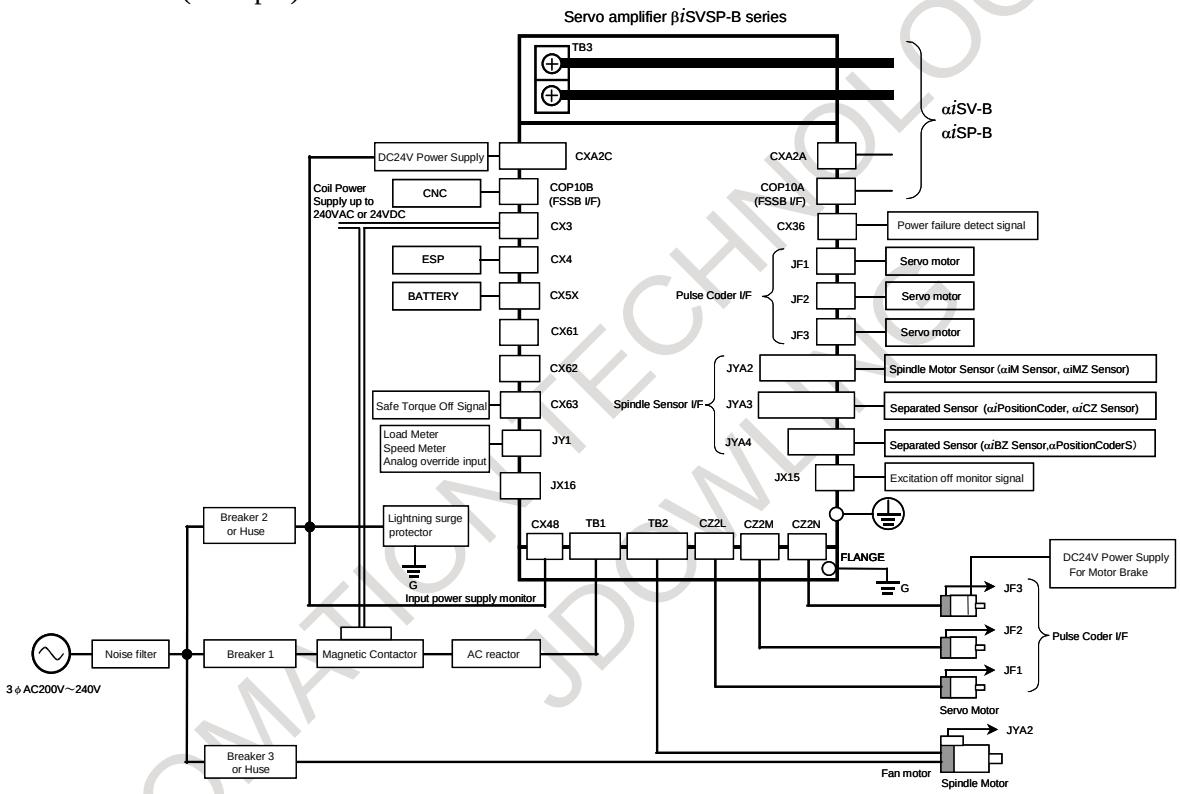
2 CONFIGURATIONS

2.1 CONFIGURATIONS

The Servo Amplifier βiSVSP-B consists of the units and components listed below:

(1) βiSVSP-B (basic)
(2) AC reactor (basic)
(3) Connectors (for connecting cables) (basic)
(4) Fuses (option)
(5) Power transformer (option)

Constituent (example)



⚠ CAUTION

1 A circuit breakers, magnetic contactor, and AC reactor are always required.
2 Install the noise filter closer to the power supply than the magnetic contactor for the βiSVSP-B series is.
3 Use a stabilized power supply as the 24-VDC power supply for the servo amplifier. The 24-VDC power supply for the motor brake cannot be used for the servo amplifier.
4 To protect the equipment from lightning surge voltages, install a lightning surge absorber across each pair of power lines and across each power line and the grounding line at the power inlet of the power magnetics cabinet.
5 Be sure to ground the tapped hole for flange grounding.

⚠ CAUTION

6 Connect a circuit breaker or fuse rated 5 A or less in the input section of the lightning surge protector to prevent the protector from being burnt out due to a short-circuit when a surge voltage higher than its rating is applied. For details, see Appendix A, "FITTING A LIGHTNING SURGE PROTECTION DEVICE" in the SERVO AMPLIFIER βi-B series DESCRIPTIONS (B-65422EN).
7 Connect a circuit breaker or fuse in the input section of the cooling fan motor to prevent burnout due to a short-circuit of the cooling fan motor or connecting cable.
8 When you use a 3 ϕ fan motor for the spindle motor, breaker 2 can be shared if its capacity is sufficient.
9 For cable protection, connect a cable to the input power supply monitor (CX48) after breaker 2 or the fuse.
10 The phase order of the cable of the input power supply monitor (CX48) must be consistent with that of TB1. For details, see Subsection 7.3.1.8, "Details of cable K124" in the SERVO AMPLIFIER βi-B series DESCRIPTIONS (B-65422EN).
11 If the breaker of the input section of the lightning surge protector trips, the lightning surge protector does not operate normally. Make sure that the trip is detected and that an alarm is issued.

2.2 MAJOR COMPONENTS

(1) 260-mm width models

Model	Order specification	Unit specification	Power printed circuit board unit specification	Control printed circuit board unit specification
βiSVSP20/20-7.5-B	A06B-6320-H201	A06B-6320-C201	A06B-6320-K501	A06B-6320-C002
βiSVSP20/20-11-B	A06B-6320-H202	A06B-6320-C202	A06B-6320-K502	
βiSVSP40/40-15-B	A06B-6320-H223	A06B-6320-C223	A06B-6320-K523	
βiSVSP40/40-18-B	A06B-6320-H224	A06B-6320-C224	A06B-6320-K524	
βiSVSP80/80-18-B	A06B-6320-H244	A06B-6320-C244	A06B-6320-K544	
βiSVSP40/40-18HV-B	A06B-6330-H244	A06B-6330-C244	A06B-6330-K549	
βiSVSP20/20/40-7.5-B	A06B-6320-H311	A06B-6320-C311	A06B-6320-K561	A06B-6320-C003
βiSVSP20/20/40-11-B	A06B-6320-H312	A06B-6320-C312	A06B-6320-K562	
βiSVSP40/40/40-11-B	A06B-6320-H332	A06B-6320-C332	A06B-6320-K572	
βiSVSP40/40/40-15-B	A06B-6320-H333	A06B-6320-C333	A06B-6320-K573	
βiSVSP40/40/80-15-B	A06B-6320-H343	A06B-6320-C343	A06B-6320-K583	
βiSVSP40/40/80-18-B	A06B-6320-H344	A06B-6320-C344	A06B-6320-K584	
βiSVSP80/80/80-18-B	A06B-6320-H364	A06B-6320-C364	A06B-6320-K594	
βiSVSP40/40/40-18HV-B	A06B-6330-H364	A06B-6330-C364	A06B-6330-K599	

(2) 180-mm width models

Model	Order specification	Unit specification	Power printed circuit board 1 specification	Power printed circuit board 2 specification	Control printed circuit board unit specification
βiSVSP20/20-7.5-B	A06B-6321-H201	A06B-6321-C201	A20B-2102-0551	A17B-2100-0601	A06B-6321-C002
βiSVSP20/20-11-B	A06B-6321-H202	A06B-6321-C202	A20B-2102-0552	A17B-2100-0602	
βiSVSP10/10-11HV-B	A06B-6331-H202	A06B-6331-C202	A20B-2102-0557	A17B-2100-0607	
βiSVSP20/20/40-7.5-B	A06B-6321-H311	A06B-6321-C311	A20B-2102-0551	A17B-2100-0661	A06B-6321-C003
βiSVSP20/20/40-11-B	A06B-6321-H312	A06B-6321-C312	A20B-2102-0552	A17B-2100-0662	
βiSVSP40/40/40-11-B	A06B-6321-H332	A06B-6321-C332	A20B-2102-0552	A17B-2100-0672	
βiSVSP20/20/20-11HV-B	A06B-6331-H332	A06B-6331-C332	A20B-2102-0557	A17B-2100-0677	

3 START-UP PROCEDURE

3.1 START-UP PROCEDURE (OVERVIEW)

Make sure that the specifications of the CNC, servo motors, spindle motors, servo amplifiers, and other units you received are exactly what you ordered, and these units are connected correctly. Then, turn on the power.
The items to be checked are described below.

No.	Description	Check method
Checking the installation of the servo amplifier		
1	Specification of the servo amplifier and servo motor	Check the combination of the servo amplifier and the servo motor is correct. Refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
2	Packing of the flange	Check the supplied packing is attached properly and that there is no gap between the control panel and the amplifier flange.
3	Keeping maintenance areas	Keep maintenance areas above and below the amplifier. For details, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
4	Prevention of contact with conductive section	Check that a protective plate is attached to the DC link terminal block and that the terminal block cover is locked. For details, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
5	Measure against entry of coolant	Take a measure to prevent electroconductive, flammable, and corrosive material as well as mist and water drop from getting in the unit. For keeping of the effective closeness of the control panel, refer to Appendix G "EXAMPLES OF RECOMMENDED POWER MAGNETICS CABINETS FOR SERVO AMPLIFIER INSTALLATION" in the Servo Amplifier βi-B series Descriptions (B-65422EN).
Checking the wiring for the servo amplifier		
6	Screwing to the terminal block	When connecting wires to the servo amplifier terminal board, be sure to tighten the screws with a proper torque. For the detail of the tightening torque for the terminal board screws, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
7	Connecting protective ground	Use a proper cable for grounding in order to prevent electrical shocks at a ground fault. For details, refer to Subsection 9.3.1.7 of the Servo Amplifier βi-B series Descriptions" (B-65422EN).
8	Installing the lightning serge protector	In order to prevent damage due to a surge voltage applied to the input power supply, install a lightning surge protector. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
9	Measure against noise	Check that ground wires, including feedback cable shielding clamps, are connected to proper places to maintain a stable operation of the machine. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
10	Phase order of motor power lines	If the phase order of motor power lines is incorrect, the motor may operate unexpectedly. Make sure that the motor power lines are connected correctly.
11	Checking the axis to which the motor feedback wire and power wire are connected	If the axis to which the motor feedback wire and power wire are connected is incorrect, the motor may operate unexpectedly. So, make sure that the connection is correct.
12	Connection of batteries	Do not connect the built-in batteries in parallel. Please make sure, if the built-in batteries are used with an amp-to-amp battery connection cable (CXA2A/C or BATL (B3)) attached, they may be connected in parallel. For details, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).
Check during startup of operation		
13	Checking the power supply voltage	Before turning on the power, check that the power supply voltage is in its proper range. For details of the power supply voltage specification, refer to the Servo Amplifier βi-B series Descriptions" (B-65422EN).

No.	Description	Check method
14	Setting the ground fault breaker	Use a ground fault interrupter that supports inverters. For information about leakage current, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
15	Checking the control power	Check that the voltage of the 24 V power supply for amplifiers is in its proper range and the selected current capacity is proper. For details, refer to the Servo Amplifier βi-B series Descriptions (B-65422EN).
16	Setting parameters	Set initial parameters with reference to Section 3.3.
17	Handling early failures	To solve start-up problems, such as being impossible to turn on the power, motor failing to rotate, and occurrence of an alarm, see Chapter 4 of this document.

3.2 CONNECTING THE POWER

3.2.1 Checking the Voltage and Capacity of the Power

Before connecting the power, you should measure the AC power voltage.
Tables 3.2.1 (b) list the input power specification for the power supply module. Use a power source with sufficient capacity so that the system will not malfunction due to a voltage drop even at a time of peak load.

(1) βiSVSP-B

Table 3.2.1(b) AC power voltage specifications (200-V input type)

Specifi - cation	260-mm width model	A06B-6320-H201	A06B-6320-H202	A06B-6320-H223	A06B-6320-H224	A06B-6320-H244
	180-mm width model	A06B-6321-H201	A06B-6321-H202	-	-	-
Model		βiSVSP 20/20-7.5-B	βiSVSP 20/20-11-B	βiSVSP 40/40-15-B	βiSVSP 40/40-18-B	βiSVSP 80/80-18-B
Nominal voltage rating		200 to 240VAC -15%,+10%				
Power source frequency		47 to 63Hz				
Power source capacity (for the main circuit) [kVA]		12	16	22	29	29
Power source capacity (for the control circuit)		24V±10% / 2.7Amax.				

Specifi- cation	260-mm width model	A06B-6320-H311	A06B-6320-H312	A06B-6320-H332	A06B-6320-H333
	180-mm width model	A06B-6321-H311	A06B-6321-H312	A06B-6321-H332	-
Model		βiSVSP20/20/40-7.5-B	βiSVSP20/20/40-11-B	βiSVSP40/40/40-11-B	βiSVSP40/40/40-15-B
Nominal voltage rating		200 to 240VAC -15%,+10%			
Power source frequency		47 to 63Hz			
Power source capacity (for the main circuit) [kVA]		12	16	16	22
Power source capacity (for the control circuit)		24V±10% / 2.7Amax.			

Specification	260-mm width model	A06B-6320-H343	A06B-6320-H344	A06B-6320-H364
	180-mm width model	-	-	-
Model		βiSVSP40/40/80-15-B	βiSVSP40/40/80-18-B	βiSVSP80/80/80-18-B
Nominal voltage rating		200 to 240VAC -15%,+10%		
Power source frequency		47 to 63Hz		
Power source capacity (for the main circuit) [kVA]		22	29	29
Power source capacity (for the control circuit)		24V±10% / 2.7Amax.		

(2) βiSVSP HV-B

Table 3.2.1(b) AC power voltage specifications (400-V input type)

Specification	260-mm width model	-	A06B-6330-H244
	180-mm width model	A06B-6331-H202	-
Model		βiSVSP10/10-11 HV-B	βiSVSP40/40-18 HV-B
Nominal voltage rating		380 to 480VAC -10%,+10%	
Power source frequency		47 to 63Hz	
Power source capacity (for the main circuit) [kVA]		16	29
Power source capacity (for the control circuit)		24V±10% / 2.7Amax.	

Specification	260-mm width model	-	A06B-6330-H364
	180-mm width model	A06B-6331-H332	-
Model		βiSVSP20/20/20-11 HV-B	βiSVSP40/40/40-18 HV-B
Nominal voltage rating		380 to 480VAC -10%,+10%	
Power source frequency		47 to 63Hz	
Power source capacity (for the main circuit) [kVA]		16	29
Power source capacity (for the control circuit)		24V±10% / 2.7Amax.	

3.2.2 Connecting a Protective Ground

Check that a protective ground is connected correctly with reference to individual items in Chapter 6 "INSTALLATION" in the FANUC SERVO AMPLIFIER βi-B series Descriptions (B-65422EN).

3.2.3 Selecting the Ground Fault Interrupter That Matches the Leakage Current

Check that a ground fault breaker is selected correctly with reference to individual items in Chapter 6 "INSTALLATION" in the FANUC SERVO AMPLIFIER βi-B series Descriptions (B-65422EN).

3.3 INITIALIZING PARAMETERS

3.3.1 βiSVSP-B Power Supply Section

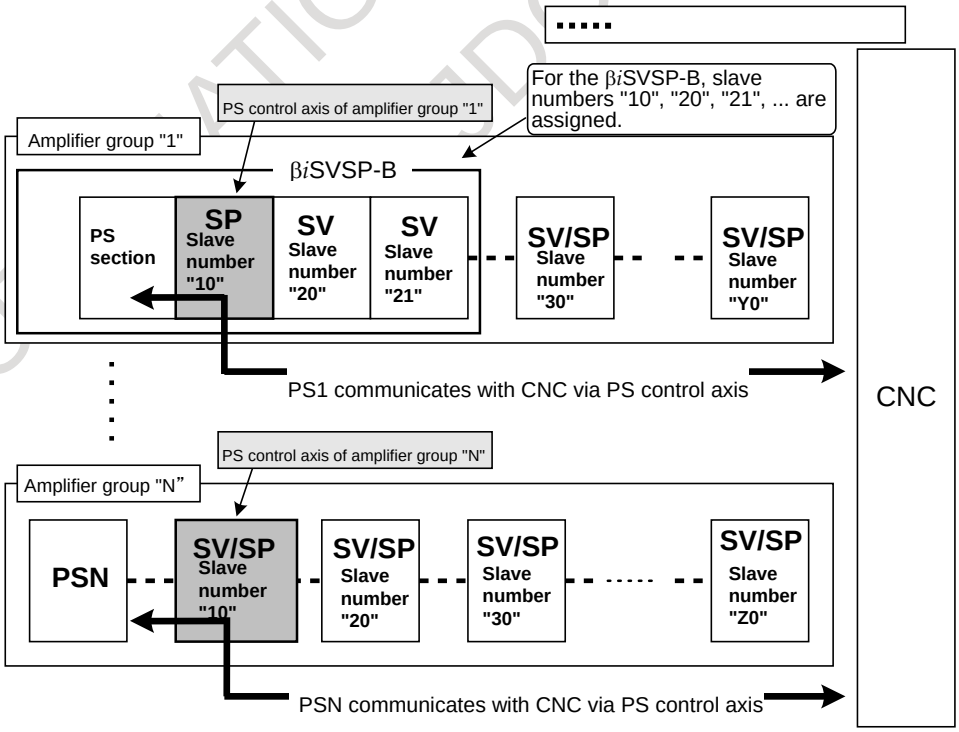
The Power Supply section of the βiSVSP-B series is controlled by software. This allows power supply information to be monitored on the CNC. Using this information, it is possible to diagnose failures resulting from power supply fluctuations.

3.3.1.1 Amplifier group number

When a Servo/Spindle Amplifier is connected to the βiSVSP-B series as an additional axis, all of them are defined collectively as a single "amplifier group". This means that a system having multiple βiSVSP-B series or having two or more βiSVSP-B series and αiPS-B series has more than one amplifier group. A unique number is assigned to each of these amplifier groups, and such numbers are called "amplifier group numbers".

3.3.1.2 PS control axis

In an amplifier group, "slave numbers", such as 10, 20, 30..., and 150, are assigned to the Servo/Spindle Amplifiers connected to the βiSVSP-B in order of connection*NOTE. In each amplifier group, the axis with the smallest slave number "10" is defined as a "PS control axis".
Data communication between the Power Supply section and CNC is performed via the PS control axis.



NOTE
This means the connection of inter-amplifier communication linked by connector CXA2x.
It does not mean the connection of FSSB.
With the βiSVSP-B series, the spindle axis of the amplifier is always the PS control axis.

3.3.1.3 Parameter setting for specifying the PS control axis

Using the βiSVSP-B series requires the following procedure.

Parameter setting procedure

For the βiSVSP-B series, set the PS control axis as follows, so that the CNC software recognizes the PS control axis.

PS control axis setting: For the spindle axis, an amplifier group number needs to be set in parameter No. 4657.

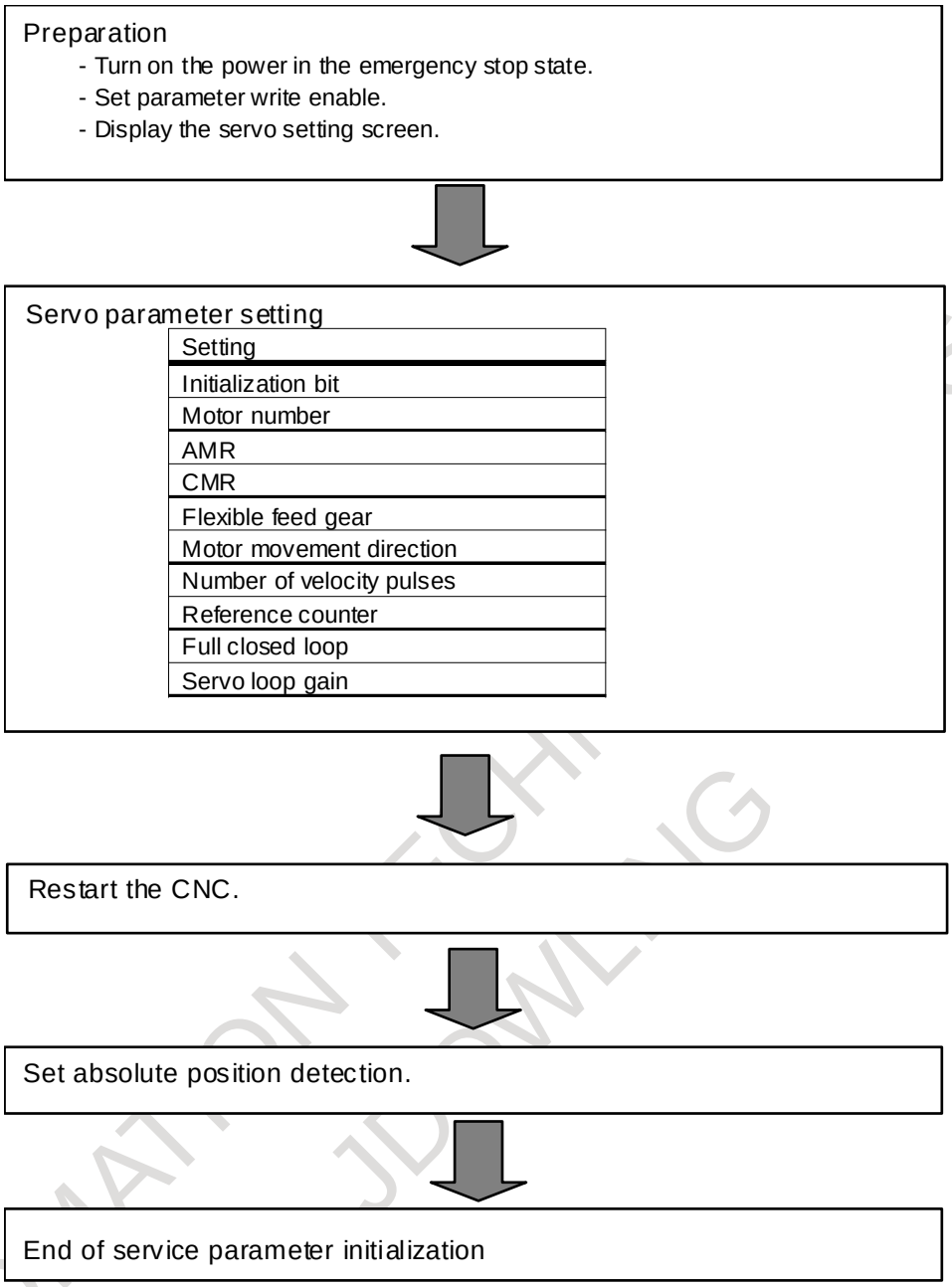
This setting can be made automatically with the following procedure.
<1> Set No. 11549#0(APS) = 1.
<2> On CNC ALARM MESSAGE screen, "PW0000 POWER MUST BE OFF" will be displayed.
<3> Turn the power to the CNC off, then on again. When the CNC is restarted, a value is automatically set in parameter No. 4657, completing the PS control axis parameter setting.

* Upon completion of the automatic parameter setting, No. 11549#0 returns to 0.
* If the amplifier configuration is changed, the alarm "PS CONTROL AXIS ERROR" occurs, in which case perform the automatic setting again.

3.3.2 βiSVSP-B Servo Section

3.3.2.1 Servo parameter initialization procedure

The procedure for initializing the servo section of the servo amplifier of the βiSVSP-B series is described below. For details of the individual items of the procedure, refer to the FANUC AC SERVO MOTOR αi series/FANUC AC SERVO MOTOR βi series/FANUC LINEAR MOTOR LiS series/FANUC SYNCHRONOUS BUILT-IN SERVO MOTOR DiS series Parameter Manual (B-65270EN).



3.3.2.2 Start-up of an individual servo axis

The conventional servo amplifiers of the βiSVSP series do not become ready unless all axes satisfy the start-up conditions. With the servo amplifier of the βiSVSP-B series, by contrast, any axis that satisfies the start-up conditions can become ready independently.

Ready status indicator for the βiSVSP-B servo section

The 7-segment LED indicator for the servo section of the βiSVSP-B series servo amplifier supports "0." (dotted zero) that indicates a multi-axis amplifier has some of its axes ready and some not ready, in addition to "0" indicating that all axes are in the ready status and "-" indicating that all axes are in the not-ready status.

7-segment LED indicator	Amplifier status	Description
-	Not ready (All axes are in the not-ready status.)	All axes are in the not-ready status (same as before). All axes are braked dynamically and inoperable.
0	Ready (All axes are in the ready status.)	All axes are in the ready status (same as before). All axes are operable.
0.	Ready (Some axes are in the not-ready status.)	Some axes are in the ready status, while some are in the not-ready status. The difference from the status in which all axes are in the ready status is that a dot is lit. Only the axes in the ready status are operable. The axes in the not-ready status are braked dynamically.

Behavior in the event of an alarm

With the conventional servo amplifiers of the βiSVSP series, if an alarm is detected for any of the servo axes, all the axes are placed in the not-ready status and a dynamic brake is applied to them, regardless of the content of the alarm. A change has been made in the servo amplifier of the βiSVSP-B series so that, if an alarm concerns a specific axis (e.g., IPM alarm), only that axis associated with the alarm is placed in the not-ready status while the servo amplifier keeps the other servo axes ready.

No restrictions imposed in the event of an alarm

The servo amplifier of the βiSVSP-B series is immune to the restrictions that are imposed on the conventional servo amplifiers of the βiSVSP series in the event of an alarm occurring in the brake control function, stop distance reduction function, or lifting function against gravity at emergency stop, even with an application that uses the operation of the normal axes.

[Behavior of normal axes in the event of an alarm]

	Alarm	Behavior of normal axes	
		Conventional servo amplifier βiSVSP series	Servo amplifier βiSVSP-B series
<1>	Alarms (such as excessive error alarm) detected by the servo or CNC software	Possible to delay the ready status. (*)	Possible to delay the ready status. (*)
<2>	Individual axis alarms detected by the servo amplifier <1> Abnormal motor current <2> IPM alarm <3> DB relay abnormal alarm	Not possible to delay the ready status.	Possible to delay the ready status. (*)
<3>	Alarms other than <1> or <2> above	Becomes Not ready instantly.	Becomes Not ready instantly.

* It is possible to lift the normal vertical axes or perform some other operation while the ready status of the servo amplifier is being delayed.

Supporting the axis detach function

With the servo amplifier of the βiSVSP-B series, the axis detach function, which is not available for the conventional servo amplifiers of the βiSVSP series, can be set individually for each servo axis.

Setting dummy axes

Starting up a specific servo axis in a conventional servo amplifier of the βiSVSP series requires attaching a dummy connector to each servo axis that is not in use. With the servo amplifier of the βiSVSP-B series, it is possible to start up any arbitrary servo axis alone, thus eliminating the need to attach dummy connectors to unused axes.

Sharing the amplifier among multiple paths

If a conventional amplifier of the βiSVSP series is shared among multiple paths when the amplifier enters the not-ready status for an axis used by one path, it is necessary to input the signal for ignoring the V ready-off alarm to prevent the amplifier from becoming not ready for the axes used by the other paths. This is not necessary for the servo amplifier of the βiSVSP-B series.

⚠ CAUTION

1 Notes on synchronization control
If an alarm occurs on one of the axes used under synchronization control, it is necessary for the amplifier to become not ready immediately for the other axes as well in order to prevent machine distortion. To meet this requirement, be sure to enable the servo software's "servo alarm two-axis simultaneous monitor function" for the axes under synchronization control.
In some cases where synchronization control or tandem control is implemented using two axes of a conventional amplifier of the βiSVSP series, the amplifier becomes not ready for both axes simultaneously in the event of an alarm and this plays a similar role to that of the "servo alarm two-axis simultaneous monitor function".
Because the ready status conditions for the servo amplifier of the βiSVSP-B series for each axis are independent of one another, there is no substitute for the "servo alarm two-axis simultaneous monitor function". Therefore, be sure to enable the "servo alarm two-axis simultaneous monitor function" for axes under synchronization control. Refer to the Parameter Manual for detailed descriptions of the "servo alarm two-axis simultaneous monitor function" and the related parameter settings.
2 If an alarm common to all axes occurs (such as a DC link low-voltage alarm), all the axes driven by the multi-axis amplifier are affected by the alarm in the same manner as in the conventional amplifier, resulting in the amplifier becoming not ready simultaneously for all the axes and a dynamic brake being applied to bring all of them to a halt.
3 If an emergency stop signal (input signal to the connector CX4 of the PS) is input, the amplifier becomes not ready for all axes and applies a dynamic brake to bring all of them to a halt.

3.3.3 βiSVSP-B Spindle Section

3.3.3.1 Parameters Related to Spindle Serial Output

This subsection provides a list of the parameters related to spindle serial output only. For details of each parameter, refer to the following manuals.
"FANUC Series 30*i*/31*i*/32*i*-MODEL B CONNECTION MANUAL (FUNCTION) : B-64483EN-1 Section 11.2, "SPINDLE SERIAL OUTPUT."
"FANUC Series 0*i*-MODEL F CONNECTION MANUAL (FUNCTION) : B-64303EN-1 Section 11.2 "SPINDLE SERIAL OUTPUT."

Parameter No.	Description
3716#0	Selection of a spindle (analog/serial) (Set 1.)
3702#1	Multi-spindle control function (Whether to use the multi-spindle control function)
3717	Amplifier number of each spindle amplifier

Parameter No.	Description
3718	Spindle indication subscript (main spindle)
3719	Spindle indication subscript (sub-spindle)

NOTE
To use the spindle serial interface, the CNC software option is required.

For the FSSB setting, refer to one of the following manuals.
"FANUC Series 30*i*/31*i*/32*i*-MODEL B CONNECTION MANUAL (FUNCTION) : B-64483EN-1 Subsection 1.4.4, "FSSB Setting."
"FANUC Series 0*i*-MODEL F CONNECTION MANUAL (FUNCTION) : B-64303EN-1 Subsection 1.4.3 "FSSB Setting."

3.3.3.2 Automatic Spindle Parameter Initialization

An automatic set up of the spindle parameters Nos. (4000 to 4799) is described below.

NOTE
If you do not want to initialize adjusted parameters, do not perform automatic initialization.

Parameter list

Parameter No.	Description
4019#7	Function for automatically initializing spindle parameters
4133	Spindle motor model code

Procedure for automatic spindle parameter initialization

Perform automatic spindle parameter initialization by following the procedure below.

<1> Set the model code for the desired motor for automatic parameter initialization.

Parameter No.	Setting value
4133	Model code

NOTE
1 The control method usable with the α*i*/β*i* series spindle is spindle HRV control only. The conventional control method is not supported.
2 For the model codes of individual motors, refer to the FANUC AC SPINDLE MOTOR α*i* series/FANUC AC SPINDLE MOTOR β*i* series/FANUC BUILT-IN SPINDLE MOTOR B*i* series Parameter Manual (B-65280EN).
3 When using a spindle motor that has no model code, set model code "300" ("400" for a spindle motor with speed range switching control) for automatic parameter setting, then manually input data according to the parameter table for each motor model.

<2> Set the relevant parameter to enable automatic spindle parameter initialization.

Parameter No.	Setting value
4019#7	1

NOTE
This bit is reset to its original value after automatic parameter initialization.

<3> Turn the CNC off, then on again. Then, the spindle parameters specified with a model code are automatically initialized.

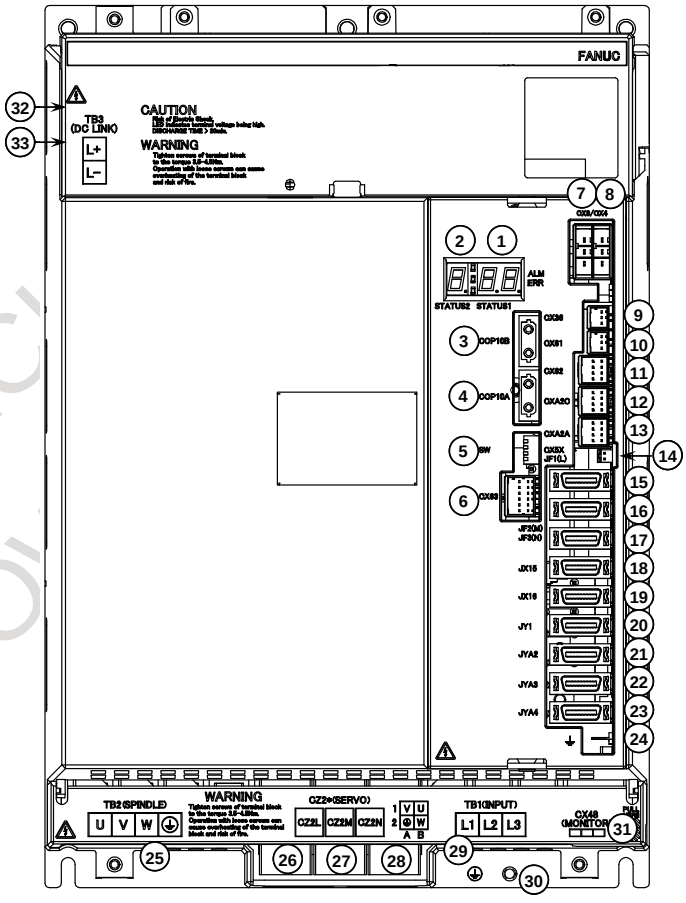
4 CONFIRMATION OF THE OPERATION

4.1 OUTLINE OF βiSVSP-B

4.1.1 Connector and STATUS LED Locations

(a) Connector location of 260-mm width models

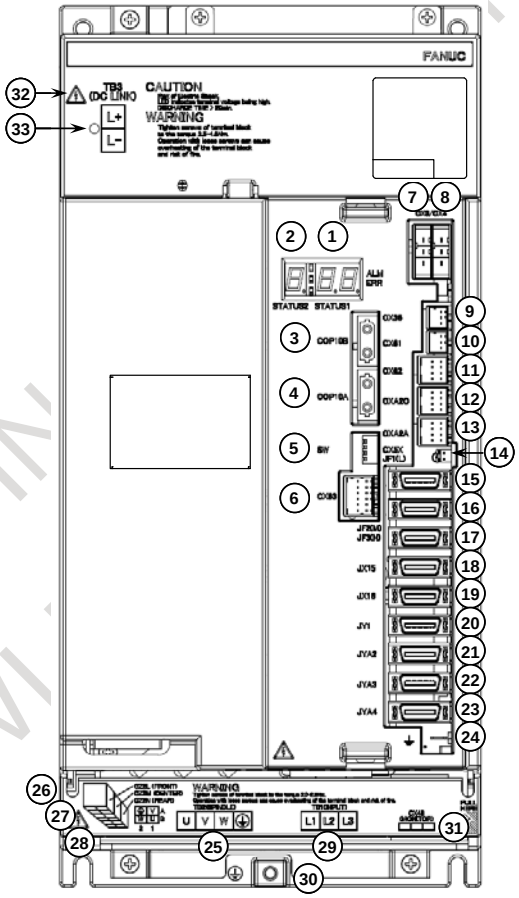
No.	Name	Remarks
1	STATUS1	Status LED : spindle
2	STATUS2	Status LED : servo
3	COP10B	FSSB optical input connector
4	COP10A	FSSB optical output connector
5	SW	Safe torque-off switch
6	CX63	Safe torque-off input/output connector
7	CX3	Main power magnetic contactor control connector
8	CX4	Emergency stop signal (ESP)
9	CX36	Power failure detection output connector
10	CX61	Not used
11	CX62	Not used
12	CXA2C	24-VDC power supply input connector
13	CXA2A	24-VDC power supply output connector
14	CX5X	Absolute Pulsecoder battery connector
15	JF1	Pulsecoder connector: L-axis
16	JF2	Pulsecoder connector: M-axis
17	JF3	Pulsecoder connector: N-axis
18	JX15	Connector for excitation off monitor signal
19	JX16	Not used
20	JY1	Load meter, speedometer, analog override
21	JYA2	Spindle sensor αi M, αi MZ
22	JYA3	Separated sensor for a spindle (αi position coder,αiCZ sensor) External one-rotation signal
23	JYA4	Separated sensor for a spindle (α position coderS, αiBZ sensor)
24	⏚	Ground terminal for signals
25	TB2	Spindle motor power line connector
26	CZ2L	Servo motor power line connector: L-axis
27	CZ2M	Servo motor power line connector: M-axis
28	CZ2N	Servo motor power line connector: N-axis
29	TB1	Main power supply connection terminal board
30	⏚	Tapped hole for grounding the flange
31	CX48	Connector for input power supply monitoring
32	TB3	DC link terminal block
33	LED	DC link charge LED (Warning)



> ⚠ **WARNING**
> Do not touch any component in the module or any connected cable when LED (33) is on, because it is dangerous.

(b) Connector location of 180-mm width models

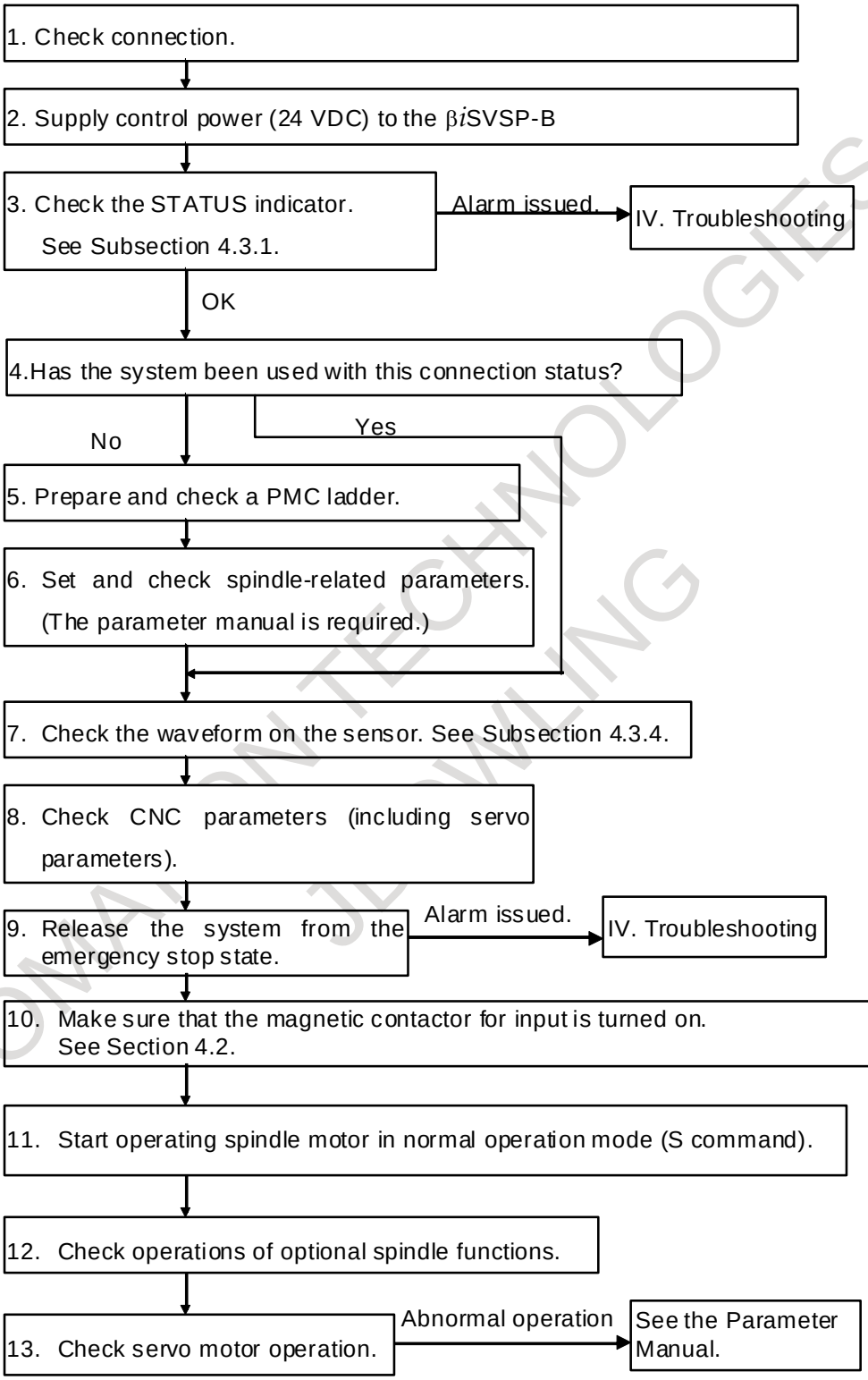
No.	Name	Remarks
1	STATUS1	Status LED : spindle
2	STATUS2	Status LED : servo
3	COP10B	FSSB optical input connector
4	COP10A	FSSB optical output connector
5	SW	Safe torque-off switch
6	CX63	Safe torque-off input/output connector
7	CX3	Main power magnetic contactor control connector
8	CX4	Emergency stop signal (ESP)
9	CX36	Power failure detection output connector
10	CX61	Not used
11	CX62	Not used
12	CXA2C	24-VDC power supply input connector
13	CXA2A	24-VDC power supply output connector
14	CX5X	Absolute Pulsecoder battery connector
15	JF1	Pulsecoder connector: L-axis
16	JF2	Pulsecoder connector: M-axis
17	JF3	Pulsecoder connector: N-axis
18	JX15	Connector for excitation off monitor signal
19	JX16	Not used
20	JY1	Load meter, speedometer, analog override
21	JYA2	Spindle sensor αi M, αi MZ
22	JYA3	Separated sensor for a spindle (αi position coder,αiCZ sensor) External one-rotation signal
23	JYA4	Separated sensor for a spindle (α position coderS, αiBZ sensor)
24	⏚	Ground terminal for signals
25	TB2	Spindle motor power line connector
26	CZ2L	Servo motor power line connector: L-axis
27	CZ2M	Servo motor power line connector: M-axis
28	CZ2N	Servo motor power line connector: N-axis
29	TB1	Main power supply connection terminal board
30	⏚	Tapped hole for grounding the flange
31	CX48	Connector for input power supply monitoring
32	TB3	DC link terminal block
33	LED	DC link charge LED (Warning)



⚠ WARNING
Do not touch any component in the module or any connected cable when LED (33) is on, because it is dangerous.

4.1.2 Start-up Procedure

Check each item according to the procedure described below.



4.2 βiSVSP-B POWER SUPPLY SECTION

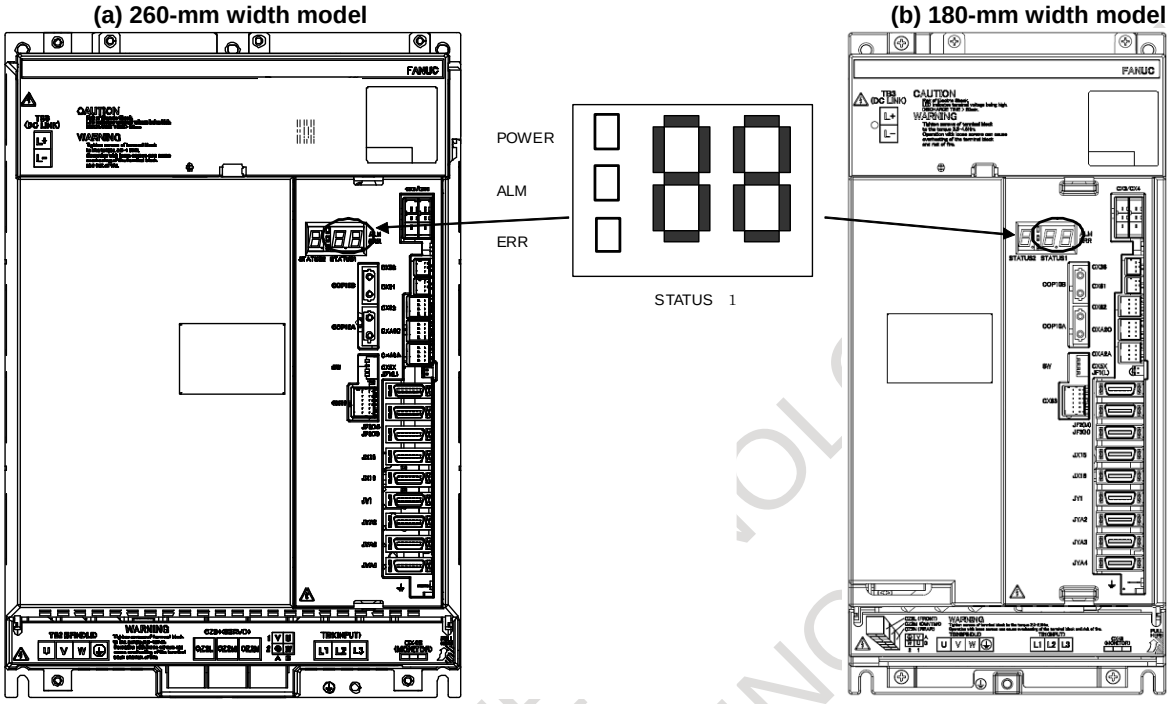
4.2.1 The STATUS LED Is Off.

Table 4.2.1 Check method and action

No.	Cause of trouble	Check method	Action
1	The 24VDC external control power is not supplied.	Check the voltage of the external power supply (24VDC).	Check whether the external power supply is not faulty.
2	The cable is defective.	Check whether the cable attached to the connector CXA2A/2C is not disconnected or short-circuited.	Check the cable attached to the connector CXA2A/2C.
		Check whether the 5V power supply is not short-circuited with the cable connected to the pulse coder.	Replace the cable connected to the pulse coder.
3	The power supply is externally connected to 0V, GND, etc.	Check whether the power cable is not short-circuited	Replace or repair the cable.
4	There is a blown fuse on the control printed circuit board.	Check whether the fuse on the control printed circuit board has not blown. (See Section 4.2 about the location of the fuse.) The fuse blow can be confirmed by checking the element of the fuse visually or removing the fuse and checking the connection of the element of the fuse by the tester.	If the fuse has blown, the control printed circuit board may be faulty. Replace the unit.
5	The printed circuit board is defective.	If the cause is not 1 to 4 above, the printed circuit board of the servo amplifier may be defective.	Replace the unit.

4.3 βiSVSP-B SPINDLE UNIT

4.3.1 STATUS 1 Indicator



No.	POWER	ALM	ERR	STATUS1	Description
1				Not displayed	The control power is not on, or the hardware is faulty. See Subsection .3.3, “Spindle Amplifier” for details.
2	Lighting			Alphanumeric characters are displayed.	During a period of approximately three seconds after the power is turned on, the information about the software series and edition is displayed in two installments. First approx. 1 second: A Next 1 second: Last 2 digits of the software series Next 1 second: 2 digits of the software edition Example) When the software series and edition are 9DB0/04 A → B 0 → 0 4
3	Lighting			-- Blinking	The CNC has not been switched on. The machine is waiting for serial communication and parameter loading to end.
4	Lighting			-- Lighting	Parameter loading has ended. The motor is not supplied with power.
5	Lighting			00	The motor is supplied with power.
6	Lighting	Lighting		01 or above is displayed.	Alarm state The βiSVSP-B is not operable. See Chapter 1 of Part IV.
7	Lighting		Lighting	01 or above is displayed.	Error state Incorrect parameter setting or improper sequence.

4.3.2 Troubleshooting at Startup

4.3.2.1 The STATUS 1 indicator is blinking with "--."

(1) When no spindle communication alarm message is indicated on the CNC
Check whether the CNC software option setting or bit setting is correct.
(2) When a communication alarm message is indicated on the CNC

No.	Cause of trouble	Check method	Action
1	The cable is defective.	Check the connector housing section, etc.	Replace the cable.
2	The printed circuit board is defective.		Replace the unit.

4.3.2.2 The motor does not turn.

(1) When "--" is indicated on the STATUS 1 indicator of the βiSVSP-B
Check whether spindle control signals are input. (An example for the first spindle is shown below.)

	#7	#6	#5	#4	#3	#2	#1	#0
G070	MRDYA		SFRA	SRVA				
G071							*ESPA	
G029		*SSTP						
G030	SOV7	SOV6	SOV5	SOV4	SOV3	SOV2	SOV1	SOV0

(2) When "00" is indicated on the STATUS 1 indicator of the βiSVSP-B
No spindle speed command is input.
Refer to Chapter 1 in " FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN)," and check related parameters.
(3) When an alarm number is indicated on the STATUS 1 indicator of the βiSVSP-B
See the description of the alarm number in Part IV.

4.3.2.3 A specified speed cannot be obtained.

(1) When the speed always differs from a specified speed
Check parameters.
Refer to Chapter 1 in " FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN)," and check related parameters.
(2) When an alarm number is indicated on the STATUS 1 indicator of the βiSVSP-B
See the description of the alarm number in Part IV.

4.3.2.4 When cutting is not performed, the spindle vibrates, making noise.

(1) When the spindle vibrates at a particular speed
Check whether the spindle also vibrates when the motor is turning by inertia. If the same vibration occurs when the motor is turning by inertia, investigate the source of mechanical vibration. There are several methods for turning the spindle by inertia, as described below. Because these methods involve machine sequences, be sure to consult with the machine tool builder.
A. Input signal MPOF (G73.2) to 1 immediately causes the spindle to turn by inertia.

B. Set bit 2 (ALSP) of parameter No. 4009 to 1. Then, when the power to the CNC is turned off during spindle rotation, the spindle turns by inertia. At this time, on the spindle amplifier, Alarm 24 is indicated.

(2) When the spindle vibrates regardless of the speed (also during a control stop)
A. Check and adjust the waveform of the spindle sensor. For details, see Subsection 4.3.4.
B. Check that the motor part number matches its parameters.
Refer to FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN) for details.
C. Adjust the velocity loop gain and so forth.
Refer to FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN) for details.

4.3.2.5 An overshoot or hunting occurs.

Refer to FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN), and adjust parameters.

4.3.2.6 Cutting power weakens or acceleration/deceleration slows down.

(1) When the load meter does not indicate the maximum output
A. A mechanical cause such as a belt slip may occur.
B. Check whether the torque limit signal is input incorrectly.

FS0*i*	#7	#6	#5	#4	#3	#2	#1	#0
G070							TLMHA	TLMLA

(2) When the load meter indicates the maximum output
A. When the αiBZ sensor is used, the sensor gear may slide over the spindle during acceleration.
B. The motor part number may not appropriate for the specific parameters.
Refer to FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN) for details.
C. The output limit pattern may be set incorrectly.
Refer to FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series /FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN) for details.

4.3.3 Status Error Indication Function

When there is a sequence or parameter error, the error LED (yellow) in the STATUS 1 indicator of the βiSVSP-B goes on with an error code displayed. This can ease troubleshooting at the time of machine startup.
Shown below is an example of how the LED indicator looks when an error occurs.

Status	LED indicator
Error display	 The error LED lights, and an error code is displayed.

If the βiSVSP-B spindle unit does not operate for a particular function, check whether a status error is indicated in βiSVSP-B STATUS1.

No.	Description	Action
01	Although neither *ESP (emergency stop signal) (there are two types of signals, a PMC signal and PSM contact signal) nor MRDY (machine ready signal) has been input, SFR (forward rotation signal), SRV (reverse rotation signal), or ORCM (orientation command) is input.	Check the *ESP and MRDY sequences. For MRDY, pay attention to the parameter that specifies whether to use the MRDY signal (bit 0 of parameter No. 4001).
03	Although parameter settings are such that that there is no position sensor (position control is not to be performed, that is, bits 3, 2, 1, and 0 of parameter No. 4002 are, respectively, 0, 0, 0, and 0), a Cs axis contour control command has been issued. In this case, the motor is not activated.	Check setting of the parameter.
04	Although parameter settings are such that that there is no position sensor (position control is not to be performed, that is, bits 3, 2, 1, and 0 of parameter No. 4002 are, respectively, 0, 0, 0, and 0), a servo mode (such as rigid tapping or Cs axis control) command or spindle synchronization control command has been issued. In this case, the motor is not activated.	Check setting of the parameter.
05	Although optional parameter for the orientation function is not set, an ORCM (orientation command) is input.	Check setting of the parameter for orientation.
06	Although optional parameter for the output switching option is not set, low-speed winding is selected (RCH = 1).	Check setting of the parameter for output switching and the power line status signal (RCH).
07	Although Cs contour control mode is input, neither SFR (forward rotation signal) nor SRV (reverse rotation signal) is input.	Check the sequence.
08	Although servo mode (such as rigid tapping or Cs axis control) control command is input, neither SFR (forward rotation signal) nor SRV (reverse rotation signal) is input.	Check the sequence.
09	Although spindle synchronization control command is input, neither SFR (forward rotation signal) nor SRV (reverse rotation signal) is input.	Check the sequence.
10	Although Cs contour control command is input, another operation mode (servo mode, spindle synchronization, or orientation) is specified.	Do not specify another mode during execution of the Cs contour control command. Before entering another mode, cancel the Cs contour control command.
11	Although servo mode (such as rigid tapping or spindle positioning) is input, another operation mode (Cs contour control, spindle synchronization, or orientation) is specified.	Do not specify another mode during execution of the servo mode command. Before entering another mode, cancel servo mode.
12	Although spindle synchronization is input, another operation mode (Cs contour control, servo mode, or orientation) is specified.	Do not specify another mode during execution of the spindle synchronization command. Before entering another mode, cancel the spindle synchronization command.
13	Although orientation specification is input, another operation mode (Cs contour control, servo mode, or synchronization control) is specified.	Do not specify another mode during execution of the orientation command. Before entering another mode, cancel the orientation command.
14	The SFR (forward rotation signal) and SRV (reverse rotation signal) are input at the same time.	Input one of the SFR and SRV signals.

No.	Description	Action
16	Although the parameter not to use the differential speed control function (bit 5 of parameter No. 4000 = 0) is set, DEFMD (differential speed mode command) is input.	Check the setting of the parameter and the differential speed mode command.
17	The parameter settings for the speed detector (bits 2, 1, and 0 of parameter No. 4011) are invalid. There is no speed detector that matches the settings.	Check the setting of the parameter.
18	Although parameter settings are such that that there is no position sensor (position control is not to be performed, that is, "bits 3, 2, 1, and 0 of parameter No. 4002 are, respectively, 0, 0, 0, and 0," a position coder-based orientation command has been issued.	Check the setting of the parameter and the input signal.
19	Although magnetic sensor orientation command is input, another operation mode (Cs contour control, servo mode, or spindle synchronization) is specified.	Do not specify another mode during execution of the orientation command. Before entering another mode, cancel the orientation command.
21	The tandem operation command was input in the spindle synchronization control enable state.	Input the tandem operation command when spindle synchronization control is canceled.
22	Spindle synchronization control was specified in the tandem operation enable state.	Specify spindle synchronization control when torque tandem operation is canceled.
23	The tandem operation command is input without the required option.	Torque tandem control requires a CNC software option. Check the option.
24	Although continuous indexing in position coder-based orientation is to be performed, an absolute position command (INCMD = 0) has been issued after incremental operation (INCMD = 1).	Check the INCMD (incremental command). Be sure to perform absolute position command-based orientation before an absolute position command.
26	The parameter settings are such that both spindle switch and three-stage speed range switch are used.	Check the parameter settings and the input signal.
29	Parameter settings are such that the shortest-time orientation function is to be used (bit 6 of parameter No. 4018 is 0 and parameter Nos. 4320 to 4323 are nonzero).	The shortest-time orientation function cannot be used in the βiSVSP-B. Use a different type of orientation.
30	The magnetic pole has not been detected, but a command is input.	In the magnetic pole undetected state (EPFIXA = 0), the motor cannot be driven even when a command is input. Input a command in the magnetic pole detected state (EPFIXA = 1). When EPFSTR is set to 1, any command is ignored and this error is displayed even in the magnetic pole detected state. After the completion of magnetic pole detection, set EPFSTR to 0.
31	This hardware configuration does not support the use of the spindle FAD function. In this case, the motor is not activated.	Check the CNC model.
32	S0 is not specified in the velocity mode, but the disturbance input function is enabled (bit 7 of parameter No. 4395 is set to 1).	Specify S0 in the velocity mode before enabling the disturbance input function (bit 7 of parameter No. 4395 to 1).
33	This hardware configuration does not support the use of the spindle EGB function. In this case, the motor is not activated.	Check the CNC model.
34	Both spindle FAD function and spindle EGB function are enabled. In this case, the motor is not activated.	These functions cannot be used at the same time. Enable only one of the functions.
35	Spindle Amplifier (SP) ID information cannot be obtained.	Replace the spindle amplifier with one with correct ID information.

No.	Description	Action
36	The submodule SM (SSM) is faulty. 1) The interface signal between the Spindle Amplifier and SSM is disconnected. 2) SSM failure	For the action to be taken for this status error, refer to Section 1.4, "Submodule SM," in Part IV in the FANUC AC SPINDLE MOTOR αi series / FANUC AC SPINDLE MOTOR βi series / FANUC BUILT-IN SPINDLE MOTOR Bi series Parameter Manual (B-65280EN).
37	The current loop setting (No. 4012) has been changed.	Check the setting of parameter No. 4012, and turn the power off, then on again.
38	A parameter related to communication between spindle amplifiers is specified incorrectly. Alternatively, a function unavailable with the torque tandem function is set.	Check the parameters.
39	Although SFR (forward rotation command), SRV (reverse rotation command), or ORCM (orientation command) is input, DSCN (disconnection detection disable signal) is input.	Check the sequence. Do not input DSCN (disconnection detection disable signal) during the input of a command which excites the motor.
43	A setting which does not support the αiCZ sensor (serial) is used.	Check the parameter settings.
44	The spindle amplifier does not support the control period setting.	Check the setting of parameter No. 4012.
45	The setting of the maximum output limit during cutting is not supported.	This is a status error concerning the function for output limit during cutting. This function cannot be used in a system in which this error occurs. Disable this function by setting bit 6 of parameter No. 4011 to 0.
46	The CNC system software does not support spindle synchronous control using a nano-command.	The CNC system software does not support a nano-command. Check the series and edition of the CNC system software.
57	The parameter setting for concurrent use of optimum orientation is used and servo mode reference position return is not correct.	Set non-zero value to the parameter for the servo mode reference position return speed (parameter No. 4074).
59	The setting for the spindle orientation stop position least setting unit 360/32768deg is not correct.	• The CNC system software does not support the spindle orientation stop position least setting unit 360/32768deg. Check the series and edition of the CNC system software. • Concurrent use with the orientation function in spindle synchronization control (bit 6 of parameter No. 4014 is 1) is invalid.
60	The sequence for using spindle phase synchronous control is not correct.	Check the sequence for phase matching of spindle synchronous control. When bit 3 of parameter No. 4006 is set to 1 (not to detect the one-rotation signal automatically), if the spindle phase synchronous command is entered in a state where the one-rotation signal is not detected, this error occurs. Check this point.
63	Spindle DC-link stabilizer during power failure is not supported.	The spindle control software does not support spindle DC-link stabilizer during power failure. Check the series and edition of the spindle control software.
64	The gear is changed during EGB mode, when you use arbitrary gear ratio function for servo EGB (FSSB type).	Check the sequence. Do not perform gear switching during EGB mode.
65	The function bit for using the Spindle smart acc./dec. function is set (bit 0 of parameter No. 4671 is set to 1) when the common power supply does not support smart spindle acceleration/deceleration.	To use Spindle smart acc./dec., update the common power supply software.
67	The parameter for using Spindle smart load meter (bit 7 of parameter No. 4542) is set when the CNC does not support the smart load meter.	To use Spindle smart load meter, update the CNC software.

No.	Description	Action
68	The settings for the terminating resistance of the feedback (bits 6 and 7 of parameter No. 4004) are not correct.	Set bits 6 and 7 of parameter No. 4004 as appropriate for the sensor in use.

NOTE

*1 When status error 43 is displayed, check the following items.

(1) For both the motor sensor and spindle sensor, the setting is made to use an αiCZ sensor (serial). (No.4010#2,1,0=0,1,0 and No.4002#3,2,1,0=0,1,1,0)
(2) Spindle HRV control is not set. (No.4012#7=0)
(3) The setting is made to use the differential speed control function. (No.4000#5=1)
(4) The setting is made to use the spindle switch control function. (No.4014#0=1)
(5) The setting is made so that an alarm related to position feedback is not detected. (No.4007#6=1 or No.4016#5=0)
(6) The setting is made so that the disconnection of the feedback signal is not detected. (No.4007#5=1)
(7) The setting is made so that an alarm related to position signal feedback is not detected during thread cutting. (No.4016#5=0)
(8) The setting is made to use an external one-rotation signal. (No.4004#2=1)
(9) The setting is made to use a position coder. (No.4002#3,2,1,0=0,0,1,0)
(10) The setting is made to drive a synchronous spindle motor. (No.4012#6=1)

4.3.4 Observing Data Using the SERVO GUIDE

4.3.4.1 Overview

Using the servo adjustment tool, SERVO GUIDE, enables you to observe internal data for the spindle. This subsection describes the spindle data that can be observed using the SERVO GUIDE. It also presents examples of observed data. Refer to online help for detailed explanations about how to use the SERVO GUIDE.

4.3.4.2 List of spindle data that can be observed using the SERVO GUIDE

The following table lists the spindle data that can be observed using the SERVO GUIDE.

Data type	Description	Remark
SPEED	Motor speed	
INORM	Motor current amplitude	
IRMS	Motor current (RMS value)	
IPEAK	Motor current (amplitude value)	
TCMD	Torque command	
TCMD2	Torque command 2	
VCMD	Motor speed command	
VERR	Speed deviation	
MCMD	Move command for an individual communication cycle	
ERR	Position deviation	
ERRC	Position deviation (CNC)	
SYNC	Synchronization error	
ORERR	Position error at orientation	

Data type	Description	Remark
ORSEQ	Orientation sequence data	
PCPOS	Integration of position feedback value	
CSPOS	Integration of position feedback value	(*1)
CSPOS2	Integration of position feedback value	(*1)
POS3D	Integration of position feedback value for 3D display	(*1)
WMDAT	Motion command per position loop	
ERR2	Position deviation 2	
ERR2C	Position deviation 2 (CNC)	
SPCMD	Speed command data from the CNC	
SPSPD	Spindle speed	
SPCT1	Spindle control signal 1	
SPCT2	Spindle control signal 2	
SPCT3	Spindle control signal 3	
SPST1	Spindle status signal 1	
SPST2	Spindle status signal 2	
SFLG1	Spindle flag 1	
SPPOS	Spindle position data	
LMDAT	Load meter data	
DTRQ	Spindle load torque (Unexpected disturbance torque detection function)	(*1)
FREQ	Frequency of disturbance torque (Disturbance input function)	(*1)
GAIN	Gain data (Disturbance input function)	(*1)
MTTMP	Motor winding temperature	
MFBDF	Motor sensor feedback incremental data (For tuning amplitude ratio and phase difference compensation)	(*1)
SFBDF	Spindle sensor feedback incremental data (For tuning amplitude ratio and phase difference compensation)	(*1)
PA1	AD data of A phase of motor sensor	(*1)
PB1	AD data of B phase of motor sensor	(*1)
PA2	AD data of A phase of spindle sensor	
PB2	AD data of B phase of spindle sensor	
VDC	DC link voltage	
SFERR	Semi-full error (Dual position feedback)	(*1)
SMERR	Semi-closed side error (Dual position feedback)	(*1)
SPACC	Spindle acceleration data	(*1)

NOTE
*1 The data cannot be observed when the spindle is driven by a speed sensor-less motor.

4.3.4.3 About the spindle control and spindle status signals

As stated in the previous item, the SERVO GUIDE can be used to observe the PMC signals (spindle control signals 1, 2, and 3 and spindle status signals 1 and 2) used by the spindle.
Listed below is the data configuration for spindle control signals 1 and 2 and spindle status signals 1 and 2. Refer to Chapter 3, "Input/Output Signals (CNC ↔ PMC)" of " FANUC AC SPINDLE MOTOR α*i* series / FANUC AC SPINDLE MOTOR β*i* series /FANUC BUILT-IN SPINDLE MOTOR B*i* series Parameter Manual (B-65280EN)" for explanations about each signal.

(a) Spindle control signal 1 (SPCT1)

#15	#14	#13	#12	#11	#10	#9	#8
RCH	RSL	INTG	SOCN	MCFN	SPSL	*ESP	ARST
#7	#6	#5	#4	#3	#2	#1	#0
MRDY	ORCM	SFR	SRV	CTH1	CTH2	TLMH	TLML

(b) Spindle control signal 2 (SPCT2)

#15	#14	#13	#12	#11	#10	#9	#8
			DSCN	SORSL	MPOF		
#7	#6	#5	#4	#3	#2	#1	#0
RCHHG	MFNHG	INCMD	OVR		NRRO	ROTA	INDX

(c) Spindle control signal 3 (SPCT3)

#15	#14	#13	#12	#11	#10	#9	#8
#7	#6	#5	#4	#3	#2	#1	#0

(d) Spindle status signal 1 (SPST1)

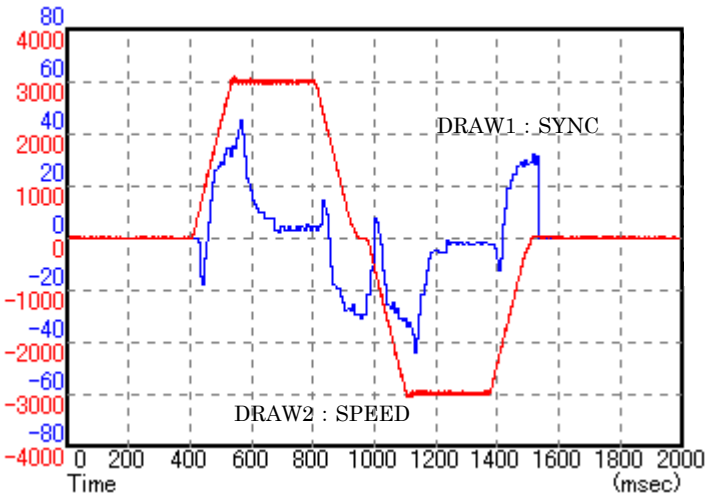
#15	#14	#13	#12	#11	#10	#9	#8
				RCFN	RCHP	CFIN	CHP
#7	#6	#5	#4	#3	#2	#1	#0
ORAR	TLM	LDT2	LDT1	SAR	SDT	SST	ALM

(e) Spindle status signal 2 (SPST2)

#15	#14	#13	#12	#11	#10	#9	#8
			CSPEN				
#7	#6	#5	#4	#3	#2	#1	#0
			EXOF	SOREN		INCST	PC1DT

4.3.4.4 Example of observing data

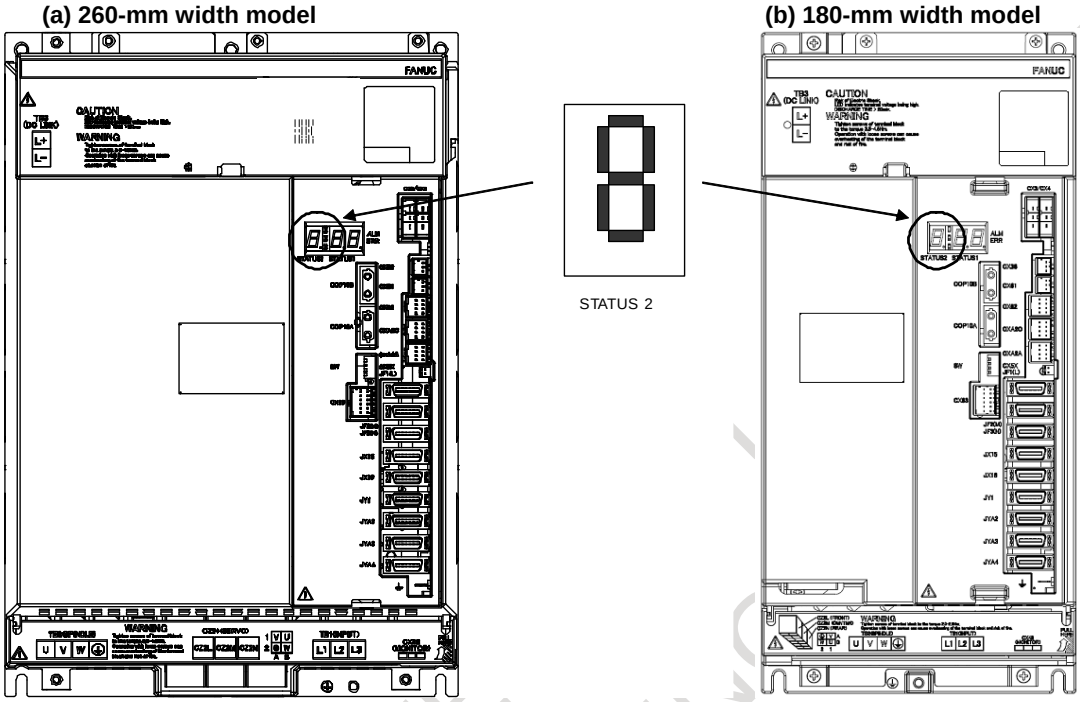
The following figure shows an example of data (synchronization error and motor speed at rigid tapping) observed using the SERVO GUIDE.



DRAW1 : SYNC (synchronization error)
DRAW2 : SPEED (motor speed)

4.4 βiSVSP-B SERVO UNIT

4.4.1 Checking the STATUS 2 Indicator



STATUS2 display	Description
Not displayed	The control power is not on, or the hardware is faulty. See Subsection 1.3.2, "Servo Amplifier" for details.
Alphanumeric characters are displayed.	During a period of approximately four seconds after the power is turned on, the information about the software series and edition is displayed in eight installments. Example) When the software series and edition are 9H00/01.0 9 → H → 0 → 0 → 0 → 1 → . → 0
-- Blinking	The servo amplifier is conducting a self-diagnosis.
-- Lighting	The system is waiting for the READY signal from the CNC.
0 Blinking	The insulation resistance is being measured.
0	The servo amplifier is ready.
01 or above is displayed.	Alarm status

4.4.2 V Ready-off Alarm Indicated on the CNC Screen

When the V ready-off alarm is indicated on the CNC, check the items listed below. In addition, V ready-off can occur also for reasons other than listed below. If the following items turn out to have not caused V ready-off, check diagnosis information No. 358 (V ready-off information) on the diagnosis screen and report it to FANUC.

(1) Emergency stop signal (ESP)
Has the emergency stop signal (connector: CX4) applied to the βiSVSP-B been released? Alternatively, is the signal connected correctly?

(2) MCON signal
Hasn't setting up the axis detach function disabled the transmission of the ready command signal MCON from the CNC to the βiSVSP-B?

(3) βiSVSP-B control printed-circuit board
The βiSVSP-B control printed-circuit board may be poorly installed or faulty. Be sure to push the faceplate as far as it will go. If the problem persist, replace the control printed-circuit board.

Checking diagnosis information (DGN) No. 358 makes it possible to analyze the cause of the V ready-off alarm.

Diagnosis 358	V ready-off information

Convert the displayed value to binary form, and check bits 5 to 14 of the resulting binary number.
When the servo amplifier starts working, these bits become 1 sequentially, starting at bit 5. When the servo amplifier has started normally, all of bits 5 to 14 become 1.
Check bits 5 to 14 sequentially, starting at the lowest-order bit. The first lowest bit that is not 0 corresponds to the processing that caused the V ready-off alarm.

#15	#14	#13	#12	#11	#10	#9	#8
	SRDY	DRDY	INTL	RLY	CRDY	MCOFF	MCONA
#7	**#6**	**#5**	**#4**	**#3**	**#2**	**#1**	**#0**
MCONS	*ESP	HRDY					

#06(*ESP) Emergency stop signal
#07,#08,#09 MCON signal (CNC → amplifier → converter)
#10(CRDY) Converter preparation completed signal
#11(RLY) Relay signal (DB relay energized)
#12(INTL) Interlock signal (DB relay de-energized)
#13(DRDY) Amplifier preparation completed signal

The following table lists diagnosis No. 358 values and main causes of problems. Do not insert or remove any connector when the power is on.

Diagnosis No. 358 value	Problem	Check item
417	The emergency stop state persists.	(1) Check whether the emergency stop signal input to CX4 of βiSVSP-B has been released. (2) Check whether there is no problem with the connection or cable for communication between the amplifiers. (3) Replace the servo amplifier.
993	The βiSVSP-B (common power supply) preparation completed signal (CRDY) is not output.	(1) Check whether there is no problem with the connection or cable for communication (CXA2A/B) between the amplifiers. (2) Check whether the input power is supplied. (3) Check whether power is supplied to the operation coil of the magnetic contactor. Check whether there is no problem with connection of CX3 of the common power supply. (4) Replace the servo amplifier.
4065	The interlock signal is not input.	Replace the servo amplifier.
225	-	Replace the servo amplifier.
481	-	Replace the servo amplifier.
2017	-	Replace the servo amplifier.
8161	-	Replace the servo amplifier.
97	-	Check whether the axis detach function is set.

4.4.3 Method for Observing Motor Current

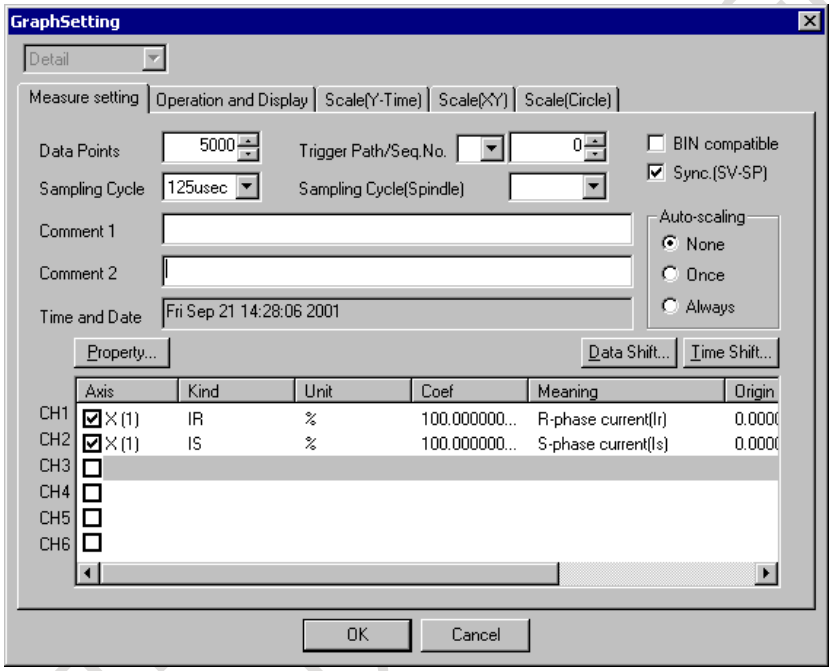
This subsection explains how to observe the current that flows through the servo motor.

(1) Method of using the SERVO GUIDE

Refer to online help for information about how to connect to and use the servo adjustment tool "SERVO GUIDE" and applicable CNC systems.

- Setting

Select an axis to be subjected to measurement in graph window channel setting. Also select IR and IS under Kind. Under Coef (conversion coefficient), set the maximum allowable current (Ap) for the amplifier in use.



NOTE
The motor current sampling cycle depends on the current control cycle.

- Display

Select the XTYT mode from the graph window mode (M) menu to display waveforms.

IV. TROUBLESHOOTING FOR βiSVSP-B

1 OVERVIEW

This part describes the troubleshooting procedure. Read the section related to your current trouble to locate it and take an appropriate action.

First, check the alarm number (indicated by the CNC) and the STATUS1 and STATUS2 indications in Chapter 2 to find the cause.

Then, take an appropriate action according to the corresponding description in Chapter 3.

2 ALARM NUMBERS AND BRIEF DESCRIPTIONS

2.1 SERVO ALARM

Alarm No.	LED	Description
	SV	
SV0001		SYNC ALIGNMENT ERROR
SV0002		SYNC EXCESS ERROR ALARM 2
SV0003		SYNCHRONOUS/COMPOSITE/SUPERIMPOSED CONTROL MODE CAN'T BE CONTINUED
SV0004		EXCESS ERROR (G31)
SV0005		SYNC EXCESS ERROR (MCN)
SV0006		ILLEGAL TANDEM AXIS
SV0007		SV ALM ANOTHER PATH(MULTI AMP.)
SV0010		SV OVERHEAT
SV0011		SV MOTOR OVER CURRENT(SOFT)
SV0012	4	SV DRIVE OFF CIRCUIT FAILURE
SV0013	3	SV CPU BUS FAILURE
SV0014	J	SV CPU WATCH DOG
SV0015	2 (Blinking)	SV LOW VOLT DRIVER
SV0016	b. C. d.	SV CURRENT DETECT ERROR
SV0017	11	SV INTERNAL SERIAL BUS FAILURE
SV0018	11 (Blinking)	SV ROM DATA FAILURE
SV0019	b C d (Blinking)	SV GROUND FAULT
SV0024		PS SOFT THERMAL
SV0031		PS ILLEGAL PARAMETER
SV0032		PS CONTROL AXIS ERROR 1
SV0033		PS CONTROL AXIS ERROR 2
SV0034		PS HARDWARE ERROR
SV0035	—	SV NO FAILURE
SV0036	A (Blinking)	PHASE OPEN
SV0037	9 (Blinking)	FAILURE OF SV(OPEN)
SV0038	—	FAILURE OF CURRENT CTRL.
SV0039	8 (Blinking)	FAILURE OF SV(SHORT)
SV0040		PS EXT-COMP. ERROR
SV0041		PS PFB-R ERROR
SV0042		PS PFB-C ERROR
SV0043		PS SUB MODULE ERROR
SV0044		MISMATCHED FUNCTION CODE

Alarm No.	LED	Description
	SV	
SV0301		APC ALARM: COMMUNICATION ERROR
SV0302		APC ALARM: OVER TIME ERROR
SV0303		APC ALARM: FRAMING ERROR
SV0304		APC ALARM: PARITY ERROR
SV0305		APC ALARM: PULSE ERROR
SV0306		APC ALARM: OVER FLOW ERROR
SV0307		APC ALARM: MOVEMENT EXCESS ERROR
SV0360		ABNORMAL CHECKSUM(INT)
SV0361		ABNORMAL PHASE DATA(INT)
SV0363		ABNORMAL CLOCK(INT)
SV0364		SOFT PHASE ALARM(INT)
SV0365		BROKEN LED(INT)
SV0366		PULSE MISS(INT)
SV0367		COUNT MISS(INT)
SV0368		SERIAL DATA ERROR(INT)
SV0369		DATA TRANS. ERROR(INT)
SV0380		BROKEN LED(EXT)
SV0381		ABNORMAL PHASE (EXT)
SV0382		COUNT MISS(EXT)
SV0383		PULSE MISS(EXT)
SV0384		SOFT PHASE ALARM(EXT)
SV0385		SERIAL DATA ERROR(EXT)
SV0386		DATA TRANS. ERROR(EXT)
SV0387		ABNORMAL ENCODER(EXT)
SV0401		IMPROPER V_READY OFF
SV0403		CARD/SOFT MISMATCH
SV0404		IMPROPER V_READY ON
SV0407		EXCESS ERROR
SV0409		DETECT ABNORMAL TORQUE
SV0410		EXCESS ERROR (STOP)
SV0411		EXCESS ERROR (MOVING)
SV0413		LSI OVERFLOW
SV0415		MOTION VALUE OVERFLOW
SV0417		ILL DGTL SERVO PARAMETER
SV0420		SYNC TORQUE EXCESS
SV0421		EXCESS ERROR(SEMI-FULL)
SV0422		EXCESS VELOCITY IN TORQUE
SV0423		EXCESS ERROR IN TORQUE
SV0430		SV MOTOR OVERHEAT
SV0431		PS OVERLOAD
SV0432		PS LOW VOLT. CONTROL
SV0433		PS LOW VOLT. DC LINK
SV0434	2	SV LOW VOLT CONTROL
SV0435	5	SV LOW VOLT DC LINK
SV0436		SOFTTHERMAL(OVC)
SV0437		PS OVERCURRENT
SV0438	b C d	SV ABNORMAL CURRENT
SV0439		PS OVER VOLT. DC LINK

Alarm No.	LED	Description
	SV	
SV0441		ABNORMAL CURRENT OFFSET
SV0442		PS PRE-CHARGE FAILURE
SV0443		PS INTERNAL FAN FAILURE
SV0444	1	SV INTERNAL FAN FAILURE
SV0445		SOFT DISCONNECT ALARM
SV0446		HARD DISCONNECT ALARM
SV0447		HARD DISCONNECT(EXT)
SV0448		UNMATCHED FEEDBACK ALARM
SV0449	8. 9. A.	SV IPM ALARM
SV0453		SPC SOFT DISCONNECT ALARM
SV0454		ILLEGAL ROTOR POS DETECT
SV0456		ILLEGAL CURRENT LOOP
SV0458		CURRENT LOOP ERROR
SV0459		HI HRV SETTING ERROR
SV0460		FSSB DISCONNECT
SV0462		SEND CNC DATA FAILED
SV0463		SEND SLAVE DATA FAILED
SV0465		READ ID DATA FAILED
SV0466		MOTOR/AMP. COMBINATION
SV0468		HI HRV SETTING ERROR(AMP)
SV0474		EXCESS ERROR (STOP:SV)
SV0475		EXCESS ERROR(MOVE:SV)
SV0476		ILLEGAL SPEED CMD.(SV)
SV0477		ILLEGAL MACHINE POS.(SV)
SV0478		ILLEGAL AXIS DATA(SV)
SV0481		SAFETY PARAM ERROR(SV)
SV0484		SAFETY FUNCTION ERROR(SV)
SV0488		SELF TEST OVER TIME
SV0489		SAFETY PARAM ERROR(CNC)
SV0490		SAFETY FUNCTION ERROR(CNC)
SV0494		ILLEGAL SPEED CMD.(CNC)
SV0496		ILLEGAL AXIS DATA(CNC)
SV0498		AXIS NUMBER NOT SET(CNC)
SV0600	8	SV DC LINK OVER CURRENT
SV0601	F	SV EXTERNAL FAN FAILURE
SV0602	6	SV RADIATOR OVERHEAT
SV0603	8. 9. A.	INV. IPM ALARM(OH)
SV0604	P	AMP COMMUNICATION ERROR
SV0606		PS EXTERNAL FAN FAILURE
SV0607		PS IMPROPER INPUT POWER
SV0646		ABNORMAL ANALOG SIGNAL(EXT)
SV0652		TEMP.ERROR
SV0654	7	DB RELAY FAILURE
SV1025		V_READY ON (INITIALIZING)
SV1026		ILLEGAL AXIS ARRANGE
SV1055		ILLEGAL TANDEM AXIS
SV1067		FSSB:CONFIGURATION ERROR(SOFT)

Alarm No.	LED	Description
	SV	
SV1068		DUAL CHECK SAFETY ALARM
SV1069		EXCESS ERROR(SERVO OFF:CNC)
SV1070		EXCESS ERROR(SERVO OFF:SV)
SV1071		EXCESS ERROR(MOVE:CNC)
SV1072		EXCESS ERROR(STOP:CNC)
SV1100		S-COMP. VALUE OVERFLOW
SV5134		FSSB:OPEN READY TIME OUT
SV5136		FSSB:NUMBER OF AMP. IS INSUFFICIENT
SV5137		FSSB:CONFIGURATION ERROR
SV5139		FSSB:ERROR
SV5197		FSSB:OPEN TIME OUT
SV5311		FSSB:ILLEGAL CONNECTION

2.2 SPINDLE ALARM

Alarm No.	LED	Description
	SP	
SP9001	01	MOTOR OVERHEAT
SP9002	02	EX DEVIATION SPEED
SP9003	03	DC-LINK FUSE IS BROKEN
SP9004	04	PS IMPROPER INPUT POWER
SP9006	06	THERMAL SENSOR DISCONNECT
SP9007	07	OVER SPEED
SP9009	09	OVERHEAT MAIN CIRCUIT
SP9010	10	LOW VOLT INPUT POWER
SP9011	11	PS OVER VOLT. DC LINK
SP9012	12	OVERCURRENT POWER CIRCUIT
	13	CPU DATA MEMORY FAULT
SP9014	14	SOFTWARE SERIES MISMATCH
SP9015	15	SPINDLE SWITCHING FAULT
SP9016	16	RAM ERROR
SP9017	17	ID NUMBER PARITY ERROR
	18	SUMCHECK ERROR PROGRAM ROM
SP9019	19	EXCESS OFFSET CURRENT U
SP9020	20	EXCESS OFFSET CURRENT V
SP9021	21	POS SENSOR POLARITY ERROR
SP9022	22	SP AMP OVER CURRENT
	24	SERIAL TRANSFER ERROR
SP9027	27	DISCONNECT POSITION CODER
SP9029	29	OVERLOAD
SP9030	30	PS OVERCURRENT
SP9031	31	MOTOR LOCK
SP9032	32	SIC-LSI RAM FAULT
SP9033	33	PS PRE-CHARGE FAILURE
SP9034	34	ILLEGAL PARAMETER
SP9036	36	OVERFLOW ERROR COUNTER
SP9037	37	ILLEGAL SETTING VELOCITY DETECTOR
SP9041	41	ILLEGAL 1REV SIGN OF POSITION CODER
SP9042	42	NO 1REV SIGN OF POSITION CODER
SP9043	43	DISCONNECT POSITION CODER DEF. SPEED
SP9046	46	ILLEGAL 1REV SIGN OF SCREW CUT
SP9047	47	ILLEGAL SIGNAL OF POSITION CODER
SP9049	49	DEF. SPEED IS OVER VALUE
SP9050	50	SYNCRONOUS VALUE IS OVER SPEED
SP9051	51	PS LOW VOLT. DC LINK
SP9052	52	ITP FAULT 1
SP9053	53	ITP FAULT 2
SP9054	54	OVERCURRENT
SP9055	55	ILLEGAL POWER LINE
SP9056	56	COOLING FAN FAILURE
SP9058	58	PS OVERLOAD
SP9059	59	PS INTERNAL FAN FAILURE
SP9061	61	SEMI-FULL ERROR EXCESS
SP9065	65	SERIAL SPINDLE ALARM
SP9066	66	COM. ERROR BETWEEN SP AMPS
SP9067	67	FSC/EGB COMMAND ERROR
SP9068	68	ILLEGAL SPINDLE PARAMETER
SP9069	69	SAFETY SPEED OVER

Alarm No.	LED	Description
	SP	
SP9070	70	ILLEGAL AXIS DATA
SP9071	71	SAFETY PARAMETER ERROR
SP9072	72	MISMATCH RESULT OF MOTOR SPEED CHECK
SP9073	73	MOTOR SENSOR DISCONNECTED
SP9074	74	CPU TEST ERROR
SP9075	75	CRC ERROR
SP9076	76	INEXECUTION OF SAFETY FUNCTIONS
SP9077	77	MISMATCH RESULT OF AXIS NUMBER CHECK
SP9078	78	MISMATCH RESULT OF SAFETY PARAMETER CHECK
SP9079	79	INITIAL TEST ERROR
SP9080	80	ALARM AT THE OTHER SP AMP.
SP9081	81	1-ROT MOTOR SENSOR ERROR
SP9082	82	NO 1-ROT MOTOR SENSOR
SP9083	83	MOTOR SENSOR SIGNAL ERROR
SP9084	84	SPNDL SENSOR DISCONNECTED
SP9085	85	1-ROT SPNDL SENSOR ERROR
SP9086	86	NO 1-ROT SPNDL SENSOR
SP9087	87	SPNDL SENSOR SIGNAL ERROR
SP9088	88	COOLING RADI FAN FAILURE
SP9089	89	SUB MODULE SM (SSM) ERROR
SP9090	90	UNEXPECTED ROTATION
SP9091	91	POLE POSITION COUNT MISS
SP9092	92	OVER SPEED TO VELOCITY COMMAND
	A	Program ROM error
	A1	Program ROM error
	A2	Program ROM error
SP9110	b0	AMP COMMUNICATION ERROR
SP9111	b1	PS LOW VOLT. CONTROL
SP9113	b3	PS EXTERNAL FAN FAILURE
SP9114	b4	PS CONTROL AXIS ERROR 1
SP9115	b5	PS CONTROL AXIS ERROR 2
SP9120	C0	COMMUNICATION DATA ERROR
SP9121	C1	COMMUNICATION DATA ERROR
SP9122	C2	COMMUNICATION DATA ERROR
SP9123	C3	SPINDLE SWITCH CIRCUIT ERROR
SP9124	C4	LEARNING CTRL ROTATION CMD ERROR
SP9125	C5	LEARNING CTRL COMP ORDER ERROR
SP9127	C7	LEARNING CTRL PERIOD ERROR
SP9128	C8	SP SYNC VELOCITY ERROR EXCESS
SP9129	C9	SP SYNC POSITION ERROR EXCESS
SP9130	d0	TORQUE TANDEM POLARITY ERROR
SP9131	d1	SPINDLE TUNING FUNCTION ALARM
SP9132	d2	SER.SENSOR DATA ERROR
SP9133	d3	SER.SENSOR TRANSFER ERROR
SP9134	d4	SER.SENSOR SOFT PHASE ERROR
SP9137	d7	SP DEVICE COMMUNICATION ERROR
SP9138	d8	CURRENT LIMIT SETTING ERROR
SP9139	d9	SER.SENSOR PULSE MISS
SP9140	E0	SER.SENSOR COUNT MISS
SP9141	E1	SER.SENSOR NO 1-ROT SIGNAL
SP9142	E2	SER.SENSOR ABNORMAL
SP9143	E3	CS HIGH SPEED CHANGE CMD ERROR
SP9144	E4	CURRENT DETECT CIRCUIT ERROR

Alarm No.	LED	Description
	SP	
SP9145	E5	LOW VOLTAGE DRIVER
SP9148	E8	AXIS NUMBER NOT SET
SP9153	F3	SP NO FAILURE
SP9154	F4	PHASE OPEN
SP9155	F5	FAILURE OF SP (OPEN)
SP9156	F6	FAILURE OF CURRENT CTRL.
SP9157	F7	FAILURE OF SP (SHORT)
SP9158	F8	MODE MISMATCH (DCS)
SP9159	F9	MISMATCHED FUNCTION CODE
SP9160	G0	THERMISTOR DISCONNECTION
SP9161	G1	POW. CABLE SHORT CIRCUIT
SP9162	G2	DELAY OF SP POS. DATA
SP9163	G3	ILLEGAL SP POS. DATA
SP9164	G4	FAILURE OF MASTER SENSOR
SP9165	G5	CONTROL METHOD CHANGED
	UU	FSSB master port wire break
	LL	FSSB slave port wire break
SP0756		ILLEGAL AXIS DATA
SP9204	M4	PS SOFT THERMAL
SP9211	L1	PS ILLEGAL PARAMETER
SP9212	L2	PS HARDWARE ERROR
SP9213	L3	PS EXT-COMP. ERROR
SP9214	L4	PS PFB-R ERROR
SP9215	L5	PS PFB-C ERROR
SP9216	L6	PS SUB MODULE ERROR

3 TROUBLESHOOTING AND ACTION

3.1 TROUBLESHOOTING PROCEDURES

3.1.1 Troubleshooting Procedure

The smart trouble shooting function is available for the combination of the 30*i*-B or 0*i*-F series CNC and the β*i*SVSP-B series servo amplifier. The function analyzes causes of alarms and shows how to remove them. If an alarm occurs, switch from the CNC screen to the trouble diagnosis guidance screen and remove the cause of the alarm according to what is displayed on the screen.

⇒ 3.2 TROUBLE DIAGNOSIS FUNCTION
⇒ 3.2.1 Trouble Diagnosis Guidance

IMPORTANT
To use the trouble diagnosis guidance requires keeping the trouble diagnosis monitor in the "SAMPLING" state. For details about how to switch to the "SAMPLING" state, see Subsection 3.2.3.

The servo amplifier-related data acquired before and at the time of alarm occurrence (concerning the power supply, motor current, and detector) is sent to the CNC. This data can be used for troubleshooting.

⇒ 3.2.2 Trouble Diagnosis Monitor

IMPORTANT
The trouble diagnosis monitor can be in either of the following two states: "SAMPLING" and "LATCHED".
To monitor data of new alarms, perform the "CLEAR" operation. To save the status observed when alarms were issued in the past, do not perform the "CLEAR" operation. For details of the operation, see Subsection 3.2.3.

For lists of CNC alarm numbers related to servos and LED indication numbers on servo amplifiers, see Chapter 2.

NOTE
Depending on the content of a failure, it may be difficult to analyze its cause correctly by using the smart trouble shooting function alone. In such a case, check the alarm number, the program associated with the alarm, and the procedure being performed, and contact your FANUC service representative.

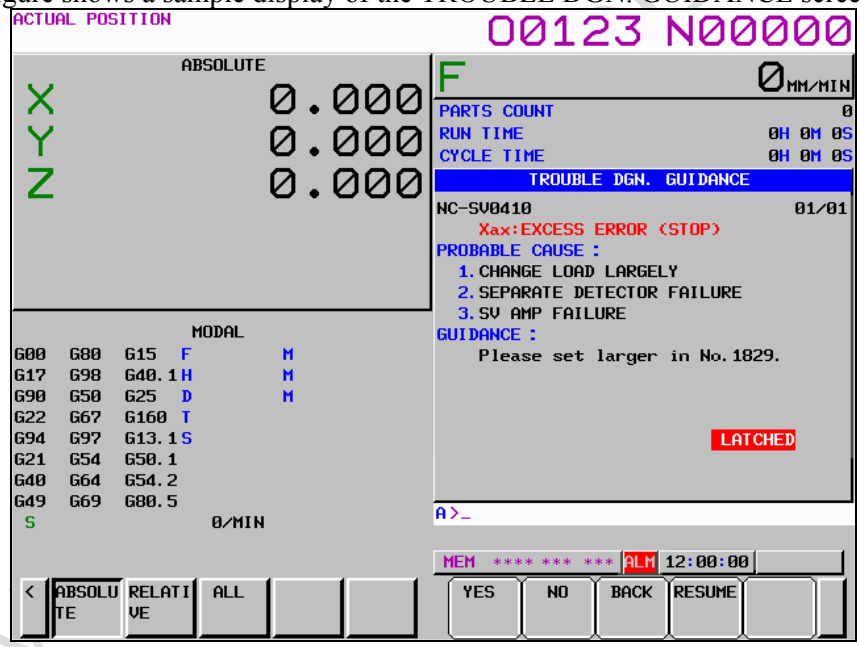
3.2 TROUBLE DIAGNOSIS FUNCTION

The 30*i*-B series CNC and 0*i*-F series CNC have a trouble diagnosis function, which allows you to check diagnostic information useful to know the status when a servo, spindle, or CNC alarm is issued, on the CNC screen.
The trouble diagnosis function has the following main features:

- "TROUBLE DGN. GUIDANCE screen": Allows you to determine the cause of an alarm according to the trouble diagnosis flow.
- "TROUBLE DGN. MONITOR screen": Allows you to latch data when an alarm is issued as well as monitor the status of servo and spindle amplifiers during normal operation.
- "TROUBLE DGN. GRAPHIC screen": Can display waveforms when a servo or spindle alarm is issued.

Among these features, the TROUBLE DGN. GUIDANCE screen can be used to determine the cause of an alarm and the action to be taken for it for a short time, which can be expected to reduce the down time of the machines.

The following figure shows a sample display of the TROUBLE DGN. GUIDANCE screen.



TROUBLE DGN. GUIDANCE screen

As the trouble diagnosis guidance, the trouble diagnosis function executes a diagnosis flow for determining the cause of an alarm. In most steps, the function automatically makes a decision based on information available in the CNC, but it may ask a question on the GUIDANCE screen in some cases. Press soft key [YES] or [NO] in response to the question to proceed to the next step in the guidance flow.

NOTE

- The most possible cause(s) and action to be taken based on obtained information are displayed as the cause(s) and guidance (action to be taken). Before any replacement, make a double check using another method (for example, detecting insulation resistance or checking conductivity).
- If the result of the diagnosis is "Failure in the amplifier" for the "SV ABNORMAL CURRENT" alarm (SV438), "OVERCURRENT POWER CIRCUIT" alarm (SP9012), or "SV IPM ALARM" (SV449), check the connection and ground insulation between the power cable and motor before replacing the amplifier.

NOTE
- If the result of the diagnosis is "Short-circuit on the power cable or motor winding" for the "SV ABNORMAL CURRENT" alarm (SV438), "OVERCURRENT POWER CIRCUIT" alarm (SP9012), or "SV IPM ALARM" (SV449), check the ground insulation between the power cable and motor as well.

3.2.1 Trouble Diagnosis Guidance

IMPORTANT
To use the trouble diagnosis guidance, the CNC must be set in the "SAMPLING" state. For details of operation for switchover to "SAMPLING" state, see Subsection 3.2.3.

Examples of determining the cause of an alarm using the trouble diagnosis guidance are shown below using diagnosis of SV0411, "EXCESS ERROR (MOVING)" and SV0449, "SV IPM ALARM."

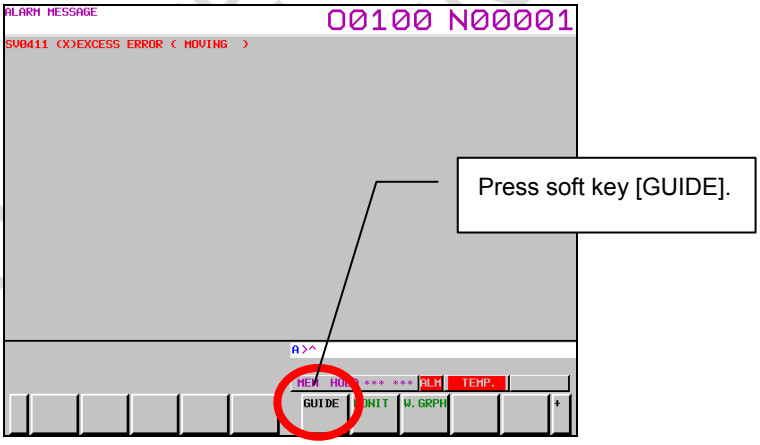
Example 1) When SV0411, "EXCESS ERROR (MOVING)" is issued

(1) When this alarm is issued, perform the following steps to display the TROUBLE DGN. GUIDANCE screen:

<1> When the ALARM MESSAGE screen is not displayed, press function key [MESSAGE].

<2> Press the continuous menu key until soft key [GUIDE] appears.

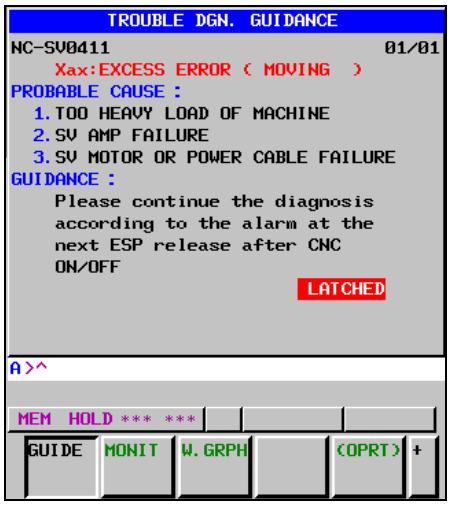
<3> Press the soft key [GUIDE].



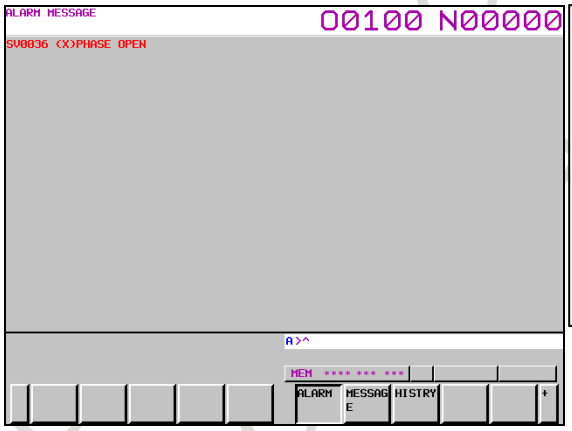
(2) Possible causes of the alarm, "EXCESS ERROR (MOVING)" are:
- Failure in the amplifier
- Short-circuit on the power cable or motor winding
- Disconnected power cable or motor winding
- Malfunction of the servo-off signal
- Large load change
- Failure in the brake
- Commanded speed exceeding the specification

As the trouble diagnosis guidance, the trouble diagnosis function executes a diagnosis flow for determining the cause of the alarm. In most steps, the function automatically makes a decision based on information available in the NC, but it may ask a question on the GUIDANCE screen in some cases. Press soft key [YES] or [NO] in response to the question to proceed to the next step in the guidance flow.

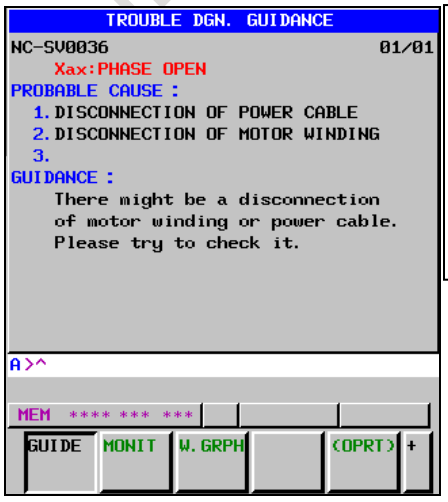
Example) When the disconnected power cable causes the alarm, “EXCESS ERROR (MOVING)” to be issued



When soft key [GUIDE] is pressed, the message shown at left is displayed. The guidance shows an instruction to "turn the power off". The function performs a self-diagnosis to check the servo amplifier for a failure when the power to the CNC is turned off, then on again.



The function performs a self-diagnosis immediately after power on of the CNC. Then, the PHASE OPEN alarm is issued. Press the soft key [GUIDE] again to display the TROUBLE DGN. GUIDANCE screen.



On the TROUBLE DGN. GUIDANCE screen, a message appears, which indicates that a possible cause is the disconnected power cable or motor winding.
Take action according to the instruction in the message.

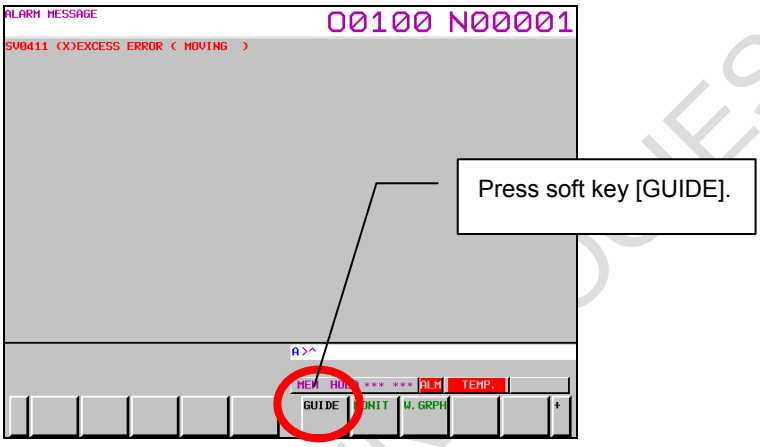
Example 2) When SV0449, “SV IPM ALARM” is issued

(1) When this alarm is issued, perform the following steps to display the TROUBLE DGN. GUIDANCE screen:

<1> When the ALARM MESSAGE screen is not displayed, press function key MESSAGE.

<2> Press the continuous menu key ▷ until soft key [GUIDE] appears.

<3> Press the soft key [GUIDE].

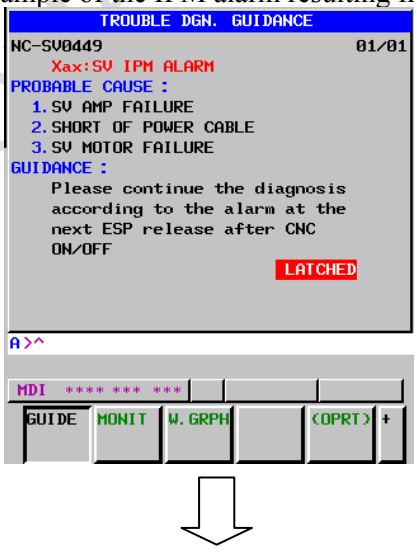


(2) Possible causes of the alarm, “SV IPM ALARM” are:

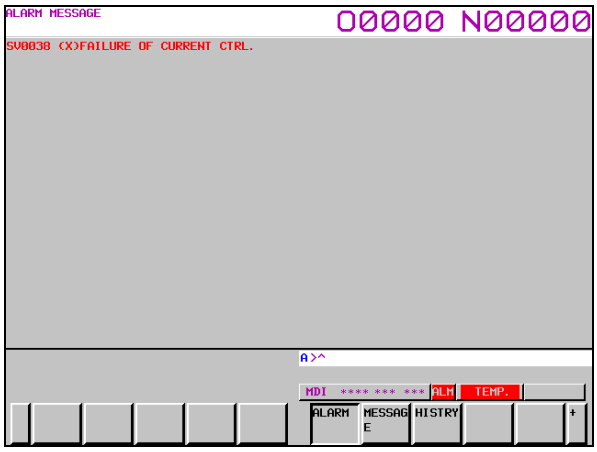
- Failure in the amplifier
- Short-circuit on the power cable or motor winding
- Disconnected power cable or motor winding
- Current control disturbance

As the trouble diagnosis guidance, the trouble diagnosis function executes a diagnosis flow for determining the cause of the alarm. In most steps, the function automatically makes a decision based on information available in the NC, but it may ask a question on the GUIDANCE screen in some cases. Press soft key [YES] or [NO] in response to the question to proceed to the next step in the guidance flow.

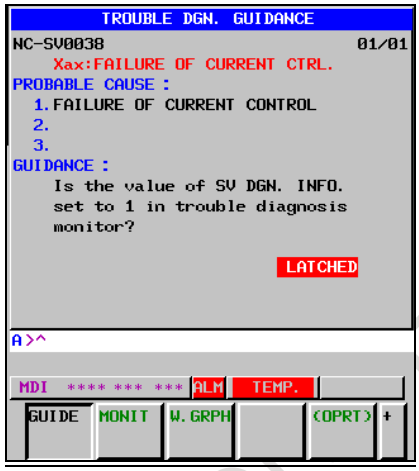
Example) Example of the IPM alarm resulting from a short-circuited power cable



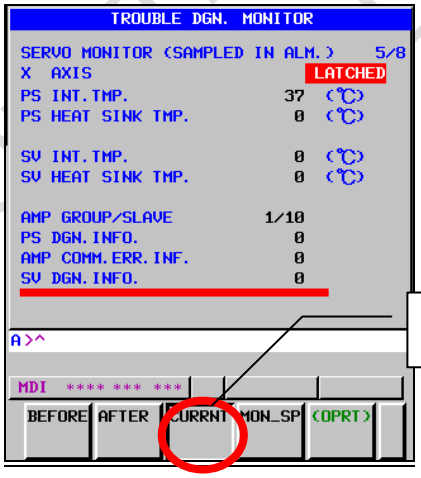
When soft key [GUIDE] is pressed, the message shown at left is displayed. The guidance shows an instruction to "turn the power off". The function performs a self-diagnosis to check the servo amplifier for a failure when the power to the CNC is turned off, then on again.



Self-diagnosis was conducted immediately after the servo amplifier was turned on, and the "FAILURE OF CURRENT CTL" alarm occurred. The trouble diagnosis guidance screen is displayed again.

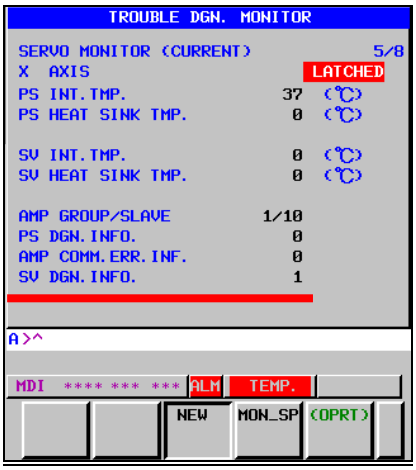


The guidance displays "Is the value of SV DGN. INFO. set to 1 in trouble diagnosis monitor". See the trouble diagnosis monitor screen.

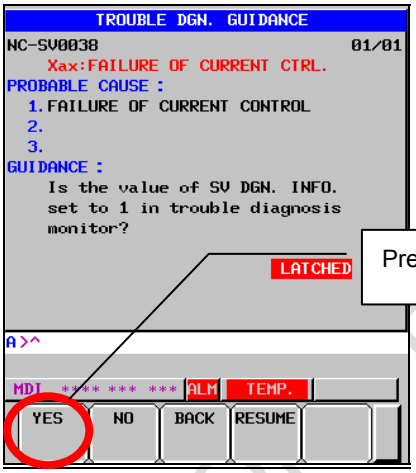


Display the trouble diagnosis monitor screen, go to the page containing the item "SV DNG. INFO.", and then press the "CURRENT" button.

Press [Current].

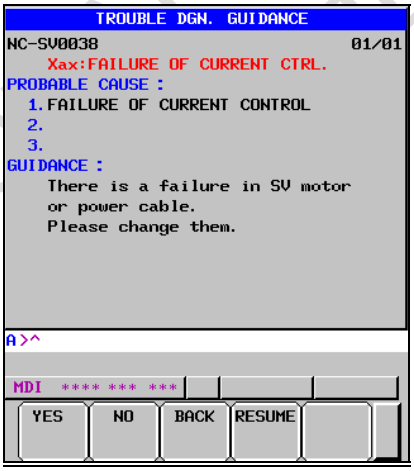


Check the value of "SV DNG INFO.", which is either "0" or "1."
"1" means that a short-circuited power cable or motor winding was detected during the servo amplifier self-diagnosis.



Display the trouble diagnosis guidance screen, and press "YES."

Press [YES].



The guidance suggests a possibility of a short-circuited power cable or motor winding.
Take action according to the message.

3.2.2 Trouble Diagnosis Monitor

IMPORTANT

The trouble diagnosis monitor can be in either of the following two states: "SAMPLING" and "LATCHED".
To monitor data when a new alarm will be issued, perform "CLEAR" operation. On the contrary, to save the status when alarms were issued in the past, do not perform "CLEAR" operation. For details of the operation, see Subsection 3.2.3.

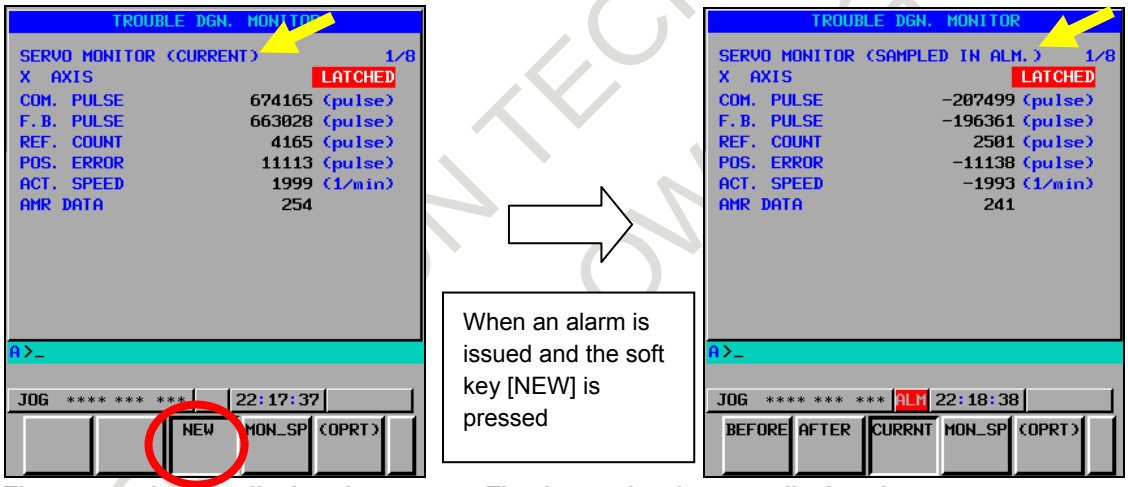
The trouble diagnosis monitor can display the information described below.
The procedures to display the TROUBLE DGN. MONITOR screen are below,

- Press function key [MESSAGE] to display the ALARM MESSAGE screen.
- Press the continuous menu key [▷] until the soft key [MONITOR] appears.
- Press the soft key [MONITOR] to display the TROUBLE DGN. MONITOR screen.

How to check the data at an alarm or just before an alarm

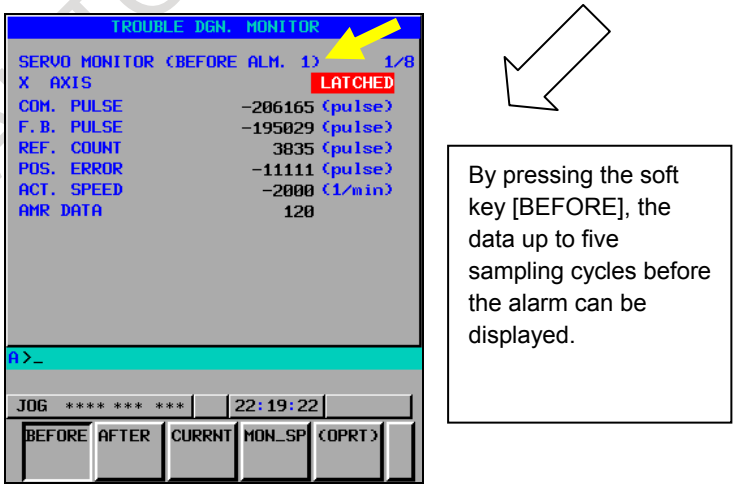
On the TROUBLE DGN. MONITOR screen, you can check the following data:

- Current data
- Data at an alarm
- Data just before an alarm during several sampling cycles



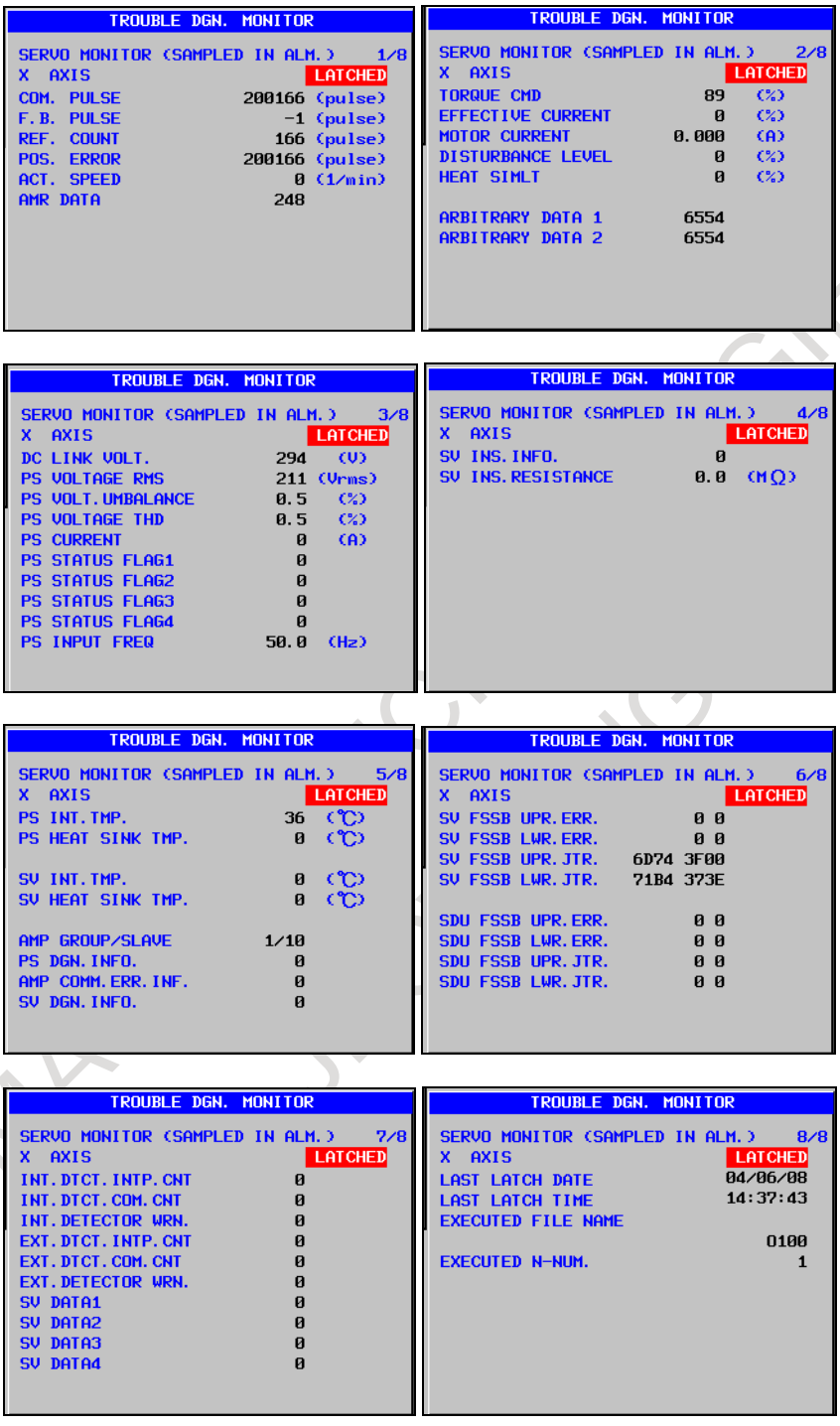
The current data are displayed.

The data at the alarm are displayed.



The data just one sampling cycle before are displayed.

Details of monitor screens related to servo amplifiers



Data (unit)	Description	Displayed page number
COM. PULSE (pulse)	Position command pulse	1/8
F.B. PULSE (pulse)	Position feedback pulse (Note 3)	1/8
REF. COUNT (pulse)	Reference counter	1/8
POS. ERROR (pulse)	Position error	1/8
ACT. SPEED (1/min)	Actual speed	1/8

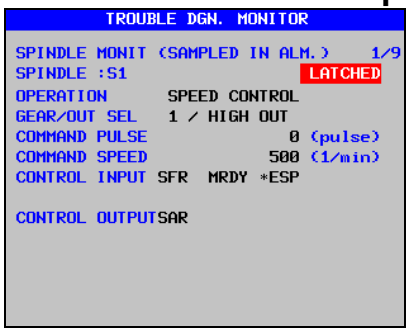
Data (unit)	Description	Displayed page number
AMR DATA	Magnetic pole position data of the motor rotor (256/rotation in electrical angle)	1/8
TORQUE CMD (%)	Torque command (Maximum torque =100%)	2/8
EFFECTIVE CURRENT (%)	Maximum amplifier current =100%	2/8
MOTOR CURRENT (A)	Actual motor current	2/8
DISTURBANCE LEVEL (%)	Alarm level when unexpected torque detection is used =100%	2/8
HEAT SIMLT (%)	Result of heat simulation (OVC alarm level =100%)	2/8
ARBITRARY DATA 1	(Note 2)	2/8
ARBITRARY DATA 2	(Note 2)	2/82
DC LINK VOLT. (V)	Instantaneous DC link voltage value (Note 3)	3/8
PS VOLTAGE RMS (Vrms)	Average PS input voltage value during one power cycle (Note 3)	3/8
PS VOLT. UMBALANCE (%)	Average PS input voltage value during one power cycle (Note 3)	3/8
PS VOLTAGE THD (%)	Average PS input voltage THD (Total Harmonic Distortion) during one power cycle (Note 3)	3/8
PS CURRENT (A)	Average current amplitude during one power cycle (Note 3)	3/8
PS STATUS FLAG1	(Note 4)	3/8
PS STATUS FLAG2	(Note 4)	3/8
PS STATUS FLAG3	(Note 4)	3/8
PS STATUS FLAG4	(Note 4)	3/8
PS INPUT FREQ (Hz)	Average frequency value during one power cycle (Note 3)	3/8
SV INS. INFO.	Status flag of the Insulation deterioration detection function	4/8
SV INS.RESISTANCE (MΩ)	Motor insulation resistance when the Insulation deterioration detection function is enabled (Note 3)	4/8
PS INT. TMP. (°C)	PS internal temperature (Note 3)	4/8
PS HEAT SINK TMP. (°C)	PS heat sink temperature (Note 3)	5/8
SV INT.TMP. (°C)	SV internal temperature (Note 3)	5/8
SV HEAT SINK TMP. (°C)	SV heat sink temperature (Note 3)	5/8
AMP GROUP/SLAVE	Group number and slave number for each Power Supply (PS)	5/8
PS DGN. INFO.	Power Supply (PS) alarm cause determination data for use by the trouble diagnosis function (Note 5)	5/8
AMP COMM. ERR. INF.	Error status flag of inter-amplifier communication	5/8
SV DGN. INFO.	Status flag of the servo amplifier (SV)	5/8
SV FSSB UPR. ERR.	FSSB error in SV (Note 6)	6/8
SV FSSB LWR. ERR.	FSSB error in SV (Note 6)	6/8
SV FSSB UPR. JTR.	FSSB jitter in SV (Note 6)	6/8
SV FSSB LWR. JTR.	FSSB jitter in SV (Note 6)	6/8
SDU FSSB UPR. ERR.	FSSB error in SDU (Note 6)	6/8
SDU FSSB LWR. ERR.	FSSB error in SDU (Note 6)	6/8
SDU FSSB UPR. JTR.	FSSB jitter in SDU (Note 6)	6/8
SDU FSSB LWR. JTR.	FSSB jitter in SDU (Note 6)	6/8
INT. DTCT. INTP. CNT	Built-in detector interpolation counter Number of times that built-in sensor data were distorted by noise (Number of times that data errors were detected)	7/8
INT. DTCT. COM. CNT	Built-in detector communication error counter Number of times that built-in sensor data were distorted by noise (number of communication errors were detected)	7/8
INT. DETECTOR WRN.	Built-in sensor warning information	7/8
EXT. DTCT. INTP. CNT	External detector interpolation counter Number of times that separate sensor data were distorted by noise (umber of times that data errors were detected)	7/8
EXT. DTCT. COM. CNT	External detector communication error counter Number of times that separate sensor data were distorted by noise (number of communication errors were detected)	7/8
EXT. DETECTOR WRN.	Separate sensor warning information	7/8

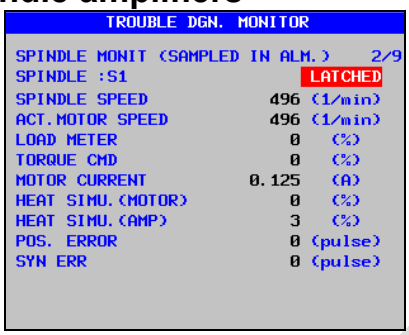
Data (unit)	Description	Displayed page number
SV DATA1	(Note 2)	7/8
SV DATA2	(Note 2)	7/8
SV DATA3	(Note 2)	7/8
SV DATA4	(Note 2)	7/8
LAST LATCH DATE	The latest date when data are latched	8/8
LAST LATCH TIME	The latest time when data are latched	8/8
EXECUTED FILE NAME	Executed program file name at the alarm	8/8
EXECUTED N-NUM.	Executed N-number at the alarm	8/8

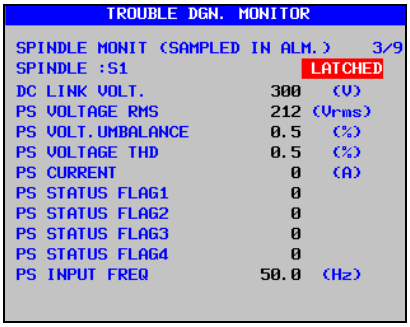
NOTE

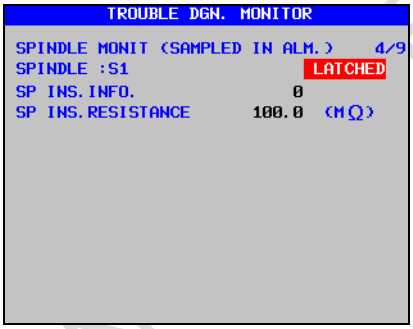
1 The specified range in this list is just the range within which the monitor function can display data, and does not indicate the performance or rating of the system.
2 ARBITRARY DATA 1 and ARBITRARY DATA 2, and SV DATA1 to SV DATA4 are used by FANUC for maintenance.
3 The displayed values related to voltage, current, frequency, and temperature are approximate and contain some errors. If you require a precise value, measure the target item using a specific measurement instrument.
4 PS STATUS FLAG1 to PS STATUS FLAG4 are used by FANUC for maintenance.
5 The data is used by the trouble diagnosis function inside the CNC to automatically determine the alarm cause if an alarm is issued in a Power Supply (PS). To use this data, operate the system in the "monitoring" state, as indicated on the trouble monitor screen. If an alarm is issued in the "monitoring" state, the trouble diagnosis guidance presents the cause, by using this data.
6 FSSB error and jitter data items indicate the FSSB communication status and are used by FANUC for maintenance.

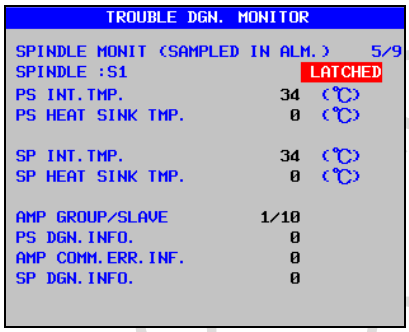
Details of monitor screens related to spindle amplifiers

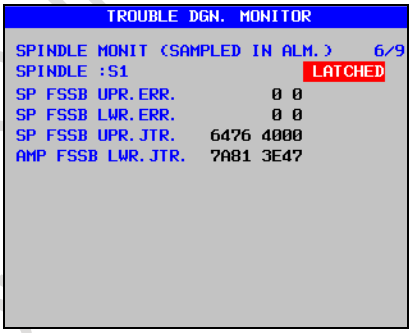


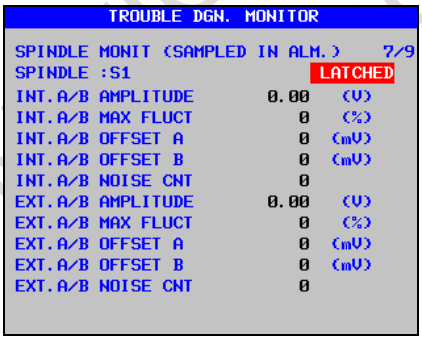


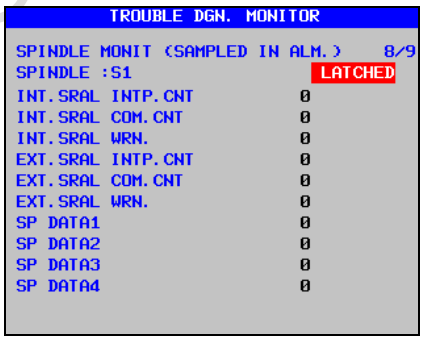


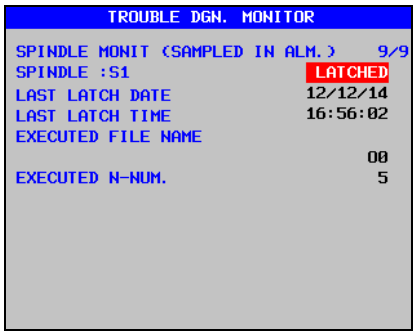












Data (unit)	Description	Displayed page number
OPERATION	Operation mode	1/9
GEAR/OUT SEL	Selected gear kind and selected output power	1/9
COMMAND PULSE (pulse)	Position command pulse	1/9
COMMAND SPEED (1/min)	Speed command (Note 2)	1/9
CONTROL INPUT	Input signals for spindle control	1/9
CONTROL OUTPUT	Output signals for spindle control	1/9
SPINDLE SPEED (1/min)	Actual spindle speed	2/9
ACT.MOTOR SPEED (1/min)	Actual spindle motor speed (Note 2)	2/9
LOAD METER (%)		2/9
TORQUE COM (%)	Torque command (Maximum torque = 100%)	2/9
MOTOR CURRENT (A)	Actual motor current	2/9
HEAT SIMU.(MOTOR) (%)	Result of heat simulation for motor (OVC alarm level = 100%)	2/9
HEAT SIMU.(AMP) (%)	Result of heat simulation for amplifier (OVC alarm level = 100%)	2/9
POS. ERROR (pulse)	Position error	2/9
SYN ERR (pulse)	Synchronous error for rigid tapping	2/9
DC LINK VOLT. (V)	Instantaneous DC link voltage value (Note 3)	3/9
PS VOLTAGE RMS (Vrms)	Average PS input voltage value during one power cycle (Note 3)	3/9
PS VOLT.UMBALANCE (%)	Average PS input voltage value during one power cycle (Note 3)	3/9
PS VOLTAGE THD (%)	Average PS input voltage THD (Total Harmonic Distortion) during one power cycle (Note 3)	3/9
PS CURRENT(A)	Average current amplitude during one power cycle (Note 3)	3/9
PS STATUS FLAG1	(Note 5)	3/9
PS STATUS FLAG2	(Note 5)	3/9
PS STATUS FLAG3	(Note 5)	3/9
PS STATUS FLAG4	(Note 5)	3/9
PS INPUT FREQ (Hz)	Average frequency value during one power cycle (Note 3)	3/9
SP INS.INFO.	Status flag of the insulation deterioration detection function	4/9
SP INS.RESISTANCE (MΩ)	Motor insulation resistance when the insulation deterioration detection function is enabled (Note 3)	4/9
PS INT.TMP. (°C)	PS internal temperature (Note 3)	5/9
PS HEAT SINK TMP. (°C)	PS heat sink temperature (Note 3)	5/9
SP INT.TMP. (°C)	SP internal temperature (Note 3)	5/9
SP HEAT SINK TMP. (°C)	SP internal temperature (Note 3)	5/9
AMP GROUP/SLAVE	Group number and slave number for each Power Supply (PS)	5/9
PS DGN.INFO.	Status flag of the Power Supply (PS)	5/9
AMP COMM.ERR.INF.	Error status flag of inter-amplifier communication	5/9
SP DGN.INFO.	Status flag of the spindle amplifier (SP)	5/9
SP FSSB UPR.ERR.	FSSB error in SV (Note 6)	6/9
SP FSSB LWR.ERR.	FSSB error in SV (Note 6)	6/9
SP FSSB UPR.JTR.	FSSB jitter in SV (Note 6)	6/9
AMP FSSB LWR.JTR.	FSSB jitter in SV (Note 6)	6/9
INT.A/B AMPLITUDE (V)	Built-in analog sensor A/B phase signal amplitude	7/9
INT.A/B MAX FLUCT (%)	Maximum fluctuation rate of the built-in analog sensor A/B phase signal	7/9
INT.A/B OFFSET A (mV)	Phase A offset of the built-in analog sensor	7/9
INT.A/B OFFSET B(mV)	Phase B offset of the built-in analog sensor	7/9
INT.A/B NOISE CNT	Number of times that built-in analog sensor data were distorted by noise (number of times that data errors were detected)	7/9
EXT.A/B AMPLITUDE (V)	Separated analog sensor A/B phase signal amplitude	7/9
EXT.A/B MAX FLUCT (%)	Maximum fluctuation rate of the separated analog sensor A/B phase signal	7/9
EXT.A/B OFFSET A(mV)	Phase A offset of the separated analog sensor	7/9
EXT.A/B OFFSET B(mV)	Phase B offset of the separated analog sensor	7/9

Data (unit)	Description	Displayed page number
EXT.A/B NOISE CNT	Number of times that separated analog sensor data were distorted by noise (number of times that data error were detected)	7/9
INT.SRAL INTP.CNT	Built-in serial sensor interpolation counter Number of times that built-in serial sensor data were distorted by noise (number of times that a data errors were detected)	8/9
INT.SRAL COM.CNT	Built-in serial sensor communication error counter Number of times that built-in serial sensor data were distorted by noise (number of communication errors were detected.)	8/9
INT.SRAL WRN.	Built-in serial sensor warning information	8/9
EXT.SRAL INTP.CNT	External serial sensor interpolation counter Number of times that separated serial sensor data were distorted by noise (number of times that data errors were detected)	8/9
EXT.SRAL COM.CNT	External serial sensor communication error counter Number of times that separated serial sensor data were distorted by noise (number of communication errors were detected.)	8/9
EXT.SRAL WRN.	Separated serial sensor warning information	8/9
SP DATA1	(Note 4)	8/9
SP DATA2	(Note 4)	8/9
SP DATA3	(Note 4)	8/9
SP DATA4	(Note 4)	8/9
LAST LATCH DATE	The latest date when data are latched	9/9
LAST LATCH TIME	The latest time when data are latched	9/9
EXECUTED FILE NAME	Executed program file name at the alarm	9/9
EXECUTED N-NUM.	Executed N-number at the alarm	9/9

NOTE

1 The specified range in this list is just the range within which the monitor function can display data, and does not indicate the performance or rating of the system.
2 To display COMMAND SPEED and ACT.MOTOR SPEED, set the parameters related to the maximum motor speed:
   - No.4020: Maximum motor speed of the main spindle
   - No.4196: Maximum motor speed of the sub-spindle (when the spindle switch function is used)
3 The displayed values related to voltage, current, frequency, and temperature are approximate and contain some errors. If you require a precise value, measure the target item using a specific measurement instrument.
4 SP DATA1 to SP DATA4 are used by FANUC for maintenance.
5 PS STATUS FLAG1 to PS STATUS FLAG4 are used by FANUC for maintenance.
6 FSSB error and jitter data items indicate the FSSB communication status and are used by FANUC for maintenance.

3.2.3 How to Switch the Trouble Diagnosis Guidance and Trouble Diagnosis Monitor to the "SAMPLING" State

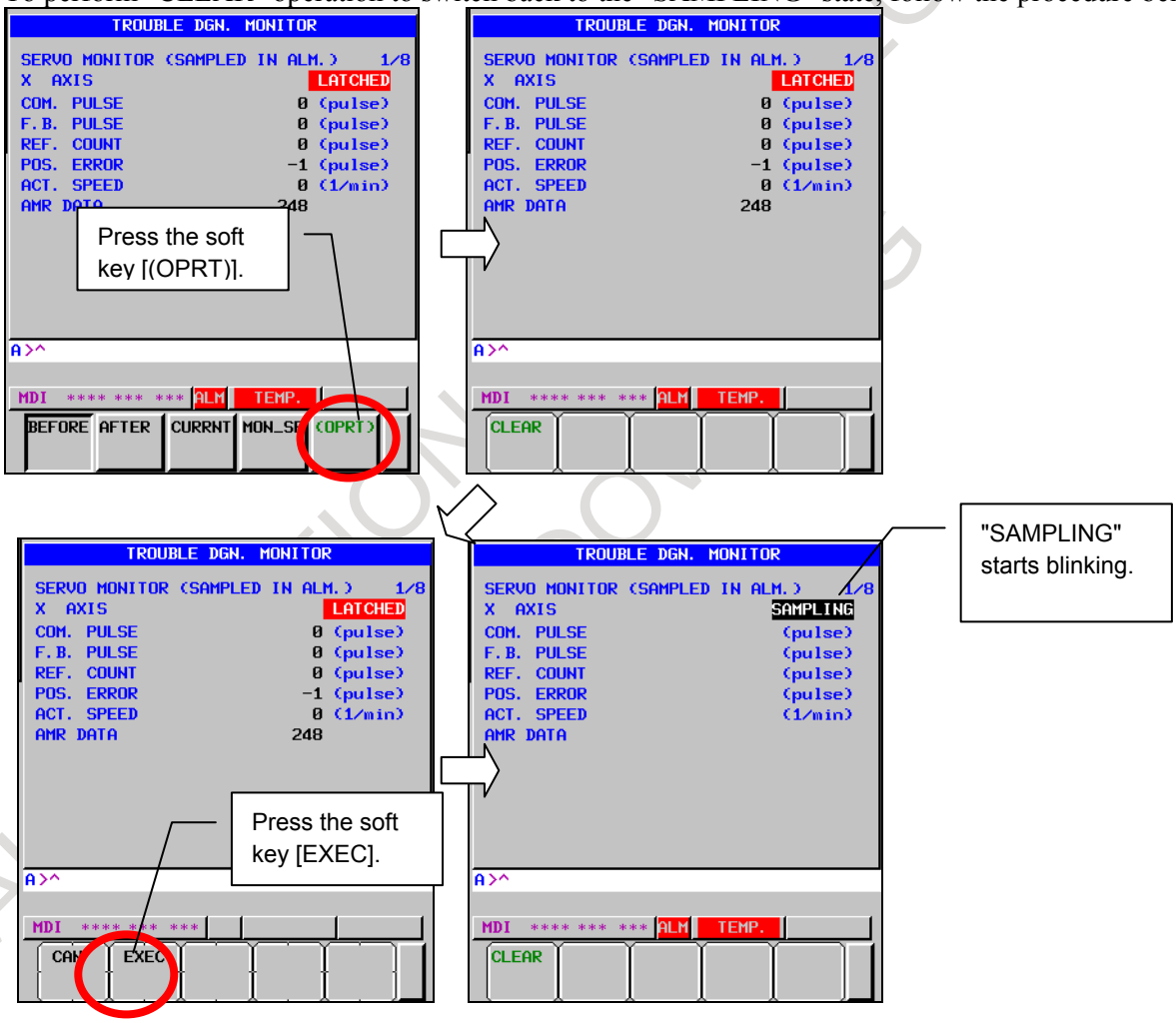
The trouble diagnosis monitor can be in either of the following two states: "SAMPLING" and "LATCHED".

When an alarm is issued, it enters into the "LATCHED" state.
When "CLEAR" operation is performed at the "LATCHED" state, the saved data when the alarm was issued are erased and the CNC returns to the "SAMPLING" state.

So,

- To monitor data when a new alarm will be issued, perform "CLEAR" operation.
- On the contrary, to save the status when an alarm was issued in the past, do not perform "CLEAR" operation.

To perform "CLEAR" operation to switch back to the "SAMPLING" state, follow the procedure below:



4 REPLACING SERVO AMPLIFIER COMPONENTS

This chapter describes how to replace a fan motor, absolute Pulsecoder battery, fuses, and printed-circuit board.

> ⚠ **WARNING**
> Because the Servo Amplifier uses a large-capacitance electrolytic capacitor internally, the Servo Amplifier remains charged for a while even after the power is turned off. Before touching the Servo Amplifier for maintenance or other purposes, ensure your safety by measuring the residual voltage in the DC link with a tester and confirming that the charge indication LED (red) is off.

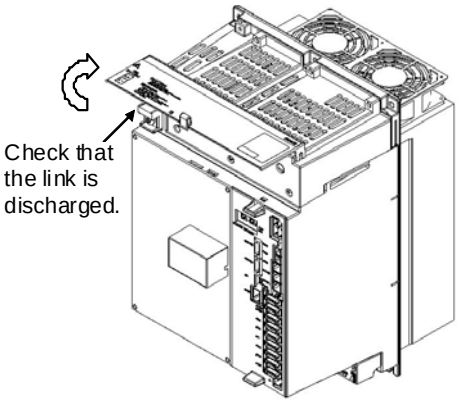
4.1 REPLACEMENT OF A FAN MOTOR

4.1.1 Removing the Fan Unit

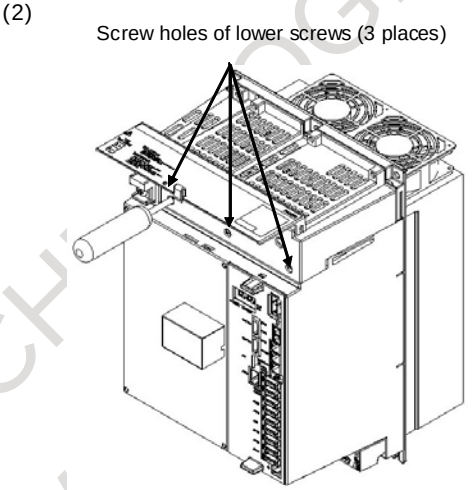
(a) 260-mm width model

(1) Unlock the cover of the DC link terminal block, open the cover, check that the DC link is discharged (that the LED is off), and remove the DC link short bar.
(2) Insert the screwdriver from the opening beside the DC link terminal block, and loosen the lower screws (three places) of the fan unit.
(3) Loosen the upper screws (three places) of the fan unit.
(4) Open the cover of the DC link terminal block, and pull out the fan unit toward you.
(5) When mounting the fan unit, perform the procedure in reverse order.

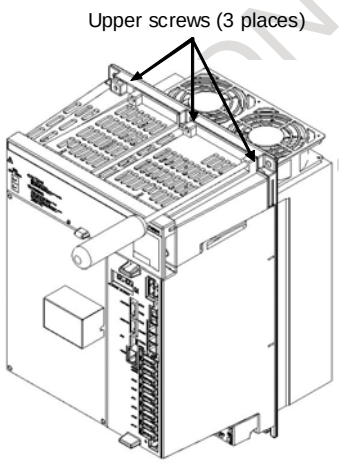
(1)



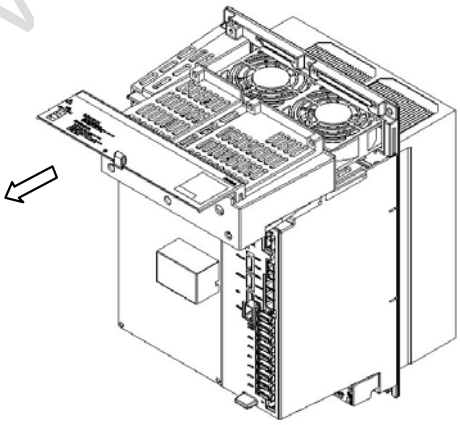
(2)



(3)



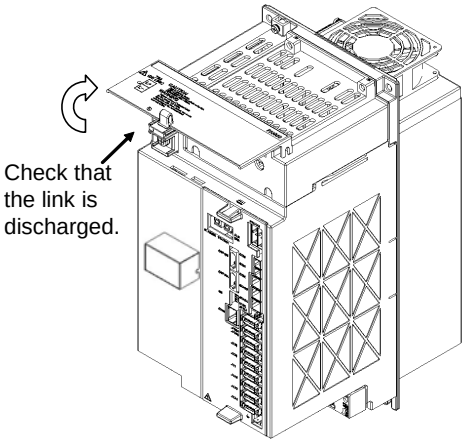
(4)



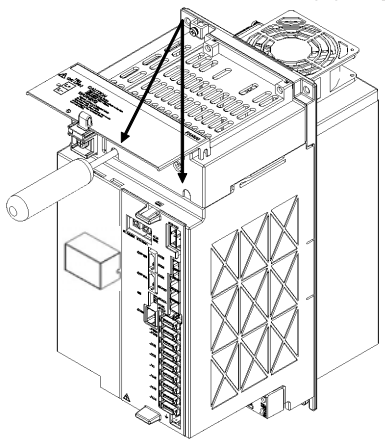
(b) 180-mm width model

(1) Unlock the cover of the DC link terminal block, open the cover, check that the DC link is discharged (that the LED is off), and remove the DC link short bar.
(2) Insert the screwdriver from the opening beside the DC link terminal block, and loosen the lower screws (two places) of the fan unit.
(3) Loosen the upper screws (two places) of the fan unit.
(4) Open the cover of the DC link terminal block, and pull out the fan unit toward you.
(5) When mounting the fan unit, perform the procedure in reverse order.

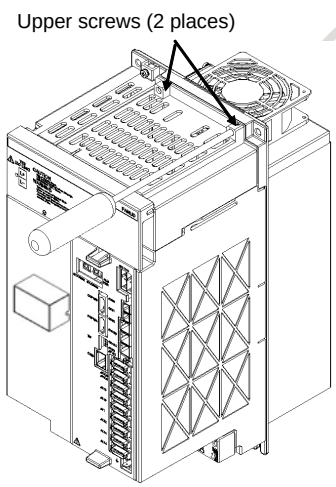
(1)



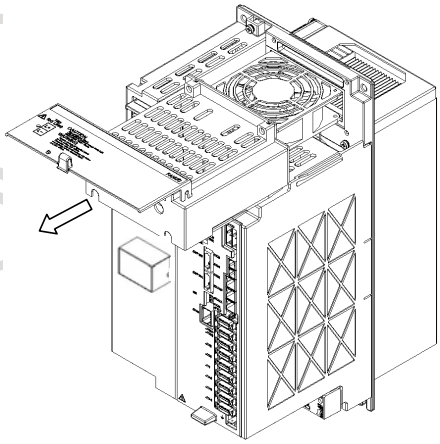
(2)



(3)



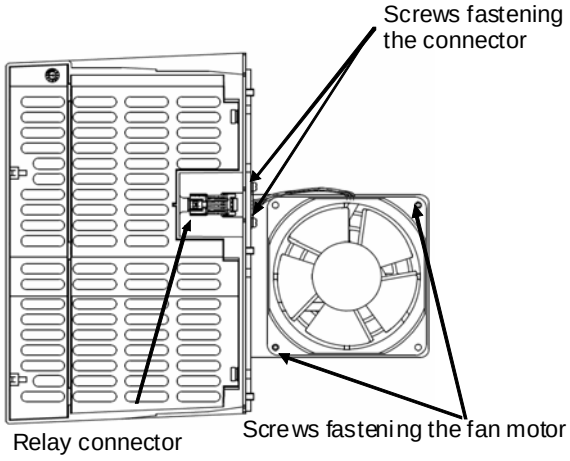
(4)



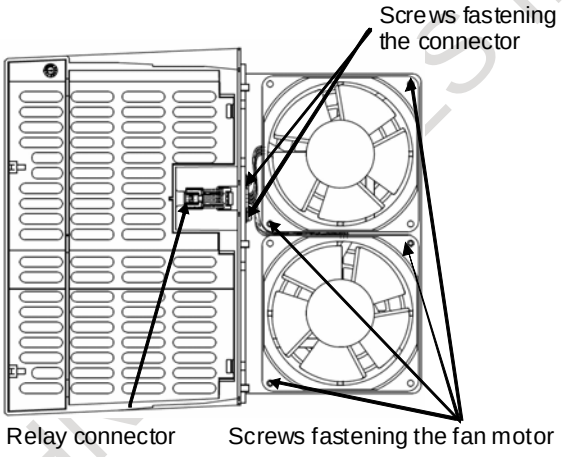
4.1.2 Removing the Fan Motor from the Fan Unit

(a) 260-mm width model

(1) Remove the relay connector from the fan connector. For details, see the figure below.
(2) Remove the two or four screws fastening the fan motor. (A screwdriver whose handle diameter is 4 mm or less is required.)
(3) Remove the two screws fastening the fan motor connector.



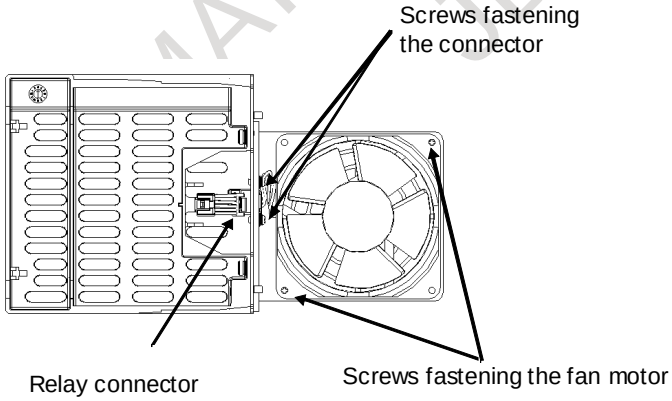
When there is 1 fan motor
(when viewed from the bottom side of the amplifier)



When there are 2 fan motors
(when viewed from the bottom side of the amplifier)

(b) 180-mm width model

(1) Remove the relay connector from the fan connector. For details, see the figure below.
(2) Remove the two screws fastening the fan motor. (A screwdriver whose handle diameter is 4 mm or less is required.)
(3) Remove the two screws fastening the fan motor connector.



When viewed from the bottom side of the amplifier

4.1.3 Specifications of Fan Units and Motors for Maintenance

(a) 260-mm width model

Model name	Internal cooling fan		Radiator cooling fan	
	Fan unit	Fan motor	Fan unit	Fan motor
βiSVSP20/20-7.5-B βiSVSP20/20-11-B βiSVSP40/40-15-B βiSVSP20/20/40-7.5-B βiSVSP20/20/40-11-B βiSVSP40/40/40-11-B βiSVSP40/40/40-15-B βiSVSP40/40/80-15-B	-	-	A06B-6320-C601	A90L-0001-0598#A
βiSVSP40/40-18-B βiSVSP80/80-18-B βiSVSP40/40-18 HV-B βiSVSP40/40/80-18-B βiSVSP80/80/80-18-B βiSVSP40/40/40-18 HV-B	-	-	A06B-6320-C602	A90L-0001-0598#B

(b) 180-mm width model

Model name	Internal cooling fan		Radiator cooling fan	
	Fan unit	Fan motor	Fan unit	Fan motor
βiSVSP20/20-7.5-B βiSVSP20/20-11-B βiSVSP10/10-11 HV-B βiSVSP20/20/40-7.5-B βiSVSP20/20/40-11-B βiSVSP40/40/40-11-B βiSVSP20/20/20-11 HV-B	-	-	A06B-6321-C601	A90L-0001-0598#A

4.2 REPLACING BATTERY FOR ABSOLUTE PULSECODERS

4.2.1 Overview

- When the voltage of the batteries for absolute Pulsecoders becomes low, alarm 307 or 306 occurs, with the following indication in the CNC state display at the bottom of the CNC screen.
  Alarm 307 (alarm indicating the voltage of the battery becomes low) :
  The indication "APC" blinks in reversed display.
  Alarm 306 (battery zero alarm) :
  The indication "ALM" blinks in reversed display.
- When alarm 307 (alarm indicating the voltage of the battery becomes low) occurs, replace the battery as soon as possible. In general, the battery should be replaced within one or two weeks, however, this depends on the number of Pulsecoders used.
- When alarm 306 (battery zero alarm) occurs, Pulsecoders are reset to the initial state, in which absolute positions are not held. Alarm 300 (reference position return request alarm) also occurs, indicating that reference position return is required.
- In general, replace the batteries periodically within the service life listed below.
  - A06B-6050-K061 or D-size alkaline dry cells (LR20): Two years (for each six-axis configuration)
  - A06B-6093-K001 : One years (for each three-axis configuration)

NOTE
The above values indicate the estimated service life of batteries used with FANUC absolute Pulsecoders. The actual battery service life depends on the machine configuration based on, for example, detector types. For details, contact the machine tool builder.

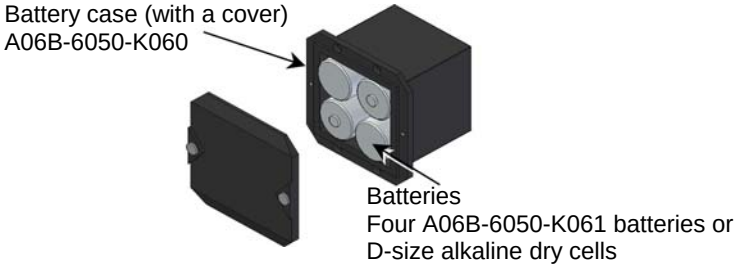
4.2.2 Replacing Batteries

To prevent absolute position information in absolute Pulsecoders from being lost, turn on the machine power before replacing the battery. The replacement procedure is described below.
<1> Ensure that the power to the servo amplifier is turned on.
<2> Ensure that the machine is in the emergency stop state (the motor is inactive).
<3> Ensure that the DC link charge LED of the servo amplifier is off.
<4> Detach the old batteries and attach new ones.
The replacement of the batteries in a separate battery case and the replacement of the battery built into the servo amplifier are described below in detail.

⚠ WARNING
1 The absolute Pulsecoder of each of the αi series servo motors and the βi series servo motors (βiS0.4 to βiS40, βiSc, and βiF) has a built-in backup capacitor. Therefore, even when the power to the servo amplifier is off and the batteries are replaced, reference position return is not required if the replacement completes within less than 10 minutes. Turn the power on and replace the batteries if the replacement will take 10 minutes or more.
2 To prevent electric shock, be careful not to touch metal parts in the power magnetics cabinet when replacing the batteries.
3 Because the servo amplifier uses a large-capacitance electrolytic capacitor internally, the servo amplifier remains charged for a while even after the power is turned off. Before touching the servo amplifier for maintenance or other purposes, ensure your safety by measuring the residual voltage in the DC link with a tester and confirming that the charge indication LED (red) is off.
4 Be sure to replace the batteries with specified ones. Pay attention to the battery polarity. If a wrong type of battery is used or a battery is installed with incorrect polarity, the battery may overheat, blow out, or catch fire, or the absolute position information in the absolute Pulsecoders may be lost.
5 Ensure that the battery connector is inserted in the correct position.

4.2.3 Replacing the Batteries in a Separate Battery Case

Use the following procedure to replace the batteries in the battery case.
<1> Loosen the screws on the battery case and detach the cover.
<2> Replace the batteries in the case (pay attention to the polarity).
<3> Attach the cover to the battery case.

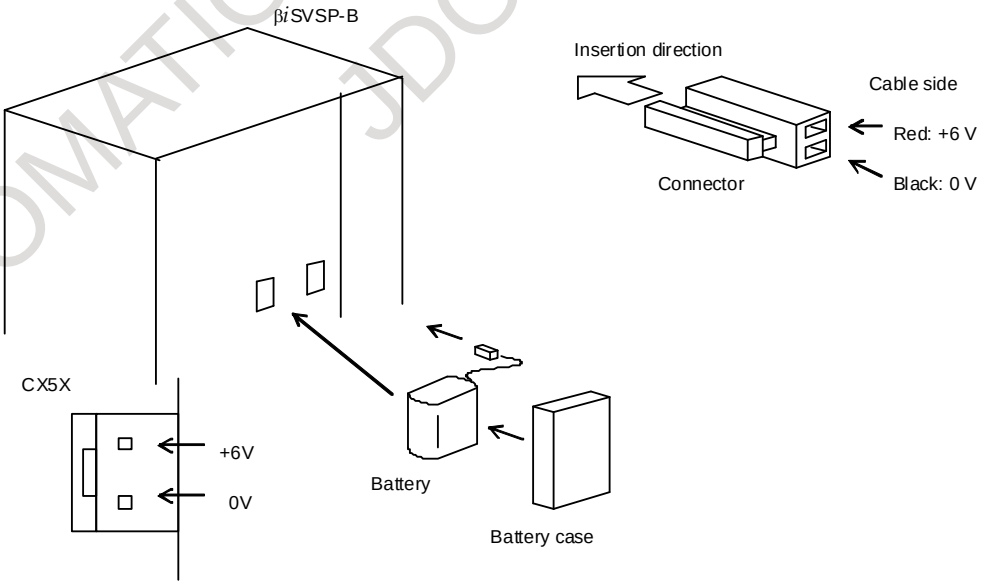


> **⚠ CAUTION**
> 1 Four D-size alkaline dry cells (LR20) that are commercially available can be used as batteries. A set of four A06B-6050-K061 batteries is optionally available from FANUC.
> 2 Replace all the four batteries with new ones. If old and new batteries are mixed, the absolute position information in the absolute Pulsecoders may be lost.

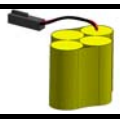
4.2.4 Replacing the Battery Built into the Servo Amplifier

Use the following procedure to replace the special lithium battery.
<1> Detach the battery case.
<2> Replace the special lithium battery.
<3> Attach the battery case.

> **⚠ CAUTION**
> 1 Purchase the battery from FANUC because it is not commercially available. It is therefore recommended that you have a backup battery.
> 2 When the built-in battery is used, do not connect BATL (B3) of connector CXA2C/CXA2A. Also, do not connect two or more batteries to the same BATL (B3) line. These connections are dangerous because battery output voltages may be short-circuited, causing the batteries to overheat.
> 3 Install the battery in the servo amplifier in a direction that allows slack in the cable. If the battery cable is under tension, a bad connection may occur.
> 4 If the +6 V pin and 0 V pin of CX5X are short-circuited, the battery may overheat, blow out, or catch fire, or the absolute position information in the absolute Pulsecoders may be lost.
> 5 When inserting the connector, align it to the connector pins.



[Battery sets and outlines]

Battery ordering drawing number	Manufacturer model number	Battery case ordering drawing number	Outline
A06B-6114-K504	BR-2/3AGCT4A (Panasonic)	A06B-6114-K506	

Used batteries

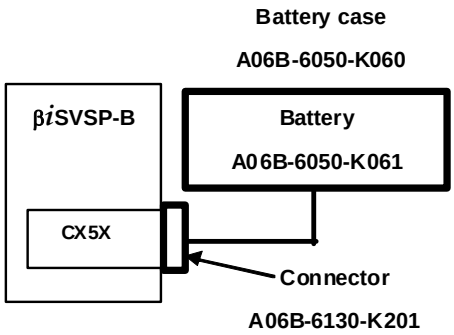
Old batteries should be disposed as "INDUSTRIAL WASTES" according to the regulations of the country or autonomy where your machine has been installed.

4.2.5 Notes on Replacing a Battery (Supplementary Explanation)

4.2.5.1 Battery connection modes

The battery for the absolute Pulsecoder can be connected using [Connection method 1] and [Connection method 2] explained below.
For details, refer to "Connecting the Battery" in the FANUC SERVO AMPLIFIER β*i* Series Descriptions (B-65322EN).

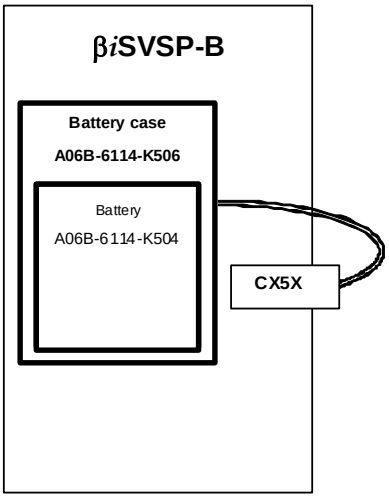
[Connection method 1] Method of supplying battery power from one battery to multiple β*i*SVSP-B amplifiers



- If a low battery voltage or a battery voltage of 0 V is indicated by an APC (absolute Pulsecoder) alarm, replace the battery. If a battery voltage of 0 V is indicated, you need to make a zero point return.
- The absolute Pulsecoder of the α*i* series servo motors and the β*i* series servo motor (β*i*S 0.4 to β*i*S 40, β*i*Sc, and β*i*F) is incorporated with a backup capacitor as standard. This backup capacitor enables an absolute position detection to be continued for about 10 minutes. Therefore, no zero point return need be performed if the time during which servo amplifier power is kept off for battery replacement is within 10 minutes.
  The Pulsecoder of some of the β*i*S series servo motors (β*i*S 0.2 to β*i*S0.3) does not include a backup capacitor. Be careful when replacing the battery for this Pulsecoder. See Subsection 4.2.5.2, “Connecting the battery for the β*i*S 0.2 to β*i*S 0.3” for details.
- The battery service life is about two years for the α*i* series servo motors and the β*i* series servo motors (β*i*S 0.4 to β*i*S 40, β*i*Sc, and β*i*F) if servo motors for six axes are connected. For some of the β*i* series servo motors (β*i*S 0.2 to β*i*S0.3), the battery service life is about one year.
  FANUC recommends that you replace the batteries periodically according to the battery service life.
- The battery unit consists of four LR20 alkaline batteries. Commercial batteries can be used in the battery unit. The optional battery offered by FANUC is A06B-6050-K061.

> ⚠ **WARNING**
> 1 Do not connect more than one battery to the same BATL (B3) line. If the output voltage is different between the batteries, they may be short-circuited, resulting in the batteries becoming very hot.
> 2 Install the battery with correct polarity. If the battery is installed with incorrect polarity, it may overheat, blow out, or catch fire.

[Connection method 2] Method of building a built-in battery into each βiSVSP-B



- If a low battery voltage or a battery voltage of 0 V is indicated by an APC (absolute Pulsecoder) alarm, replace the battery (A06B-6114-K504). If a battery voltage of 0 V is indicated, you need to make a zero point return.
- The absolute Pulsecoder of the α*i* series servo motors and the β*i* series servo motor (β*i*S 0.4 to β*i*S 40, β*i*Sc, and β*i*F) is incorporated with a backup capacitor as standard. This backup capacitor enables an absolute position detection to be continued for about 10 minutes. Therefore, no zero point return need be performed if the time during which servo amplifier power is kept off for battery replacement is within 10 minutes.
  The Pulsecoder of some of the β*i* series servo motors (β*i*S 0.2 to β*i*S0.3) does not include a backup capacitor. Be careful when replacing the battery for this Pulsecoder. See Subsection 4.2.5.2, "Connecting the battery for the β*i*S 0.2 to β*i*S 0.3" for details.
- The battery service life is about one year for the β*i* series servo motors (β*i*S 0.4 to β*i*S 40, β*i*Sc, and β*i*F) if servo motors for three axes are connected.
  FANUC recommends that you replace the batteries periodically according to the battery service life.
- The built-in batteries are not commercially available. They must be purchased from FANUC. So, FANUC recommends that you keep spares.

⚠ WARNING
1 When using the built-in batteries (A06B-6114-K504), do not connect them to the BATL(B3) of connector CXA2C.
  The output voltages from different batteries may be short-circuited, resulting in the batteries becoming very hot.
2 Do not connect more than one battery to the same BATL(B3) line. If the output voltage is different between the batteries, they may be short-circuited, resulting in the batteries becoming very hot.
3 Install the battery with correct polarity. If the battery is installed with incorrect polarity, it may overheat, blow out, or catch fire.

4.2.5.2 Replacing βiS 0.2 to βiS 0.3 batteries

Some servo motors of the β*i* series (β*i*S 0.2 to β*i*S 0.3) do not have a backup capacitor in the Pulsecoder as a standard feature. Therefore, to avoid losing the absolute position data of the absolute Pulsecoder, you need to have the control power on when replacing the battery. The replacement procedure is described below.

[Replacement procedure]

1 Check that the power of βiSVSP-B is on (that the "POWER" LED of STATUS LED is on).
2 Check that the emergency stop button of the system has been pressed.
3 Check that the motor is not excited.
4 Check that the DC link charge LED of βiSVSP-B is off.
5 Remove the old battery, and attach the new one.
6 The replacement procedure is complete. You are ready to turn off the power of the system.

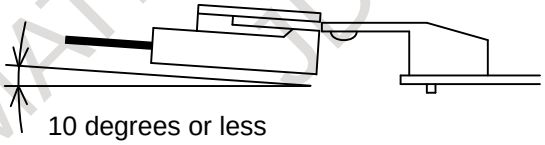
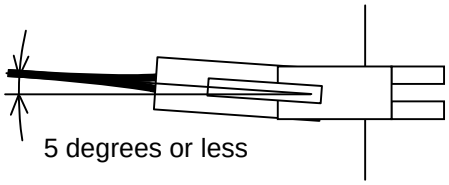
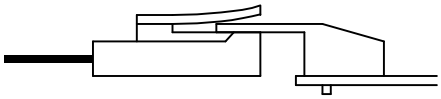
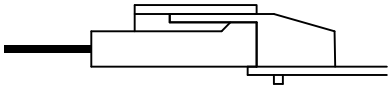
⚠ WARNING

1 When replacing the battery, be careful not to touch bare metal parts in the power magnetics cabinet. Particularly, touching a high voltage part may cause electric shock.
2 Before replacing the battery, check that the DC link charge LED on the front side of the servo amplifier is off. Replacing the battery when this LED is on may cause electric shock.
3 When connecting the battery, pay attention to its polarity. If connected with the wrong polarity, the battery may overheat, burst, or catch fire.
4 Be careful not to short-circuit '+6V' and '0V' of the battery. If short-circuited, the battery may overheat, burst, or catch fire.

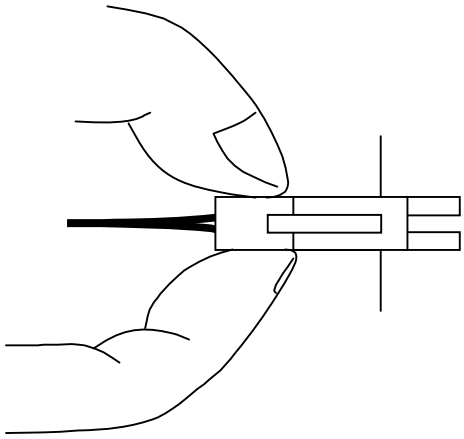
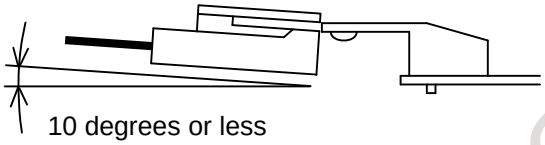
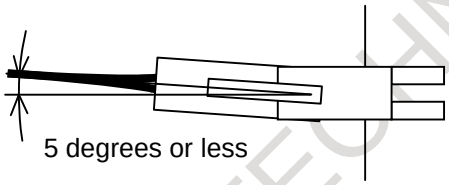
4.2.6 Notes on Attaching Connectors

If an excessive strain is applied to a connector when it is inserted or removed, a poor contact may result. When inserting and removing the battery connector, therefore, be careful not to apply an excessive wrenching force to it; just follow the instructions given in the following table.

(1) Attaching connectors

<1>		Check the attachment position.
<2>		Plug the cable connector while raising it slightly.
<3>		Here, the angle of the cable connector to the horizontal must be 5 degrees or less.
<4>		After passing the lock pin, insert the connector straight.
<5>		The attachment of the connector is completed.

(2) Detaching the connector

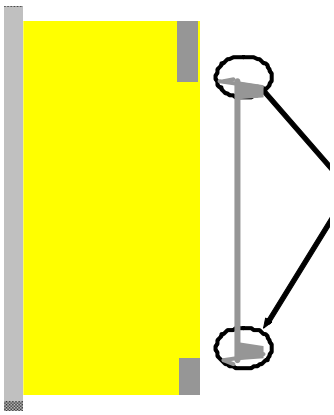
<1>		Hold both the sides of the cable insulator and the cable, and pull them horizontally.
<2>		Pull out the cable side while raising it slightly.
<3>		Here, the angle of the cable to the horizontal must be 5 degrees or less.

4.3 HOW TO REPLACE THE FUSES AND PRINTED CIRCUIT BOARDS

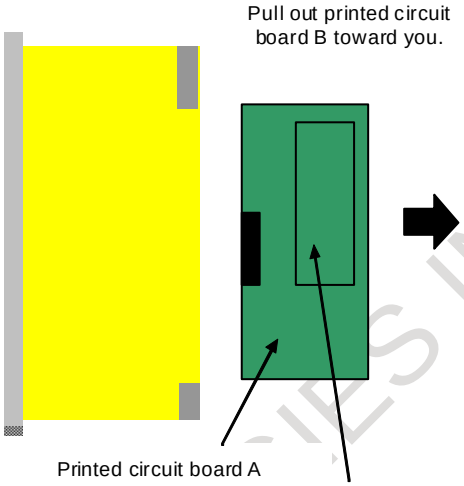
4.3.1 How to Replace the Fuses and Printed Circuit Boards

In the βiSVSP-B, a printed circuit board can be removed and inserted from the front of the servo amplifier.

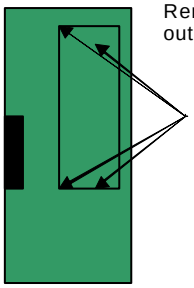
NOTE
1 If the fuse has blown, the cause may be that another device (e.g., sensor) connected to the servo amplifier is short-circuited with the power supply. Check that the other device is not faulty, and then replace the fuse. If the cause is not eliminated, it is likely that the fuse will blow again.
2 Do not use a fuse other than the one supplied from FANUC.
3 Check the indication on the printed circuit board against that printed on the fuse to ensure that the rating is correct.



Hold the upper and lower hooks, and remove the face plate.



When removing the fuse



Remove the screws fastening the printed circuit boards, and pull out printed circuit board B.

Locations of screws

When inserting the printed circuit board, perform the procedure above in reverse order.
Ensure that the upper and lower hooks snap into the housing.
If the printed circuit board is not completely inserted, the housing remains lifted. In that case, pull out the printed circuit board and insert it again.
Poor connector contact may cause an unpredictable problem.

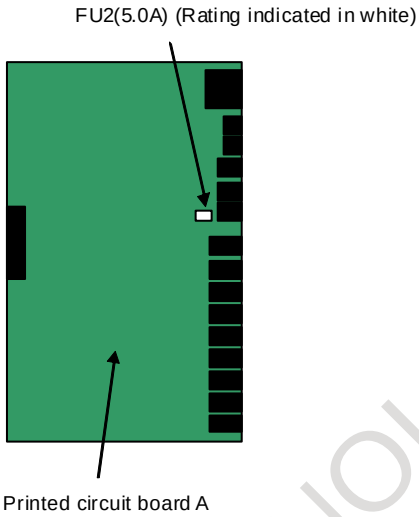
Fuse specification

Symbol	Ordering number
FU1	A60L-0001-0290#LM50C

When replacing the fuse, be sure to confirm the fuse specification.
Insert the fuse in the fuse socket securely.
Tighten the screws to securely fasten the printed circuit board.
Poor connector contact may cause an unpredictable problem.

4.3.2 Fuse Locations

There is one fuse on the βiSVSP-B printed-circuit board.



V. MOTOR/DETECTOR/AMPLIFIER PREVENTIVE MAINTENANCE

1 MOTOR/DETECTOR/AMPLIFIER PREVENTIVE MAINTENANCE

This chapter describes preventive maintenance of motors, detectors, and amplifiers that is to be performed by the customer the machine uses.

Contents

1.1 LIST OF MANUALS RELATED TO MOTORS AND AMPLIFIERS

Details of individual motors and amplifiers are described in the manuals listed in the table below. Before performing periodic inspection or any other maintenance work, consult with the machine tool builder and, if necessary, obtain the latest version of the corresponding manual shown in the list. The information about the specifications of each device, such as the weight and winding resistance value, is given in the relevant "DESCRIPTIONS" manual.

Manual name	Type of manual	Specification number
FANUC AC SERVO MOTOR αi–B/αi series	DESCRIPTIONS	B-65262
FANUC AC SERVO MOTOR βi –B/βi series	DESCRIPTIONS	B-65302
FANUC SYNCHROUNOUS BUILT-IN SERVO MOTOR D*i*S series	DESCRIPTIONS	B-65332
FANUC LINEAR MOTOR L*i*S series	DESCRIPTIONS	B-65382
FANUC AC SPINDLE MOTOR αi series	DESCRIPTIONS	B-65272
FANUC AC SPINDLE MOTOR βi series	DESCRIPTIONS	B-65312
FANUC BUILT-IN SPINDLE MOTOR B*i*I series	DESCRIPTIONS	B-65292
FANUC SYNCHROUNOUS BUILT-IN SPINDLE MOTOR B*i*S series	DESCRIPTIONS	B-65342
FANUC - NSK SPINDLE UNIT series	DESCRIPTIONS	B-65352
FANUC SERVO AMPLIFIER αi series	DESCRIPTIONS	B-65282
FANUC SERVO AMPLIFIER βi series	DESCRIPTIONS	B-65322
FANUC SERVO AMPLIFIER βi-B series	DESCRIPTIONS	B-65422
FANUC AC SERVO MOTOR αi series FANUC AC SERVO MOTOR βi series FANUC LINEAR MOTOR L*i*S series FANUC SYNCHRONOUS BUILT-IN SERVO MOTOR D*i*S series	PARAMETER MANUAL	B-65270
FANUC AC SPINDLE MOTOR αi/βi series BUILT-IN SPINDLE MOTOR B*i* series	PARAMETER MANUAL	B-65280
FANUC AC SERVO MOTOR αi series AC SPINDLE MOTOR αi series SERVO AMPLIFIER αi series	MAINTENANCE MANUAL	B-65285
FANUC AC SERVO MOTOR βi series AC SPINDLE MOTOR βi series SERVO AMPLIFIER βi series	MAINTENANCE MANUAL	B-65325
FANUC SERVO AMPLIFIER βi series	MAINTENANCE MANUAL	B-65395
FANUC SERVO GUIDE	OPERATOR'S MANUAL	B-65404
FANUC AC SERVO MOTOR αis/αi/βis series	SERVO TUNING PROCEDURE (BASIC)	B-65264

1.2 PREVENTIVE MAINTENANCE OF MOTORS AND DETECTORS

1.2.1 Warnings, Cautions, and Notes on Preventive Maintenance of Motors and Detectors

This subsection contains the safety precautions for motor and detector preventive maintenance, which are classified into "warnings", "cautions", and "notes" according to their bearing on safety. Make sure that you understand and comply with these precautions when carrying out the maintenance work.

⚠ WARNING

- **Make sure that you are safely dressed and have a safe working environment when performing preventive maintenance for a motor.**
  - Be dressed safely, e.g. by wearing gloves and safety shoes, to protect against injury due to an edge or protrusion and electric shock.
  - Have the work done by more than one person, where possible, so that immediate action can be taken if an accident occurs when handling a motor.
  - A motor is heavy. When moving it, use a crane or other appropriate equipment to protect against injury. For information about the weight of the motor, refer to its DESCRIPTIONS manual (shown earlier).
  - Clothes or fingers can be caught in a rotating motor or come into contact with a moving part of it. Standing in the direction of motor rotation (direction of motion) can pose a risk of injury. Before rotating a motor, check that there is no object that is thrown away by motor rotation.

- **Be careful about electric shock, fire, and other accidents.**
  - Do not handle a motor with a wet hand.
  - To prevent electric shock, make sure that no conductive object, such as a terminal, is exposed when the motor is powered on.
  - Before touching a motor or any surrounding part, check that the power is shut off and take appropriate safety precautions.
  - High voltage remains across power line terminals of a motor even after the power is shut off (for at least twenty minutes). Do not touch a motor in such a condition or connect it to other equipment.
  - A loose or disconnected terminal, short-circuited terminals, or a terminal connected to the ground can cause overheating, spark, fire, or damage to the motor. Take appropriate precautions to prevent these accidents.
  - When placed near any inflammable object or material, a motor can be ignited, catch fire, or explode. Avoid placing it near such object or material.

- **Do not disassemble or modify a motor.**

  Motors such as linear motors, synchronous built-in servo motors, and synchronous built-in spindle motors contain very strong magnets. If electronic medical apparatus comes near, these motors can cause the apparatus to malfunction, potentially putting the user's life in danger. Also, disassembling or modifying a motor can cause a failure, regardless of the type of motor. Do not disassemble or modify a motor in any way not specified by FANUC.

⚠ CAUTION

- **Ensure that the specified cooling conditions are met.**
  If the specified cooling conditions are not met (the motor is insufficiently or excessively cooled), the motor can fail. Problems that can cause a motor failure, such as liquid piping clog, leakage, and fan motor trouble, should be eliminated through periodic inspection. Do not drive the motor when the cooling system is in an abnormal condition.

- **Do not change the system configuration.**
  Do not change the configuration of the system when it is running normally. Doing so can cause an accident or failure. If you disconnect a cable for maintenance or some other purpose, take an appropriate measure, such as putting a mark on it, to ensure you can restore the original state.

- **Use the tapped holes of a motor only to move the motor.**
  Do not use the tapped holes of a motor to lift or move any other object along with the motor. Doing so can damage the motor. Depending on the type of motor, the place and direction in which the motor can be lifted may be predetermined. For details, refer to the DESCRIPTIONS manual of the motor (shown earlier).

- **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.

NOTE

- **Do not remove a nameplate from a motor.**
  The nameplate is used to identify the motor during maintenance work. If a nameplate comes off, be careful not to lose it.

- **Do not step or sit on a motor, and avoid applying shock to a motor.**
  Any of these acts can deform or break the motor or affect its component, crippling the normal motor operation. Do not put a motor on top of another motor.

- **Comply with the specified conditions when conducting an electric test (winding resistance test, insulation resistance test, etc.) for a motor or other device or supplying power.**
  - Conduct an electric test according to the specified method. Conducting such a test by any method that is not specified can damage the motor.
  - Do not conduct a dielectric strength test or insulation test for a Pulsecoder or other detector, or do not apply a commercial power source voltage. Doing so can destroy the internal elements.

- **Perform preventive maintenance (inspection of the external appearance, measurement of winding resistance, insulation resistance, etc.) and cleaning on a regular basis.**
  To use a motor safely throughout its entire service life, perform preventive maintenance and cleaning on a regular basis. Be careful, however, because excessively severe inspection (dielectric strength test, etc.) can damage its windings. For information about winding resistance values, refer to the DESCRIPTIONS manual of the motor (its specification number is shown in this manual). Information about insulation resistance is given later in this manual.

NOTE
- This manual is focused on the preventive maintenance work to be performed for a single FANUC motor or detector alone. The information contained herein may not apply depending on the type or configuration of the machine. When reading this manual, refer to the manual of the machine as well. If you have any questions or doubts, do not act on your own; please contact the machine tool builder or FANUC.
- For detailed information about a motor, see the manual list shown earlier and, if necessary, obtain the latest version of the corresponding manual.

1.2.2 Preventive Maintenance of a Motor (Common to All Models)

This subsection describes the common preventive maintenance items to be handled regardless of the model of the motor. For the items specific to a particular motor model, see one of the subsequent subsections that pertains to that particular motor model.

⚠ CAUTION
- The preventive maintenance method differs from machine to machine in many respects. Depending on the machine in use, it may be difficult for the user to perform periodic inspection or cleaning. If you are not sure about anything as to preventive maintenance, consult with the machine tool builder and ensure that you can perform periodic inspection and cleaning.
- The machine should be used within the scope of specification defined by the machine tool builder. Using the machine in any way that is outside the specified scope can reduce the motor's service life or cause a failure.

1.2.2.1 Main inspection items

The following table summarizes the main inspection items for a motor. If any of these items **is found to be abnormal, stop the use of the machine immediately and fix the abnormal part** by repairing or replacing it. At the same time, **identify and remove the cause and take a measure to prevent its recurrence**. If it is difficult to take a preventive measure or to prevent its recurrence, consult with the machine tool builder or FANUC.

Appearance of the motor	Crack or deformation	- Check the motor for any scar, crack, deformation, bulge, etc. - If the interior of the motor is visible or there is interference with a peripheral component, it is imperative to replace the motor or the peripheral component. - A light peel-off or scar of the surface may be repairable; consult with FANUC.
	Wet or dirty part	- If you find any wet or dirty part, clean it immediately. - A preventive measure is needed if the part in question remains wet continually due to cutting fluid or dew condensation.
Operating conditions	Temperature, humidity, etc.	- Comply with the operating conditions of the machine. For details of the operating conditions of a specific motor, refer to the corresponding DESCRIPTIONS manual. Generally, the ambient temperature should be 0°C to 40°C (or 30°C for a spindle unit) and dew condensation is not allowed. In a place subject to severe vibration, the components of the motor may be broken.

Connection state	Cable	- Check for any cable sheath damage, exposed conductor, damaged conduit or cable bearing, abnormal bending, loose terminal, etc. - If there is any trace of fluid flowing, the fluid may have entered the inside of the motor or connector. It is necessary to make a check and take a measure to prevent recurrence.
	Connector/terminal	- Check for any cracked, exposed, loose, or removed terminal or connector, etc. - Fluid causes a failure; be sure to remove fluid. - A scarred or damaged connector or terminal needs to be replaced. In the case of a resin molded motor, such as a linear motor, the motor needs to be replaced.
Operation of the motor	Noise/vibration	- Check for any abnormal noise or vibration not only when the motor is running (the spindle is rotating) but also when it is stopped. - Abnormal noise heard when the motor is rotating indicates an abnormality of the bearing or a failure inside the motor. - If abnormal noise is generated from the connection section of a Spindle Amplifier, check the following items: Belt connection: Check whether the belt tension is appropriate. Gear connection: Check whether an appropriate value is set for the gear backlash. Coupling connection: Check whether the coupling is free from deformation, crack, and looseness.
	Movement	- Check that the motor operates normally and smoothly. - If the circuit breaker trips at the same time the motor starts to operate, it indicates abnormal motor windings.
	Heat	Check whether the motor does not overheat during the normal operation cycle. Note: While the motor is running or immediately after it is stopped, the motor surface may become very hot. Instead of touching the motor directly by hand, use a thermolabel, surface thermometer, etc.
Electric characteristics of the motor	Winding resistance	If the resistance value exceeds the specified range, the motor needs to be replaced. Note: When conducting winding resistance measurement, disconnect the motor from the amplifier and measure the resistance at the power line or connector closest to the motor.
	Insulation resistance	For the measuring method and judgment criteria, see the table that follows.
Cooling fan (for a model with a fan motor)	Noise/vibration	- Check that the fan blows air normally without causing abnormal noise or vibration. - If abnormal noise is heard even when the motor is stopped, it indicates a fan motor failure.
	Movement	- If the power is on and if the fan does not operate or the fan blades cannot be moved even manually, or if the fan blades are rotating but no cooling wind is blown out, the fan motor may have cutting chips or sludge accumulated in it and needs to be cleaned. - If the fan does not operate normally for any other reason, the fan motor needs to be replaced.

Forcible cooling unit (when using an external cooling unit such as liquid cooling unit)	Dew condensation (over-cooling)	- Check that forcible cooling does not cause dew condensation on the motor surface. Dew condensation is likely particularly when the cooling unit continues to run after the machine is stopped. In that case, be sure to make this check. - Dew condensation or water drop on the motor surface can reduce the motor's service life. It is necessary to wipe it dry and take a measure to prevent recurrence.
	Liquid leakage/clog	- Check the cooling pipe for leakage or clog. Do not drive the motor unless the leakage or clog is fixed. - Liquid leakage from a spindle motor with a through hole indicates a failure of the coolant joint. In this case, the joint needs to be replaced. - In the case of liquid leakage from a linear motor (coil slider), the linear motor (coil slider) needs to be replaced. - If the motor gets wet due to liquid leakage or any other cause, it is necessary to clean and dry the motor and perform electric characteristic checks (winding resistance/insulation resistance).

Insulation resistance measurement

The following table shows the judgment criteria to be applied when measuring insulation resistance between winding and frame using a megohmmeter (500 VDC).

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

If insulation resistance drops sharply during a short period of time or if the circuit breaker trips, the cutting fluid or other foreign matter may have entered the inside of the motor or cable. In that case, contact the machine tool builder or FANUC for instructions.

⚠ CAUTION

- Let the motor dry and cool to room temperature before winding or insulation resistance is measured. Otherwise, not only an accurate measurement cannot be performed but also the motor may be damaged.
- The winding or insulation resistance measurement should be performed on the motor alone, with its power line disconnected.
  Measuring insulation resistance with the motor connected to the amplifier may damage the amplifier.
- During insulation resistance measurement, applying voltage to the motor for a long time may further deteriorate the insulation of the motor. Therefore, the measurement of insulation resistance should be performed in a minimum amount of time where possible.
- When disconnecting the power line and other cables, take an appropriate measure, such as labeling, to ensure that they can be restored to their original state.

1.2.2.2 Periodic cleaning of a motor

Periodic cleaning is necessary to remove an accumulation of cutting chips or sludge that may eventually cause a failure. Also, leaving the cutting fluid or other chemical substance attached for a long time can reduce the motor's service life substantially. When forcible cooling is provided by a liquid or air cooling unit, check the unit for pipe clog, fan failure, etc. and perform cleaning periodically to ensure that the coolant flows smoothly and that the motor is cooled properly.

> ⚠ **WARNING**
> Depending on the type of motor, the handling may involve a risk and require safety education in advance. Also, some machines are difficult for users to clean on their own. If you are to clean the motor, consult with the machine tool builder in advance with regard to the cleaning method, safety education, etc.

1.2.2.3 Notes on motor cleaning

A motor is an electric product, which is incompatible with most kinds of fluid. When removing cutting chips, sludge, cutting fluid, etc. during cleaning, note the following.

Note on cleaning	Measure
Do not sprinkle fluid. Do not wash by submerging.	Do not sprinkle or spray detergent or any other fluid over the motor (including its peripheral components), or do not wash the motor by submerging it in such fluid. When cleaning the motor, use a cloth moistened with a small amount of neutral detergent so that the fluid does not enter the inside the motor.
Do not use solvent.	Solvent may damage the motor; do not use one. If the dirt is difficult to remove with neutral detergent, use a cloth moistened with a small amount of industrial alcohol (e.g., IPA). Be careful, however, because rubbing with force or repeatedly may damage the coated or resin surface.
Do not leave the motor wet or moistened.	If the motor is wet or moistened after cleaning, dry it before supplying power and before performing electric tests. When drying the motor in an oven, make sure that the temperature is below 40°C and that hot air does not blow directly against the motor.

1.2.2.4 Notes on the cutting fluid (informational)

Depending on the type of cutting fluid used, the motor and amplifier may be affected greatly. Take due care because, even if you ensure that they do not come into direct contact with the fluid, a mist or atmosphere of the fluid can cause the problems described below.

Type of cutting fluid requiring care	Expected problem
Cutting fluid containing highly active sulfur	Some types of cutting fluid contain highly active sulfur. If such cutting fluid enters the inside of the motor or amplifier, it causes copper, silver, and other kinds of metal to corrode, leading to a component failure.
Synthetic cutting fluid with high permeability	Some types of cutting fluid containing such substance as polyalkylene glycol have very high permeability. Such cutting fluid permeates into the inside of the motor, causing insulation deterioration or component failure.
Highly alkaline, water-soluble cutting fluid	Some types of cutting fluid that enhance their alkaline property using such substance as alkanolamine remain highly alkaline - pH10 or higher - when diluted. If such cutting fluid is left attached for a long time, its chemical change will deteriorate the resin and other materials of the motor and amplifier.

Other types of cutting fluid not mentioned above may cause various unexpected problems. If any problem arises for which the cutting fluid is thought to be responsible, consult with the machine tool builder or FANUC.

1.2.3 Routine Inspection of a Spindle Motor with a Through Hole

- Check whether coolant does not always leak from the drain on the rotation joint support housing. (See Fig. 2)
- Check whether coolant does not always leak from the notch on the rotation joint support housing. (See Fig. 2)
- Check whether coolant leaking from the coolant joint does not leak from the coupling. (See Fig. 3)
- Check whether leaking coolant is not collected in the coupling box.

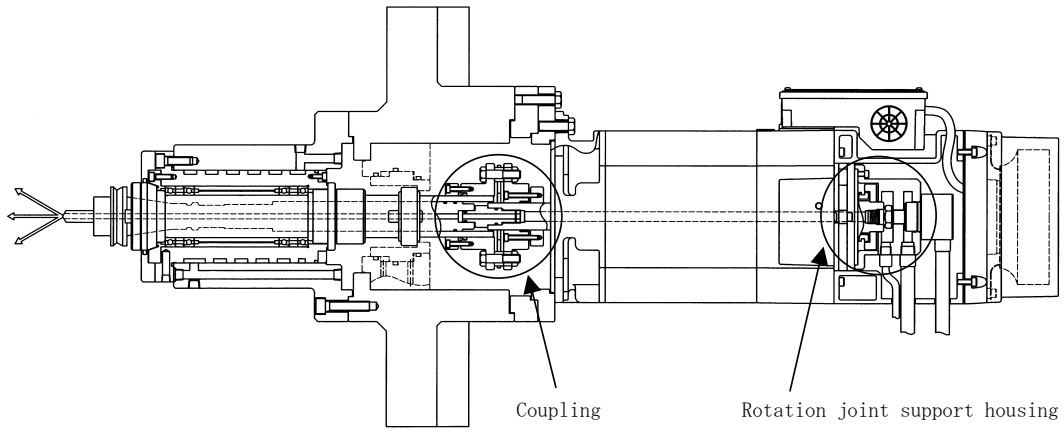


Fig. 1: Example of using a coolant-through spindle motor

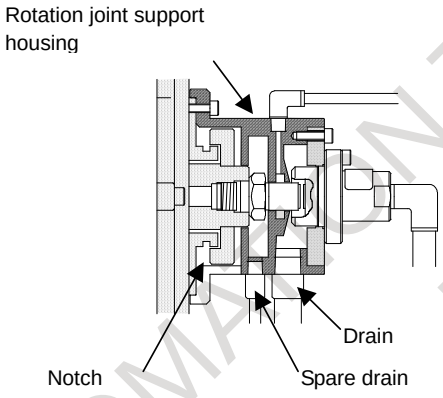


Fig. 2: Rotation joint support housing

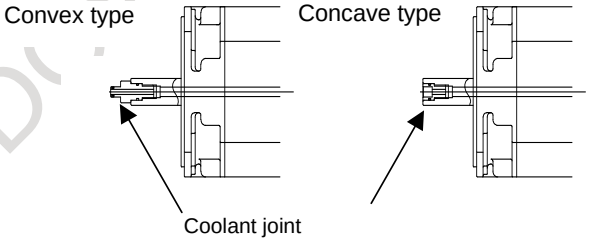


Fig. 3: Example of a coolant joint

1.2.4 Preventive Maintenance of a Linear Motor

The magnet plate of a linear motor contains very strong magnets. When performing the maintenance work, make sure all those engaged in the work fully understand the potential risks involved.

⚠ WARNING

- The FANUC linear motors use very strong magnets. Improper handling of the motor is very dangerous and can lead to a serious accident. Particularly, a person wearing a pacemaker or other medical apparatus should stay away from the linear motor; otherwise, the apparatus may malfunction, potentially resulting in a life-threatening accident.
- Those who will come near or touch a linear motor for maintenance work should receive safety education in advance. For details, contact the machine tool builder or FANUC.

1.2.4.1 Appearance inspection of the linear motor (magnet plate)

Perform an appearance inspection as well during cleaning or other maintenance work. A crack, chip, deformation, or any other abnormality in appearance of the motor can lead to a serious failure in the not-so-distant future. If you find any such abnormality, be sure to report it to the machine tool builder. A scratch or other slight scar on the motor surface can also be a sign of future trouble and needs to be addressed with care. Some suggested appearance inspection items for the magnet plate are described below.

* For the coil slider (the side to which the power line is connected), see "Main inspection items" earlier in this manual.

Appearance of the magnet plate (which may have a stainless cover)

Appearance inspection item	Measure
Crack or chip in the magnet plate resin Deformation or bulge of the magnet plate or softening of the resin	The magnet plate needs to be replaced. If unattended, it can cause trouble in the not-so-distant future. If the problem is extremely minor, consult with the machine tool builder or FANUC.
The magnet is exposed, or the resin or magnet is floating	The magnet plate needs to be replaced urgently.
Scratch on the magnet plate	Foreign matter may have entered into the motor, or interference between parts is likely. It is necessary to eliminate the cause and take a measure to prevent recurrence.
Floating, bulging, or deformed stainless cover	The cover or magnet plate needs to be replaced.

1.2.5 Maintenance of a Detector

⚠ CAUTION

- Detectors such as Pulsecoders are precision equipment. When handling a detector, avoid applying shock to it. Also, exercise care to prevent cutting powder, dust, cutting fluid, or other foreign matter from attaching to it.
- Make sure that all connectors are connected properly and securely. A connection failure can cause an alarm or some other problem.
- If the detector and/or connectors are not installed securely, cutting fluid may enter the inside of the detector, making it necessary to replace the detector. In that case, contact the machine tool builder or FANUC.

NOTE

If you use a detector not manufactured by FANUC, contact the machine tool builder or detector manufacturer for detailed information on the detector.

1.2.5.1 Alarms for built-in detectors (αi and βi Pulsecoders) and troubleshooting actions

These alarms concern built-in detectors that are connected directly to the control unit (CNC/servo amplifier).
Based on the alarm number and description, take an appropriate action as described in the following subsection, "Detailed troubleshooting methods".

Alarm No.: Alarm	Description	Possible cause	Action	Detailed troubleshooting method
361: ABNORMAL PHASE DATA(INT)	- Communication error in the Pulsecoder - ID data error	- Pulse coder failure - Noise	Replace the Pulsecoder.	(3) (4)
364: SOFT PHASE ALARM(INT)	Position data alarm	- Noise - Entry of cutting fluid	Check the effect of noise. Replace the Pulsecoder.	(1) (3)
365: BROKEN LED(INT)	LED disconnection	- Pulse coder failure	Replace the Pulsecoder.	(3)
366: PULSE MISS(INT)	Small internal signal amplitude	- Pulse coder failure - Noise	Replace the Pulsecoder.	(3) (4)
367: COUNT MISS(INT)	Position data count error	- Pulse coder failure - Noise	Replace the Pulsecoder.	(3) (4)
368: SERIAL DATA ERROR(INT)	Communication interruption	- Cable disconnection - Pulse coder failure - Noise	Check the cable. Replace the Pulsecoder.	(2) (3) (4)
369: DATA TRANS. ERROR(INT)	Communication data alarm	- Noise	Check the effect of noise.	(1)
453: SPC SOFT DISCONNECT ALARM	Position - pole data error	- Pulse coder failure - Entry of cutting fluid	Replace the Pulsecoder.	(3)

1.2.5.2 Alarms for separate detectors and troubleshooting actions

These alarms concern separate detectors that are connected to the control unit via a separate detector interface unit (SDU).
Based on the alarm number and description, take an appropriate action as described in the following subsection, "Detailed troubleshooting methods".

Alarm No.: Alarm	Description	Possible cause	Action	Detailed troubleshooting method
380: BROKEN LED(EXT)	LED disconnection	- Detector failure	Replace the detector.	(4)
382: COUNT MISS(EXT)	Position data count error			
383: PULSE MISS(EXT)	Small internal signal amplitude			
384: SOFT PHASE ALARM(EXT)	Position data alarm			
385: SERIAL DATA ERROR(EXT)	Communication interruption	- Cable disconnection - Noise - Detector failure	Check the cable. Check the effect of noise. Replace the detector.	(2) (1) (4)

Alarm No.: Alarm	Description	Possible cause	Action	Detailed troubleshooting method
386: DATA TRANS. ERROR(EXT)	Communication data alarm	- Noise	Check the effect of noise.	(1)
381: ABNORMAL PHASE (EXT) 387: ABNORMAL ENCODER(EXT)	For details, contact the machine tool builder or detector manufacturer.			

1.2.5.3 Detailed troubleshooting methods

(1) Checking the effect of noise

Check CNC diagnosis information No.356 (Built-in detector), No.357 (Separate detector).
Normally, 0 is displayed. However, if the position data from the Pulsecoder becomes unstable due to noise or some other factor, this value is incremented. The value is cleared when the CNC unit is powered off. Immediately after the power is turned on, 0 is displayed.

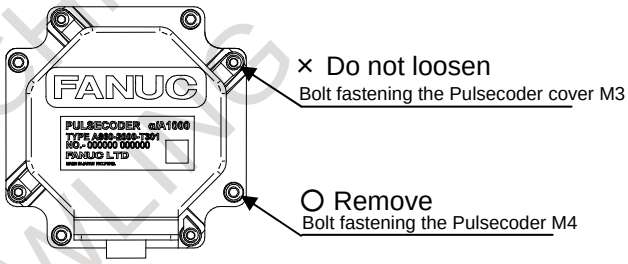
(2) Checking the cable

Check whether the feedback cable is not disconnected and whether the connector is properly plugged.

(3) Replacing the Pulsecoder

(3)-1 Pulsecoder replacement procedure

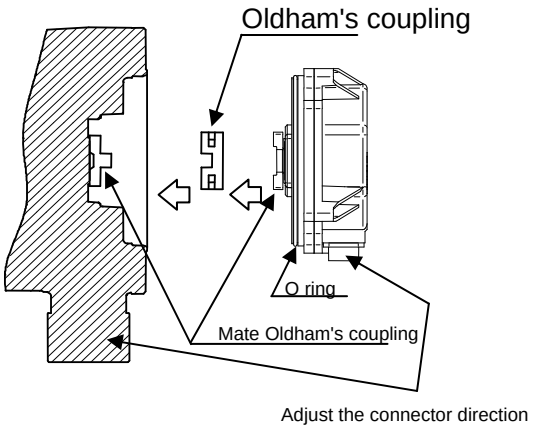
<1> Remove the four M4 hexagon socket head cap screws fastening the Pulsecoder. The M3 bolts fastening the Pulsecoder cover do not need to be loosed. (See the figure at right.)

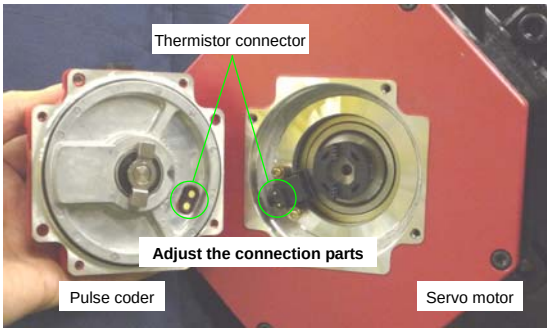


<2> Remove the Pulsecoder and Oldham's coupling (see the following figure).

<3> Set the new Pulsecoder and Oldham's coupling on the motor. Adjust the direction of the mate Oldham's coupling to that of the Oldham's coupling so that the teeth are engaged.

Push in the Pulsecoder until the O ring fits in the joint between the motor and Pulsecoder. Take care so that the O ring of the Pulsecoder is not bitten.



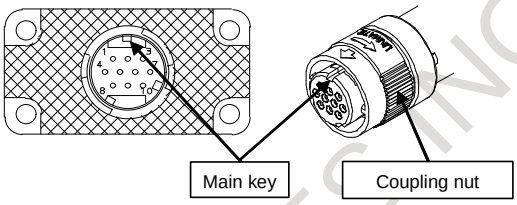


Attach the Pulsecoder in such a direction that the power connector of the servo motor and the feedback cable of the Pulsecoder face the same direction or that the thermistor connection parts of the servo motor and Pulsecoder match each other (see the figure at left).

<4> Fastening the Pulsecoder with the four M4 hexagon socket head cap screws. (Appropriate torque: 1.5 Nm)

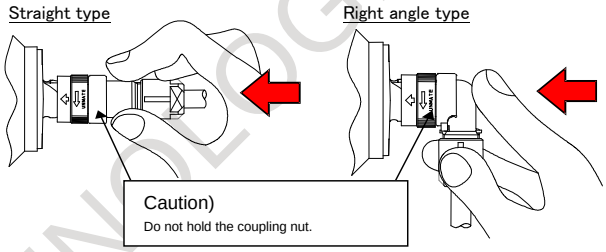
(3)-2 Feedback cable plugging procedure

Plug in the feedback cable connector, as instructed in the procedure below, and check that the connector is securely connected.



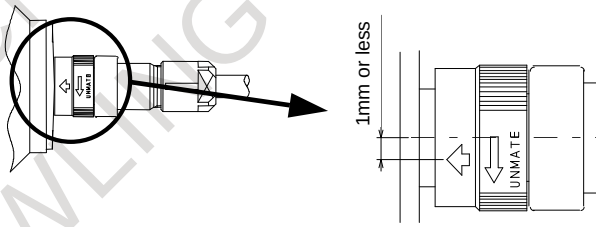
<1> Check the plugging side and key direction.
Check that the plugging side is free of foreign matter, such as dirt or oil.

<2> Plug in the feedback cable connector.
Hold the connector, as shown in the figure at right. Plug in the connector until you hear a click.



<3> Check the connection condition.

1. Check that the arrow mark of the connector is at the center, as shown in the figure at right. If the arrow mark is not at the center, turn the coupling nut manually until the mark comes to the appropriate position.



2. Hold the connector by the same part as in <2>, and pull it lightly to check that the connector does not come off. Do not pull the cable.

(4) If troubleshooting is difficult for the user

If the problem is difficult for the user to troubleshoot because it is due to a detector failure or noise, consult with the machine tool builder or FANUC.

1.2.5.4 Maintenance of βiS servo motor (□40 and □60) Pulsecoders

Problems concerning the Pulsecoders of the motors listed in the table below require the maintenance (replacement) of the entire motor (it is not possible to maintain the Pulsecoder alone).

Motor model	Motor specification	Remarks
βiS 0.2/5000	A06B-0111-Bcc3#dddd	Frame size □40
βiS 0.3/5000	A06B-0112-Bcc3#dddd	
βiS 0.4/5000	A06B-0114-Bcc3#dddd	Frame size □60
βiS 0.4/5000-B	A06B-2114-Bcc3#dddd	
βiS 0.5/6000	A06B-0115-Bcc3#dddd	
βiS 0.5/6000-B	A06B-2115-Bcc3#dddd	
βiS 1/6000	A06B-0116-Bcc3#dddd	
βiS 1/6000-B	A06B-2116-Bcc3#dddd	

(cc, dddd : Any)

1.3 PREVENTIVE MAINTENANCE OF SERVO AMPLIFIERS

1.3.1 Warnings, Cautions, and Notes on Operation of Servo Amplifiers

This subsection contains the safety precautions on preventive maintenance of a servo amplifier (a generic term to refer to the β*i*SV-B and β*i*SVSP-B). These precautions are classified into "warnings", "cautions", and "notes" according to their bearing on safety. Make sure that you understand and comply with these precautions when carrying out the maintenance work.

⚠ WARNING

- **Make sure that you are safely dressed and have a safe working environment when performing preventive maintenance for a servo amplifier.**
  - Be dressed safely, e.g. by wearing gloves and safety shoes, to protect against injury due to an edge or protrusion and electric shock.
  - Have the work done by more than one person, where possible, so that immediate action can be taken if an accident occurs when handling a motor.
  - A servo amplifier and AC reactor contain heavy components. Be careful when transporting them or mounting them on the power magnetic cabinet. Also be careful not to get your fingers caught between the power magnetics cabinet and servo amplifier.

- **Before turning on the power, check that the door of the power magnetics cabinet and all other doors.**
  - Ensure that the door of the power magnetics cabinet containing the servo amplifier, as well as all other doors, are closed and locked except during maintenance work.

- **When the need arises to open the door of the power magnetics cabinet, only a person trained in the maintenance of the corresponding machine or equipment should do the task 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.**

- **Be careful about electric shock, fire, and other accidents.**
  - If the machine must be operated with the door open for adjustment or 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.
  - Ensure that the door of the power magnetics cabinet is locked so that the door cannot be opened by anyone, except service personnel or a qualified person trained in maintenance to prevent electric shock, when the servo amplifier is powered on.
  - When the need arises for an operator to open the door of the power magnetics cabinet and perform an operation, ensure that the operator is sufficiently educated in safety or that a protective cover is added to prevent the operator from touching any dangerous part.
  - The servo amplifier contains a large-capacity electrolytic capacitor in it and remains charged for a while after the power is shut off. Before touching the servo amplifier for maintenance or some other purpose, measure the residual voltage of the DC link connection using a tester and check that the red LED for indicating charging is in progress is not lit, in order to ensure safety.
  - After wiring, be sure to close the servo amplifier cover.
  - A loose screw or poor connector contact can cause a motor malfunction or overheating, connection to ground, or short-circuit. Be extremely careful with power supply lines, motor power lines, and DC link connections through which a large electric current flows, because a loose screw or poor connector contact may lead to a fire. Tighten screws and connectors using the specified screw tightening torque.

- The surfaces of the regenerative discharge unit and heat radiator may become very hot. Do not touch them directly by hand.

- **When operating the machine for the first time after preventive maintenance, check that the machine operates as instructed.**
  - To check whether the machine operates as instructed, first specify a small value for the motor and then increase the value gradually. If the motor operates abnormally, perform an emergency stop immediately.
  - When pressing the emergency stop button, check that the motor stops immediately and that the power being supplied to the amplifier is shut off by the magnetic contactor.

- **Notes on alarms**
  - If the machine stops due to an alarm, check the alarm number. Depending on the alarm issued, if the power is supplied without replacing the failed component, another component may be damaged, making it difficult to identify the original cause of the alarm.
  - Before resetting an alarm, ensure that the original cause of the alarm has been removed.

- **If the motor causes any abnormal noise or vibration while operating, stop it immediately.**
  - Using the motor in spite of the abnormal noise or vibration may damage the servo amplifier.

- **Do not disassemble or modify a servo amplifier.**
  Do not disassemble or modify a servo amplifier in any way not specified by FANUC; doing so can lead to a failure.

⚠ CAUTION

- **Notes on servo amplifier replacement and wiring**
  - The work of servo amplifier replacement and wiring should be carried out by a person trained in the maintenance of the machine and equipment concerned.
  - When replacing a servo amplifier, check that the combination of the amplifier and the motor is appropriate.
  - Check that the servo amplifier is securely mounted on the power magnetics cabinet. If there is any clearance between the power magnetics cabinet and the surface on which the amplifier is mounted, dust entering the gap may hinder the normal operation of the servo amplifier.
  - Ensure that the power supply lines, motor power lines, and signal lines are each connected to the correct terminal or connector.
  - Unless otherwise instructed, do not unplug a connector and plug it back with the power on; doing so may cause the servo amplifier to fail.
  - When mounting or unmounting the servo amplifier, exercise care not to get your fingers caught between the servo amplifier and power magnetics cabinet.
  - Take care not to lose track of removed screws. Turning on the power with any lost screw left in the unit may damage the machine.
  - Exercise care to prevent the power supply lines and motor power lines from being connected to the ground or being short-circuited.
  - Protect the lines from any stress such as bending. Handle the line ends appropriately.

- **Be careful about the handling of a servo amplifier.**
  - Do not disassemble a servo amplifier. Doing so poses the risk of electric shock, because the capacitor may remain charged.
  - Do not apply shock to a servo amplifier. Doing so may damage its components, potentially causing the amplifier to malfunction.

- Do not apply an excessively large force to plastic parts. If a plastic section breaks, it may damage internal parts, thus hindering normal operation or leading to a risk of injury due to a broken section.

- **Be careful about the operating environment of a servo amplifier.**
  - Prevent conductive, combustible, or corrosive foreign matter, mist, or drops of water from entering the inside of the unit. The entry of any such material may cause the unit to explode, break, malfunction, etc.
  - Exercise care to prevent cutting fluid, oil mist, cutting chips, or other foreign matter from attaching to the radiator or fan motor exposed to the outside of the power magnetics cabinet. Otherwise, the servo amplifier may become unable to meet its specifications. The service lives of the fan motor and semiconductors can also be reduced.

- **Clean the heat sink and fan motor on a regular basis.**
  - Replace the filter of the power magnetics cabinet on a regular basis.
  - Before cleaning the heat sink, shut down the power and ensure that the temperature of the heat sink is as cool as the room temperature. The heat sink is very hot immediately after power shutdown, touching it may cause burn injury.
  - When cleaning the heat sink by blowing air, be careful about dust scattering. Conductive dust attached to the servo amplifier or its peripheral equipment can lead to a failure.

NOTE

- **Make sure that there is sufficient maintenance clearance around the doors of the machine and equipment.**

- **Do not step or sit on the servo amplifier, or do not apply shock to it.**

- **Do not remove a nameplate from a motor.**
  - The nameplate is necessary to identify the servo amplifier during maintenance work.
  - If a nameplate comes off, be careful not to lose it.

NOTE

1 This manual is focused on the preventive maintenance work to be performed for a FANUC servo amplifier. The information contained herein may not apply depending on the type or configuration of the machine. When reading this manual, refer to the manual of the machine as well. If you have any questions or doubts, do not act on your own; please contact the machine tool builder or FANUC.
2 For detailed information about a servo amplifier, see the manual list shown earlier and, if necessary, obtain the latest version of the corresponding manual.

1.3.2 Preventive Maintenance of a Servo Amplifier

To use a servo amplifier safely throughout its entire service life, perform daily and periodic inspections.

⚠ CAUTION

1 The preventive maintenance method differs from machine to machine in many respects. Depending on the machine in use, it may be difficult for the user to perform periodic inspection or cleaning. If you are not sure about anything as to preventive maintenance, consult with the machine tool builder and ensure that you can perform periodic inspection and cleaning.
2 The machine should be used within the scope of specification defined by the machine tool builder. Using the machine in any way that is outside the specified scope can reduce the servo amplifier's service life or cause a failure.

Inspection part	Inspection item	Inspection interval		Judgment criterion
		Routine	Periodic	
Operating environment	Ambient temperature	V		Around the power magnetics cabinet: 0°C - 45°C Inside the power magnetics cabinet: 0°C - 55°C
	Humidity	V		90% or below RH (dew condensation not allowed)
	Dust/oil mist	V		There shall be no dust or oil mist attached near the servo amplifier.
	Cooling air path	V		The cooling fan shall be operating normally without the air flow being interrupted.
	Abnormal vibration/noise	V		- No abnormal noise or vibration shall be present that has not been experienced in the past. - Vibration near the servo amplifier shall be 0.5 G or less.
	Supply voltage	V		200-V input type: Within 200 - 240 V 380-V input type: Within 400 - 480 V
Servo amplifier	General	V		There shall be no abnormal noise or smell, and there shall be no dust or oil mist attached.
	Screw		V	There shall be no loose screw.
	Fan motor (NOTE 1, 2)	V		- There shall be no abnormal vibration or noise, and the fan blades shall be rotating normally. - There shall be no dust or oil mist attached.
	Connector		V	There shall be no loose or broken connector.
	Cable		V	There shall be no sign of overheating or sheath deterioration (discoloration pr crack).
CNC	Absolute (NOTE 2) Pulse coder battery	V		The machine operator's panel or screen shall not display the alarm indicating the battery voltage of the absolute Pulsecoder is low.
External equipment	Magnetic contactor		V	The contactor shall not rattle or chatter.
	Ground fault interrupter		V	The interrupter shall be able to trip.
	AC reactor		V	There shall be no hum.

NOTE

1 Fan motors are periodic-replacement parts. It is recommended to inspect fan motors on a routine basis and replace them in a preventive manner.
2 Fan motors and batteries are periodic-replacement parts. It is recommended to keep spare parts.

1.3.3 Maintenance of a Servo Amplifier

1.3.3.1 Display of the servo amplifier operation status

The STATUS LEDs on the front of the servo amplifier indicate the operation status of the servo amplifier (whether it is operating normally, the type of alarm, etc.). Use these LEDs for maintenance, inspection, troubleshooting, etc.

> ⚠ **CAUTION**
> A servo amplifier failure may arise from a combination of multiple causes, in which case it can be difficult to identify all those causes. Handling the failure in an improper way may worsen the problem. It is therefore important to analyze the failure status minutely and identify the true cause or causes of the failure. There may be cases in which the failure appears to have been fixed but later recurs or cause a more serious trouble. If you are not sure about the root cause of or corrective action for a failure, do not act on your own; please contact the machine tool builder or FANUC for instructions on proper action.

(1) β*i*SV-B: See Chapter 4, “CONFIRMATION OF THE OPERATION” in Part I, “START-UP PROCEDURE FOR β*i*SV-B.”
(2) β*i*SVSP-B: See Chapter 4, “CONFIRMATION OF THE OPERATION” in Part III, “S START-UP PROCEDURE FOR β*i*SVSP-B.”

1.3.3.2 Replacement of a fan motor

(1) β*i*SV-B: See Section 4.1, “REPLACEMENT OF A FAN MOTOR” in Part II, “TROUBLESHOOTING FOR β*i*SV-B.”
(2) β*i*SVSP-B: See Section 4.1, “REPLACEMENT OF A FAN MOTOR” in Part IV, “TROUBLESHOOTING FOR β*i*SVSP-B.”

1.4 REPLACING BATTERY FOR ABSOLUTE PULSECODERS

(1) β*i*SV-B: See Section 4.2, “REPLACING BATTERY FOR ABSOLUTE PULSECODERS” in Part II, “TROUBLESHOOTING FOR β*i*SV-B.”
(2) β*i*SVSP-B: See Section 4.2, “REPLACING BATTERY FOR ABSOLUTE PULSECODERS” in Part IV, “TROUBLESHOOTING FOR β*i*SVSP-B.”

VI. MOTOR MAINTENANCE

1 SERVO MOTOR MAINTENANCE

1.1 SERVO MOTOR MAINTENANCE PARTS

1.1.1 Pulsecoder

The following lists the ordering specification numbers for maintenance.
(1) Pulsecoder: ordering specification

Motor model	Motor specification		Pulsecoder: ordering specification		
βiS-B series βiF-B series	A06B-2aaa-BccX A06B-2aaa-BccX #0100	X=3	A860-2070-T321	βiA1000	Standard specification IP67 specification Common
βiSc-B series	A06B-2aaa-BccX A06B-2aaa-BccX #0100	X=7	A860-2070-T371	βiA1000 (dedicated to the βiSc-B)	Standard specification IP67 specification Common

(aaa, cc : Any)

Motor model	Motor specification		Pulsecoder: ordering specification		
βiS series βiF series	A06B-0aaa-BccX	X=3	A860-2020-T301	βiA128	Standard specification
	A06B-0aaa-BccX #0100	X=3	A860-2020-T321	βiA128	IP67 specification
βiSc series	A06B-0aaa-BccX	X=7	A860-2020-T361	βiA128 (dedicated to the βiSc)	Standard specification
	A06B-0aaa-BccX #0100	X=7	A860-2020-T371	βiA128 (dedicated to the βiSc)	IP67 specification

(aaa, cc : Any)

(2) Oldham's coupling: ordering specification

Motor model	Motor specification	Oldham's coupling: ordering specification
βiS-B series βiSc-B series βiF-B series	A06B-2aaa-BccX	A290-0501-V535
βiS series βiSc series βiF series	A06B-0aaa-BccX	

(aaa, cc, X : Any)

NOTE
Problems concerning the Pulsecoders of the motors listed in the table below require the maintenance (replacement) of the entire motor.
(It is not possible to maintain the Pulsecoder alone.)

Motor model	Motor specification	Remark
βiS 0.2/5000	A06B-0111-Bcc3#dddd	Frame size □40
βiS 0.3/5000	A06B-0112-Bcc3#dddd	
βiS 0.4/5000	A06B-0114-Bcc3#dddd	Frame size □60
βiS 0.4/5000-B	A06B-2114-Bcc3#dddd	
βiS 0.5/6000	A06B-0115-Bcc3#dddd	
βiS 0.5/6000-B	A06B-2115-Bcc3#dddd	
βiS 1/6000	A06B-0116-Bcc3#dddd	
βiS 1/6000-B	A06B-2116-Bcc3#dddd	

(cc, dddd : Any)

2 SPINDLE MOTOR MAINTENANCE PARTS

2.1 SPINDLE MOTOR MAINTENANCE PARTS

(1) Parts of the terminal box (βiI, βiIP, and βiIC series)

Model	Terminal box assembly	Lid of terminal box
βiI 3/12000, βiI 6/12000 βiIC 3/6000, βiIC 6/6000	A290-1404-T400	A290-1402-V410
βiI 8/12000 to βiI 15/8000 βiIP 8/6000 to βiIP 30/8000 βiIC 8/6000	A290-1406-T400	A290-1406-V410
sβi IP 40/6000	A290-1410-T400	A290-1410-V410

(2) Parts of the terminal box (βiIT series)

Model	Terminal box assembly	Lid of terminal box
βi IT 12/10000、βi IT 15/8000	A290-1406-T400	A290-1406-V410

(3) Fan motor parts (βiI, βiIP, and βiIC series)

Model	Fan assembly (*1)	Fan cover	Fan motor	Exhaust direction
βiI 3/12000, βiI 6/12000 βiIC 3/6000, βiIC 6/6000	A290-1404-T500	A290-1404-X501	A90L-0001-0538/R	Rear
	A290-1404-T501	A290-1404-X501(*2)	A90L-0001-0538/F	Front
βiI 8/12000 to βiI 12/10000 βiIP 8/6000, βiIP 12/6000 βiIC 8/6000	A290-1406-T500	A290-1406-X501	A90L-0001-0515/R	Rear
	A290-1406-T501	A290-1406-X501(*2)	A90L-0001-0515/F	Front
βiI 15/8000 βiIP 15/6000 to βiIP 30/8000	A290-1408-T500	A290-1408-X501	A90L-0001-0548/R	Rear
	A290-1408-T501	A290-1408-X501(*2)	A90L-0001-0548/F	Front
βiIP 40/6000	A290-1412-T510	A290-1412-X502	A90L-0001-0554/RW	Rear
	A290-1412-T511	A290-1412-X502(*2)	A90L-0001-0554/FW	Front

NOTE
1 These drawing numbers include fan motors.
2 Performing maintenance on the fan covers only requires the label indicating the rotation direction (A370-1204-0006).

(4) Fan motor parts (βiIT series)

Model	Fan assembly (*1)	Fan cover	Fan motor
βi IT 12/10000	A290-1466-T500	A290-1406-X501	A90L-0001-0515/RL
βi IT 15/8000	A290-1469-T500	A290-1408-X501	A90L-0001-0548/RL

NOTE
1 These drawing numbers include fan motors.

ADDITIONAL INFORMATION

Addition of the inspection item when the motor rotates abnormally

1. Type of applied technical documents

Title	FANUC AC SERVO MOTOR αi series, FANUC AC SPINDLE MOTOR αi series, FANUC SERVO AMPLIFIER αi series MAINTENANCE MANUAL FANUC AC SERVO MOTOR βi series, FANUC AC SPINDLE MOTOR βi series, FANUC SERVO AMPLIFIER βi series MAINTENANCE MANUAL FANUC AC SERVO MOTOR βi-B/βi series, FANUC AC SPINDLE MOTOR βi series, FANUC SERVO AMPLIFIER βi-B series MAINTENANCE MANUAL FANUC AC SERVO MOTOR αi-B/αi series, FANUC AC SPINDLE MOTOR αi -B series, FANUC SERVO AMPLIFIER αi-B series, FANUC AC SERVO MOTOR βi-B/βi series, FANUC AC SPINDLE MOTOR βi-B series, FANUC SERVO AMPLIFIER βi-B series MAINTENANCE MANUAL
Spec. No./Ver.	B-65285EN/04 B-65325EN/02 B-65425EN/02 B-65515EN/01

2. Summary of change

Group	Name／Outline	New・Add Correct・Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction	Addition of the inspection item when the motor rotates abnormally	Add	Jul, 2018
Another			

				Title	Addition of the inspection item when the motor rotates abnormally
				Draw.	B-65285EN/04-04, B-65325EN/02-01, B-65425EN/02-01, B-65515EN/01-01
01	18.07.09	A. Nishioka	New design	FANUC CORPORATION	PAGE 1／2
Edit	Date	Design	Description		

3. Outline

Noise and vibration from the motor may be occurred by the phase loss of power line, for example the connection failure, etc.

The confirmation of the cable connection is added to the inspection item when the motor rotates abnormally.

4. Details of correction

Items described in the following table need be checked when the motor rotates abnormally.

Table 1: Main inspection items when the motor rotates abnormally

Operation of the motor	Noise/vibration	- Check for any abnormal noise or vibration not only when the motor is running (the spindle is rotating) but also when it is stopped. - Abnormal noise heard when the motor is rotating indicates an abnormality of the bearing or a failure inside the motor. - Check the cable connections. Especially, check whether there is any phase loss of power line. - If abnormal noise is generated from the connection section of a Spindle Amplifier, check the following items: + Belt connection: Check whether the belt tension is appropriate. + Gear connection: Check whether an appropriate value is set for the gear backlash. + Coupling connection: Check whether the coupling is free from deformation, crack, and looseness.	Add
	Movement	- Check that the motor operates normally and smoothly. - If the circuit breaker trips at the same time the motor starts to operate, it indicates abnormal motor windings.	
	Heat	Check whether the motor does not overheat during the normal operation cycle. Note: While the motor is running or immediately after it is stopped, the motor surface may become very hot. Instead of touching the motor directly by hand, use a thermolabel, surface thermometer, etc.	

				Title	Addition of the inspection item when the motor rotates abnormally
				Draw.	B-65285EN/04-04, B-65325EN/02-01, B-65425EN/02-01, B-65515EN/01-01
01	18.07.09	A. Nishioka	New design	FANUC CORPORATION	PAGE 2／2
Edit	Date	Design	Description		

Cautions for replacing the fan motor of the servo amplifier

1.Type of applied technical documents

Name	FANUC AC SERVO MOTOR αi series FANUC AC SPINDLE MOTOR αi series FANUC SERVO AMPLIFIER αi series MAINTENANCE MANUAL FANUC AC SERVO MOTOR βi series FANUC AC SPINDLE MOTOR βi series FANUC SERVO AMPLIFIER βi series MAINTENANCE MANUAL FANUC SERVO AMPLIFIER βi series I/O Link Option MAINTENANCE MANUAL FANUC AC SERVO MOTOR βi-B /βi series FANUC AC SPINDLE MOTOR βi-B series FANUC SERVO AMPLIFIER βi-B series MAINTENANCE MANUAL FANUC SERVO AMPLIFIER βi-B series I/O Link Option MAINTENANCE MANUAL FANUC AC SERVO MOTOR αi-B /αi series FANUC AC SPINDLE MOTOR αi-B series FANUC SERVO AMPLIFIER αi-B series FANUC AC SERVO MOTOR βi-B /βi series FANUC AC SPINDLE MOTOR βi-B series FANUC SERVO AMPLIFIER βi-B series MAINTENANCE MANUAL
Spec.No./Ed.	B-65285EN/04 B-65325EN/02 B-65395EN/02 B-65425EN/02 B-65435EN/02 B-65515EN/01

Ed.	Date	Design	Description
Date	20.01.17	Desig. Yamamoto	Check / Apprv.

Title	Cautions for replacing the fan motor of the servo amplifier
Draw No.	B-65285EN/04-06,B-65325EN/02-03,B-65395EN/02-01, B-65425EN/02-02,B-65435EN/02-01,B-65515EN/01-04
FANUC CORPORATION	Sheet. 1/3

2.Summary of Change

Group	Name/Outline	New, Add, Correct, Delete	Applicable Date
Basic			
Optional Function			
Unit			
Maintenance Parts			
Notice	Cautions for replacing the fan motor of the servo amplifier	Add	Jan.2020
Correction			
Another			

1. Summary

Replacing the fan motor while the power of the machine (control unit) is supplied may result in failure of the servo amplifier. Therefore, we add cautions when replacing the fan motor of the servo amplifier.

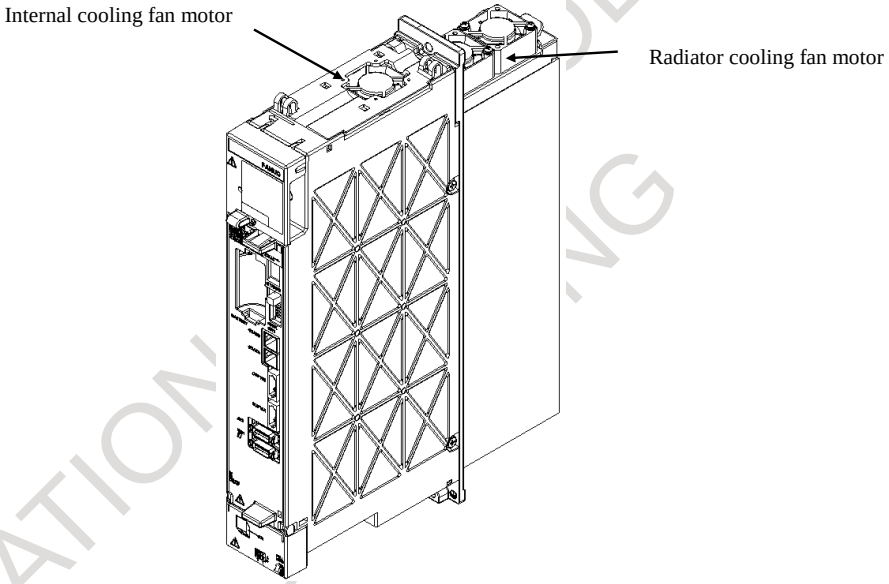
2. Cautions for replacing the fan motor of the servo amplifier

⚠WARNING

When replacing the fan motor of the servo amplifier, be sure to turn off the power of the machine (control unit).

Replacing the fan motor while the main power or control power is supplied may result in failure of the fan motor or the servo amplifier, and a risk of electric shock.

Because the amplifier uses a large-capacitance electrolytic capacitor internally, the amplifier remains charged for a while even after the power is turned off. Before touching the servo amplifier for maintenance or other purposes, ensure your safety by measuring the residual voltage in the DC link with a tester and confirming that the charge indication LED (red) is off.



Example of αiSV-B

				Title. Cautions for replacing the fan motor of the servo amplifier	
				Draw.No.. B-65285EN/04-06,B-65325EN/02-03,B-65395EN/02-01, B-65425EN/02-02,B-65435EN/02-01,B-65515EN/01-04	CUST.
Edit	Date	Design	Description	FANUC CORPORATION	Sheet. 3/3

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REVISION RECORD

Edition	Date	Contents
02	Jul., 2015	- Change of the title to FANUC AC SERVO MOTOR βi-B/βi series - Addition of models to the βiSVSP-B series lineup (180-mm width models and 400-V input models)
01	Nov., 2014	

B-65425EN/02

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