Specifications and Instruction Manual
MDS-C1-N Series
Introduction

Thank you for selecting the Mitsubishi numerical control unit. This instruction manual describes the handling and caution points for using this AC servo/spindle. Incorrect handling may lead to unforeseen accidents, so always read this instruction manual thoroughly to ensure correct usage.

Make sure that this instruction manual is delivered to the end user. Always store this manual in a safe place. In order to confirm if all function specifications described in this manual are applicable, refer to the specifications for each CNC.

Notes on Reading This Manual

(1) Since the description of this specification manual deals with NC in general, for the specifications of individual machine tools, refer to the manuals issued by the respective machine tool builders. The “restrictions” and “available functions” described in the manuals issued by the machine tool builders have precedence to those in this manual. 

(2) This manual describes as many special operations as possible, but it should be kept in mind that items not mentioned in this manual cannot be performed.

In this manual, the following abbreviations might be used.

MTB: Machine tool builder
Precautions for Safety

Please read this manual and auxiliary documents before starting installation, operation, maintenance or inspection to ensure correct usage. Thoroughly understand the device, safety information and precautions before starting operation.

The safety precautions in this instruction manual are ranked as "WARNING" and "CAUTION".

⚠️ DANGER
When there is a potential risk of fatal or serious injuries if handling is mistaken.

⚠️ WARNING
When a dangerous situation, or fatal or serious injuries may occur if handling is mistaken.

⚠️ CAUTION
When a dangerous situation may occur if handling is mistaken leading to medium or minor injuries, or physical damage.

Note that some items described as "⚠️ CAUTION" may lead to major results depending on the situation. In any case, important information that must be observed is described.
The signs indicating prohibited and mandatory matters are explained below.

- Indicates a prohibited matter. For example, "Fire Prohibited" is indicated as ☓.
- Indicates a mandatory matter. For example, grounding is indicated as ✡.

The meaning of each pictorial sign is as follows.

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<td>☓</td>
<td>Prohibited</td>
</tr>
<tr>
<td>✡</td>
<td>Disassembly is prohibited</td>
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<tr>
<td>☣</td>
<td>Keep fire away</td>
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<td>☣</td>
<td>General instruction</td>
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<tr>
<td>☣</td>
<td>Earth ground</td>
</tr>
<tr>
<td>☣</td>
<td>Danger Electric shock risk</td>
</tr>
<tr>
<td>☣</td>
<td>Danger explosive</td>
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<tr>
<td>☣</td>
<td>CAUTION HOT</td>
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<tr>
<td>☣</td>
<td>CAUTION rotated object</td>
</tr>
<tr>
<td>☣</td>
<td>CAUTION</td>
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</tbody>
</table>

After reading this specifications and instructions manual, store it where the user can access it easily for reference.

The numeric control unit is configured of the control unit, operation board, servo drive unit, spindle drive unit, power supply, servo motor and spindle motor, etc.

In this section "Precautions for safety", the following items are generically called the "motor".
- Servo motor
- Linear servo motor
- Spindle motor
- Direct-drive motor

In this section "Precautions for safety", the following items are generically called the "unit".
- Servo drive unit
- Spindle drive unit
- Power supply unit
- Scale interface unit
- Magnetic pole detection unit

**CAUTION rotated object**

**CAUTION HOT**

**Danger Electric shock risk**

**Danger explosive**

**Prohibited**

**Disassembly is prohibited**

**KEEP FIRE AWAY**

**General instruction**

**Earth ground**

**CAUTION**

**CAUTION rotated object**

**CAUTION HOT**

**Danger Electric shock risk**

**Danger explosive**

Important matters that should be understood for operation of this machine are indicated as a **POINT** in this manual.

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For Safe Use

Mitsubishi CNC is designed and manufactured solely for applications to machine tools to be used for industrial purposes. Do not use this product in any applications other than those specified above, especially those which are substantially influential on the public interest or which are expected to have significant influence on human lives or properties.
1. Electric shock prevention

⚠️ Do not open the front cover while the power is ON or during operation. Failure to observe this could lead to electric shocks.

⚠️ Do not operate the unit with the front cover removed. The high voltage terminals and charged sections will be exposed, and can cause electric shocks.

⚠️ Do not remove the front cover and connector even when the power is OFF unless carrying out wiring work or periodic inspections. The inside of the units is charged, and can cause electric shocks.

⚠️ Since the high voltage is supplied to the main circuit connector while the power is ON or during operation, do not touch the main circuit connector with an adjustment screwdriver or the pen tip. Failure to observe this could lead to electric shocks.

⚠️ Wait at least 15 minutes after turning the power OFF, confirm that the CHARGE lamp has gone out, and check the voltage between P and N terminals with a tester, etc., before starting wiring, maintenance or inspections. Failure to observe this could lead to electric shocks.

⚠️ Ground the unit and motor. For the motor, ground it via the drive unit.

⚠️ Wiring, maintenance and inspection work must be done by a qualified technician.

⚠️ Wire the servo drive unit and servo motor after installation. Failure to observe this could lead to electric shocks.

⚠️ Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks.

⚠️ Do not damage, apply forcible stress, place heavy items on the cables or get them caught. Failure to observe this could lead to electric shocks.

⚠️ Always insulate the power terminal connection section. Failure to observe this could lead to electric shocks.

⚠️ After assembling the built-in IPM spindle motor, if the rotor is rotated by hand etc., voltage occurs between the terminals of lead. Take care not to get electric shocks.
2. Injury prevention

⚠️ When handling a motor, perform operations in safe clothing.

⚠️ In the system where the optical communication with CNC is executed, do not see directly the light generated from CN1A/CN1B connector of drive unit or the end of cable. When the light gets into eye, you may feel something is wrong for eye.

(The light source of optical communication corresponds to class1 defined in JISC6802 or IEC60825-1.)

⚠️ The linear servo motor, direct-drive motor and built-in IPM spindle motor uses permanent magnets in the rotor, so observe the following precautions.

(1) Handling
   • The linear servo motor, direct-drive motor and built-in IPM spindle motor could adversely affect medical electronics such as pacemakers, etc., therefore, do not approach the rotor.
   • Do not place magnetic materials as iron.
   • When a magnetic material as iron is placed, take safety measure not to pinch fingers or hands due to the magnetic attraction force.
   • Remove metal items such as watch, piercing jewelry, necklace, etc.
   • Do not place portable items that could malfunction or fail due to the influence of the magnetic force.
   • When the rotor is not securely fixed to the machine or device, do not leave it unattended but store it in the package properly.
   • When installing the motor to the machine, take it out from the package one by one, and then install it.
   • It is highly dangerous to lay out the motor or magnetic plates together on the table or pallet, therefore never do so.

(2) Transportation and storage
   • Correctly store the rotor in the package to transport and store.
   • During transportation and storage, draw people's attention by applying a notice saying "Strong magnet-Handle with care" to the package or storage shelf.
   • Do not use a damaged package.

(3) Installation
   • Take special care not to pinch fingers, etc., when installing (and unpacking) the linear servo motor.
1. Fire prevention

⚠️ Install the units, motors and regenerative resistor on non-combustible material. Direct installation on combustible material or near combustible materials could lead to fires.

⚠️ Always install a circuit protector and contactor on the servo drive unit power input as explained in this manual. Refer to this manual and select the correct circuit protector and contactor. An incorrect selection could result in fire.

⚠️ Shut off the power on the unit side if a fault occurs in the units. Fires could be caused if a large current continues to flow.

⚠️ When using a regenerative resistor, provide a sequence that shuts off the power with the regenerative resistor’s error signal. The regenerative resistor could abnormally overheat and cause a fire due to a fault in the regenerative transistor, etc.

⚠️ The battery unit could heat up, ignite or rupture if submerged in water, or if the poles are incorrectly wired.

⚠️ Cut off the main circuit power with the contactor when an alarm or emergency stop occurs.

2. Injury prevention

⚠️ Do not apply a voltage other than that specified in this manual, on each terminal. Failure to observe this item could lead to ruptures or damage, etc.

⚠️ Do not mistake the terminal connections. Failure to observe this item could lead to ruptures or damage, etc.

⚠️ Do not mistake the polarity (+, -). Failure to observe this item could lead to ruptures or damage, etc.

⚠️ Do not touch the radiation fin on unit back face, regenerative resistor or motor, etc., or place parts (cables, etc.) while the power is turned ON or immediately after turning the power OFF. These parts may reach high temperatures, and can cause burns or part damage.

⚠️ Structure the cooling fan on the unit back face, etc., etc so that it cannot be touched after installation. Touching the cooling fan during operation could lead to injuries.

⚠️ Take care not to suck hair, clothes, etc. into the cooling fan.
3. Various precautions

Observe the following precautions. Incorrect handling of the unit could lead to faults, injuries and electric shocks, etc.

(1) Transportation and installation

⚠️ Correctly transport the product according to its weight.

⚠️ Use the motor’s hanging bolts only when transporting the motor. Do not transport the machine when the motor is installed on the machine.

⚠️ Do not stack the products above the tolerable number.

⚠️ Follow this manual and install the unit or motor in a place where the weight can be borne.

⚠️ Do not get on top of or place heavy objects on the unit.

⚠️ Do not hold the cables, axis or encoder when transporting the motor.

⚠️ Do not hold the connected wires or cables when transporting the units.

⚠️ Do not hold the front cover when transporting the unit. The unit could drop.

⚠️ Always observe the installation directions of the units or motors.

⚠️ Secure the specified distance between the units and control panel, or between the servo drive unit and other devices.

⚠️ Do not install or run a unit or motor that is damaged or missing parts.

⚠️ Do not block the intake or exhaust ports of the motor provided with a cooling fan.

⚠️ Do not let foreign objects enter the units or motors. In particular, if conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter, rupture or breakage could occur.

⚠️ Provide adequate protection using a material such as connector for conduit to prevent screws, metallic detritus, water and other conductive matter or oil and other combustible matter from entering the motor through the power line lead-out port.

⚠️ The units, motors and encoders are precision devices, so do not drop them or apply strong impacts to them.
⚠️ Store and use the units under the following environment conditions.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Unit</th>
<th>Servo motor</th>
<th>Spindle motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>Operation: 0 to +55°C (with no freezing), Storage / Transportation: -15°C to +70°C (with no freezing)</td>
<td>Operation: 0 to +40°C (with no freezing), Storage: -15°C to +70°C (Note 2) (with no freezing)</td>
<td>Operation: 0 to +40°C (with no freezing), Storage: -20°C to +65°C (with no freezing)</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>Operation: 90%RH or less (with no dew condensation), Storage / Transportation: 90%RH or less (with no dew condensation)</td>
<td>Operation: 80%RH or less (with no dew condensation), Storage: 90%RH or less (with no dew condensation)</td>
<td>Operation: 90%RH or less (with no dew condensation), Storage: 90%RH or less (with no dew condensation)</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Indoors (no direct sunlight)</td>
<td>With no corrosive gas, inflammable gas, oil mist, dust or conductive fine particles</td>
<td>According to each unit or motor specification</td>
</tr>
<tr>
<td>Altitude</td>
<td>Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level</td>
<td>Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level</td>
<td></td>
</tr>
</tbody>
</table>

(Note 1) For details, confirm each unit or motor specifications in addition.
(Note 2) -15°C to +55°C for linear servo motor.

⚠️ When disinfectants or insecticides must be used to treat wood packaging materials, always use methods other than fumigation (for example, apply heat treatment at the minimum wood core temperature of 56°C for a minimum duration of 30 minutes (ISPM No. 15 (2009))). If products such as units are directly fumigated or packed with fumigated wooden materials, halogen substances (including fluorine, chlorine, bromine and iodine) contained in fumes may contribute to the erosion of the capacitors.

When exporting the products, make sure to comply with the laws and regulations of each country.

⚠️ Do not use the products in conjunction with any components that contain halogenated flame retardants (bromine, etc). Failure to observe this may cause the erosion of the capacitors.

⚠️ Securely fix the servo motor to the machine. Insufficient fixing could lead to the servo motor slipping off during operation.

⚠️ Always install the servo motor with reduction gear in the designated direction. Failure to do so could lead to oil leaks.

⚠️ Structure the rotary sections of the motor so that it can never be touched during operation. Install a cover, etc., on the shaft.

⚠️ When installing a coupling to a servo motor shaft end, do not apply an impact by hammering, etc. The encoder could be damaged.

⚠️ Do not apply a load exceeding the tolerable load onto the servo motor shaft. The shaft could break.

⚠️ Store the motor in the package box.

⚠️ When inserting the shaft into the built-in IPM spindle motor, do not heat the rotor higher than 130°C. The magnet could be demagnetized, and the specifications characteristics will not be ensured.

⚠️ Always use a nonmagnetic tool (explosion-proof beryllium copper alloy safety tool: NGK Insulators, etc.) when installing the built-in IPM spindle motor, direct-drive motor and linear servo motor.

⚠️ Always provide a mechanical stopper on the end of the linear servo motor's travel path.

⚠️ If the unit has been stored for a long time, always check the operation before starting actual operation. Please contact the Service Center, Service Station, Sales Office or delayer.

⚠️ Install the heavy peripheral devices to the lower part in the panel and securely fix it not to be moved due to vibration.
(2) Wiring

⚠ Correctly and securely perform the wiring. Failure to do so could lead to abnormal operation of the motor.

⚠ Do not install a condensing capacitor, surge absorber or radio noise filter on the output side of the drive unit.

⚠ Correctly connect the output side of the drive unit (terminals U, V, W). Failure to do so could lead to abnormal operation of the motor.

⚠ When using a power regenerative power supply unit, always install an AC reactor for each power supply unit.

⚠ In the main circuit power supply side of the unit, always install an appropriate circuit protector or contactor for each unit. Circuit protector or contactor cannot be shared by several units.

⚠ Always connect the motor to the drive unit's output terminals (U, V, W).

⚠ Do not directly connect a commercial power supply to the servo motor. Failure to observe this could result in a fault.

⚠ When using an inductive load such as a relay, always connect a diode as a noise measure parallel to the load.

⚠ When using a capacitance load such as a lamp, always connect a protective resistor as a noise measure serial to the load.

⚠ Do not reverse the direction of a diode which connect to a DC relay for the control output signals such as contractor and motor brake output, etc. to suppress a surge. Connecting it backwards could cause the drive unit to malfunction so that signals are not output, and emergency stop and other safety circuits are inoperable.

⚠ Do not connect/disconnect the cables connected between the units while the power is ON.

⚠ Securely tighten the cable connector fixing screw or fixing mechanism. An insecure fixing could cause the cable to fall off while the power is ON.

⚠ When using a shielded cable instructed in the instruction manual, always ground the cable with a cable clamp, etc. (Refer to "EMC Installation Guidelines")

⚠ Always separate the signals wires from the drive wire and power line.

⚠ Use wires and cables that have a wire diameter, heat resistance and flexibility that conforms to the system.

(3) Trial operation and adjustment

⚠ Check and adjust each program and parameter before starting operation. Failure to do so could lead to unforeseen operation of the machine.

⚠ Do not make remarkable adjustments and changes of parameter as the operation could become unstable.

⚠ The usable motor and unit combination is predetermined. Always check the combinations and parameters before starting trial operation.

⚠ The direct-drive motor and linear servo motor do not have a stopping device such as magnetic brakes. Install a stopping device on the machine side.

⚠ When using the linear servo motor for an unbalance axis, adjust the unbalance weight to 0 by installing an air cylinder, etc. on the machine side. The unbalance weight disables the initial magnetic pole adjustment.
(4) Usage methods

⚠️ In abnormal state, install an external emergency stop circuit so that the operation can be stopped and power shut off immediately.

⚠️ Turn the power OFF immediately if smoke, abnormal noise or odors are generated from the unit or motor.

⚠️ Do not disassemble or repair this product.

⚠️ Never make modifications.

⚠️ When an alarm occurs, the machine will start suddenly if an alarm reset (RST) is carried out while an operation start signal (ST) is being input. Always confirm that the operation signal is OFF before carrying out an alarm reset. Failure to do so could lead to accidents or injuries.

⚠️ Reduce magnetic damage by installing a noise filter. The electronic devices used near the unit could be affected by magnetic noise. Install a line noise filter, etc., if there is a risk of magnetic noise.

⚠️ Use the unit, motor and regenerative resistor with the designated combination. Failure to do so could lead to fires or trouble.

⚠️ The brake (magnetic brake) of the servo motor are for holding, and must not be used for normal braking.

⚠️ There may be cases when holding is not possible due to the magnetic brake’s life, the machine construction (when ball screw and servo motor are coupled via a timing belt, etc.) or the magnetic brake’s failure. Install a stop device to ensure safety on the machine side.

⚠️ After changing the programs/parameters or after maintenance and inspection, always test the operation before starting actual operation.

⚠️ Do not enter the movable range of the machine during automatic operation. Never place body parts near or touch the spindle during rotation.

⚠️ Follow the power supply specification conditions given in each specification for the power (input voltage, input frequency, tolerable sudden power failure time, etc.).

⚠️ Set all bits to "0" if they are indicated as not used or empty in the explanation on the bits.

⚠️ Do not use the dynamic brakes except during the emergency stop. Continued use of the dynamic brakes could result in brake damage.

⚠️ If a circuit protector for the main circuit power supply is shared by several units, the circuit protector may not activate when a short-circuit fault occurs in a small capacity unit. This is dangerous, so never share the circuit protector.

⚠️ Mitsubishi spindle motor is dedicated to machine tools. Do not use for other purposes.

(5) Troubleshooting

⚠️ If a hazardous situation is predicted during power failure or product trouble, use a servo motor with magnetic brakes or install an external brake mechanism.

⚠️ Use a double circuit configuration that allows the operation circuit for the magnetic brakes to be operated even by the external emergency stop signal.

⚠️ Always turn the main circuit power of the motor OFF when an alarm occurs.

⚠️ If an alarm occurs, remove the cause, and secure the safety before resetting the alarm.
(6) Maintenance, inspection and part replacement

⚠️ Always backup the programs and parameters before starting maintenance or inspections.

⚠️ The capacity of the electrolytic capacitor will drop over time due to self-discharging, etc. To prevent secondary disasters due to failures, replacing this part every five years when used under a normal environment is recommended. Contact the Service Center, Service Station, Sales Office or dealer for repairs or part replacement.

⚠️ Do not perform a megger test (insulation resistance measurement) during inspections.

⚠️ If the battery low warning is issued, immediately replace the battery. Replace the batteries while applying the drive unit's control power.

⚠️ Do not short circuit, charge, overheat, incinerate or disassemble the battery.

⚠️ For after-purchase servicing of the built-in motor, only the servicing parts for MITSUBISHI encoder can be supplied. For the motor body, prepare the spare parts at the machine tool builders.

⚠️ For maintenance, part replacement, and services in case of failures in the built-in motor (including the encoder), take necessary actions at the machine tool builders. For drive unit, Mitsubishi can offer the after-purchase servicing as with the general drive unit.

(7) Disposal

⚠️ Take the batteries and backlights for LCD, etc., off from the controller, drive unit and motor, and dispose of them as general industrial wastes.

⚠️ Do not disassemble the unit or motor.

⚠️ Dispose of the battery according to local laws.

⚠️ Always return the secondary side (magnet side) of the linear servo motor to the Service Center or Service Station.

⚠️ When incinerating optical communication cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of optical communication cable, request for specialized industrial waste disposal services that has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

(8) Transportation

⚠️ The unit and motor are precision parts and must be handled carefully.

⚠️ According to a United Nations Advisory, the battery unit and battery must be transported according to the rules set forth by the International Civil Aviation Organization (ICAO), International Air Transportation Association (IATA), International Maritime Organization (IMO), and United States Department of Transportation (DOT), etc.

(9) General precautions

The drawings given in this manual show the covers and safety partitions, etc., removed to provide a clearer explanation. Always return the covers or partitions to their respective places before starting operation, and always follow the instructions given in this manual.
Treatment of waste

The following two laws will apply when disposing of this product. Considerations must be made to each law. The following laws are in effect in Japan. Thus, when using this product overseas, the local laws will have a priority. If necessary, indicate or notify these laws to the final user of the product.

(1) Requirements for "Law for Promotion of Effective Utilization of Resources"
   (a) Recycle as much of this product as possible when finished with use.
   (b) When recycling, often parts are sorted into steel scraps and electric parts, etc., and sold to scrap contractors. Mitsubishi recommends sorting the product and selling the members to appropriate contractors.

(2) Requirements for "Law for Treatment of Waste and Cleaning"
   (a) Mitsubishi recommends recycling and selling the product when no longer needed according to item (1) above. The user should make an effort to reduce waste in this manner.
   (b) When disposing a product that cannot be resold, it shall be treated as a waste product.
   (c) The treatment of industrial waste must be commissioned to a licensed industrial waste treatment contractor, and appropriate measures, including a manifest control, must be taken.
   (d) Batteries correspond to "primary batteries", and must be disposed of according to local disposal laws.
Disposal

(Note) This symbol mark is for EU countries only.
This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:
Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)
In the European Union there are separate collection systems for used batteries and accumulators. Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

Please, help us to conserve the environment we live in!
Trademarks

MELDAS, MELSEC, EZSocket, EZMotion, iQ Platform, MELSOFT, GOT, CC-Link, CC-Link/LT and CC-Link IE are either trademarks or registered trademarks of Mitsubishi Electric Corporation in Japan and/or other countries.

Other company and product names that appear in this manual are trademarks or registered trademarks of the respective companies.
Handling of our product

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
WARRANTY

Please confirm the following product warranty details before using MITSUBISHI CNC.

1. Warranty Period and Coverage

Should any fault or defect (hereafter called "failure") for which we are liable occur in this product during the warranty period, we shall provide repair services at no cost through the distributor from which the product was purchased or through a Mitsubishi Electric service provider. Note, however, that this shall not apply if the customer was informed prior to purchase of the product that the product is not covered under warranty. Also note that we are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is replaced.

[Warranty Term]
The term of warranty for this product shall be twenty-four (24) months from the date of delivery of product to the end user, provided the product purchased from us in Japan is installed in Japan (but in no event longer than thirty (30) months, including the distribution time after shipment from Mitsubishi Electric or its distributor).

Note that, for the case where the product purchased from us in or outside Japan is exported and installed in any country other than where it was purchased; please refer to “2. Service in overseas countries” as will be explained.

[Limitations]
(1) The customer is requested to conduct an initial failure diagnosis by him/herself, as a general rule. It can also be carried out by us or our service provider upon the customer's request and the actual cost will be charged.
(2) This warranty applies only when the conditions, method, environment, etc., of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual, user's manual, and the caution label affixed to the product, etc.
(3) Even during the term of warranty, repair costs shall be charged to the customer in the following cases:
   (a) a failure caused by improper storage or handling, carelessness or negligence, etc., or a failure caused by the customer's hardware or software problem
   (b) a failure caused by any alteration, etc., to the product made by the customer without Mitsubishi Electric's approval
   (c) a failure which may be regarded as avoidable, if the customer's equipment in which this product is incorporated is equipped with a safety device required by applicable laws or has any function or structure considered to be indispensable in the light of common sense in the industry
   (d) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
   (e) any replacement of consumable parts (including a battery, relay and fuse)
   (f) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning, and natural disasters
   (g) a failure which is unforeseeable under technologies available at the time of shipment of this product from our company
   (h) any other failures which we are not responsible for or which the customer acknowledges we are not responsible for

2. Service in Overseas Countries

If the customer installs the product purchased from us in his/her machine or equipment, and export it to any country other than where he/she bought it, the customer may sign a paid warranty contract with our local FA center. This falls under the case where the product purchased from us in or outside Japan is exported and installed in any country other than where it was purchased.

For details please contact the distributor from which the customer purchased the product.

3. Exclusion of Loss in Opportunity and Secondary Loss from Warranty Liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:
(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

4. Changes in Product Specifications

Specifications shown in our catalogs, manuals or technical documents are subject to change without notice.

5. Product Application

(1) For the use of this product, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in the product, and a backup or fail-safe function should operate on an external system to the product when any failure or malfunction occurs.
(2) Mitsubishi CNC is designed and manufactured solely for applications to machine tools to be used for industrial purposes. Do not use this product in any applications other than those specified above, especially those which are substantially influential on the public interest or which are expected to have significant influence on human lives or properties.
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Introduction
1.1 Outline

MDS-C1-N Series is the drive unit for NC system that has been developed as a substitute product for MDS-A/B/C1 Series.

1.1.1 Features

(1) Integration
MDS-A/B/C1 Series were integrated into MDS-C1-N Series.

(2) Compatibility
The main wiring, encoder and function specifications are compatible with MDS-A/B/C1 Series. (Some parts are not compatible.)

(3) Supporting OHE/OHA encoder (the motor end)
OHE/OHA encoder (the motor end) which was not supported by MDS-C1 Series is available.

1.1.2 Caution

(1) Selection
The selection methods are the same as the current MDS-A/B/C1 Series.

(2) Unsupported function
Select the current model to drive a linear or direct-drive motor, because these motors are not supported by MDS-C1-N Series.

(3) Incompatible model

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(1) Servo drive unit

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<td>MDS-C1-SP-260U</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MDS-C1-SPH-260U</td>
<td>-</td>
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<td></td>
</tr>
<tr>
<td>MDS-C1-SP-300-N/NA</td>
<td>MDS-C1-SP-300</td>
<td>MDS-B-SP-300</td>
<td>MDS-A-SP-300</td>
</tr>
<tr>
<td>MDS-C1-SPH-300</td>
<td>MDS-B-SPH-300</td>
<td>MDS-A-SPH-300</td>
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</tr>
<tr>
<td>MDS-C1-SPM-300</td>
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<td>-</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-SPX-300</td>
<td>MDS-B-SPX-300</td>
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<td>MDS-C1-SPHX-300</td>
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<td>MDS-C1-SP-300U-N/NA</td>
<td>MDS-C1-SP-300U</td>
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<tr>
<td>MDS-C1-SPH-300U</td>
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<td>MDS-C1-SP-370-N/NA</td>
<td>-</td>
<td>MDS-B-SP-370</td>
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<td>MDS-C1-SP-370</td>
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<td>MDS-C1-SPM-370</td>
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<td>MDS-B-SPM-370</td>
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<td>MDS-C1-SPX-370</td>
<td>-</td>
<td>MDS-B-SPX-370</td>
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<tr>
<td>MDS-C1-SP-450-N/NA</td>
<td>-</td>
<td>MDS-B-SP-450</td>
<td>-</td>
</tr>
<tr>
<td>MDS-C1-SP-450</td>
<td>-</td>
<td>MDS-B-SPH-450</td>
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<tr>
<td>MDS-C1-SPM-450</td>
<td>-</td>
<td>MDS-B-SPM-450</td>
<td>-</td>
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<tr>
<td>MDS-C1-SP-550-N/NA</td>
<td>-</td>
<td>MDS-B-SP-550</td>
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<tr>
<td>MDS-C1-SP-550</td>
<td>-</td>
<td>MDS-B-SPH-550</td>
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</tbody>
</table>
# 1.1.4 List of Encoder Compatibility

<table>
<thead>
<tr>
<th>Encoder type</th>
<th>MDS-C1-N</th>
<th>MDS-C1</th>
<th>MDS-B-V14/V24</th>
<th>MDS-A/B</th>
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<tbody>
<tr>
<td>Motor end encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABZ+UVW</td>
<td>OHE25K-6</td>
<td>○</td>
<td>×</td>
<td>○</td>
</tr>
<tr>
<td>OHE25K-85</td>
<td>×</td>
<td>○</td>
<td>×</td>
<td>○</td>
</tr>
<tr>
<td>ABZ (+Low-speed serial)</td>
<td>OHA25K-6</td>
<td>○</td>
<td>×</td>
<td>○</td>
</tr>
<tr>
<td>OHA25K-85</td>
<td>×</td>
<td>○</td>
<td>×</td>
<td>○</td>
</tr>
<tr>
<td>High-speed serial</td>
<td>OSE104/104S</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSA104/104S</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSA105</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSE105S</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OBA17/18</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>OSA18</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Ball screw end encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABZ+UVW</td>
<td>OHE25K-ET</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>ABZ (+Low-speed serial)</td>
<td>OHA25K-ET</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>High-speed serial</td>
<td>OSE104-ET</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSA104-ET</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSE105-ET</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSA105-ET</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Machine end encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABZ (+Low-speed serial)</td>
<td>Optical scale</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Magnescale</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MPI scale</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Low-speed serial</td>
<td>AT41 (Mitutoyo)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FME type</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FLE type (Futaba corporation)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>High-speed serial</td>
<td>AT342 (Mitutoyo)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>LC191M (HEIDENHAIN)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MDS-B-HR</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

## 1.1.5 List of Peripheral Device Compatibility

### (1) NC

<table>
<thead>
<tr>
<th>Model</th>
<th>MDS-C1-N</th>
<th>MDS-C1</th>
<th>MDS-A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>M500M/L</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>M600M/L</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>M64</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>C5/C6/C64</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>COS NC(HDLC)</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### (2) Encoder conversion unit

<table>
<thead>
<tr>
<th>Model</th>
<th>MDS-C1-N</th>
<th>MDS-C1</th>
<th>MDS-A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-B-HR</td>
<td>×*1</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MDS-B-SD</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MDS-B-PJEX</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MDS-B-MD</td>
<td>×*1</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

*1 When driving a linear or direct-drive motor, the unit is not available with MDS-C1-N Series.

### (3) Battery

<table>
<thead>
<tr>
<th>Model</th>
<th>MDS-C1-N</th>
<th>MDS-C1</th>
<th>MDS-A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-A-BT-□□□</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>FCU6-BTBOX-36</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
1.2 Servo/Spindle Drive System Configuration

1.2.1 System Configuration

1-axis servo drive unit (MDS-C1-V1-□-N/NA)  
2-axis servo drive unit (MDS-C1-V2-□-N/NA)  
Spindle drive unit (MDS-C1-SP-□-N/NA)  
Power supply unit (MDS-C1-CV)  
Battery unit MDS-A-BT

Connect a terminator when a battery unit is not used.

From NC  
Servo motor  
1-axis servo drive unit (MDS-C1-V1-□-N/NA)  
2-axis servo drive unit (MDS-C1-V2-□-N/NA)  
Spindle drive unit (MDS-C1-SP-□-N/NA)  
Power supply unit (MDS-C1-CV)  
Battery unit MDS-A-BT

Circuit protector or protection fuse (Note) Prepared by user.

AC reactor (B-AL/D-AL)

Circuit protector (Note) Prepared by user.

3-phase 200VAC power supply

To 2nd and 3rd axis servo

Linear scale (for full closed loop control) (Note) Prepared by user.

Magnetic sensor or spindle side encoder

Servo motor  
Spindle motor

(Note) Prepared by user.
1.2.2 Servo drive unit type

(1) 1-axis servo drive unit

MDS-C1-________ (1) -N/NA

<table>
<thead>
<tr>
<th>Motor type</th>
<th>Capacity (kW)</th>
<th>Unit width</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1-01</td>
<td>0.1</td>
<td>60mm</td>
</tr>
<tr>
<td>V1-03</td>
<td>0.3</td>
<td>60mm</td>
</tr>
<tr>
<td>V1-05</td>
<td>0.5</td>
<td>90mm</td>
</tr>
<tr>
<td>V1-10</td>
<td>1.0</td>
<td>90mm</td>
</tr>
<tr>
<td>V1-20</td>
<td>2.0</td>
<td>90mm</td>
</tr>
<tr>
<td>V1-35</td>
<td>3.5</td>
<td>90mm</td>
</tr>
<tr>
<td>V1-45S</td>
<td>4.5</td>
<td>120mm</td>
</tr>
<tr>
<td>V1-45</td>
<td>4.5</td>
<td>120mm</td>
</tr>
<tr>
<td>V1-70S</td>
<td>7.0</td>
<td>120mm</td>
</tr>
<tr>
<td>V1-70</td>
<td>7.0</td>
<td>120mm</td>
</tr>
<tr>
<td>V1-90</td>
<td>9.0</td>
<td>120mm</td>
</tr>
<tr>
<td>V1-110</td>
<td>11.0</td>
<td>150mm</td>
</tr>
<tr>
<td>V1-150</td>
<td>15.0</td>
<td>150mm</td>
</tr>
</tbody>
</table>

● or ▲ indicates the compatible motor for each servo drive unit.

Note continuous operation of ▲ (V1-45S, V1-70S) is limited.

⚠️ CAUTION

The dynamic brake unit (MDS-B-DBU) is required for the MDS-C1-V1-110/150-NA.
## 2-axis servo drive unit

<table>
<thead>
<tr>
<th>Motor type</th>
<th>Capacity (kW)</th>
<th>Unit width</th>
<th>HA</th>
<th>N</th>
<th>HC</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2-0101</td>
<td>0.1+0.1</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-0301</td>
<td>0.3+0.1</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-0303</td>
<td>0.3+0.3</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-0501</td>
<td>0.5+0.1</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-0503</td>
<td>0.5+0.3</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-0505</td>
<td>0.5+0.5</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-1003</td>
<td>1.0+0.3</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-1005</td>
<td>1.0+0.5</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-1010</td>
<td>1.0+1.0</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-2003</td>
<td>2.0+0.3</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-2010</td>
<td>2.0+1.0</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-2020</td>
<td>2.0+2.0</td>
<td>60mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-3510S</td>
<td>3.5+1.0</td>
<td>90mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-3520</td>
<td>3.5+2.0</td>
<td>90mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-3535</td>
<td>3.5+3.5</td>
<td>90mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-4520</td>
<td>4.5+2.0</td>
<td>120mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-4535</td>
<td>4.5+3.5</td>
<td>120mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-4545S</td>
<td>4.5+4.5</td>
<td>120mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-7070S</td>
<td>7.0+7.0</td>
<td>150mm</td>
<td>L</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>V2-9090S</td>
<td>9.0+9.0</td>
<td>150mm</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- or ▲ indicates the compatible motor for each servo drive unit.

Note continuous operation of ▲ (V2-4545S, V2-7070S, V2-9090S) is limited.

### CAUTION

1. The MDS-C1-V2-3510/3520-NA shape is compatible with the MDS-B Series. When newly incorporating the MDS-C1 Series, use the MDS-C1-V2-3510S/3520S-NA.

2. Limits apply to continuous operation of the MDS-C1-V2-4545S/9090S-NA.
1.2.3 Spindle Drive Unit Type

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Capacity (kW)</th>
<th>Unit width (outline type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>0.4</td>
<td>60 (A0)</td>
</tr>
<tr>
<td>075</td>
<td>0.75</td>
<td>60 (A1)</td>
</tr>
<tr>
<td>15</td>
<td>1.5</td>
<td>90 (B1)</td>
</tr>
<tr>
<td>22</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>150S</td>
<td>15.0</td>
<td>120 (C1)</td>
</tr>
<tr>
<td>150</td>
<td>15.0</td>
<td>150 (D1)</td>
</tr>
<tr>
<td>185</td>
<td>18.5</td>
<td>150 (D2)</td>
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<tr>
<td>220</td>
<td>22.0</td>
<td>150 (D1)</td>
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<tr>
<td>260U</td>
<td>26.0</td>
<td>150 (D2)</td>
</tr>
<tr>
<td>300</td>
<td>30.0</td>
<td>150 (D2)</td>
</tr>
<tr>
<td>300U</td>
<td>30.0</td>
<td>240 (E1)</td>
</tr>
<tr>
<td>370</td>
<td>37.0</td>
<td></td>
</tr>
<tr>
<td>450</td>
<td>45.0</td>
<td>300 (F1)</td>
</tr>
<tr>
<td>550</td>
<td>55.0</td>
<td></td>
</tr>
</tbody>
</table>

(1) Spindle drive unit

MDS-C1- (1) - (2) - N/NA

(2) Capacity
Specifications
2.1 Drive unit

2.1.1 Installation environment conditions

Common installation environment conditions for servo, spindle and power supply unit are shown below.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>Operation: 0 to 55°C (with no freezing), Storage / Transportation: -15°C to 70°C (with no freezing)</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>Operation: 90%RH or less (with no dew condensation), Storage / Transportation: 90%RH or less (with no dew condensation)</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Indoors (no direct sunlight)</td>
</tr>
<tr>
<td>Altitude</td>
<td>Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level</td>
</tr>
<tr>
<td>Vibration/impact</td>
<td>4.9m/s² (0.5G) / 49m/s² (5G)</td>
</tr>
</tbody>
</table>

2.1.2 Servo drive unit

(1) 1-axis servo drive unit

<table>
<thead>
<tr>
<th>Servo drive unit type</th>
<th>01</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>20</th>
<th>35</th>
<th>45S</th>
<th>45</th>
<th>70S</th>
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<tr>
<td>Braking</td>
<td>Regenerative braking and dynamic brakes</td>
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<td>Dynamic brakes</td>
<td>Built-in</td>
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<td>External analog output</td>
<td>0 to +5V, 2ch (data for various adjustments)</td>
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<tr>
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<td>Natural-cooling</td>
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</tr>
<tr>
<td>Mass [kg]</td>
<td>2.8</td>
<td>3.5</td>
<td>4.3</td>
<td>5.0</td>
<td>5.9</td>
<td>6.7</td>
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<td>Heat radiated at rated output [W]</td>
<td>21</td>
<td>27</td>
<td>37</td>
<td>53</td>
<td>91</td>
<td>132</td>
<td>158</td>
<td>185</td>
<td>189</td>
<td>284</td>
<td>331</td>
<td>465</td>
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<td>Less than 55dB</td>
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<td>A1</td>
<td>B1</td>
<td>C1</td>
<td>D2</td>
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## 2-axis servo drive unit

### Specifications

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<thead>
<tr>
<th>Servo drive unit type</th>
<th>2-axis servo drive unit MDS-C1-V2- □ -N/NA Series</th>
</tr>
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<tbody>
<tr>
<td><strong>Rated output [kW]</strong></td>
<td>0.1 0.3 0.3 0.5 0.5 1.0 1.0 2.0 2.0 2.0 3.5 3.5</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>155AC</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>*</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>270 to 311AC</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>2 4 6 5 7 8 10 11 14 17 21 28 24 24</td>
</tr>
<tr>
<td><strong>Control power</strong></td>
<td></td>
</tr>
<tr>
<td>Voltage [V]</td>
<td>200AC / 200 to 230AC</td>
</tr>
<tr>
<td>Frequency [Hz]</td>
<td>50/60</td>
</tr>
<tr>
<td>Maximum current [A]</td>
<td>0.2</td>
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<tr>
<td>Maximum rush current [A]</td>
<td>35</td>
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<tr>
<td>Maximum rush conductivity time [ms]</td>
<td>6</td>
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<tr>
<td><strong>Earth leakage current [mA]</strong></td>
<td>1 (Max. 4 For two axes)</td>
</tr>
<tr>
<td><strong>Control method</strong></td>
<td>Sine wave PWM control method</td>
</tr>
<tr>
<td><strong>Braking</strong></td>
<td>Regenerative braking and dynamic brakes</td>
</tr>
<tr>
<td>Dynamic brakes</td>
<td>Built-in</td>
</tr>
<tr>
<td><strong>External analog output</strong></td>
<td>0 to +5V, 2ch (data for various adjustments)</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Cooling method</strong></td>
<td>Natural-cooling, Forced air cooling (fin)</td>
</tr>
<tr>
<td><strong>Mass [kg]</strong></td>
<td>3.5 3.5 3.5 3.5 3.5 3.5 3.5</td>
</tr>
<tr>
<td><strong>Heat radiated at rated output [W]</strong></td>
<td>38 41 43 46 52 62 68 78 98 127 155 178 190 190</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Less than 55dB</td>
</tr>
<tr>
<td><strong>Unit outline dimension drawing</strong></td>
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### 2-axis servo drive unit MDS-C1-V2- □ -N/NA Series

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<th>Servo drive unit type</th>
<th>2-axis servo drive unit MDS-C1-V2- □ -N/NA Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated output [kW]</strong></td>
<td>3.5 3.5 3.5 4.5 4.5 4.5 4.5 7.0 7.0 7.0 9.0 9.0</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>155AC</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>*</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>270 to 311AC</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>31 31 34 44 47 60 60 52 64 70 70 90</td>
</tr>
<tr>
<td><strong>Control power</strong></td>
<td></td>
</tr>
<tr>
<td>Voltage [V]</td>
<td>200AC / 200 to 230AC</td>
</tr>
<tr>
<td>Frequency [Hz]</td>
<td>50/60</td>
</tr>
<tr>
<td>Maximum current [A]</td>
<td>0.2</td>
</tr>
<tr>
<td>Maximum rush current [A]</td>
<td>35</td>
</tr>
<tr>
<td>Maximum rush conductivity time [ms]</td>
<td>6</td>
</tr>
<tr>
<td><strong>Earth leakage current [mA]</strong></td>
<td>1 (Max. 4 For two axes)</td>
</tr>
<tr>
<td><strong>Control method</strong></td>
<td>Sine wave PWM control method</td>
</tr>
<tr>
<td><strong>Braking</strong></td>
<td>Regenerative braking and dynamic brakes</td>
</tr>
<tr>
<td>Dynamic brakes</td>
<td>Built-in</td>
</tr>
<tr>
<td><strong>External analog output</strong></td>
<td>0 to +5V, 2ch (data for various adjustments)</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Cooling method</strong></td>
<td>Forced air cooling (fin)</td>
</tr>
<tr>
<td><strong>Mass [kg]</strong></td>
<td>4.3 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2</td>
</tr>
<tr>
<td><strong>Heat radiated at rated output [W]</strong></td>
<td>213 213 280 280 357 280 359 406 459 365 558 558</td>
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<tr>
<td><strong>Noise</strong></td>
<td>Less than 55dB</td>
</tr>
<tr>
<td><strong>Unit outline dimension drawing</strong></td>
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2.1.3 Spindle Drive Unit

(1) 1-axis spindle drive unit

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<tbody>
<tr>
<td>Rated output [kW]</td>
<td>04 075 15 22 37 55 75 110 150S 150 185</td>
</tr>
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<td>Output</td>
<td></td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>AC155V</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>1.5 2.6 4.5 10.0 15.0 18.0 26.0 37.0 49.0 49.0 63.0</td>
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<tr>
<td>Input</td>
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</tr>
<tr>
<td>Rated voltage [V]</td>
<td>DC270 to 311V</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>3.0 4.0 7.0 13.0 17.0 20.0 30.0 41.0 58.0 58.0 76.0</td>
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<td>Control power</td>
<td></td>
</tr>
<tr>
<td>Voltage [V]</td>
<td>AC200/200 to 230V</td>
</tr>
<tr>
<td>Frequency [Hz]</td>
<td>50/60</td>
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<tr>
<td>Maximum current [A]</td>
<td>0.2</td>
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<tr>
<td>Maximum rush current [A]</td>
<td>35</td>
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<tr>
<td>Maximum rush conductivity time [ms]</td>
<td>6</td>
</tr>
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Rated output [W] Average: 26.8 30.0 49.0 60.0 79.0 108.0 137.0 181.0 235.0 297.0 342.0

Earth leakage current [mA] 6 (Max. 15)

Control method: Sine wave PWM control method

Braking: Regenerative braking

External analog output: 0 to +10V, 2ch (data for various adjustments)

Degree of protection: IP20

Cooling method: Natural-cooling Forced air cooling (fin)

Mass [kg] Average: 4.1 4.9 5.9 6.8 6.8 8.7 16.0 18.8

Heat radiated at rated output [W] Average: 112 150 150 181 181 205 205 238

Noise: Less than 55dB

Unit outline dimension drawing: A0 A1 B1 C1
2.1.4 AC Reactor
An AC reactor must be installed for each power supply unit.

(1) 200V series

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<thead>
<tr>
<th>AC reactor model</th>
<th>D-AL-</th>
<th>7.5K</th>
<th>11K</th>
<th>18.5K</th>
<th>30K</th>
<th>37K</th>
<th>45K</th>
<th>55K</th>
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<td>MDS-C1-CV-</td>
<td>37, 55, 75</td>
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<td>150, 185</td>
<td>220, 260, 300</td>
<td>370</td>
<td>450</td>
<td>550</td>
</tr>
<tr>
<td>Rated capacity [kW]</td>
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<td>11</td>
<td>18.5</td>
<td>30</td>
<td>37</td>
<td>45</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>200AC / 200 to 230AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Rated current [A]</td>
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<td>66</td>
<td>110</td>
<td>133</td>
<td>162</td>
<td>198</td>
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<tr>
<td>Frequency [Hz]</td>
<td>50/60</td>
<td>Tolerable fluctuation : between +5% and -5%</td>
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<table>
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<tr>
<th>Environment</th>
<th>Ambient temperature</th>
<th>Operation: -10°C to 60°C (with no freezing), Storage/Transportation: -10°C to 60°C (with no freezing)</th>
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<tbody>
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<td></td>
<td>Ambient humidity</td>
<td>Operation: 80%RH or less (with no dew condensation), Storage/Transportation: 80%RH or less (with no dew condensation)</td>
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<td>Atmosphere</td>
<td>Indoors (no direct sunlight) With no corrosive gas, inflammable gas, oil mist or dust</td>
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<td></td>
<td>Altitude</td>
<td>Operation/Storage: 1000 meters or less above sea level, Transportation: 10000 meters or less above sea level</td>
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<td></td>
<td>Vibration / impact</td>
<td>9.8m/s² (1G) / 98m/s² (10G)</td>
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<tr>
<td>Mass [kg]</td>
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<td>4.2 3.7 5.3 6.1 8.6 9.7 11.5</td>
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⚠️ CAUTION
B-AL or D-AL is used for MDS-C1-N Series.
### 2.1.5 Unit Outline Drawing

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<th>A2</th>
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<td><img src="image-url" alt="A1 Diagram" /></td>
<td><img src="image-url" alt="A2 Diagram" /></td>
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<td>Wiring allowance at front: 50mm</td>
<td>Wiring allowance at front: 50mm</td>
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<tr>
<td>A0 type does not have fins</td>
<td>Required ventilation space at back: 15mm</td>
<td>Heat radiation allowance at back: 15mm</td>
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</tr>
<tr>
<td><strong>Heat dissipation method</strong></td>
<td>In-panel heat radiation</td>
<td>Heat radiated outside panel (forced air cooling)</td>
<td>Heat radiated outside panel (natural air cooling)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit outline type</th>
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<th>C1</th>
<th>D1/D2</th>
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</thead>
<tbody>
<tr>
<td><strong>Outline dimensions [mm]</strong></td>
<td><img src="image-url" alt="B1 Diagram" /></td>
<td><img src="image-url" alt="C1 Diagram" /></td>
<td><img src="image-url" alt="D1/D2 Diagram" /></td>
</tr>
<tr>
<td>Wiring allowance at front: 50mm</td>
<td>Wiring allowance at front: 50mm</td>
<td>Wiring allowance at front: 50mm</td>
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</tr>
<tr>
<td>Required ventilation space at back: 15mm</td>
<td>Required ventilation space at back: 15mm</td>
<td>Required ventilation space at back: 15mm (D2: 12mm)</td>
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<tr>
<td><strong>Heat dissipation method</strong></td>
<td>Heat radiated outside panel (forced air cooling)</td>
<td>Heat radiated outside panel (forced air cooling)</td>
<td>Heat radiated outside panel (forced air cooling)</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Unit outline type</th>
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<th>F1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outline dimensions [mm]</strong></td>
<td><img src="image-url" alt="E1 Diagram" /></td>
<td><img src="image-url" alt="F1 Diagram" /></td>
</tr>
<tr>
<td>Wiring allowance at front: 50mm</td>
<td>Wiring allowance at front: 50mm</td>
<td></td>
</tr>
<tr>
<td>Required ventilation space at back: 22mm</td>
<td>Required ventilation space at back: 22mm</td>
<td></td>
</tr>
<tr>
<td><strong>Heat dissipation method</strong></td>
<td>Heat radiated outside panel (forced air cooling)</td>
<td>Heat radiated outside panel (forced air cooling)</td>
</tr>
</tbody>
</table>
2.1.6 Unit Outline Dimension Drawing

MDS-C1-Vx-□-N/NA Series

(1) 60 width  Without fin

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V2-0101-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0301-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0303-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0501-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0503-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V1-01-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V1-03-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V1-05-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V1-10-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0101-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0301-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0303-N/NA</td>
<td></td>
</tr>
<tr>
<td>MDS-C1-V2-0503-N/NA</td>
<td></td>
</tr>
</tbody>
</table>

(Note 1) The square hole does not need to be machined.
(2) 60 width

MDS-C1-V1-20-N/NA  MDS-C1-V1-35-N/NA  MDS-C1-V1-45S-N/NA
MDS-C1-V2-2010-N/NA  MDS-C1-V2-2020-N/NA  MDS-C1-V2-3510S-N/NA  MDS-C1-V2-3520S-N/NA  MDS-C1-SP-22-N/NA  MDS-C1-SP-37-N/NA

(Note 1) Attach packing around the square hole for sealing.

(Note 2) The MDS-C1-V1-20-N does not have a fan at the top.

Panel mounting hole machining drawing

Square hole (Note 1)

2-M5 screw hole

2-M6 screw

2-M4 screw

- For MDS-C1-V1-□-N/NA

3-M4 screw

Note that the MDS-C1-V1-45S-N uses a 3-M5 screw

2-M4 screw

- For MDS-C1-V2-□-N/NA

6-M4 screw

3-M4 screw

(Note 1) Attach packing around the square hole for sealing.

(Note 2) The MDS-C1-V1-20-N does not have a fan at the top.
(3) 90 width

MDS-C1-V1-45-N/NA  MDS-C1-V1-70S-N/NA

Panel mounting hole machining drawing

Square hole (Note 1)  3-M5 screw

2-M5 screw hole

(Wiring allowance)

Terminal block cover

Required wind passage space

Intake

2-M6 screw

2-M4 screw

(Note 1) Attach packing around the square hole for sealing.
(Note 1) Attach packing around the square hole for sealing.
(Note 1) Attach packing around the square hole for sealing.
(4) 120 width

MDS-C1-V1-70-N/NA
MDS-C1-V1-90-N/NA
MDS-C1-SP-150-N/NA
MDS-C1-SP-185-N/NA

(Note 1) Attach packing around the square hole for sealing.

Panel mounting hole machining drawing

Square hole (Note 1)

(Wiring allowance)

2-M6 screw

2-M4 screw

Terminal block cover

Required wind passage space

Intake

Φ6 hole

10

60

6

120

112

46

52

24

124.5

92

360

2-M5 screw hole

3-M5 screw

2-M5 screw

(Note 1) Attach packing around the square hole for sealing.
(Note 1) Attach packing around the square hole for sealing.
(5) 150 width

MDS-C1-SP-220-N/NA
MDS-C1-SP-260U-N/NA  MDS-C1-V2-7070-N/NA
MDS-C1-SP-300U-N/NA  MDS-C1-V2-9090S-N/NA

(Note 1) Attach packing around the square hole for sealing.

Panel mounting hole maching drawing

Square hole (Note 1)

2-Φ6 hole

2-M6 screw

2-M4 screw

Terminal block cover

Required wind passage space

Wiring allowance

4-M5 screw hole

6-M4 screw

3-M4 screw

(Note 1) Attach packing around the square hole for sealing.
Panel mounting hole machining drawing

(MDSC1-V1-110-N/NA)
(MDSC1-V1-150-N/NA)
(MDSC1-SP-260-N/NA)
(MDSC1-SP-300-N/NA)

**Panel mounting hole**

*(Note 1) Attach packing around the square hole for sealing.*

Square hole (Note 1)

2-Φ6 hole

2-Φ6 hole (State with terminal block cover removed)

[Diagram showing various dimensions and screw locations]

- 4-M5 screw hole
- 2-M6 screw
- 2-M4 screw
- Terminal block cover
- Exhaust
- Intake
- Heat dissipation allowance
- (Wiring allowance)

[Dimensions and screw locations annotated on the diagram]
(6) 240 width

MDS-C1-SP-370-N/NA

[Diagram showing dimensions and screw holes]

[Unit: mm]
(7) 300 width

MDS-C1-SP-450-N/NA
MDS-C1-SP-550-N/NA

Panel mounting hole machining drawing

2-Φ6 hole

2-M4 screw

4-M5 screw hole

2-M10 screw

3-M10 screw

Square hole

Intake

(Wiring allowance)

(State with terminal block cover removed)

[Unit: mm]

(Required wind passage space)
2.1.7 AC Reactor Outline Dimension Drawing

[Unit: mm]

D-AL-7.5K

D-AL-11K

D-AL-18.5K

D-AL-30K

D-AL-37K
2.1.8 Explanation of Each Part

(1) 200V series

(a) Explanation of each servo drive unit part

The connector and terminal block layout may differ according to the unit being used. Refer to each unit outline drawing for details.

< Each part name >

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) LED</td>
<td>Unit status indication LED</td>
</tr>
<tr>
<td>(2) SW1</td>
<td>Axis No. setting switch (Left: L axis, Right: M axis)</td>
</tr>
<tr>
<td>(3) CN1A</td>
<td>NC or upward axis communication connector</td>
</tr>
<tr>
<td>(4) CN1B</td>
<td>Battery unit/terminator/lower axis communication connector</td>
</tr>
<tr>
<td>(5) CN9</td>
<td>Analog output connector</td>
</tr>
<tr>
<td>(6) CN4</td>
<td>Power supply communication connector</td>
</tr>
<tr>
<td>(7) CN2L</td>
<td>Motor side encoder connection connector (L axis)</td>
</tr>
<tr>
<td>(8) CN3L</td>
<td>Machine side encoder connection connector (L axis)</td>
</tr>
<tr>
<td>(9) CN2M</td>
<td>Motor side encoder connection connector (M axis)</td>
</tr>
<tr>
<td>(10) CN3M</td>
<td>Machine side encoder connection connector (M axis)</td>
</tr>
<tr>
<td>(11) CN20</td>
<td>Motor brake/dynamic brake control connector (for V1-110/150)</td>
</tr>
<tr>
<td>(12) TE2</td>
<td>Converter voltage input terminal (DC input)</td>
</tr>
<tr>
<td>(13) TE3</td>
<td>Control power input terminal (single-phase AC input)</td>
</tr>
<tr>
<td>(14) TE1</td>
<td>Motor power output terminal (3-phase AC output)</td>
</tr>
<tr>
<td>(15) PE</td>
<td>Grounding terminal</td>
</tr>
</tbody>
</table>

(Note) The connector names differ for the V1 drive unit. The CN2L/CN3L are named CN2/CN3, and LU, LV and LW terminals are named U, V and W.

< Screw size >

<table>
<thead>
<tr>
<th>Type</th>
<th>1-axis servo drive unit MDS-C1-V1-</th>
<th>2-axis servo drive unit MDS-C1-V2-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>01 to 35, 45S</td>
<td>45, 70S</td>
</tr>
<tr>
<td>Unit width (mm)</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>(12) L+, L-</td>
<td>M6×14</td>
<td></td>
</tr>
<tr>
<td>(13) L11, L21</td>
<td>M4×10</td>
<td></td>
</tr>
<tr>
<td>(14) LU, LV, LW</td>
<td>M4×12 (Note)</td>
<td>M5×12</td>
</tr>
<tr>
<td>(15) MU, MV, MW</td>
<td>M4×8 (Note)</td>
<td>M5×12</td>
</tr>
</tbody>
</table>

(Note) The V1-45S UVW terminal screw size is M5, the same as V1-45.
(b) Explanation of each spindle drive unit part

The connector and terminal block layout may differ according to the unit being used. Refer to each unit outline drawing for details.

< Each part name >

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>LED --- Unit status indication LED</td>
</tr>
<tr>
<td>(2)</td>
<td>SW1 --- Axis No. setting switch</td>
</tr>
<tr>
<td>(3)</td>
<td>SW2 --- Model selection setting switch</td>
</tr>
<tr>
<td>(4)</td>
<td>CN1A --- NC or upward axis communication connector</td>
</tr>
<tr>
<td>(5)</td>
<td>CN1B --- Battery unit/terminator/Lower axis communication connector</td>
</tr>
<tr>
<td>(6)</td>
<td>CN9 --- Analog output connector</td>
</tr>
<tr>
<td>(7)</td>
<td>CN4 --- Power supply communication connector</td>
</tr>
<tr>
<td>(8)</td>
<td>CN5 --- Internal PLG encoder connection connector</td>
</tr>
<tr>
<td>(9)</td>
<td>CN8 --- Magnetic sensor connection connector</td>
</tr>
<tr>
<td>(10)</td>
<td>CN7 --- C axis control encoder connection connector (Motor side encoder connection connector)</td>
</tr>
<tr>
<td>(11)</td>
<td>CN6 --- CNC connection connector</td>
</tr>
<tr>
<td>(12)</td>
<td>TE2 L+ L- Converter voltage input terminal (DC input)</td>
</tr>
<tr>
<td>(13)</td>
<td>TE3 L11 L21 Control power input terminal (single-phase AC input)</td>
</tr>
<tr>
<td>(14)</td>
<td>TE1 LU, LV, LW Motor power output terminal (3-phase AC output)</td>
</tr>
<tr>
<td>(15)</td>
<td>PE Grounding terminal</td>
</tr>
</tbody>
</table>

< Screw size >

<table>
<thead>
<tr>
<th>Type</th>
<th>Spindle drive unit MDS-C1-SP-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>04, 075, 15</td>
</tr>
<tr>
<td></td>
<td>22, 37</td>
</tr>
<tr>
<td></td>
<td>55, 75, 110</td>
</tr>
<tr>
<td></td>
<td>150S</td>
</tr>
<tr>
<td></td>
<td>150, 185</td>
</tr>
<tr>
<td></td>
<td>220, 260U,</td>
</tr>
<tr>
<td></td>
<td>300U</td>
</tr>
<tr>
<td></td>
<td>260, 300</td>
</tr>
<tr>
<td></td>
<td>370</td>
</tr>
<tr>
<td></td>
<td>450, 550</td>
</tr>
<tr>
<td>(12)</td>
<td>L+, L-</td>
</tr>
<tr>
<td>(13)</td>
<td>L, L1, L21</td>
</tr>
<tr>
<td>(14)</td>
<td>LU, LV, LW</td>
</tr>
<tr>
<td>(15)</td>
<td>PE</td>
</tr>
</tbody>
</table>
2.1.9 Setting DIP Switch

As for spindle drive unit, setting the DIP switches is necessary prior to turning ON the power depending on the target model. Setting of the DIP switches at the time of turning ON the power is validated. Set the model to be used before turning ON the power. All the switches of the DIP switches are OFF at the initial setting.

The switches are OFF when facing bottom as illustrated.

<table>
<thead>
<tr>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
<th>Replacement target model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MDS-A/B/C1-SP-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MDS-B/C1-SPM-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MDS-A/B/C1-SPH-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MDS-B/C1-SPX-</td>
</tr>
</tbody>
</table>

(Note) All the other settings lead to Alarm 7F (Power reboot request).
Setting of the DIP switches differs depending on the replacement target model.
Set them according to the target model and the operation conditions.

< Combination of the replacement target model >

<table>
<thead>
<tr>
<th>Replacement target</th>
<th>Spindle motor</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP</td>
<td>IM motor</td>
<td>Usable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not usable</td>
</tr>
<tr>
<td>SPH</td>
<td>IM motor</td>
<td>Not usable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usable</td>
</tr>
<tr>
<td>SPX (SPHX)</td>
<td>IM motor</td>
<td>Not usable</td>
</tr>
<tr>
<td>(PJEX is connected)</td>
<td></td>
<td>Usable</td>
</tr>
<tr>
<td>SPM</td>
<td>IPM motor</td>
<td>Not usable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usable</td>
</tr>
</tbody>
</table>

(Note 1) Do not set the switches of the unit for which PJEX is not used.
(Note 2) The alarm differs depending on the SP037 (SFNC5) setting.
SP037: bit0=1 (Encoder orientation valid) … Alarm No.: 89
SP037: bit2=1 (PLG orientation valid) ... Alarm No.: 37

< Details of alarm No. >

Investigation details for the DIP switch setting are added to the following alarms.

<table>
<thead>
<tr>
<th>Alarm No.</th>
<th>Investigation details</th>
<th>Investigation results</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Machine side encoder: No signal 2: Spindle: The encoder no-signal was detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Initial parameter error: An incorrect parameter was detected among the parameters received from the CNC at the power ON. &quot;S02 Initial parameter error ####&quot; appears on the NC screen. (####: Error parameter No.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7F</td>
<td>Power reboot request: A mismatch in the program mode selection was detected. Turn the drive unit power ON again.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>Encoder converter unit 2 connection error: Initial communication with the MDS-B-PJEX was not possible.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Investigation details
Check the used model setting of the DIP switches.

The used model setting of the DIP switches and the parameter are mismatched.
Check the used model setting of the DIP switches.
Characteristics
3.1 Drive Unit

3.1.1 Environmental Conditions

<table>
<thead>
<tr>
<th>Environment</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>0°C to +55°C (with no freezing)</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>90% RH or less (with no dew condensation)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-15°C to +70°C (with no freezing)</td>
</tr>
<tr>
<td>Storage humidity</td>
<td>90% RH or less (with no dew condensation)</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, dust or conductive fine particles</td>
</tr>
<tr>
<td>Altitude</td>
<td>Operation/storage: 1000m or less above sea level</td>
</tr>
<tr>
<td></td>
<td>Transportation: 10000m or less above sea level</td>
</tr>
<tr>
<td>Vibration</td>
<td>Operation/storage: 4.9m/s² (0.5G) or less</td>
</tr>
<tr>
<td></td>
<td>Transportation: 49m/s² (5G) or less</td>
</tr>
</tbody>
</table>

(Note) When installing the machine at 1,000m or more above sea level, the heat dissipation characteristics will drop as the altitude increases in proportion to the air density. The ambient temperature drops 1% with every 100m increase in altitude.

When installing the machine at 1,800m altitude, the heating value of the drive unit must be reduced to 92% or less. The heating value is proportional to the square of the current, and required current decreasing rate follows the expression below.

\[
\text{Required current decreasing rate} = \sqrt{0.92} = 0.95
\]

Therefore, use the unit with the reduced effective load rate to 95% or less.
3.1.2 Heating Value

Each heating value is calculated with the following values. The values for the servo drive unit apply at the stall output. The values for the spindle drive unit apply for the continuous rated output.

(Note 1) The values for the spindle drive unit are the heating value at the continuous rated output, and the values for the servo drive unit are the heating values at the stall output when operating in the high-gain mode. The heating value when operating the servo drive unit in the standard mode (MDS-B compatible mode) is lower than the MDS-B Series heating value. However, with the new design, the standard operation mode will not presumably be used, so the data has been eliminated.

(Note 2) The total heating value for the unit is the total sum of the heating values for the above corresponding units which are mounted in the actual machine.

(Note 3) When designing the panel for sealed mounting, take the actual load rate into consideration, and calculate the heating value inside the servo drive unit panel with the following expression:

Heating value inside servo drive unit panel (considering load rate) = Heating value in panel obtained from above table × 0.5

If the load rate is clearly larger than 0.5, substitute that load rate for (× 0.5) in the above expression.

Example) When the V1-35 servo drive unit is mounted

Heating value in panel (at rated output) = 30(W)

Thus, the heating value in the panel (considering the load rate) is 30 × 0.5 = 15(W)

<table>
<thead>
<tr>
<th>Type</th>
<th>Heating value [W]</th>
<th>Type</th>
<th>Heating value [W]</th>
<th>Type</th>
<th>Heating value [W]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo drive unit</td>
<td></td>
<td>Spindle drive unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDS-C1-□-N/NA</td>
<td>Inside</td>
<td>Outside</td>
<td>MDS-C1-□-N/NA</td>
<td>Inside</td>
<td>Outside</td>
</tr>
<tr>
<td>V1-01</td>
<td>21</td>
<td>0</td>
<td>V2-0101</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>V1-03</td>
<td>27</td>
<td>0</td>
<td>V2-0301</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>V1-05</td>
<td>37</td>
<td>0</td>
<td>V2-0303</td>
<td>43</td>
<td>0</td>
</tr>
<tr>
<td>V1-10</td>
<td>53</td>
<td>0</td>
<td>V2-0501</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>V1-20</td>
<td>25</td>
<td>66</td>
<td>V2-0503</td>
<td>52</td>
<td>0</td>
</tr>
<tr>
<td>V1-35</td>
<td>30</td>
<td>102</td>
<td>V2-0505</td>
<td>62</td>
<td>0</td>
</tr>
<tr>
<td>V1-45S</td>
<td>34</td>
<td>124</td>
<td>V2-1005</td>
<td>78</td>
<td>0</td>
</tr>
<tr>
<td>V1-45</td>
<td>37</td>
<td>148</td>
<td>V2-1010</td>
<td>96</td>
<td>0</td>
</tr>
<tr>
<td>V1-70S</td>
<td>38</td>
<td>151</td>
<td>V2-2010</td>
<td>37</td>
<td>117</td>
</tr>
<tr>
<td>V1-70</td>
<td>50</td>
<td>234</td>
<td>V2-2020</td>
<td>41</td>
<td>137</td>
</tr>
<tr>
<td>V1-90</td>
<td>56</td>
<td>275</td>
<td>V2-3510S</td>
<td>44</td>
<td>146</td>
</tr>
<tr>
<td>V1-110</td>
<td>74</td>
<td>392</td>
<td>V2-3510</td>
<td>42</td>
<td>148</td>
</tr>
<tr>
<td>V1-150</td>
<td>98</td>
<td>545</td>
<td>V2-3520S</td>
<td>48</td>
<td>165</td>
</tr>
<tr>
<td>V2-3520</td>
<td>45</td>
<td>166</td>
<td>SP-260U</td>
<td>80</td>
<td>403</td>
</tr>
<tr>
<td>V2-3535</td>
<td>51</td>
<td>209</td>
<td>SP-300</td>
<td>98</td>
<td>522</td>
</tr>
<tr>
<td>V2-4520</td>
<td>52</td>
<td>214</td>
<td>SP-300U</td>
<td>98</td>
<td>522</td>
</tr>
<tr>
<td>V2-4535</td>
<td>57</td>
<td>249</td>
<td>SP-370</td>
<td>243</td>
<td>607</td>
</tr>
<tr>
<td>V2-4545S</td>
<td>55</td>
<td>225</td>
<td>SP-450</td>
<td>280</td>
<td>720</td>
</tr>
<tr>
<td>V2-4545</td>
<td>64</td>
<td>295</td>
<td>SP-550</td>
<td>330</td>
<td>870</td>
</tr>
<tr>
<td>V2-7035</td>
<td>70</td>
<td>336</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-7045</td>
<td>77</td>
<td>382</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-7070S</td>
<td>65</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-7070</td>
<td>90</td>
<td>468</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2-9090S</td>
<td>65</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dedicated Options
4.1 Drive Unit

4.1.1 Dynamic Brake Unit (MDS-B-DBU)

The MDS-C1-V1-110 and MDS-C1-V1-150 units do not have dynamic brakes built in, so install an external dynamic brake unit.

(1) Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Coil specifications</th>
<th>Compatible drive unit</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-B-DBU-150</td>
<td>DC24V 160mA</td>
<td>MDS-C1-V1-110/150</td>
<td>2kg</td>
</tr>
</tbody>
</table>

(2) Outline dimension drawings

MDS-B-DBU-150

[Unit:mm]
(3) Connecting with the servo drive unit

**CAUTION**
Correctly wire the dynamic brake unit to the servo drive unit. Do not use for applications other than emergencies (normal braking, etc.). The internal resistor could heat up, and lead to fires or faults.

**POINT**
When you use a motor with a brake, please wire (between 1pin and 3pin) for the CN20 connector.
Appendix 1

EMC Installation Guidelines
Appendix 1.1 Introduction

As the NC unit is a component designed to control machine tools, it is believed to be out of the direct EMC Instruction subject. However, we would like to introduce the following measure plans to backup EMC Instruction compliance of the machine tool as the NC unit is a major component of the machine tools.

[1] Methods for installation in control/operation panel
[2] Methods of wiring cable outside of panel
[3] Introduction of countermeasure parts

Mitsubishi is carrying out tests to confirm the compliance to the EMC Standards under the environment described in this manual. However, the level of the noise will differ according to the equipment type and layout, control panel structure and wiring lead-in, etc. Thus, we ask that the final noise level be confirmed by the machine tool builder.

For measures for CNC, refer to "EMC INSTALLATION GUIDELINES" of each NC Connection Manual.

Appendix 1.2 EMC Instructions

The EMC Instructions regulate mainly the following two withstand levels.

Emission ...... Capacity to prevent output of obstructive noise that adversely affects external sources.

Immunity ...... Capacity not to malfunction due to obstructive noise from external sources.

The details of each level are classified in the table below. It is assumed that the Standards and test details required for a machine tool are about the same as these.

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Details</th>
<th>Generic Standard</th>
<th>Standards for determining test and measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission</td>
<td>Radiated noise</td>
<td>Electromagnetic noise radiated through the air</td>
<td>EN61000-6-4 (General industrial machine)</td>
<td>EN61000-6-2 (Motor control unit)</td>
</tr>
<tr>
<td></td>
<td>Conductive noise</td>
<td>Electromagnetic noise discharged from power line</td>
<td>EN61000-3</td>
<td></td>
</tr>
<tr>
<td>Immunity</td>
<td>Static electricity electrical discharge immunity test</td>
<td>(Example) Withstand level of discharge of electricity charged in a human body.</td>
<td>EN61000-4-2</td>
<td>EN61000-4-3</td>
</tr>
<tr>
<td></td>
<td>Radiated radio-frequency magnetic field immunity test</td>
<td>(Example) Simulation of immunity from digital wireless transmitters</td>
<td>EN61000-4-3</td>
<td>EN61000-4-4</td>
</tr>
<tr>
<td></td>
<td>Electrical fast transient/burst immunity test</td>
<td>(Example) Withstand level of noise from relays or connecting/disconnecting live wires</td>
<td>EN61000-6-2 (General industrial machine)</td>
<td>EN61000-4-6</td>
</tr>
<tr>
<td></td>
<td>Immunity to conducted disturbance induced by radio-frequency magnetic field</td>
<td>(Example) Withstand level of noise entering through power line, etc.</td>
<td>EN61000-3 (Motor control unit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power supply frequency field immunity test</td>
<td>(Example) 50/60Hz power frequency noise</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Immunity test for voltage dip, short-time power failure and voltage fluctuation</td>
<td>(Example) Power voltage drop withstand level</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surge immunity test</td>
<td>(Example) Withstand level of noise caused by lightning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1.3 EMC Measures

The main items relating to EMC measures include the following.

1. Store the device in an electrically sealed metal panel.
2. Earth all conductors that are floating electrically. (Lower the impedance.)
3. Wire the power line separated from the signal wire as far as possible.
4. Use shielded wires for the cables wired outside of the panel.
5. Install a noise filter.

Ensure the following items to suppress noise radiated outside of the panel.

1. Accurately ground the devices.
2. Clamp shielded wires in the control panel.
3. Increase the panel’s electrical seal. Reduce the gap and hole size.

Appendix 1.4 Measures for Panel Structure

The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.

Appendix 1.4.1 Measures for Control Panel Unit

1. Use metal for all materials configuring the panel.
2. For the joining of the top plate and side plates, etc., mask the contact surface with paint, and fix with welding or screws so that the impedance is reduced. In either case, keep the joining clearance to a max. of 20cm for a better effect.

Note that if the plate warps due to the screw fixing, etc., creating a clearance, noise could leak from that place.

3. Plate the earth plate (with nickel, tin), and connect the connections with a low impedance.
4. If there is a opening on the panel surface, such as the ventilation holes, cover it with a metal plate or expanded metal.

Make sure not to connect using metal or a conductor without peeling off the surface, which results in an insufficient electrical connection. (ex. connection by putting painted surfaces together)
Appendix 1.4.2 Measures for Door

[1] Use metal for all materials configuring the door.

[2] Use an EMI gasket or conductive packing for the contact between the door and control panel unit.

[3] The EMI gasket or conductive packing must contact at a uniform and correct position of the metal surface of the control panel unit.

[4] The surface of the control panel unit contacted with the EMI gasket or conductive packing must have conductance treatment.

(Example) Weld (or screw) a plate that is plated (with nickel, tin).

[5] As a method other than the above, the control panel unit and door can be connected with a plain braided wire. In this case, the panel and door should be contacted at as many points as possible.

Appendix 1.4.3 Measures for Operation Board Panel

[1] Always connect the operation board and indicator with an earthing wire.

[2] If the operation board panel has a door, use an EMI gasket or conductive packing between the door and panel to provide electrical conductance in the same manner as the control panel.

[3] Connect the operation board panel and control panel with a sufficiently thick and short earthing wire.

Appendix 1.4.4 Shielding of the Power Supply Input Section

[1] Separate the input power supply section from other parts in the control panel so that the input power supply cable will not be contaminated by radiated noise.

[2] Do not lead the power line through the panel without passing it through a filter.

The power supply line noise is eliminated by the filter, but cable contains noise again because of the noise radiated in the control panel.

Use a metal plate, etc., for the shielding partition. Make sure not to create a clearance.
Appendix 1.5 Measures for Various Cables

The various cables act as antennas for the noise and discharge the noise externally. Thus appropriate treatment is required to avoid the noise.

The wiring between the drive unit and motor act as an extremely powerful noise source, so apply the following measures.

Appendix 1.5.1 Measures for Wiring in Panel

1. If the cables are led unnecessarily in the panel, they will easily pick up the radiated noise. Thus, keep the wiring length as short as possible.

2. The noise from other devices will enter the cable and be discharged externally, so avoid internal wiring near the openings.

3. Connect the control device earthing terminal and earthing plate with a thick wire. Take care to the leading of the wire.

Appendix 1.5.2 Measures for Shield Treatment

Common items

Use of shield clamp fittings is recommended for treating the shields. The fittings are available as options, so order as required. (Refer to the section "Shield Clamp Fitting" in this chapter.)

Clamp the shield at a position within 10cm from the panel lead out port.

POINT

1. When leading the cables, including the grounding wire (FG), outside of the panel, clamp the cables near the panel outlet (recommendation: within 10cm).

2. When using a metal duct or conduit, the cables do not need to be clamped near the panel outlet.

3. When leading cables not having shields outside the panel, follow the instructions given for each cable. (Installation of a ferrite core, etc., may be required.)
Appendix 1.5.3 Servo/Spindle Motor Power Cable

1. Use four wires (3-phase + earthing) for the power cable that are completely shielded and free from breaks.
2. Earth the shield on both the control panel side and motor chassis side. The shield earth position on the drive unit side must be 10cm or less from the control panel.
3. Earth the shield with a metal P clip or U clip.
   (A cable clamp fitting can be used depending on the wire size.)
4. Directly earth the shield. Do not solder the braided shield onto a wire and earth the end of the wire.

5. When not using a shield cable for the power cable, use a conventional cabtyre cable. Use a metal conduit outside the cable.
6. Earth the power cable on the control panel side at the contact surface of the conduit connector and control panel.
   (Mask the side wall of the control panel with paint.)
7. Follow the treatment shown in the example for the conduit connector to earth the power cable on the motor side.
   (Example: Use a clamp fitting, etc.)
Appendix 1.5.4 Servo/Spindle Motor Encoder Cable

Use a shield pair cable for encoder cable of the servo motor to earth on NC side (inside the control panel.) Mounting a ferrite core directly behind the unit connector is also effective in suppressing noise.

< Installation example >
Appendix 1.6 EMC Countermeasure Parts

Appendix 1.6.1 Shield Clamp Fitting

The effect can be enhanced by connecting the cable directly to the earthing plate. Install an earthing plate near each panel's outlet (within 10cm), and press the cable against the earthing plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together. Securely earth the earthing plate with the frame ground. Install directly on the cabinet or connect with an earthing wire.

![Diagram of Shield Clamp Fitting](image)

<table>
<thead>
<tr>
<th>Ground Plate</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Enclosed fittings</th>
</tr>
</thead>
<tbody>
<tr>
<td>#D</td>
<td>100</td>
<td>86</td>
<td>30</td>
<td>Clamp fitting A x 2</td>
</tr>
<tr>
<td>#E</td>
<td>70</td>
<td>56</td>
<td>-</td>
<td>Clamp fitting B x 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clamp fitting A (maximum dimension when it is open)</th>
<th>Clamp fitting B (reference dimension)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>25 (77)</td>
<td>12 (54)</td>
</tr>
</tbody>
</table>

Appendix 1.6.2 Ferrite Core

Noise can be suppressed by installing a ferrite core to the cable if the power cable and encoder cable, which are led from outside of the control panel, are the noise sources.

Specify the frequency of radiated noise and select the ferrite with high impedance corresponding to the frequency.

By wrapping the cable around the ferrite core according to the cable diameter as shown in the example, the impedance rises, obtaining a better effect.

< Example of use >

![Example of use](image)

The clearance between the ferrite core and cable must be as narrow as possible when winding a cable.
< Recommended ferrite core >

A ferrite core is integrated and mounted on the plastic case. Quick installation is possible without cutting the interface cable or power cable. This ferrite core is effective against common mode noise, allowing measures against noise to be taken without affecting the signal quality.

**TDK ZCAT Series**

![Figure 1](image1.png)

![Figure 2](image2.png)

<table>
<thead>
<tr>
<th>Part number</th>
<th>Fig</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Applicable cable outline</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZCAT3035-1330(-BK)<strong>1</strong></td>
<td>1</td>
<td>39±1</td>
<td>34±1</td>
<td>13</td>
<td>30</td>
<td>-</td>
<td>13max.</td>
<td>63</td>
</tr>
<tr>
<td>ZCAT2035-0930-M(-BK)</td>
<td>2</td>
<td>35±1</td>
<td>28±1</td>
<td>9±1</td>
<td>19.5±1</td>
<td>17.4±1</td>
<td>6 to 9</td>
<td>22</td>
</tr>
</tbody>
</table>

**1** A fixing band is enclosed when shipped.

Contact:
TDK Corporation
http://www.global.tdk.com/

**Kitagawa Industries GRFC Series**

![Figure 3](image3.png)

<table>
<thead>
<tr>
<th>Part number</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Applicable bundle diameter</th>
<th>Impedance Ω/100MHz (1 turn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC-H13</td>
<td>31.7</td>
<td>29.4</td>
<td>41.0</td>
<td>-</td>
<td>Φ12.5 to 13.5</td>
<td>≥170</td>
</tr>
<tr>
<td>RFC-20</td>
<td>40.0</td>
<td>40.0</td>
<td>47.0</td>
<td>-</td>
<td>Max.Φ20</td>
<td>≥180</td>
</tr>
</tbody>
</table>

Contact:
KITAGAWA INDUSTRIES CO.,LTD.
http://www.kitagawa-ind.com/eng/
Appendix 1.6.3 Power Line Filter
HF3000C-SZA Series for 200V/400V

■ Features
(a) 3-phase 3-wire type (500V series)
(b) Compatible with 200V/400V
(c) Compliant with EU Standards EN55011 (Group 1 Class A)
(d) Downsized for the space-saving book type

■ Application
(a) Applications such as large machine tool, inverter, servo, etc.

■ Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Rated current (typ.)</th>
<th>Mass (typ.)</th>
<th>Dimension [Unit:mm]</th>
<th>Frequency [MHz]</th>
<th>Acceleration rate [m/s²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF3010C-SZA</td>
<td>10A</td>
<td>0.9kg</td>
<td>220 66 78</td>
<td>10Hz to 55Hz</td>
<td>9.8m/s²</td>
</tr>
<tr>
<td>HF3020C-SZA</td>
<td>20A</td>
<td>1.3kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3030C-SZA</td>
<td>30A</td>
<td>1.3kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3040C-SZA</td>
<td>40A</td>
<td>2.0kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3050C-SZA</td>
<td>50A</td>
<td>2.0kg</td>
<td>270 80 84</td>
<td>10Hz to 55Hz</td>
<td>9.8m/s²</td>
</tr>
<tr>
<td>HF3060C-SZA</td>
<td>60A</td>
<td>2.1kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3080C-SZA</td>
<td>80A</td>
<td>5.4kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3100C-SZA</td>
<td>100A</td>
<td>5.9kg</td>
<td>310 100 210</td>
<td>10Hz to 55Hz</td>
<td>9.8m/s²</td>
</tr>
<tr>
<td>HF3150C-SZA</td>
<td>150A</td>
<td>9.0kg</td>
<td>395 110 230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3200C-SZA</td>
<td>200A</td>
<td>11kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3250C-SZA</td>
<td>250A</td>
<td>12kg</td>
<td>400 120 260</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF3300C-SZA</td>
<td>300A</td>
<td>13kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1.6.4 Surge Absorber

Insert a surge absorber in the power input section to prevent damage to the control panel or power supply unit, etc. caused by the surge (lightning or sparks, etc.) applied on the AC power line. Use a surge absorber that satisfies the following electrical specifications.

< Surge absorber for 200V >
RSPD Series for 200V (for both between phases and between phase and earth)

<table>
<thead>
<tr>
<th>Part name</th>
<th>Rated voltage 50/60Hz</th>
<th>Voltage protection level</th>
<th>Surge withstand level 8/20 μs</th>
<th>Service temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSPD-250-U4</td>
<td>3AC 250V</td>
<td>1300V</td>
<td>2500A</td>
<td>-40 to 70°C</td>
</tr>
</tbody>
</table>

< Surge absorber for 400V >
RSPD Series for 400V (for both between phases and between phase and earth)

<table>
<thead>
<tr>
<th>Part name</th>
<th>Rated voltage 50/60Hz</th>
<th>Voltage protection level</th>
<th>Surge withstand level 8/20 μs</th>
<th>Service temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSPD-500-U4</td>
<td>3AC 500V</td>
<td>2000V</td>
<td>2500A</td>
<td>-40 to 70°C</td>
</tr>
</tbody>
</table>

Outline dimension drawings

Circuit diagram

< Example of surge absorber installation >

An example of installing the surge absorber in the machine control panel is shown below.

A short-circuit fault will occur in the surge absorber if a surge exceeding the tolerance is applied. Thus, install a circuit protector in the stage before the surge absorber. Note that almost no current flows to the surge absorber during normal use, so a circuit protector installed as the circuit protection for another device can be used for the surge absorber.

Installing the surge absorber

⚠️ **CAUTION**

1. The wires from the surge absorber should be connected without extensions.
2. If the surge absorber cannot be installed just with the enclosed wires, keep the wiring length of A to 2m or less. If the wires are long, the surge absorber’s performance may drop and inhibit protection of the devices in the panel.
3. Surge absorber to be selected varies depending on input power voltage.
Appendix 2

EC Declaration of Conformity
Appendix 2.1 EC Declaration of Conformity

Each series can respond to LVD and EMC directive. Approval from a third party certification organization has been also acquired for the Low Voltage Directive.
The declaration of conformity of each unit is shown below.

![EU DECLARATION OF CONFORMITY]

We,
Manufacturer : MITSUBISHI ELECTRIC CORPORATION
Address : TOKYO 100-8310, JAPAN
Brand Name :

declare under our sole responsibility that the product
Description : AC Servo/Spindle Drive Unit
Type of Model : MDS-C1-Vx-NA/N Series, MDS-C1-SP-NA/N Series
Notice :

to which this declaration relates is in conformity with the following standard and directive.

<table>
<thead>
<tr>
<th>Directive</th>
<th>Harmonized Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IEC61800-5-1:2007 edition 2</td>
</tr>
<tr>
<td></td>
<td>IEC 61800-3-2:2004/A1:2011</td>
</tr>
</tbody>
</table>

The last two digits of the year in which the CE marking was affixed for Low Voltage Directive is 07

Authorized representative in Europe
(The person authorized to compile the Technical file or relevant Technical documentation)

Hartmut Puetz
FA Product Marketing, Director, MITSUBISHI ELECTRIC EUROPE B.V., German Branch
Mitsubishi-Electric-Platz 1, 40862 Ratingen, Germany

Issue Date (Date of Declaration): 15 May, 2017
Signed for and on behalf of

(Signature) [Signature]

Yasushi Ikawa
General Manager, Drive System Dept
MITSUBISHI ELECTRIC CORPORATION
Appendix 3

Instruction Manual for Compliance with UL/c-UL Standard
The instructions of UL/c-UL listed products are described in this manual. The descriptions of this manual are conditions to meet the UL/c-UL standard for the UL/c-UL listed products. To obtain the best performance, be sure to read this manual carefully before use. To ensure proper use, be sure to read specification manual, connection manual and maintenance manual carefully for each product before use.

**Appendix 3.1 Operation Surrounding Air Ambient Temperature**

The recognized operation ambient temperature of each unit are as shown in the table below. The recognized operation ambient temperatures are the same as an original product specification for all of the units.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Unit name</th>
<th>Operation ambient temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC servo/spindle system</td>
<td>Power supply unit, AC Reactor</td>
<td>0 to 55°C</td>
</tr>
<tr>
<td></td>
<td>Servo, Spindle drive unit</td>
<td>0 to 55°C</td>
</tr>
<tr>
<td></td>
<td>Option unit, Battery unit</td>
<td>0 to 55°C</td>
</tr>
<tr>
<td></td>
<td>Servo motor, Spindle motor</td>
<td>0 to 40°C</td>
</tr>
</tbody>
</table>

**Appendix 3.2 Notes for AC Servo/Spindle System**

**Appendix 3.2.1 Warning**

It takes 10 minutes maximum to discharge the bus capacitor. When starting wiring or inspection, shut the power off and wait for more than 15 minutes to avoid a hazard of electrical shock.

**Appendix 3.2.2 Installation**

MDS-C1-N/NA Series are UL/c-UL listed “open type” drives and must be installed into an end-use electrical enclosure. The minimum enclosure size is based on 150 percent of each MDS-C1-N/NA Series are installed a pollution degree 2 environment. And also, design the enclosure so that the ambient temperature in the enclosure is 55°C (131°F) or less, refer to the specifications manual.

**Appendix 3.2.3 Short-circuit Ratings (SCCR)**

Suitable for use in a circuit capable of delivering not more than 100kA rms symmetrical amperes, 500 volts maximum.

**Appendix 3.2.4 Over-temperature Protection for Motor**

Motor Over temperature sensing is not provided by the drive.
Appendix 3.2.5 Peripheral Devices

To comply with UL/c-UL Standard, use the peripheral devices which conform to the corresponding standard.

### Circuit Protector, Fuses, Magnetic contactor and AC Reactor

<table>
<thead>
<tr>
<th>Applicable power supply unit</th>
<th>UL489 Circuit Protector</th>
<th>UL Fuse Class T</th>
<th>AC Reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-CV-37</td>
<td>40A</td>
<td>70A</td>
<td>B/D-AL-7.5K</td>
</tr>
<tr>
<td>MDS-C1-CV-55</td>
<td>40A</td>
<td>100A</td>
<td>B/D-AL-7.5K</td>
</tr>
<tr>
<td>MDS-C1-CV-75</td>
<td>40A</td>
<td>100A</td>
<td>B/D-AL-7.5K</td>
</tr>
<tr>
<td>MDS-C1-CV-110</td>
<td>50A</td>
<td>100A</td>
<td>B/D-AL-11K</td>
</tr>
<tr>
<td>MDS-C1-CV-150</td>
<td>100A</td>
<td>200A</td>
<td>B/D-AL-18.5K</td>
</tr>
<tr>
<td>MDS-C1-CV-185</td>
<td>100A</td>
<td>200A</td>
<td>B/D-AL-18.5K</td>
</tr>
<tr>
<td>MDS-C1-CV-220</td>
<td>150A</td>
<td>200A</td>
<td>B/D-AL-30K</td>
</tr>
<tr>
<td>MDS-C1-CV-260</td>
<td>150A</td>
<td>300A</td>
<td>B/D-AL-30K</td>
</tr>
<tr>
<td>MDS-C1-CV-300</td>
<td>150A</td>
<td>300A</td>
<td>B/D-AL-30K</td>
</tr>
<tr>
<td>MDS-C1-CV-370</td>
<td>175A</td>
<td>300A</td>
<td>B/D-AL-37K</td>
</tr>
<tr>
<td>MDS-B-CVE-450</td>
<td>200A</td>
<td>400A</td>
<td>B/D-AL-45K</td>
</tr>
<tr>
<td>MDS-B-CVE-550</td>
<td>300A</td>
<td>600A</td>
<td>B/D-AL-55K</td>
</tr>
</tbody>
</table>

#### Circuit Protector for spindle motor Fan

Select the Circuit Protector by doubling the spindle motor fan rated.

A rush current that is approximately double the rated current will flow, when the fan is started.

**<Notice>**

- For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.
- For installation in Canada, branch circuit protection must be provided, in accordance with the Canadian Electrical Code and any applicable provincial codes.
Appendix 3.2.6 Field Wiring Reference Table for Input and Output (Power Wiring)

Use the UL-approved round crimping terminals to wire the input and output terminals of each unit. Crimp the terminals with the crimping tool recommended by the terminal manufacturer. Please protect terminal ring by the insulation cover. Following described crimping terminals and tools type are examples of Japan Solderless Terminal Mfg. Co., Ltd.

This wire size is each unit maximum rating. The selection method is indicated in each specification manual.

(See Manual: IB-1501296, BNP-C3040, BNP-B2365, BNP-C3016)

(1) Power Supply Unit (MDS-C1-CV)

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>MDS-C1-CV-</th>
<th>Terminal Screw Size</th>
<th>Torque [lb in/ N m]</th>
<th>M6</th>
<th>M6</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE2 (L+, L-)</td>
<td>37 to 75</td>
<td>#12/60°C</td>
<td>35.4/4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>110 to 185</td>
<td>#10/75°C</td>
<td>35.4/4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>220 to 370</td>
<td>#8/75°C</td>
<td>35.4/4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>MDS-C1-CV-</th>
<th>Terminal Screw Size</th>
<th>Torque [lb in/ N m]</th>
<th>M4</th>
<th>M4</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE3 (L11, L21, MC1)</td>
<td>10.6/1.2</td>
<td>#6: R14-5</td>
<td>10.6/1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.6/1.2</td>
<td>#8: R8-5</td>
<td>10.6/1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.7/2.0</td>
<td>#6: R14-5</td>
<td>10.6/1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>#4: R22-5</td>
<td>10.6/1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>MDS-C1-CV-</th>
<th>Terminal Screw Size</th>
<th>Torque [lb in/ N m]</th>
<th>M4</th>
<th>M5</th>
<th>M8</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE1 (L1, L2, L3, ⊕)</td>
<td>10.6/1.2</td>
<td>#8: R8-5</td>
<td>17.7/2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.7/2.0</td>
<td>#6: R14-5</td>
<td>17.7/2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>#4: R22-5</td>
<td>17.7/2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Note 1) 60°C: Polyvinyl chloride insulated wires (IV).
75°C: Grade heat-resistant polyvinyl chloride insulated wires (HIV).
Use copper wire only.
Above listed wire are for use in the electric cabinet on machine or equipment.

(Note 2) Select the wire size according to the motor's rated current.
(2) Spindle Drive Unit (MDS-C1-SP-N/NA)

<table>
<thead>
<tr>
<th>Terminal Screw Size</th>
<th>Unit Type</th>
<th>Number of Axes</th>
<th>04 to 37-N/NA</th>
<th>55 to 185-N/NA, 150S-N/NA</th>
<th>220 to 300-N/NA, 260U, 300U-N/NA</th>
<th>370-N/NA</th>
<th>450, 550-N/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE2 (L+, L-)</td>
<td>MDS-C1-SP-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torque [lb in / N m]</td>
<td></td>
<td>M6</td>
<td>35.4/4.0</td>
<td>35.4/4.0</td>
<td>35.4/4.0</td>
<td>M10</td>
<td>M10</td>
</tr>
<tr>
<td>TE3 (L11, L21)</td>
<td></td>
<td>M4</td>
<td>10.6/1.2</td>
<td>10.6/1.2</td>
<td>10.6/1.2</td>
<td>M4</td>
<td>M4</td>
</tr>
<tr>
<td>Torque [lb in / N m]</td>
<td></td>
<td>M4</td>
<td>10.6/1.2</td>
<td>17.7/2.0</td>
<td>53.1/6.0</td>
<td>M8</td>
<td>M10</td>
</tr>
</tbody>
</table>

TE3 (L11, L21)

Wire size depends on the Power Supply Unit (MDS-C1-CV Series).

TE1 (U, V, W, \( \phi \))

<table>
<thead>
<tr>
<th>Crimping Terminals Type</th>
<th>Unit Type</th>
<th>MDS-C1-SP-</th>
<th>04 to 37-N/NA</th>
<th>55-N/NA</th>
<th>75-N/NA</th>
<th>110-N/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2-4</td>
<td></td>
<td></td>
<td>( #14/60^\circ )</td>
<td>( #14/75^\circ )</td>
<td>( #14/60^\circ )</td>
<td>( #14/75^\circ )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( #14/75^\circ )</td>
<td>( #12/75^\circ )</td>
<td>( #10/60^\circ )</td>
<td>( #8/75^\circ )</td>
</tr>
<tr>
<td>R3.5-4</td>
<td></td>
<td></td>
<td>( #12/60^\circ )</td>
<td>( #12/75^\circ )</td>
<td>( #10/60^\circ )</td>
<td>( #8/75^\circ )</td>
</tr>
<tr>
<td>R5.5-5</td>
<td></td>
<td></td>
<td>( #10/60^\circ )</td>
<td>( #10/75^\circ )</td>
<td>( #6/80^\circ )</td>
<td>( #6/75^\circ )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( #6/80^\circ )</td>
<td>( #6/75^\circ )</td>
<td>( #4/60^\circ )</td>
<td>( #4/75^\circ )</td>
</tr>
<tr>
<td>#6: R14-5</td>
<td></td>
<td></td>
<td>( #6/80^\circ )</td>
<td>( #6/75^\circ )</td>
<td>( #4/60^\circ )</td>
<td>( #4/75^\circ )</td>
</tr>
<tr>
<td>#8: R8-5</td>
<td></td>
<td></td>
<td>( #8/75^\circ )</td>
<td>( #8/75^\circ )</td>
<td>( #10/60^\circ )</td>
<td>( #2/75^\circ )</td>
</tr>
<tr>
<td>Crimping Tools Type</td>
<td></td>
<td></td>
<td>( YHT-2210 )</td>
<td>( YHT-2210 )</td>
<td>( YHT-2210 )</td>
<td>( YPT-60N )</td>
</tr>
</tbody>
</table>

(Note 1) 60°C: Polyvinyl chloride insulated wires (IV).
75°C: Grade heat-resistant polyvinyl chloride insulated wires (HIV).
Use copper wire only.
Above listed wire are for use in the electric cabinet on machine or equipment.

(Note 2) Select the wire size according to the motor's rated current.
### Appendix 3 Instruction Manual for Compliance with UL/c-UL Standard

#### (3) Servo Drive Unit (MDS-C1-V1/V2-N/NA)

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Number of Axes</th>
<th>Terminal Screw Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V1</td>
<td>01 to 45S-N/NA</td>
<td>TE2 (L+, L-)</td>
</tr>
<tr>
<td></td>
<td>45 to 90-N/NA</td>
<td>Torque [lb in/ N m]</td>
</tr>
<tr>
<td></td>
<td>110, 150-N/NA</td>
<td>M6</td>
</tr>
<tr>
<td></td>
<td>0101 to 9090S-N/NA</td>
<td>35.4/4.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TE3 (L1, L2, L3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Torque [lb in/ N m]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.6/1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TE1 (L1, L2, L3, )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Torque [lb in/ N m]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.6/1.2</td>
</tr>
</tbody>
</table>

Wire size depends on the Power Supply Unit (MDS-C1-CV Series).

#### TE2 (L+, L-)

Wire size depends on the Power Supply Unit (MDS-C1-CV Series).

#### TE3 (L11, L21)

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Wire Size (AWG)/Temp Rating Note 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V2</td>
<td>V1-01 to 150-N/NA, V2-0101 to 9090S-N/NA</td>
</tr>
<tr>
<td></td>
<td>#14/80°C</td>
</tr>
<tr>
<td></td>
<td>#14/75°C</td>
</tr>
</tbody>
</table>

### TE1 (U, V, W, )

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Wire Size (AWG)/Temp Rating Note 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V1</td>
<td>01 to 20-N/NA</td>
</tr>
<tr>
<td></td>
<td>#14/80°C</td>
</tr>
<tr>
<td></td>
<td>#14/75°C</td>
</tr>
</tbody>
</table>

### Crimping Terminals Type

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Crimping Terminals Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V1</td>
<td>R2-4</td>
</tr>
<tr>
<td></td>
<td>R3.5-4</td>
</tr>
<tr>
<td></td>
<td>R5.5-4</td>
</tr>
</tbody>
</table>

### Crimping Tools Type

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Crimping Tools Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V1</td>
<td>YHT-2210</td>
</tr>
<tr>
<td></td>
<td>YHT-2210</td>
</tr>
</tbody>
</table>

#### TE2 (L+, L-)

Wire size depends on the Power Supply Unit (MDS-C1-CV Series).

#### TE3 (L11, L21)

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Wire Size (AWG)/Temp Rating Note 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V2</td>
<td>01 to 20-N/NA</td>
</tr>
<tr>
<td></td>
<td>#8/60°C</td>
</tr>
<tr>
<td></td>
<td>#8/75°C</td>
</tr>
</tbody>
</table>

### Crimping Terminals Type

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Crimping Terminals Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V2</td>
<td>R8-5</td>
</tr>
<tr>
<td></td>
<td>R3.5-4(M)</td>
</tr>
<tr>
<td></td>
<td>R5.5-5(M)</td>
</tr>
</tbody>
</table>

### Crimping Tools Type

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Crimping Tools Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-C1-V2</td>
<td>YHT-2210</td>
</tr>
<tr>
<td></td>
<td>YHT-2210</td>
</tr>
</tbody>
</table>

#### Note 1

- 60°C: Polyvinyl chloride insulated wires (IV).
- 75°C: Grade heat-resistant polyvinyl chloride insulated wires (HIV).
- Use copper wire only.
- Above listed wire are for use in the electric cabinet on machine or equipment.

#### Note 2

Select the wire size according to the motor's rated current.
(4) AC Reactor (B-AL, D-AL)

<table>
<thead>
<tr>
<th>Type</th>
<th>B-AL, D-AL</th>
<th>7.5K, 11K</th>
<th>18.5K to 37K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal Screw Size</td>
<td>L11, L12, L13, L21, L22, L23</td>
<td>M5</td>
<td>M6</td>
</tr>
<tr>
<td>Torque [lb in/ N m]</td>
<td>17.7/2.0</td>
<td>35.4/4.0</td>
<td></td>
</tr>
</tbody>
</table>

Input/Output (L11, L12, L13, L21, L22, L23)
The wire connected with AC Reactor becomes same size as TE1 of the selected Power supply unit.

(5) Notes of Round Crimping Terminals and Terminal Block
The non-insulation ring tongue must have the insulated sleeving described below to prevent electric shock. The insulated sleeve must be provided with SUMITOMO ELECTRIC FINE POLYMER INC. (File No.: E48762, Catalogue No.: SUMITUBE F(Z) or 939) per the illustration below.

Appendix 3.2.7 Motor Over Load Protection
Servo drive unit MDS-C1-V1/V2 series have each solid-state motor over load protection. (The motor full load current is the same as rated current.)
When adjusting the level of motor over load, set the parameter as follows.

(1) MDS-C1-SP-N/NA (Spindle drive unit)

<table>
<thead>
<tr>
<th>Parameter No.</th>
<th>Parameter abbr.</th>
<th>Parameter Name</th>
<th>Setting Procedure</th>
<th>Standard Setting Value</th>
<th>Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP063</td>
<td>OLT</td>
<td>Overload time constant</td>
<td>Set the time constant for overload detection. (Unit: 1 second.)</td>
<td>60s</td>
<td>0 to 1000s</td>
</tr>
<tr>
<td>SP064</td>
<td>OLL</td>
<td>Overload detection level</td>
<td>Set the overload current detection level with a percentage (%) of the stall rating.</td>
<td>150%</td>
<td>1 to 200%</td>
</tr>
</tbody>
</table>

(1) MDS-C1-V1/V2-NA/NA (Servo drive unit)

<table>
<thead>
<tr>
<th>Parameter No.</th>
<th>Parameter abbr.</th>
<th>Parameter Name</th>
<th>Setting Procedure</th>
<th>Standard Setting Value</th>
<th>Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV021</td>
<td>OLT</td>
<td>Overload time constant</td>
<td>Set the time constant for overload detection. (Unit: 1 second.)</td>
<td>60s</td>
<td>1 to 300s</td>
</tr>
<tr>
<td>SV022</td>
<td>OLL</td>
<td>Overload detection level</td>
<td>Set the overload current detection level with a percentage (%) of the stall rating.</td>
<td>150%</td>
<td>1 to 500%</td>
</tr>
</tbody>
</table>

Appendix 3.2.8 Installation of Servo Motor
Mount the servo motor on a flange which has the following size or produces an equivalent or higher heat dissipation effect:

<table>
<thead>
<tr>
<th>Flange Size [mm]</th>
<th>HC, HC-H</th>
<th>HC-RF</th>
<th>HC-MF</th>
<th>HC-FF</th>
<th>HC-FF</th>
</tr>
</thead>
<tbody>
<tr>
<td>150×150×6</td>
<td>---</td>
<td>---</td>
<td>Under 100W</td>
<td>Under 100W</td>
<td>---</td>
</tr>
<tr>
<td>250×250×6</td>
<td>---</td>
<td>---</td>
<td>200W</td>
<td>200W, 300W</td>
<td>---</td>
</tr>
<tr>
<td>250×250×12</td>
<td>0.5 to 1.5 kW</td>
<td>1.0 to 2.0 kW</td>
<td>400W</td>
<td>400W, 600W</td>
<td>0.5 to 1.5 kW</td>
</tr>
<tr>
<td>300×300×12</td>
<td>---</td>
<td>---</td>
<td>750W</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>300×300×20</td>
<td>2.0 to 7.0 kW</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>2.0 to 7.0 kW</td>
</tr>
</tbody>
</table>
Appendix 3.3 AC Servo/Spindle System Connection

Appendix 3.3.1 MDS-C1-Vx/SP-N/NA Series

From NC

Regarding the connection of NC, see the CNC manual book.

External Emergency Stop
Refer to specification manual

Enclosure Side

Machine Side

Servo Motor
Encoder

Spindle Motor
Encoder and Thermal Protection

Servo Motor

Battery Unit

Fuse or Circuit Breaker (MCCB)

3 phase C1-N/NA Series: 200 to 230VAC
## Revision History

<table>
<thead>
<tr>
<th>Date of revision</th>
<th>Manual No.</th>
<th>Revision details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 2015</td>
<td>IB(NA)1501296-A</td>
<td>First edition created.</td>
</tr>
<tr>
<td>Jul. 2017</td>
<td>IB(NA)1501296-B</td>
<td>- &quot;Introduction&quot; was revised.</td>
</tr>
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<td></td>
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<td>- &quot;Replacement Model List&quot; was revised.</td>
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<tr>
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<td></td>
<td>- &quot;System Configuration&quot; was revised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Spindle Drive Unit Type&quot; was added.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Drive unit&quot; was revised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Unit Outline Drawing&quot; was revised.</td>
</tr>
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<td></td>
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<td>- &quot;Unit Outline Dimension Drawing&quot; was revised.</td>
</tr>
<tr>
<td></td>
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<td>- &quot;AC Reactor Outline Dimension Drawing&quot; was revised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Explanation of Each Part&quot; was revised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Setting DIP Switch&quot; was added.</td>
</tr>
<tr>
<td></td>
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<td>- &quot;Heating Value&quot; was revised.</td>
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<td>- &quot;EMC Installation Guidelines&quot; was revised.</td>
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<td>- &quot;EC Declaration of Conformity&quot; was revised.</td>
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<td>- &quot;Instruction Manual for Compliance with UL/c-UL Standard&quot; was revised.</td>
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<td>- &quot;Global Service Network&quot; was revised.</td>
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<td>- Miswrite is corrected.</td>
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Global Service Network

**AMERICA**

**MITSUBISHI ELECTRIC AUTOMATION INC. (AMERICA FA CENTER)**

500 CORPORATE WOODS PARKWAY, VERNON HILLS, ILLINOIS 60061, U.S.A.


Minneapolis, MN Service Satellite

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Indianapolis, IN Service Satellite

St. Louis, MO Service Satellite

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Charlotte, NC Service Satellite

Raleigh, NC Service Satellite

Dallas, TX Service Satellite

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Nashville, TN Service Satellite

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Pittsburgh, PA Service Satellite

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**Notice**

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible. Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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