

# Yaskawa Siemens CNC Series

# Maintenance Manual



Yaskawa Siemens Numerical Controls Corp. has been merged to Siemens K.K. and Siemens Japan K.K. as of August, 2010 respectively. "Yaskawa Siemens Numerical Controls Corp." in this manual should therefore be understood as "Siemens Japan K.K."

This manual is intended for both of Yaskawa Siemens 840DI and Yaskawa Siemens 830DI. In this manual, the functional differences of these two models are not taken into account in its description, thus please refer to the catalog (MANUAL No.: NCKAE-PS41-01) for available basic functions and possible optional functions of each model.

## Safety-related symbol marks

The following symbol marks are used in this manual to draw special attention to safety information.

The information next to these symbol marks is important for safety and thus must always be followed.

MARNING

Indicates activities that could result in a dangerous condition, including death and serious injury, if done wrongly.

Indicates activities that could result in a dangerous condition, including major and minor injury, or in damage to objects, if done wrongly.

It is noted that those activities as indicated by the  $\underline{\land} CAUTION$  symbol mark could even result in death or serious injury if done wrongly in a worst-case situation.

Indicates what you must not do. For example, the 🛞 mark means that you must not make or use a fire here.

MANDATORY

Indicates what you must do unconditionally. For example, the **U** ground mark means that you must always ground the object you are working with.

## Icon display

For clear categorization of explanation, the following icons are used where necessary.



Indicates important matters to be remembered.

Also indicates notes on minor level items that may not lead to equipment damage but causes alarms display.



Indicates program examples or operation examples.



Indicates supplementary items or convenient functions that should be remembered.



Explains terms that are difficult to understand or used with no preliminary explanation.

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### Outline of the manual

- This manual explains daily maintenance of Yaskawa Siemens CNC series. For items that are not covered in this manual, refer to the relevant manuals.
- For maintenance of the entire machine, refer to the manuals published by the machine tool builder.
- This manual is intended for both of Yaskawa Siemens 840DI and Yaskawa Siemens 830DI. In this manual, the functional differences of these two models are not taken into account in its description, thus please refer to the catalog (MANUAL No.: NCKAE-PS41-01) for available basic functions and possible optional functions of each model.

### Trade marks

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Any other designation used in this publication could be brands which, if being used by third parties of their purpose, could be impair the right of the owners.

# Related manuals

- Related manuals are listed below, which you should read as necessary along with this manual.
- Read all related manuals to grasp the specifications.

Manual Name	Manual Number
Yaskawa Siemens CNC series (Catalog)	NCKAE-PS41-01
Yaskawa Siemens CNC series Operating Manual for Standard HMI	NCSIE-SP02-24
Yaskawa Siemens CNC series Operating Manual for Machining Center	NCSIE-SP02-25
Yaskawa Siemens CNC series Programming Manual for Machining Center	NCSIE-SP02-20
Yaskawa Siemens CNC series Programming Manual for Lathe	NCSIE-SP02-21
Yaskawa Siemens CNC series Maintenance Manual (This manual)	NCSIE-SP02-10
Yaskawa Siemens CNC series Maintenance Manual Serviceman Handbook	NCSIE-SP02-19
SINUMERIK Operator's Guide HMI Advanced	6FC5398-2AP10-0BA0

### How to use the Manual

#### Target readers

This manual is intended for use by personnel in charge of maintenance of machine control panel and operator panel of machine tools controlled by the Yaskawa Siemens CNC series.

#### The name of Drive Units

In this manual, the following terms are used fundamentally.

- Servo Unit : A unit that drives Servomotors.
- Inverter : A unit that drives a Spindle Motor.
- Converter : A unit that converts AC power to DC power and supplies it to Servo Units and Inverters.
- Drive Unit : A generic name of Servo Unit, Inverter and Converter.

### Cautions

This manual describes some optional functions, too, but some of these may not be available in your machine. To determine the optional functions installed in your machine, refer to the specification documents or manuals published by the machine tool builders.

We have made every effort to describe individual functions and their relationships to other functions as accurately as possible. However, there are many things that cannot or must not be performed and it is not possible to describe all of these. Accordingly, readers are requested to understand that unless it is specifically stated that something can be performed, it should be assumed that it could not be performed.

Also bear in mind that the performance and functions of an NC machine tool are not determined solely by the CNC unit. The entire control system consists of the mechanical system, the machine operation panel and other machine related equipment in addition to the CNC. Therefore, read the manuals published by the machine tool builder for detailed information relating to the machine.

## Safety precautions

Listed below are important safety precautions that you must always follow when using the product. Read and fully understand this manual and other related manuals before attempting to install, operate, maintain, or service the product. The safety precautions and the knowledge of the product are indispensable for the safety of yourself and the product.

#### Transportation

cover.



Otherwise injury or damage could result by dropping of units onto your foot.

· Don't hold onto the cables to carry the units.

Otherwise injury or damage could result by dropping of unit.

# ) PROHIBITED

· Don't carry the product in such places where it could get wet from rain or water drops, or where harmful gas or liquid is present.

Otherwise injury or damage could result.



 Turn the safety handle of hard disk unit behind CNC unit to the "non-operating position while carrying.

Otherwise damage could result.

#### Storage



# MANDATORY

• Store the product in an indoor clean place satisfying the environmental requirements.

Otherwise damage could result.

- Ambient temperature : -20 to +60 °C
- Relative humidity : 10 to 90 %
- Altitude : 1000 m or lower

#### Installation





· Observe the following when installing the units.

Poorly installed units could result in damage or malfunction:

- The Drive Units must be fixed upright using screws or bolts.
- The Drive Units must be provided with enough space over and under them to allow them to effectively dissipate their heat.
- Install a Drive Unit in an enclosure such that the heat sink fins of the unit come out of the enclosure to keep the unit's internal temperature lower. The exposed heat sink fins must be subjected to a 2.5 m/s air draft.
- If an air stirring fan is installed inside an enclosure, the fan must be oriented such that the air does not directly hit a Drive Unit (to prevent the Drive Unit from collecting more dust).
- Units must be installed such that check, replacement and other servicing activities are implement easily.
- Do not install and attempt to operate any units that are physically broken or damaged.

Otherwise injury could result.

 The maximum operating temperature of 55°C must not be exceeded. The air draft hitting the heat sink of Drive Units must be at not more than 45°C.

Overheat by failure to do so could result in a burn or a fire.

#### Wiring



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• Never apply an AC three-phase power to the U, V, and W output terminals on a Drive Unit powering a motor.

Otherwise the Drive Unit would be damaged.

• The capacity and wiring size of customer's power supply must be so selected as to satisfy the specific operating conditions and required capacity. Note that the actual capacity of a cable decreases significantly if the ambient temperature exceeds 30 °C. Determine a correct cable size according to applicable electrical installation regulations and the technical specifications issued by the cable manufacturer.

Use of a cable of incorrect size could result in a fire.

• Signal cables must be of twist pair, twist-pair multi-strand, or shielded twist-pair multi-strand type. If a type is specified for signal cables in this manual, that type must always be used.

Otherwise malfunction could result.

· Cables must be so routed as to be as short as possible.

Otherwise malfunction could result.

• Input or output signal cables must not be bundled together with power cables or routed in the same wiring duct with power cables inside or outside the panels.

Properly separating signal cables from power cables reduces the effect of electric noise from the power cables on the signal cables.

 If electric noise comes into the product along the power line, install a noise filter at the panel. For information on the required capacity and other specifications of a noise filter, see related manual.

A properly selected noise filter can reduce conducted electric noise significantly.

• Provide the last Drive Units module with a terminating connector.

Otherwise malfunction could result.

• Ensure that the voltage of the AC power supply to a Converter is equal to the rated voltage of that Converter.

Otherwise injury or a fire could result.

• Do not subject the Drive Unit to a high-voltage withstanding test.

Otherwise their semiconductor components would be damaged.

- Wiring to the Drive Unit must be done according to the relevant wiring drawing. Otherwise damage could result.
- The screws of a terminal block must be tightened to a specified torque.

Otherwise a fire could result.



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#### Operating

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• Do not touch live units or terminals.

Otherwise electric shock or malfunction could result.

• Do not touch any current-carrying parts even if you have shut off power to them, until at least 5 minutes have passed (to let any residual charge go out).

Otherwise electric shock or malfunction could result.

• Take care not to damage, pull on, or pinch the cables.

Otherwise electric shock could result.

- Do not touch any rotating parts before you shut off power to them. Otherwise injury could result.
- Never attempt to modify the product.

Otherwise electric shock, a fire, damage or malfunction could result.

Close the up-down covers before switching on the input power.

Otherwise electric shock could result.

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· Ensure that the environmental requirements are fully met.

A fire, electric shock, or malfunction could result if the product were operated in excessively hot, humid, dusty, corrosive, vibration-, or shock-ridden conditions. The environmental requirements are these:

- The atmosphere must be free of corrosive gas or vapor.
- There must be no risk of being splashed with machining oil or organic solvent.
- The relative humidity must be between 10 and 90% with no dew.
- The ambient temperature around the control panel must be between 5 and 30°C. The control panels must be protected from freezing, direct sunlight, heat sources, or the elements.
- Floor vibration must not be more than  $4.9 \text{m/s}^2$ .
- · Take care so that no wire chips or other foreign matter would enter the product.

Otherwise a fire, damage, or malfunction could result.

• When using the programming functions, always follow the instructions given in the relevant manuals.

Otherwise injury or malfunction could result.

- Do not touch the heat sinks, as they can get very hot.
- Otherwise a burn could result.
- Confirm that the speed limits of the motors are compatible with the Inverter settings before operation.

Otherwise injury could result.

· Do not measure the signal voltages during operation.

Otherwise damage could result.

• The Inverters and Servo Units are already set at the factory. Do not change the settings unless you know exactly what you are doing.

Otherwise damage could result.

# MANDATORY

• When switching on the main power, ensure that at least 2 seconds have elapsed after the last switching-off operation.

Otherwise malfunction could result.

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- Never attempt to disassemble or modify the units or devices in the control panels.
- Otherwise a fire, damage, or malfunction could result.
- Do not tamper with the settings of the rheostats or other devices of the control panels.

Otherwise a fire, damage, or malfunction could result.

#### Maintenance

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• Confirm that the main power and the control power supplies are switched off and the CHARGE indicator is not lit before starting maintenance work except confirmation of running status.

Otherwise electric shock or damage could result.

• Do not touch the terminals of the Inverters and Converters, as some of them are at high voltage and very dangerous.

Otherwise electric shock could result.

• Do not leave the up-down cover open when the panel is energized. Always turn off the circuit breaker before opening the covers.

Otherwise electric shock could result.

- Only qualified personnel may perform maintenance or service work.
  - Otherwise electric shock could result.



 For malfunction concerning machine sequences, refer to the relevant manuals issued by the machine tool builder.

#### General notes

#### Notes on the usage of this manual

- Illustrations and drawings in this manual may show parts with their cover or safety shield removed so that inside details can be seen. Regardless of the drawings, the products must always be operated according to the manual with all the covers and shields installed in place.
- Illustrations and photos in this manual represent typical configurations, and may not exactly represent the products delivered.
- This manual is subject to change to reflect modification or specification change to the product or to make it easier to read. An updated manual No. means a new version of this manual.
- If you need additional copies of this manual to replace damaged or lost ones or otherwise, please order from the nearest sales office indicated on the back cover referring to the manual No. printed on the front cover of this manual.
- If the nameplate on the products is defaced or damaged, order a new one from your dealer or the nearest sales office indicated on the back cover of this manual.
- Yaskawa Siemens Numerical Controls would not guarantee the quality of the product modified by the customer. Yaskawa Siemens Numerical Controls is not responsible for any injury or damage due to the product modified by the customer.

### Warning labels

Warning labels are attached to the product to draw special attention. Always follow the instructions. The locations and meanings of the warning labels are as follows:

Warning label 1



4	心危険WARNING
	▲ けが感電のおそれがあります.
4	Risk of electric shock.
•	据付け、運転の前には必ず取扱説明書をお読み下さい。
•	通電中及び電源遮断後5付以内は端子部に触らないで 下さい。
•	Read manual before installing.
•	Wait 5 minutes for capacitor discharge after disconnecting power supply.

Risk of electric shock

- · Read manual before installing.
- Wait 5 minutes for capacitor discharge after disconnecting power supply.

Warning label 2



#### Risk of electric shock

• Do not touch the terminals while the product is switched on or for 5 minutes after the product is switched off.



Warning marking





Ground the unit by connecting a grounding wire to this grounding terminal.



# 1

# Hardware

This chapter explains the hardware of Yaskawa Siemens CNC series.

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## 1.1 General connections between equipments



The example connections for Yaskawa Siemens 840DI system are described in the figure below.



#### Notes on above figure

(1) Equipments

The figure shows an example of connections for Yaskawa Siemens 840DI. Please refer to the documents published by machine tool builder for actually connected or available equipments on your machine.

(2) CNC power supply

DC UPS module and battery module for UPS may not be installed on your machine tool builder. Please refer to the connection diagram published by machine tool builder.

(3) Only one of the floppy disk drive and the PC card drive can be used for a CNC unit.

# 1.2 Outside appearance

The figures are described roughly in the following subsections. Therefore, its image may be different from the actual unit.

### 1.2.1 Operator panel

The operator panel has CNC unit on the rear side and they are treated as a unit.



#### 1.2.2 CNC unit

The CNC unit is installed on the rear side of operator panel and they are treated as a unit.

#### Rear view



Table 1.2 CNC unit				
General name	Type/ Order number	Specifications/ Remarks		
CNC unit	6FC5220-0AAxx -xAA0 6FC5210-0DFxx -xAA0 (spare part)	x: There are several kinds depending on the performance and installed OS		

#### Bottom view



■ Top view



#### IMPORTANT

Don't push RESET button. The system will be rebooted by pushing the RESET button.

### 1.2.3 Drive Unit



General name	Type/ Order number	Specifications/ Remarks
Converter	CIMR-MRXN2xxx5	x: Depending on capacity.
Inverter	CIMR-MXN2xxx5	x: Depending on capacity.
Servo Unit (single axis)	SGDK-xxAEA	x: Depending on capacity.
Servo Unit (two axes)	SGDK-xxxxAEA	x: Depending on capacity.
Servo Unit (three axes)	SGDK-xxxxxAEA	x: Depending on capacity.

Table 1.3 Drive Unit

### 1.2.4 ET200M remote I/O system



Table 1.4 ET200M remote I/O system

Specifications/

Remarks

x: Depending on specification.

x: Depending on specification.

x: Depending on specification.

x: Depending on current capacity.

#### 1.2.5 Board type I/O module



#### External memory device 1.2.6



#### Table 1.5 Board type I/O module

#### 1.2.7 Power supply for CNC unit



General name	Type/ Order number	Specifications/ Remarks
Power supply module	6EP1334-2BA0x	24VDC, 10A x: Depending on generation.
DC UPS module	6EP1931-2ECx1	24VDC, 15A x: Depending on generation.
Battery module for	6EP1935-6MD11	3.2Ah 40°C max.
UPS	6EP1935-6MD31	2.5Ah 60°C max.

#### Table 1.7 Power supply for CNC unit



#### Backup battery for UPS

#### Reactor for Drive Unit 1.2.8



Table 1.8 Reactor for Drive Unit				
General name	Type/ Order number	Specifications/ Remarks		
Reactor	X010xxx	x: Corresponds to the capacity of Converter.		

### 1.2.9 Brake power supply unit



Table 1.9	Brake	power	supply	unit
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General name	Type/ Order number	Specifications/ Remarks	
Brake power supply unit	OPR-109A	200VAC	

### 1.2.10 Serial converter



Table 1.10 Serial converter				
General name Type/ Specifications/ Order number Remarks				
Serial converter	JZDP-B001-000	For ENDAT scale		

### 1.2.11 Electromagnetic contactor for switching winding



Table 1.11 Electromagnetic contactor for switching winding

General name	Type/ Order number	Specifications/ Remarks	
Electromagnetic contactor for switching winding	HV-xxxxP4	x: Depending on the capacity of Inverter and motor type.	

# **Check and Maintenance**

This chapter explains the check and maintenance to keep the basic performance of Yaskawa Siemens CNC series.

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# \land WARNING

 Confirm that the main power and the control power supplies are switched off and the CHARGE indicator is off before starting maintenance work except confirmation of operation status. It is insufficient for safety just to push the "POWER OFF" button on the machine control panel, because some portions within CNC system are left powered.

Otherwise electric shock or damage could result.

For the long and safe use of Yaskawa Siemens CNC series, never fail to execute the daily maintenance work described below.

Be sure to shut down the power supply to the CNC system before daily maintenance except for inspections that can be performed with the power supply for the CNC system turned on, such as inspection for external contamination, vibration, or abnormal sound.

To shut down the power supply to the CNC system, turn OFF the MCCB (breaker for main power supply) on (or in) the electrical control panel on the machine side. When the power supply to the inside of the CNC system is shut down, all fans within the panel stop. Therefore, you can check for the power supply by observing the fans.

### 2.1 Check of control panel

#### 2.1.1 Check of securely closing door (daily)

The system has a complete airtight structure and is so designed that external air containing oil mists do not get into the panel. You are encouraged to make it a habitual practice to securely close each door of the control panel all the time; this should not be restricted to the operation time.

#### 2.1.2 Check of gap or damage of airtight structure (monthly)

For a longer and stable use of Yaskawa Siemens CNC series, make sure you observe the following:

- 1. Open each door and check the packing on the edge of the door for damage.
- 2. Check the inside of the system for abnormal contamination. If any contamination is detected, check the cause and wipe it off as early as possible.
- 3. Set the door locks securely, and check for gap with the door closed.

# 2.2 Check of Servomotor and Servo Unit

#### 2.2.1 Check of Servomotor

The following table shows how to conduct a daily check and maintenance of the Servomotor. Since AC Servomotors are brushless, you need not conduct any other checks than a brief daily check. The check timing in the table shows a guideline only; you need to define appropriate check timing according to the motor operating conditions.

#### IMPORTANT

Do not disassemble the Servomotor for the purpose of maintenance and check. Be sure to contact our distributor or sales office nearest to you for disassembly of motor.

Check item	Check timing	Check/maintenance method	Remark
Vibration and sound check	Once per day	Touching and hearing.	Shall not be larger than normal
Appearance check	According to the degree of contamination	Cleaning with a cloth or air	_
Insulation resistance measurement	Once per year at least	Isolating the motor from Servo Unit, measure insulation resistance using a 500 V megger tester. Normal resistance is more than 10 M $\Omega$ . *	If the resistance is 10 $M\Omega$ or less, contact our service group.
Oil seal replacement	Once per 5,000 hours at least	Replace the seal by removing the motor from a machine.	Only for a motor with an oil seal.
Overall check	Once per 20,000 hours or 5 years at least	Contact our service group.	Do not disassemble and clean the Servomotors.

Table 2.1	Check of Servomotor	

\* To be measured between FG and either of the motor power line U, V, and W phases.

### 2.2.2 Check of Servo Unit

The following table summarizes how to check the Servo Unit. You need not conduct a daily check; however, conduct a check once a year at least.

Check item	Check timing	Check method	Corrective action
Cleaning of body and board	Once per year at least	Shall be free from adherent matters such as dirt, dust, and oil.	Clean with a cloth or air.
Loose screw	Once per year at least	Fixing screws shall not be loose on terminal blocks and connectors etc.	Retighten the screws.
Failed parts on body or boards	Once per year at least	Shall be free from discoloration resulting from heat generation, breakage, wire-break.	Contact our service group.

Table 2.2 Check of Servo Unit

## ■ A guide line of parts replacement timing

The following parts become worn or degraded over years. Conduct a periodical check.

As to the Servo Units that we made an overall repair, we are returning them to users with resetting their drive specific machine data to initial values. Be sure to check drive specific machine data before starting operation.

Table 2.3 F	Periodical	parts	check
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Part name	Standard replacement timing	Replacement method etc.	
Cooling fan	4-5 years	Replace with new one.	
Smoothing capacitor	7-8 years	Replace with new one (after a check).	
Relays	-	Determine after a check.	
Fuse	10 years	Replace with new one.	
Aluminum electrolytic capacitor on print circuit board	5 years	Replace entire board with new one (after a check).	

Above table is described supposing:

- Ambient temperature: 30 °C on average
- Load factor : 80% or less
- Availability : 20 hours or less per day

# 2.3 Check of Spindle Motor, Inverter, and Converter

Conduct scheduled maintenance management so that the system may keep operating correctly in good conditions.

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• To check the converter, you must turn off the power and wait for 5 minutes before accessing inside the unit. Be sure to wait until the "CHARGE" indicator turns off, showing the smoothing capacitor has been discharged completely.

Otherwise, you may receive an electric shock or may be injured.

#### 2.3.1 Daily maintenance

Conduct a daily maintenance check on the following items:

Chock object	Check procedure		Criteria	Corrective action	
Item		Method	Cilicita		
Environment	Ambient temperature	Thermometer	Inverter/Converter: 0-55 °C (Non-congelation) Motor: 0-40 °C	Improve installation environment so that the values may become within standard ranges.	
	Humidity	Hygrometer	95%RH or less (Non-condensation)		
	Ventilation	Viewing	Intake/exhaust air shall flow smoothly.	Remove any obstacles blocking smooth airflow.	
Power supply status	Voltage	Voltmeter	Shall be within a range from -15% to +10% in comparison with rated voltage.	Adjust the voltage within standard range (by using different transformer tap or so).	
	Current	Ammeter	Shall be within a rated current and no frequently change.	Adjust a load.	
Appearance	Contamination on Inverter, Converter, Motor, and frame axis hole due to dust and others	Viewing	Contamination shall not be excessive than normal.	If contamination is excessive, clean them.	
Operation status	Vibration	Touching or vibration meter	Shall be free from abnormal vibration or increase in the amplitude.	If allowable limit is exceeded, stop the system and remove any cause.	
	Bad smell	Smelling	Smell of burning is not allowed.	Stop the system and remove any cause.	
	Abnormal sound	Hearing	Shall be free from abnormal sound or increase in noise level.	If normal operation becomes difficult, stop the system and remove any cause.	
	Temperature rise of Inverter, Converter, and motor	Touching or thermometer	Shall be free from abnormal temperature rise.	Stop and cool the system to check if the cooling devices such as fan operate correctly. Make a repair if any trouble is found.	

Check object	Check procedure		Criteria	Corrective action
	Item			
Around the bearing	Sound from the bearing	Hearing or auscultation stick	Shall be free from abnormal sound or increase in noise level.	Replace the bearing.
	Vibration	Touching or vibration meter	Shall be free from abnormal vibration.	
	Bearing temperature	Touching or thermometer	Shall be free from abnormal temperature rise.	
	Grease	Viewing	Grease leakage shall not exist.	Remove any cause.
Motor cooling fan	Operation status	Viewing or hearing	Shall be operated normally.	Remove any cause or replace the fan if defective.

Table 2.4 Daily maintenance for Spindle Motor, Inverter, and Converter (cont'd)

#### 2.3.2 Scheduled maintenance

Clean and check the Inverters, Converters, and Motors in the following way periodically.

- 1. If air filters are used in the control panel or other devices, clean the filters once a month at least.
- 2. If contaminated with dirt or dust, electronic parts may exhibit overheat or decrease in insulation characteristics. Therefore remove the dirt or dust periodically. Likewise, if the heat sink is contaminated with dust or oil at the rear surface of the Inverter and Converter, it becomes unable to dissipate heat effectively, resulting in a damage. Clean the heat sink with an air blow or a cloth once per 6 months at least. (If it is contaminated considerably, cleaning shall be made more frequently.)
- 3. Checking vibration and sound levels by touching and hearing every day to verify that the levels do not become greater than normal.
- 4. Checking their appearance, clean them if necessary with an air blow or cloth according to the degree of contamination.

#### 2.3.3 Megger test on Spindle Motor

Test the insulation of Spindle Motor using a Megger tester (500 VDC) as follows:

- 1. Isolate the Spindle Motor from the Inverter by disconnecting connections.
- Measure the resistance between either of the motor power lines U, V, and W phases and the FG (Frame Ground). [If Spindle Motor uses 6 wires: U (U1), V (V1), W (W1), X (U2), Y (V2), and Z (W2); measure the resistance between each of the U (U1), V (V1), and W (W1) and the FG.]
- 3. The resistance is correct if the Megger tester reading is  $10 \text{ M}\Omega$  or higher.

### 2.3.4 Periodical check

Referring to the following table, establish a maintenance schedule and conduct a periodical check. Check timing is mentioned for some items in the table; however, it is guide line. Determine appropriate timing that best fits your machine considering operating status and environment by increasing or decreasing the described value.

Chack chiest	Check pro	ocedure	Critoria	Corrective action	
Check Object	ltem	Method	Chiena	Corrective action	
Daily maintenance status	Review records	Viewing		Use as reference for periodical check.	
Mounting status	Bolts for mounting Inverter, Converter, and Motor	Viewing	Shall not become loose.	Retightening	
Grounding	Grounding terminals for Inverter, Converter, and Motor	Viewing	Grounding shall be made securely.	Restoration and retightening	
Coating	Paint removal or rust	Viewing	Paint damage, discoloration, removal, or rust shall not exist.	Rustproofing and repainting	
Connection and electric wire	Looseness, break on wire insulation, terminal box	Viewing	Looseness, break, deterioration, or deformation shall not exist.	Restoration and retightening	
Cooling fan	Vibration	Touching	Shall be free from abnormal vibration or increase in the amplitude.	Replacing a cooling fan	
	Abnormal sound	Hearing	Shall be free from abnormal sound or increase in noise level.		
Electrolytic capacitor	Electrolyte leakage and expansion	Viewing	Electrolyte leakage or expansion shall not exist.	Parts replacement	
	(Measure capacitance)	(Capacitance meter)	(Reading shall be within a standard value.)		
Relay and contactor	Abnormal sound during operation	Hearing	Shall be free from abnormal sound such as rattle sound.	Parts replacement	
Resistor	Crack in insulator	Viewing	Shall be free from abnormality.	Parts replacement	
	Break in wire	Circuit analyzer and others	Reading shall be within a standard value.		
Print circuit board	Discoloration	Viewing	Abnormal or partial discoloration shall not exist.	Print circuit board replacement	
Control circuit	Functional check	Operating Inverter alone	Output voltage from each phase shall not be out of balance.	Readjust print circuit board or repair Inverter.	
Insulation resistance	Motor (Between stator and Ground)	See section 2.3.3.	Shall be 500 VDC $10M\Omega$ or higher.	Contact our service group if the value is less than $10M\Omega$ .	

	book object	Check pro	Check procedure		Corrective action
	meck object	Item	Method	Cillena	Conective action
Moto statu	r coupling s	Repetitive run out	_	-	Readjustment by direct-coupled centering
	1. Shaft coupling	Sunk key	Viewing	Scratch or deformation shall not exist.	Replacement
	2. V-belt	Shaft coupling without key		Match marker shall not be fit loose.	Restoration
		Fastening reamer bolt		Shall not become loose.	Retightening
		Wear		Wear shall be a little.	Replacement
Moto	r	Bearing	Hearing, vibration meter and others (Check timing: Once per 12,000 hours or 2 years.)	Shall be free from abnormal sound, increase in noise level, or temperature rise.	Consumable parts replacement by disassembling and necessary care
		Cooling fan	Hearing, vibration meter and others (Check timing: Once per 15,000 hours or 2 years.)		Cooling fan replacement
		Oil seal	Viewing (Check timing: Once per 5,000 hours)	Wear shall be a little.	Seal is to be replaced by being removed from a machine. Contact our service group.
		Overall check	Contact our service group. (Check timing: Once per 20,000 hours or 5 years)		Do not disassemble and clean the Motor.

Table 2.5	Periodical check	(cont'd)	۱
10010 2.0			,

#### IMPORTANT

Note that if you are leaving a machine unused for a long time, take care the following points:

• If you have installed Converter for spare that is not used normally, check if it operates correctly by energizing it every 6 month.

Specifically, if you have not used the Converter for more than 1 year, re-transform the electrolytic capacitor in the following method.

- Open the emergency stop signal and turn on the power. ("CHARGE" indicator does not light.)
- Close the emergency stop signal. ("CHARGE" indicator turns on.)
- In this state, keep energizing it for 30 minutes.
- Slightly rotate the motor axis once a week so that it may be lubricated well.

#### A guide line of parts replacement timing

Inverter and Converter comprise a lot of parts that make possible for Inverter and Converter to achieve full functionality only when they work correctly.

Some of them need to be replaced according to their operating status. These parts must be checked periodically and replaced depending on their service life to use Inverter and Converter without trouble for a long time.

Standard service life of them depends on installation environment and operating situation. Please refer to the replacement timing of each part in Inverter and Converter described in below table.

Parts	Replacement timing	Replacement method	
Cooling fan	2 to 3 years	Replace with new one.	
Smoothing capacitor	5 years	Replace with new one (after a check).	
Circuit breaker Relays	_	Determine after a check.	
Fuse	10 years	Replace with new one.	
Aluminum electrolytic capacitor on print circuit board	5 years	Replace with new one (after a check).	

Table 2.6 Replacement timing of the parts in Inverter and Converter

Above table is described supposing:

- Ambient temperature : 30 °C on average
- Load factor : 80 % or less
- Availability : 12 hours or less per day

# 2.4 Check of battery

Yaskawa Siemens CNC series may be used with backup batteries for

- SRAM in CNC unit,
- calendar in CNC unit,
- 24V power supply to CNC unit (Your machine may not have backup battery for 24V power supply to CNC.) and / or
- position value in absolute encoder.

The procedure of replacing each battery is described below.

#### 2.4.1 Battery for SRAM memory in CNC

#### Battery type

3V-lithium battery

• Order number: 6FC5247-0AA18-0AA0

#### Battery life

3 or 5 years, but it will change depending on operating status and environment.

#### Criteria of replacing battery

The 3V lithium battery to backup the SRAM is monitored in two stages:

Table 2.7	Monitored	Battery	Voltage
-----------	-----------	---------	---------

Battery voltage	Message
2.7 to 2.9 V	ALARM: "2100 NCK battery warning threshold reached"
2.4 to 2.6 V	ALARM: "2101 NCK battery alarm" ALARM: "2102 NCK battery alarm"

The alarm "2101 - NCK battery alarm" occurs when undervoltage of the battery is detected during cyclic operation.

The alarm "2102 - NCK battery alarm" occurs when undervoltage of battery is detected during boot.

#### Replacing battery

# ⚠ WARNING

· When carrying out maintenance work on this equipment, below warnings must be followed.

• Maintenance may only be performed by qualified personnel.

• The service intervals and the instructions for repair and replacement must be strictly followed.

When operating electrical devices, certain parts of these devices are inevitably under hazardous voltage. Failure to properly maintain the equipment can result in death, serious body injury or substantial material damage.

After alarm "2100 NCK - battery warning threshold reached" has occurred, contact your maintenance stuff and request to manage replacing battery.

#### 2.4.2 Battery for calendar function

#### Battery type

3.6V lithium battery

• Order number: W79084-E1003-B1

#### Battery life

5 years and over, but it will change depending on operating status and environment.

#### Criteria of replacing battery

The voltage drop of battery result in reset of the calendar for PC. No alarm occurs similarly to the case of general PC.

#### Replacing battery



• When carrying out maintenance work on this equipment, below warnings must be followed.

• Maintenance may only be performed by qualified personnel.

• The service intervals and the instructions for repair and replacement must be strictly followed.

When operating electrical devices, certain parts of these devices are inevitably under hazardous voltage. Failure to properly maintain the equipment can result in death, serious body injury or substantial material damage.

Contact your maintenance stuff if the calendar is reset.

INFO

### 2.4.3 Battery for 24V power supply to CNC unit

The battery for 24V power supply to CNC unit may not be used in your machine. Please see the document published by machine tool builder.

#### Battery type

24V sealed lead-acid battery (secondary battery)

```
Order number: 6EP1935-6MD31 (2.5Ah, 60°C max.)
6EP1935-6MD11 (3.2Ah, 40°C max.)
```

#### Battery life

The maintenance period should be scheduled on the basis of guide line of battery life indicated in the following table.

Table 2.8 Guide line of battery life	Table 2.8	Guide line of battery	life
--------------------------------------	-----------	-----------------------	------

Ambient temperature	20°C	40°C
6EP1935-6MD31	13 years	3 years
6EP1935-6MD11	4 years	2 years

Criteria of replacing battery

# 

• Shut down sequence for CNC software must be complete before turning off the power supply for control of CNC unit if Alarm LED light up on DC UPS module.

Otherwise buffered memory data could be lost or no system software could launch.

Uninterruptible power supply module (DC UPS module) check if battery module can supply electrical power sufficiently and make alarm (red) LED blink in front of DC UPS module when a defect of the battery module is detected.



- Alarm (red) LED in normal operation indicates no capability of power supply from battery module because of incorrect setting of DIP switch on DC UPS module, disconnection or reverse polar connection between DC UPS module and battery module or defective battery module.
- Alarm concerned with battery module may be announced by other way than LED using output signal from DC UPS module. Please refer to the document published by machine tool builder.

#### Replacing battery

# **▲** WARNING

- · When replacing battery module for UPS, following term must be taken in account.
  - Qualified personnel may only perform maintenance.
  - Before carrying out any maintenance and service work, the equipment must be disconnected from main power supply and the main power switch must be fixed on OFF position.
  - The service intervals and the instructions for repair and replacement must be strictly followed.
  - Fuse on new battery module must not be inserted into socket before completion of work.
  - Use battery module for UPS with same order number as the battery installed before replacement.

When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment. Failure to properly maintain the equipment can result in death, serious body injury or substantial material damage.

· Fuse on battery module must be removed before maintenance work.

Otherwise, death, serious body injury or substantial material damage could result.

Contact your maintenance stuff if the Alarm LED light up or blink on DC UPS module and request to manage replacing battery.

#### 2.4.4 Battery for absolute encoder

Backup battery is requested for the motor with absolute encoder in order to keep the position value also during power-off.



Necessity of backup battery for absolute encoder is determined by installed motor type. Please refer to the documents published by machine tool builder.

#### Battery type

3.6V lithium battery 2000mAh

Type: ER6VC3N

#### Battery life

Battery life may change depending on operating status. Therefore, typical value is described below.

Estimated life expectancy is 11.4 years a motor encoder under the conditions with 20 degree temperature and without control power supply. This life time is normally extended because battery hardly discharge during control power supply ON.

#### Criteria of replacing battery

If the voltage of the absolute encoder battery decreases to 2.7V or less, the Servo Unit issues a "Battery warning (A.93)" and following message is displayed on Operator panel of CNC.

"380500 Profibus-DP: fault on drive %1, code 147, value %3, time %4"

"%1" is substituted by an axis name.



- Estimated time for position data loss after warning is 2 weeks a motor encoder under the conditions with 20 degree temperature and without control power supply. But it may change depending on operating status.
- If position value is lost by battery exhaustion, Servo Unit issue "encoder backup alarm (A.81)" and CNC display
  - "380500 Profibus-DP: fault on drive %1, code 129, value %3, time %4"

on operator panel. Only reset for absolute encoder can remove above alarm. In this case, machine zero point must be referenced again after replacing battery. Please refer to the document published by machine tool builder.

#### Replacing battery

# A WARNING

· Only qualified personnel may perform replacing battery for absolute encoder.

Otherwise an electric shock, a malfunction, an injury or a damage of equipment could result.

• Before replacing the battery for absolute encoder, confirm that the main circuit power supply is switched off and the control power supply is switched on.

Position value in absolute encoder could be lost if work is executed with control power supply OFF.

# 

· Don't touch terminals on Converter or connector of battery.

Otherwise, electrical device could be destroyed by electrostatic discharge.

Backup battery for absolute encoder is equipped in Converter.

Replace the battery by following procedure.

- 1. Turn on control power supply and turn off main circuit power supply.
- 2. Take out 2-M4 screws for battery cover and remove battery cover.
- 3. Pull out battery connector (CN8).
- 4. Remove battery from the battery cover.
- 5. Mount new battery on the battery cover.
- 6. Insert battery connector of new battery. (CN8)
- 7. Mount the battery cover on Converter and fixed it by 2-M4 screws.



- Old type Converter may not have battery cover. In this case, remove option cover fixed by 2-M4 screws instead of battery cover in above procedure.
- "Battery warning" is automatically deselected after replacing battery.
- Machine zero point must be referenced again if position value in absolute encoder is lost. Please refer to the document published by machine tool builder.



# 2.5 Replacing fan of Drive Unit

The fan of Drive Unit is mounted on upside of unit.

The type of mounting fan is divided into two types as shown in the table below. The appearance of those types and the way of replacing fan can be referred in the following subsections.

Table 2.9 Type of mounting fan of Drive Unit

Unit type	Fan unit type	Fan cover type
Converter CIMR-MRXN2⊡5	-	All capacity (3P7, 5P5, 7P5, 011, 015, 018, 022, 030, 037, 045)
Inverter CIMR-MXN2⊡5	3.7kW, 5.5kW (3P7, 5P5)	7.5kW to 45kW (7P5, 011, 015, 018, 022, 030, 037, 045)
Servo Unit SGDK-⊡AEA	0.5kW to 5.0kW (05, 0505, 050505, 10, 1010, 101010, 15, 1515, 20, 2020, 30, 3030, 50)	6.0kW, 7.5kW (60, 75)

#### 2.5.1 Replacement timing

The fan of Drive Unit is consumable supply.

Replace the fan depending on "■ A guide line of parts replacement timing" in "2.2.2 Check of Servo Unit" and "2.3.4 Periodical check" or when the fan goes down.

### 2.5.2 Replacing in fan unit type

Replace the Drive Unit fans as follows:

- 1. Open the up-down cover.
- 2. Unscrew the screw that holds the fan unit. The screw will remain loosely attached to the panel cover.
- 3. Remove the fan unit.
- 4. Disengage the connector.
- 5. Remove the fan from its fan cover, and install a new one.





#### 2.5.3 Replacing in fan cover type

Replace the Drive Unit fans as follows:

- 1. Unscrew the screw that holds the fan cover.
- 2. Remove the fan.
- 3. Disengage the junction connector.\*
- 4. Replace the fan with a new one.



\* Inverter with 7.5kW and 11kW and Converter from 3.7kW to 11kW has no junction connector. The connector attached for fan is directly connected to fan connector located on point "A" of Drive Unit (see above figure).

# Diagnosis

This chapter explains the diagnosis method when an alarm or operation error occurs.

3.1 Diagnosis Operating Area	3-2
3.1.1 Alarms/ Messages	3-2
3.1.2 Alarm help	3-2
3.1.3 Sorting alarm overview	3-3
3.2 Errors without alarm display and troubleshooting	3-4
3.3 Important messages	3-7

# 3.1 Diagnosis Operating Area

#### 3.1.1 Alarms/ Messages

The overview of alarms or messages, which are currently issued, can be displayed by pressing [Alarms] (HSK1) or [Messages] (HSK2) soft key in Diagnosis Operating Area.

For further information about these screens, please refer to "Operating Manual for Machining Center" (NCSIE-SP02-25) or "SINUMERIK Operator's Guide HMI Advanced" (6FC5398-2AP10-0BA0).

#### 3.1.2 Alarm help

The help information about the alarm, that is currently displayed and selected, can be displayed by pressing "Information key"  $\boxed{\begin{matrix} i \\ Help \end{matrix}}$  in the alarm overview screen. The displayed information is the electrical documentation of "Diagnostics guide" (NCSI-ZZ02-03). The information shows meaning and remedy of the alarm.



The help information may not be prepared for some alarms, because they are supplemented by machine manufacture and not described in Diagnostics guide. For explanation of such alarms, please refer to the document published by machine tool builder or inquire machine tool builder.

#### 3.1.3 Sorting alarm overview

Complete alarms that are currently issued in the channel including alarms for each axis are displayed in alarm overview screen. Therefore, multiple alarms with same number are often issued at the same time.

In such case, pressing the vertical softkey [Sort] makes easier to take hold of the currently issued alarms because alarms with same number or same code number of drive alarm (380500) are gathered together and displayed on a line.





Sorting alarm overview screen may not be used in earlier software version.

# 3.2 Errors without alarm display and troubleshooting

The table below shows the causes and their remedies for the malfunctions accompanied with no alarm generation.

Before you check or take a remedy for what is described in the half-tone meshing column, you must turn off the power supply of Drive Unit.

Malfunction	Cause	Check point	Remedy
Motor does not start.	The power supply is not turned on.	Check the voltage between the main power supply terminals.	Turn on the main power supply.
		Check the voltage between the control power supply terminals.	Turn on the control power supply.
		Check the voltage between the main circuit power supply terminals.	Turn on the main circuit power supply.
	Connection is loose between Drive Unit	Check the looseness of connector.	Insert and fix the connector securely.
	and motor.	Check the wiring.	Correct the wiring or replace the cable.
	Poor connection of bus signal between	Check the looseness of connector.	Insert and fix the connector securely.
	Drive Units. (CN5)	Check the wiring.	Replace the cable.
	No "Servo enable" signal.	Check signal "DB3x.DBX93.7" on PLC status screen (see 5.2).	Contact maintenance stuff or machine tool builder to check the sequence of PLC.
	Spindle Motor winding is disconnected.	Measure the resistance between Spindle Motor terminals.	Replace Spindle Motor.
	The feed axis is overloaded.	Try the no-load running.	Reduce the load or consider replacement of new machine with larger capacity.
	Spindle Motor is fault. (Rotor and stator contact each other by fault of bearing.)	Separate Spindle Motor from load and check whether the shaft can be rotated by hand.	Replace Spindle Motor.
Spindle Motor rotates slowly or it is prevented from rotating by vibration.	The power line from Inverter is disconnected or connected incorrectly.	Check wiring between Inverter and motor.	Correct the wiring.
	The encoder wiring is disconnected, connect incorrectly or the encoder connector is pulled out.	Check the wiring of encoder signals.	Correct the wiring.
	Motor encoder is fault.	Turn the motor by hand and check whether unusual speed is displayed on speed meter.	Replace motor or encoder.

Table 3.1 Errors without alarm display

Malfunction	Cause	Check point	Remedy	
Spindle Motor does not rotate as specified	Motor rated speed is set incorrectly.	Check drive specific machine data MD6500.	Set MD correctly.	
speed.	Speed loop with P control.	Check signal "DB3x.DBX21.6" on PLC status screen (see 5.2).	Contact maintenance stuff or machine tool builder to check the sequence of PLC.	
The machine cannot be operated after sudden stop during operation.	Power supply is turned off.	Check power supply.	Turn on the power supply.	
Servomotor rotates unstably.	The connection to the motor is wrong.	Check the condition of connectors of the power cable (U-, V-, and W- phase) and encoder cable.	Correct the looseness and other malfunctions of terminals and connectors.	
Servomotor vibrates at the frequency around 200 to 400 Hz.	The speed loop gain is excessively high.		Decrease the setting value for MD3030 (speed loop gain).	
When the motor starts or stops, the speed overshoot is very large.	The speed loop gain is excessively high.		Decrease the setting value for MD3030 (speed loop gain). Decrease the setting value for MD3031 (integral time constant).	
Servomotor overheats.	The ambient temperature is excessively high.	Measure the temperature around the Servomotor.	Lower the ambient temperature to 40 degree or below.	
	The surface of Servomotor is dirty.	Visually check the surface.	Remove the dust and oil from the motor surface.	
	The Servomotor is overloaded.	Operate the Servomotor without load.	Reduce the load or consider replacement of new machine with larger capacity.	
Spindle Motor generates unusual	Power line from Inverter is disconnected.	Check wiring between Inverter and motor.	Correct the wiring.	
noise or vibration.	Motor has imbalance.	Check imbalance of rotor.	Replace the motor.	

Table 3.1 Errors without alarm display (cont'd)

Malfunction	Cause	Check point	Remedy	
Spindle Motor and Servomotor generates unusual noise or	The earth ground of Motor or Drive Units is wrong.	Check connection to ground for motor and Drive Unit.	Ground securely.	
vibration.	The encoder cable affected by noise.	<ul> <li>Check separation of encoder signal and power line.</li> <li>Check grounding shield of encoder cable.</li> </ul>	Arrange the encoder cable suitably.	
		Check if twisted pair cable with shield is used for encoder wiring.	Replace cable.	
	Drive machine data have wrong value.	Compare current value of drive machine data with setting list.	Correct drive machine data.	
	The motor is not mounted securely.	Check looseness of mounting.	Retighten the fixing screw.	
	There is something abnormal on the bearing or rotor.	Check the noise and vibration around the bearing during independent operation of the motor.	Replace the motor.	
	Coupling or centering between machine and motor is not precise.	Check misalignment and imbalance of coupling.	Adjust the alignment or balance of coupling.	
	Machine has source of vibration or insufficient strength.	Check the movable part of machine for any foreign matters, damage, deformation and/or source of vibration.	Contact maintenance stuff or machine tool builder.	
	Foundation bolts is loosened.	Check the looseness of foundation bolts.	Retighten the foundation bolts.	

Table 3.1 Errors without alarm display (cont'd)

# 3.3 Important messages

Warning message may be displayed as shown below if fatal error is detected or acknowledge is requested at replacement of whole memory data.

-SINU	MERIK 840Di NCK/PLC	X
	Alarm: Old backup of user data loaded into MC The user data were saved on 07.07.2000 10:30	I card. )



The indications such as title bar, illustration of warning ( $\triangle$ ) or warning message depends on notification.

The most of these messages are only indicated at set-up by machine tool builder or maintenance by our service group. Although, in case of indication of these message during usual operation, please leave message and contact our service.

In following pages, meaning and remedy are described as a table in each message.

Message	Alarm: Power-Fail detected, NCK/PLC restart with OK.
Meaning	<ul> <li>When CNC system detects that the voltage of 24V power supply to CNC unit is dropped for 5 ms, following response is automatically produced.</li> <li>turn off backlight LCD of operator panel</li> <li>shut down NCK/PLC</li> <li>store NCK/PLC data into SRAM on MCI (PLC) board</li> <li>If 24V power supply is restored before above procedure is done completely, then this message is displayed.</li> </ul>
Remedy	Press INPUT key. Then turn off and on power supply. It is assumed to be due to temporary power failure or damage of power supply unit. If the cause is not specified, please contact our service.

Message	Note: User Data Loaded into MCI card.
Meaning	This message is indicated at first power on after replacement of MCI board (should be done by our service). It may be displayed at first power on after extracting of Ghost data on rare occasions.
Remedy	In case of indication of this message during usual operation, please leave message being indicated and contact our service.

TERMS

MCI board: MCI board is installed in CNC unit. SRAM and PLC are equipped on this board.

Ghost data: Ghost data comprises the data into which whole data on hard disk drive is compressed and backed up collectively.

Message	Alarm: Old backup of user data loaded into MCI card. The user data were saved on 07.07.2000 10:30.
Meaning	This message may be indicated at first power on after replacement of MCI board (should be done our service). It may be displayed at first power on after extracting of Ghost data on rare occasions.
Remedy	In case of indication of this message during usual operation, please leave message being indicated and contact our service.
Message	Note: User data from MCI card used.
Meaning	This message is indicated at first power on after replacement of CNC unit with MCI board used before replacement or after update of CNC software (both works should be done our service). It may be displayed at first power on after extracting of Ghost data on rare occasions.
Remedy	In case of indication of this message during usual operation, please leave message being indicated and contact our service.
Message	<ul><li>New MCI card detected. Valid user data are found:</li><li>on MCI card</li><li>on harddisk</li></ul>
	If you want to use the user data from MCI card, press "Yes" If you want to use the user data from the hard disk, press "No"
Meaning	This message may be indicated at first power on after replacement of CNC unit or MCI board (should be done by our service).
Remedy	In case of indication of this message during usual operation, please leave message being indicated and contact our service.
Message	Alarm: NCK started while Power Failure, shutdown with OK
Meaning	When DC UPS module is used for power supply, NCK/PLC data are stored and shut down sequence is carried out after AC power supply turn off. These procedures are continued even if AC power supply is restored before the completion of these procedures. If AC power supply is turn off and on furthermore, this message is indicated
Remedy	It is assumed to be due to operation error or malfunction of power supply module/ DC UPS module. If the cause is not specified, please contact our service.
Message	Alarm: System order executed.
Meaning	This message is indicated after reset NCK/PLC memory by extra-operation for maintenance.
Remedy	In case of indication of this message during usual operation, please leave message being indicated and contact our service.

Message	HMI-embedded-WIN32 Exception Handler (in title bar)				
	Sorry, but HMI-embedded-WIN32 has caused an exception in task 27				
	Function at 00411eb6 with code 00083.				
	Exception has occurred at CS=1b; EIP=0040 C41bEAX=0114f4b4				
	EAX=01100040 ECX=0114f57C EDX=000000b8				
	EDI=0110002c ESI=15133C01 FLAGS=00010202				
	ESP=00638e3c EBP=01638e68 SS=0023				
	DS=0023 ES=0023 FS=0038 GS=0000				
	• • • • • • • • • • • • • • •				
	Save Dump OK				
Meaning	This message is indicated when system detects that HMI, PLC or others does not run up. Generally this is indicated during operation of setting up machine such as debugging PLC sequence or initial setting/adjusting of machine data.				
Remedy	In case of indication of this message during usual operation, please leave message being indicated and contact our service.				

# 4

# Backup of Data

CNC contains data and programs required for processing, such as tool information and part programs, and memory for storing programs and data required for system operation.

Some of the data written to the memory changes with processing and procedures. By taking a backup of such data, you can use the machine tool with relief. Otherwise, you may not restore data. It is recommended that you take a backup daily.

This chapter explains the types of data and the backup procedure.

4.1 Data backup procedure	4-2
4.1.1 Data in/Data out/Manage data	4-2
4.1.2 Series startup	4-2
4.2 Data type	4-3

### 4.1 Data backup procedure

Yaskawa Siemens CNC series has Data in/out screens. Various data of CNC can be backed up on these screens.

This page describes the outline of these screen. For further operation of these screens, please refer to "Operating Manual for Machining Center" (NCSIE-SP02-25) or "SINUMERIK Operator's Guide HMI Advanced" (6FC5398-2AP10-0BA0).

#### 4.1.1 Data in/Data out/Manage data

CNC data are displayed in form of folder tree in each screen of [Data in], [Data out] and [Manage data] under data in/out screen.

Various data can be saved into the file with binary or punch tape format in [Data out] screen. In addition to HDD of CNC, external storage device connected with RS-232C port, PC card/ Floppy disk and/or PC connected via network can be specified as target, if those are installed. Saved data can be restored in [Data in] screen.

Desired data can be copied on folder tree in [Manage data] screen. In addition to HDD of CNC, PC card/Floppy disk and/or PC connected via network can be specified as target, if those are installed.

#### 4.1.2 Series startup

The data, displayed in [Data in], [Data out] and [Manage data] screens, are actually stored in memory or HDD of CNC. [Series startup] screen can be used to save collectively the stored data in each actually stored area in the form of binary format.

In [Series startup] screen, "NC" data specify the memory data and "HMI" data specify the HDD data. "PLC" data, "Loadable compile cycle" data and others can be specified in addition to "NC" data and "HMI" data. It is benefit for operator that one more data can be specified simultaneously.

The data, that can be unload from CNC memory, are stored on the memory after load and they are stored on HDD after unload. The stored area must be taken into account at making series startup file.

# 4.2 Data type

		General user			
Display name	Stored area	End user	MTB*	Our company	Contents
NC active data	CNC memory	Х	х	х	Various data stored in CNC memory. (See table 4.2 "Main NC active data" for sub-folder structure.)
Workpieces	HDD/ CNC memory	х			Program and associated data for machining particular work.
Part programs	HDD/ CNC memory	Х			Main part program is stored here. Generally this is not used in the system for machining center.
Subprograms	HDD/ CNC memory	Х			Subprogram is stored here. Generally this is not used in the system for machining center.
User cycles	HDD/ CNC memory	Х			Cycle program generated by end user. Usually, they are loaded into CNC memory.
manufacturer cycles	HDD/ CNC memory		Х		Cycle program generated by machine tool builder. Usually, they are loaded into CNC memory.
Standard cycles	HDD/ CNC memory			Х	Cycle program supplied by our company. Usually, they are loaded into CNC memory.
Definitions	HDD/ CNC memory		UGUD UMAC	MGUD GUD5-7 MMAC SMAC	Global user data (GUD) and Macro data (MAC) are stored here.
Archives	HDD	Х	Х		The backup data saved by [Archive] soft key is stored here.
Diagnostics	HDD	Х	(x)		User settings for display of machine data/PLC status or log files are stored here.

Main folders of data folders displayed in [Manage data] screen are listed in the following table.

\* MTB stands for machine tool builder.

Various data stored in CNC memory is shown as NC active data in form of folder tree. General user depends on kind of the data. Main data are described in the following table.

Table 4.2 Iviain NC active data
---------------------------------

		General	user	Contents
Display name	End user	MTB*	Our company	
Work offsets	х			Offset data in work coordinate system.
R variable	х			Arithmetic variables used in part program.
Tool offsets	Х			Tool length, tool radius and other tool specific configuration data.
Setting data	х	Х		Setting data from number 40000 to 49999.
Machine data		Х		
Option data			Х	

\* MTB stands for machine tool builder.

# Monitoring

This chapter explains how to monitor the system operating status.

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5.1.1 Monitor cable	5-2
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# 5.1 Monitor of Drive Unit

You can monitor various signals by using analog voltage.

#### 5.1.1 Monitor cable

To monitor analog monitor signals, use a dedicated monitor cable (DE9404559) connected to the CN6 (or CN16/CN26/CN36) of Servo Unit and Inverter as shown below.



Example : SGDK-50AEA

Table 5.1 Pin location

Pin No.	Cable color	Signal name
2	White	Analog monitor 1
1	Red	Analog monitor 2
3, 4	Black (2 pcs)	GND (0 V)



Dedicated monitor cable

### 5.1.2 Data selection of Servo Unit

MD3003 can be used to specify the monitoring data of Servo Unit that is output as analog signal.

Table 5.2	Configuration	of MD3003
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MD n	umber	Meaning	Default
MD3003	1st digit	Data selection for 1st analog monitor	2
	2nd digit	Magnification for 1st analog monitor	0
	3rd digit	Data selection for 2nd analog monitor	0
	4th digit	Magnification for 2nd analog monitor	0

Meanings for specific setting values in each digit are described below.

Monitor data can be set as follows:

Setting for 1st/3rd	Meaning		
digit of MD3003	Monitor signal	Observation gain	
0	Motor speed <sup>*1</sup>	1V/1000 min <sup>-1</sup>	
1	Speed setpoint <sup>*1</sup>	1V/1000 min <sup>-1</sup>	
2	Torque setpoint <sup>*2</sup>	1V/100% Rated torque	
3	Position deviation <sup>*3</sup>	0.05V/input increment	
4	Position amplitude deviation <sup>*3</sup> (Position control compensator deviation)	0.05V/input increment	
5	Position command speed [min <sup>-1</sup> conversion] <sup>*1</sup>	1V/1000 min <sup>-1</sup>	
6	Observer speed <sup>*1</sup>	1V/1000 min <sup>-1</sup>	
7	Deviation between direct and motor encoder <sup>*4</sup>	0.01V/input increment	
8	Quadrant error compensation	1V/100%	
9	Speed feed forward <sup>*1</sup>	1V/100 min <sup>-1</sup>	
А	Torque feed forward	1V/100%	
В	Reserved	-	
С	Reserved	-	
D	Estimated disturbance torque <sup>*2</sup>	1V/100%	
E	Vibration-damping monitor*1	1V/125 min <sup>-1</sup>	
F	Reserved	_	

Table 5.3 MD3003 Monitor Data Selection

\* 1. The voltage is increased 10 times if DD motor is used.

- \* 2. Torque reference after gravity compensation (Pn411)
- \* 3. In the case of speed control, the monitor signal for position deviation is indefinite.
- \* 4. Gap (0.01V/pulse) is output if Drive Clearance Control is active.

Monitor magnification can be set as follows:

Table 5.4 Monitor magnification

Settings for 2nd/4th digit of MD3003	Meaning
0	Monitor magnification: 1
1	Monitor magnification: 10
2	Monitor magnification: 100
3	Monitor magnification: 1/10
4	Monitor magnification: 1/100



Analog monitor output voltage is  $\pm$  10 V max. MD3003 must be set so that maximum voltage is not exceeded.

#### 5.1.3 Data selection of Inverter

Following machine data can be used to specify the monitoring data of Inverter that is output as analog signal.

MD number	Meaning	Default	Min.	Max.	Unit
MD6472	Data selection for 1st analog monitor	0	0	65535	Ι
MD6473	Gain for 1st analog monitor	1.00	0.00	10.00	Ι
MD6474	Offset for 1st analog monitor	0.00	-1.00	1.00	V
MD6475	Data selection for 2nd analog monitor	1	0	65535	Ι
MD6476	Gain for 2nd analog monitor	1.00	0.00	10.00	Ι
MD6477	Offset for 2nd analog monitor	0.00	-1.00	1.00	V

Table 5.5 Machine data for analog monitor of Inverter

Desired monitor data can be specified by the setting below.

Table 5.6 Setting of MD6472, MD6475

Setting value	Monitor data	Unit
0	Motor speed	5V/Max. speed
1	Torque setpoint (reference to peak torque of motor)	6V/100%
2	Zero speed monitoring (sp_ZSPD)	-
3	Speed agree (sp_AGR)	-
4	Speed detection (sp_SDET)	-
5	Torque detection (sp_TDET)	-
6	In torque limitation (sp_TLE)	-
9	Winding switchover completion (sp_CHWEND)	-
10	Fault signal (sp_FLTSIG)	-
11	Warning signal (sp_TALM)	-
12	C-axis changeover (sp_CAXCMP)	-
13	0 V (for adjusting monitor output)	-
14	+ 10 V (for adjusting monitor output)	-
15	- 10 V (for adjusting monitor output)	-
16	Power monitor *	5kW/V
20	Speed setpoint	5V/rated speed (MD6500)

\* Meaningful only if MD6490 bit 0 = 1 is set.

# 5.2 Interface signal monitoring

Digital signals, bit memories, data blocks, timers or counters programmed in logic sequence can be monitored by pressing [PLC status] soft key in Maintenance operating area (for machining center system) or Diagnostic operating area (for turning/laser system).

For further information of this screen, please refer to "Operating Manual for Machining Center" (NCSIE-SP02-25) or "SINUMERIK Operator's Guide HMI Advanced" (6FC5398-2AP10-0BA0).

#### Yaskawa Siemens CNC Series

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