Safety manual for those who install and set-up the tapping center

Tapping Center
TC-S2A

Please read this safety manual carefully before operating the tapping centre.

Brother Industries, Ltd. Machinery & Solution Company.

Contents

Outline of the safety manual ---------- 3
Read this manual ---------- 3
Purpose ---------- 3
Contents of Safety Manual and
Relationship with Other Manuals ---------- 3
Relationship to safety labels ---------- 4
Language ---------- 4
Purchasing ---------- 4
Handling the safety manual ---------- 5
Degree of danger ---------- 5
Explanation order ---------- 5
Meaning of symbols ---------- 6

Section Names ---------- 8

Warnings and preventive measures ---------- 10

Description of safety label ---------- 19

©1999-2007 BROTHER INDUSTRIES, LTD. Machinery & Solution Company
All Rights Reserved.
Printed in Japan.

Outline of the safety manual

Read this manual

All people who use the tapping center, including those who install the tapping center at the factory, who process materials by operating the tapping center, who adjust and repair the tapping center, are requested to read this safety manual.
In this safety manual, all people who use the tapping center are expressed as the user.

Purpose

The tapping centre consists of high voltage electric circuits, tools which rotate at high speed, and tables and ATC magazines which move with powerful force. Therefore, various hazards are associated with the machine.
The purpose of this safety manual is to protect users from these hazards.
Therefore, the safety manual explains the following:
Warnings: types of hazards
Preventive measures: ways to prevent any hazards from occurring

Contents of Safety Manual and Relationship with Other Manuals

Each instruction manual, other than the programming manual, includes a safety manual.
Safety manuals are given to each respective personnel group.
Please read the main text of the instruction manual for machine functions and operation methods.

1.Operation manual for general operators
"Safety Manual for Operator"
"Safety manual for those who install ant set-up the tapping center"
"Operation manual :
Operation of the machine necessary for basic operations"
English part code : 693075001

2.Operation manual for advanced personnel
"Safety Manual for Operator"
"Safety manual for those who install ant set-up the tapping center"
"DOOR INTERLOCK FUNCTION"
"Operation manual:
Operation of the machine necessary for set-up and machining"

Conversational programming machine		NC language programming machine	
Japanese part code	: 693312001	Japanese part code	: 693310001
English part code	: 693307001	English part code	: 693305001

3.Installation manual "Safety manual for those who install and set-up the tapping center"
"Installation manual:
Installation and assembly of the machine and its options"

Japanese part code : 693311001
English part code : 693306001

4.Programming manual "Programming manual: Creating machine programs"

Conversational programming machine		NC language programming machine	
Japanese part code	: 693314001	Japanese part code	: 693313001
English part code	: 693309001	English part code	: 693308001

5.Maintenance manual "Safety manual for those who qualified for tapping center maintenance attached to the maintenance manual."
"Maintenance manual: Adjustment and repair of the machine"
The maintenance manual is not distributed to customers.

Relationship to safety labels

Items of particular importance that appear in this safety manual are also attached to the machine as safety labels.
An explanation of the safety labels is provided at the end of this safety manual. If any safety labels have peeled off the machine, obtain new safety labels and attach them correctly.

Language

Machines shipped domestically within Japan are provided with safety manuals and safety labels written in Japanese. Machines shipped abroad from Japan are provided with safety manuals and safety labels written in four languages: English, German, French, and Chinese.
For manuals and labels in other languages, consult the dealer from which you purchased the machine.

Purchasing

When the safety manuals or safety labels have been lost, obtain these items from the dealer you have purchased the machine from.
If you do not know of a dealer, consult the offices specified below.

1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD. Machinery & Solution Company,
phone +81-52-824-2232
fax +81-52-811-0469

Handling the safety manual

Be careful not to lose the safety manuals, and keep them handy at all times.
Also, when the machine changes hands, pass the manuals to the new owner together with the machine.

Degree of danger

The degree of danger is classified into three categories depending upon the level of damage that may occur when instructions are not observed.

1. DANGER

DANGER

Damage which may result in death or severe injury to persons.

2. WARNING

WARNING

Damage which may lead to a serious injury.

3. CAUTION

CAUTION

Damage less serious than that above.

Explanation order

The safety instructions are explained in the following order:

1. Signal words (DANGER, WARNING, CAUTION) and symbols indicating the degree of danger
2. Type of danger (Subject)
3. Type of predicted damages
4. Preventive measure

Meaning of symbols

Symbols are used on the safety labels and in the warnings in the safety manual to intuitively explain possible dangers.

1. Hazard

Slippery

Moving parts

Stumble

Caught

Electric shock

Electric shock

High temperature

High temperature

Hand pinched

Cut

Cut

Shart point

Burst

Falling object

Falling object

Fall

Rotating object

Splash

Splash

Fire

2. Preventive measures

Protect ears.

Protect hands.

Protect feet.

Remove power plug.

Connect grounding cable

Protect head.

Do not touch.

Do not disassemble.

Protect eyes.

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

Warnings and preventive measures

The numbers in ( ) such as 1, 2 correspond to the names of each part.

Danger **DANGER**

SD1 Various hazards are associated with the tapping center.
SD1-1 Read the safety manual before operating the machine to understand these hazards and preventive measures.
SD1-2 All users must know the position of the emergency stop switch (18) and its operation.

SD2 High voltage parts are present in the control box (1). Touching such parts by mistake may result in serious injury or death.
SD2-1 Only operators qualified for electrical work and familiar with the electric circuits of this machine are allowed to maintain and inspect the electrical components.
SD2-2 Turn off the main power breaker (21) before operation. Put up a signboard which says 'Under maintenance.'
SD2-3 When leaving the machine, close the control box door and bolt it.

SD3 You may be caught in the machine during machining, resulting in a serious injury.
SD3-1 Do not enter within the splash guard (2) during operation.
SD3-2 Press the stop switch (3) or the reset key. Visually check that the stop lamp (4) is lit and then you can put your hands, feet, and body into the machine.
SD3-3 Visually check that nobody is inside the splash guard before starting machine operation.
SD3-4 Keep your hands, feet, and body away from moving parts during operation.
SD3-5 When you have to enter the machine, turn off the main power breaker and padlock it so that the main power breaker (21) cannot be turned on.

SD4 When the door interlock switch (5) is invalid, the machine moves even when the work door (6) is open. You may cut yourself on a rotating tool (15) or be caught in the machine.
SD4-1 During machine maintainance, pay extreme attention to the machine motion so that you can stop the machine whenever required. After finishing maintenance and set-up, return the door interlock switch to valid. Pull out the door interlock key (7) for storage.
SD4-2 Do not leave the machine with the door interlock switch invalid.

SD5 When the door interlock switch (5) is invalid, the table (19) can move even when the work door (5) is open. You may be caught by the table, resulting in injury.
SD5-1 During machine set-up, pay extremely attention to the machine motion so that you can stop the machine whenever required. When you have finished machine set-up, set the door interlock switch to the ON position. Remove the door interlock key (7) that the supervisor must then always keep.

Warning **WARNING**

SW1 Touching rotating tools (15) results in injury.
SW1-1 Keep away from rotating tools.

SW2 You may be injured due to broken tools (15) or parts flung out.
SW2-1 Close the work door (6), and start machine operation.

SW3 You may be caught in the rotating part, resulting in an injury.
SW3-1 Keep away from rotating tools (15) , the spindle (8), and the ATC magazine (9).
SW3-2 Wear snug-fitting clothes. Put long hair up in cap. Do not wear gloves except for set-up operations carried out with the machine stopped. Do not wear any accessories. Do not hold the rotating part.

SW4 If the safety device is modified, its function may be altered, thus you may be caught in the machine, hit your body against the machine, or get an electric shock.
SW4-1 Do not modify safety devices. Do not alter the safety device in such a way that it does not function.

SW5 When chips scatter and get into the eyes, you may damage your eyeballs and lose your eyesight.
SW5-1 Wear safety goggles against the chips.
SW5-2 Do not blow the chips by air.

SW6 If you touch chips with bare hands, you may have your hand cut or burnt.
SW6-1 Do not touch chips with bare hands. Do not touch sharp edges of workpieces.
SW6-2 Wear gloves and use a brush to remove chips.
SW6-3 Clean cutting chips when machine is stopped.

SW7 If you grip the tool (15) blade, you may cut your hand.
SW7-1 Do not touch the edge of the tool. Always hold the shank of the tool holder (16).

SW8 Dropping a heavy object onto your foot may fracture your foot bones.
SW8-1 When lifting heavy objects, wear safety shoes.

SW9 Lifting heavy objects may cause a hernia of vertebral disk.
SW9-1 When lifting heavy objects, ask for help.
SW9-2 Lift object with the strength of your legs instead of your back.

SW10 Hearing ability is reduced when ears are exposed to excessive noise for a long period of time.
SW10-1 Use protection such as earplugs when working in a noisy environment.

SW11 You may hurt your eyes due to high pressure air bursts.
SW11-1 People other than those qualified for high pressure air handling and who understand the piping of this machine are not allowed to install or change the high pressure air piping.
SW11-2 To repair the high pressure air hose, disconnect the pressure source and release remaining pressure first. Put up a signboard which says “Under maintenance.”

SW12 You may hit your head when standing up.
SW12-1 Wear a helmet when working in and around the machine.

SW13 When the machine is operated while any tools are left in the machine, the tools may scatter and you may be injured.
SW13-1 Do not leave hand tools in the machine.

SW14 You may have your hand caught in the work door (6) if you are opening and closing while holding parts other than the handle (10).

SW14-1 Hold the handle when opening and closing the outer door.

SW15 High temperature parts are present in the control box(1). Therefore, if papers protrude from the control box document holder (11), these papers may catch fire.

SW15-1 Do not put papers larger than A4 or letter size in the control box document case.

SW16 If tools are placed on the control box (1) or the machine, these may fall down due to vibration.

SW16-1 Do not place any objects on the control box and the machine.

SW17 You may fall down and be injured when climbing on the machine or the coolant tank (22).

SW17-1 Do not climb on the machine or the coolant tank.

SW18 When putting your hand under the leveling bolts (12), you may have your hand caught, resulting in an injury.

SW18-1 Do not put your hands under the leveling bolt. Use tools to adjust the level.

SW19 When the cable is hanging down or is not covered, you may stumble or slip and fall.

SW19-1 Remove any slack in the cable. Cover the cable when placing the cable on the floor.

SW20 Remodeling the machine may affect the safety device, rendering all given warnings invalid.

SW20-1 Do not modify the machine. When modification is required, contact Brother Industries, Ltd. beforehand and ask for permission in writing.

SW21 You may have your eyes hurt if coolant splashes into your eyes.
SW21-1 When adjusting the coolant nozzle (13), wear safety goggles.
SW21-2 When coolant has splashed into your eyes, wash your eyes with clean water, and see a doctor.

SW22 If you put your finger in the clearance of the machine, you may have your finger caught, resulting in an injury.
SW22-1 Do not put fingers between grip cover (14).
SW22-2 Do not put the finger in the clearance between the tool (15) or the tool holder (16) and the ATC magazine.

SW23 When coolant, oil, or chips are scattered, you may slip and fall down, or hit yourself against something, resulting in an injury.
SW23-1 Turn off the power of the machine, clean inside and the surroundings of the machine, and then start operation.
SW23-2 Wear a helmet and safety shoes during machine installation.

SW24 When attaching and detaching tool holder (16), you may cut your hand on the edge of a tool (15) or hit your hand against the machine.
SW24-1 Do not hold the edge of the tool. Wear leather gloves. Hold the tool holder with both hands.

SW25 The machine may suddenly move or tools may fall down.
SW25-1 When the stop lamp (4) is not lit, do not put your hands, feet, and body under the spindle head (17).
SW25-2 Draw the pallet toward the operator to set-up the pallet changer.
SW25-3 Turn off the main power breaker (21), padlock the main power breaker so that it cannot be turned on, and apply grease.

SW26 When machining workpiece using an oil type coolant, the machined part may heat up and catch fire.
SW26-1 When using an oil type coolant, install a fire alarm and an automatic fire extinguisher.
SW26-2 When machining the workpiece, an operator must attend the machine.

SW27 If you lean on the machine, you may be caught or hit yourself against the machine when the machine moves, resulting in an injury.
SW27-1 Do not lean on the machine.

SW28 When objects are hung on the emergency stop switch (18), the emergency stop switch may not be pressed.
SW28-1 Do not hang any objects on the emergency stop switch.

SW30 Because the coolant tank (22) is heavy, you may suffer from a herniated vertebral disk or drop the tank on your feet when lifting the tank.
SW30-1 Do not lift the coolant tank even when removing chips.

SW31 When entering the machine, you may slip and fall down or be caught in the machine.
SW31-1 When entering the machine, be sure to cut the main power breaker (21), padlock the breaker so that the breaker is not turned on, and remove any coolant and chips. Also, wear safety shoes and a helmet. Put up a signboard which says “Under maintenance” near the machine.

SW32 If the splash guard (2) side cover (23) is not attached, you may be caught in the machine or injured due to broken tools.
SW32-1 Visually check that the side cover is attached before turning on the power.

SW33 Tools (15) or tool holder (16) whose weight and size exceed the specified limit may spring out while being used.
SW33-1 Use tools holder whose weight and size are within the specified limit.
SW33-2 For the limit of the tools, see the tool label attached on the machine or the operation manual.

SW34 If you touch the regenerative resistor, you may be burned because the regenerative resistor is heated during operation.
SW34-1 Do not remove the regenerative resistor cover (24).

SW35 If you touch the motor, you may be burned because the motor is heated during operation.
SW35-1 Do not touch the motor for 30 minutes after operation is finished.

SW36 If an incorrect fuse is set, a fire may break out because the protective device does not function.
SW36-1 Replace with the same rating fuse.

SW37 If the setting of thermal relay is changed, a fire may break out because the protective device does not function.
SW37-1 Do not change the setting of the thermal relay.

SW38 If the ATC magazine (9) rotates, tools (15) may hit machined workpieces, jigs, or the machine, and may be broken.
SW38-1 Set the tool length so that the tools do not contact machined workpieces, jigs, or the machine even if the ATC magazine rotates.

SW39 If the control box (1) or the operation panel (25) are wet, you may get an electric shock.
SW39-1 Do not sprinkle coolant, water, or chips on the control box and the operation panel.
SW39-2 Do not touch the control box with wet hands.

SW40 When the power PE line wired from outside is too short, the PE line may come off when the cable is pulled and you may get an electric shock.
SW40-1 Make the power PE line longer than other lines (L1, L2, L3) allowing some slack.

SW41 If the power is turned on or workpieces are machined in an explosive atmosphere, an explosion may occur due to a spark from the machine.
SW41-1 Do not carry out maintenance in an explosive atmosphere.
SW41-2 Do not turn on the power of the machine, or carry out machining or set-up in an explosive atmosphere.

SW42 If you forget to mount the splash guard side cover (23), you may get caught in the machine, resulting in injury.
SW42-1 Before turning on the power, visually check that the splash guard side cover is mounted.

SW44 Cutting chips may catch fire or explode depending on the workpiece material (e.x. Magnesium).
SW44-1 Remove any cutting chips immediately.
SW44-2 Install a fire extinguisher near the machine when machining a workpiece made of such material, and never perform unmanned operation.

SW45 The milliing inserts may come off the tool, resulting in serious injury.
SW45-1 Check that the milling inserts is secured before mounting the tool to the machine.

SW46 Fire may occur when a 3-wire sensor that includes an exclusive power line is used.
SW46-1 Use a 2-wire sensor, instead of a 3-wire sensor.
SW46-2 If it is not possible to avoid using 3-wire sensors, add a fuse (1 A or less) to the power line of each sensor.

SW47 If the terminal block screws are loose after wiring, heat may be generated due to faulty contact, causing a fire.
SW47-1 Make sure that there are no loose screws after wiring.

SW48 When the plant is poorly illuminated, inside the machine is dark and you may injure your hands on jigs or cutters.
SW48-1 Install a machine light when the illumination inside the machine is 500 lux or below.

Description of safety label

Particularly important descriptions in the safety manual are printed on a safety label, and the label is attached to the machine. Carefully read and understand the descriptions on the label before operating the machine.

The safety labels are attached to the positions shown in the illustration below. Check that the labels are not damaged. If damaged, obtain a new label for replacement.

Position of safety label

230S00C02.doc

S2A00401.ai

1. Safety label , front and side

(1) Language: English, Japanese, Chinese

Part Code : 690373001
Part Name : PS LABEL,TC FRONT JCE

(2) Language: English, German, French

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

Diese Maschine birgt Gefahren.
Um Risiken zu erkennen und vermeiden, vor dem Einschalten die Betriebsanleitung lesen.

L'utilisation de cette machine comporte des risques.
Lisez les manuels d'instruction pour connaître les risques et les éviter avant d'utiliser cette machine.

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
GEFAHR	**WARNUNG**	**WARNUNG**
Maschine in Betrieb kann plötzlich laufen und Sie stoßen. Beim Betrieb der Maschine von allen bewegenden Teilen sich fernhalten, um Verletzungen zu vermeiden.	Gebrochene Werkzeuge oder Werkstücke könnten Sie treffen und verletzen. Vor dem Start der Maschine Tür schließen.	Umlaufende Teile könnten Sie fassen und verletzen. Von umlaufendem Werkzeug, Spindel und Magazin sich fernhalten. Rotierende Teile nicht berühren. Während des Bedienens keine Handschuhe tragen.
DANGER	**AVERTISSEMENT**	**AVERTISSEMENT**
En opération, cette machine bougera soudainement et provoquera des risques d'écrasement. Ne vous approchez jamais des parties mobiles.	Les outils cassés ou les pièces usinées peuvent être projetés et risquent de vous frapper et de vous blesser. Fermez la porte avant de faire démarrer la machine.	Les parties tournantes peuvent vous accrocher et vous blesser. Ne vous approchez jamais des outils tournant, de la broche et du magasin. Ne saisissez jamais les parties en mouvement. Ne portez pas de gants pendant l'utilisation.

691042001 / 0302 (2)

Part Code : 691042001
Part Name : PS LABEL,TC FRONT EGF

2. Tool label

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

Part Code : 653379001
Part Name : Tool LABEL250

3. Safety label, rear and High pressure coolant equipment

(1) Language: English, Japanese, Chinese

Part Code : 690730001
Part Name : PSLABEL, TC REARJCE

(2) Language: English, German, French

Part Code : 691045001
Part Name : PSLABEL, TC REAR EGF

4. Label, regenerative resistor

(1) Language: English, Japanese, Chinese

Part Code: 690729001
Part Name: LABEL, TC REGENERATIVE JCE

(2) Language: English, German, French

Part Code: 691058001
Part Name: LABEL, TC REGENERATIVE EGF

5. Label, removing tool

(1) Language: English, Japanese, Chinese

Part Code : 653080001
Part Name : LABEL, Removing Tool JCE

(2) Language: English, German, French

Part Code : 69104001
Part Name : LABEL, Removing Tool EGF

6. Label, side cover

(1) Language: English, Japanese, Chinese

Part Code : 690731001
Part Name : LABEL, TC MAINTENANCE DOOR JCE

(2) Language: English, German, French

Part Code : 690732001
Part Name : LABEL, TC MAINTENANCE DOOR EGF

7. “Keep Off” label 40

Part code : 693178001

693178001 / 0607 (1)

693178001.ai

Safety Manual for Operator

Tapping Center
TC-S2A

Please read this safety manual carefully before operating the tapping center.

Brother Industries, Ltd. Machinery & Solution Company.

Contents

Outline of the safety manual ---------- 3
Read this manual ---------- 3
Purpose ---------- 3
Contents of Safety Manual and
Relationship with Other Manuals ---------- 3
Relationship to safety labels ---------- 4
Language ---------- 4
Purchasing ---------- 4
Handling the safety manual ---------- 5
Degree of danger ---------- 5
Explanation order ---------- 5
Meaning of symbols ---------- 6

Section Names ---------- 8

Warnings and preventive measures ---------- 10

Description of safety label ---------- 18

©1999-2007 BROTHER INDUSTRIES, LTD. Machinery & Solution Company
All Rights Reserved.
Printed in Japan.

Outline of the safety manual

Read this manual

All people who use the tapping center, including those who install the tapping center at the factory, who process materials by operating the tapping center, who adjust and repair the tapping center, are requested to read this safety manual.
In this safety manual, all people who use the tapping center are expressed as the user.

Purpose

The tapping centre consists of high voltage electric circuits, tools which rotate at high speed, and tables and ATC magazines which move with powerful force. Therefore, various hazards are associated with the machine.
The purpose of this safety manual is to protect users from these hazards.
Therefore, the safety manual explains the following:
Warnings: types of hazards
Preventive measures: ways to prevent any hazards from occurring

Contents of Safety Manual and Relationship with Other Manuals

Each instruction manual, other than the programming manual, includes a safety manual.
Safety manuals are given to each respective personnel group.
Please read the main text of the instruction manual for machine functions and operation methods.

1.Operation manual for general operators
"Safety Manual for Operator"
"Safety manual for those who install ant set-up the tapping center"
"Operation manual :
Operation of the machine necessary for basic operations"
English part code : 693075001

2.Operation manual for advanced personnel
"Safety Manual for Operator"
"Safety manual for those who install ant set-up the tapping center"
"DOOR INTERLOCK FUNCTION"
"Operation manual:
Operation of the machine necessary for set-up and machining"

Conversational programming machine		NC language programming machine	
Japanese part code	: 693312001	Japanese part code	: 693310001
English part code	: 693307001	English part code	: 693305001

3.Installation manual "Safety manual for those who install and set-up the tapping center"
"Installation manual:
Installation and assembly of the machine and its options"

Japanese part code : 693311001
English part code : 693306001

4.Programming manual "Programming manual: Creating machine programs"

Conversational programming machine		NC language programming machine	
Japanese part code	: 693314001	Japanese part code	: 693313001
English part code	: 693309001	English part code	: 693308001

5.Maintenance manual "Safety manual for those who qualified for tapping center maintenance attached to the maintenance manual."
"Maintenance manual: Adjustment and repair of the machine"
The maintenance manual is not distributed to customers.

Relationship to safety labels

Items of particular importance that appear in this safety manual are also attached to the machine as safety labels.
An explanation of the safety labels is provided at the end of this safety manual. If any safety labels have peeled off the machine, obtain new safety labels and attach them correctly.

Language

Machines shipped domestically within Japan are provided with safety manuals and safety labels written in Japanese. Machines shipped abroad from Japan are provided with safety manuals and safety labels written in four languages: English, German, French, and Chinese.
For manuals and labels in other languages, consult the dealer from which you purchased the machine.

Purchasing

When the safety manuals or safety labels have been lost, obtain these items from the dealer you have purchased the machine from.
If you do not know of a dealer, consult the offices specified below.

1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD. Machinery & Solution Company,
phone +81-52-824-2232
fax +81-52-811-0469

Handling the safety manual

Be careful not to lose the safety manuals, and keep them handy at all times.
Also, when the machine changes hands, pass the manuals to the new owner together with the machine.

Degree of danger

The degree of danger is classified into three categories depending upon the level of damage that may occur when instructions are not observed.

1. DANGER

DANGER

Damage which may result in death or severe injury to persons.

2. WARNING

WARNING

Damage which may lead to a serious injury.

3. CAUTION

CAUTION

Damage less serious than that above.

Explanation order

The safety instructions are explained in the following order:

1. Signal words (DANGER, WARNING, CAUTION) and symbols indicating the degree of danger
2. Type of danger (Subject)
3. Type of predicted damages
4. Preventive measure

Meaning of symbols

Symbols are used on the safety labels and in the warnings in the safety manual to intuitively explain possible dangers.

1. Hazard

Slippery

Moving parts

Stumble

Caught

Electric shock

Electric shock

High temperature

High temperature

Hand pinched

Cut

Cut

Shart point

Burst

Falling object

Falling object

Fall

Rotating object

Splash

Splash

Fire

2. Preventive measures

Protect ears.

Protect hands.

Protect feet.

Remove power plug.

Connect grounding cable

Protect head.

Do not touch.

Do not disassemble.

Protect eyes.

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

Warnings and preventive measures

The numbers in ( ) such as 1, 2 correspond to the names of each part.

Danger **DANGER**

OD1 Various hazards are associated with the tapping centre.
OD1-1 Read the safety manual before operating the machine to understand these hazards and preventive measures.
OD1-2 All users must know the position of the emergency stop switch (18) and its operation.

OD2 High voltage parts are present in the control box (1). Touching such parts by mistake may result in serious injury or death.
OD2-1 Only those qualified for electrical work, as well as having sufficient knowledge of the electric circuits of this machine, are allowed to maintain and inspect the electrical components. Operators must not open the control box.
OD2-2 If an alarm occurs, report it to the supervisor immediately. Operators are not allowed to repair the machine. Only qualified persons with sufficient knowledge of the machine are allowed carry out repair and installation.

OD3 You may be caught in the machine during machining, resulting in a serious injury.
OD3-1 Do not enter within the splash guard (2) during operation.
OD3-2 Visually check that nobody is inside the splash guard before starting machine operation
OD3-3 Keep your hands, feet, and body away from moving parts during operation.
OD3-4 If an alarm occurs, report it to the supervisor immediately. Do not put your hands, feet, and body in the machine.

OD4 When the door interlock switch (5) is invalid, the machine moves even when the work door (6) is open. You may cut yourself on a rotating tool (15) or be caught in the machine.
OD4-1 When the door interlock switch is invalid, do not put your hands, feet, and body in the machine. The operator must report it to the supervisor. The supervisor must set the door interlock switch to ON. The supervisor must always keep the key.
OD4-2 When the door interlock is invalid, the supervisor must not allow anybody to operate the machine.
OD4-3 Visually check by yourself that the door interlock switch is valid before starting machine operation.
OD4-4 If the door interlock key (7) is attached, report it to the supervisor.
OD4-5 The supervisor must always keep the door interlock key (7).

Warning **WARNING**

OW1 Touching rotating tools (15) results in injury.
OW1-1 Keep away from rotating tools.

OW2 You may be injured due to broken tools (15) or parts flung out.
OW2-1 Close the work door (6), and start machine operation.

OW3 You may be caught in the rotating part, resulting in an injury.
OW3-1 Keep away from rotating tools (15) , the spindle (8), and the ATC magazine (9).
OW3-2 Wear snug-fitting clothes. Put long hair up in cap. Do not wear gloves except for set-up operations carried out with the machine stopped. Do not wear any accessories. Do not hold the rotating part.

OW4 If the safety device is modified, its function may be altered, thus you may be caught in the machine, hit your body against the machine, or get an electric shock.
OW4-1 When the safety device is modified or fixed so that the device does not function, do not operate the machine.

OW5 When chips scatter and get into the eyes, you may damage your eyeballs and lose your eyesight.
OW5-1 Wear safety goggles against the chips.
OW5-2 Do not blow the chips by air.

OW6 If you touch chips with bare hands, you may have your hand cut or burnt.
OW6-1 Do not touch chips with bare hands. Do not touch sharp edges of workpieces.
OW6-2 Wear gloves and use a brush to remove chips.
OW6-3 Clean cutting chips when machine is stopped.

OW7 If you grip the tool (15) blade, you may cut your hand.
OW7-1 Do not touch the edge of the tool. Always hold the shank of the tool holder (16).

OW8 Dropping a heavy object onto your foot may fracture your foot bones.
OW8-1 When lifting heavy objects, wear safety shoes.

OW9 Lifting heavy objects may cause a hernia of vertebral disk.
OW9-1 When lifting heavy objects, ask for help.
OW9-2 Lift object with the strength of your legs feet instead of your back.

OW10 Hearing ability is reduced when ears are exposed to excessive noise for a long period of time.
OW10-1 Use protection such as earplugs when working in a noisy environment.

OW11 You may hurt your eyes due to high pressure air bursts.
OW11-1 People other than those qualified in high pressure air handling and who understand the piping of this machine are not allowed to install or change the high pressure air piping.

OW12 You may hit your head when standing up.
OW12-1 Wear a helmet when working in and around the machine.

OW13 When the machine is operated while any tools are left in the machine, the tools may scatter and you may be injured.
OW13-1 Do not operate the machine if tools are left in the machine. Report it to the supervisor.

OW14 You may have your hand caught in the work door (6) if you are opening and closing while holding parts other than the handle (10).
OW14-1 Hold the handle when opening and closing the outer door.

OW15 If tools are placed on the control box (1) or the machine, these may fall down due to vibration.
OW15-1 Do not place any objects on the control box and the machine.

OW16 You may fall down and be injured when climbing on the machine or the coolant tank (22).
OW16-1 Do not climb on the machine or the coolant tank.

OW17 When putting your hand under the leveling bolts (12), you may have your hand caught, resulting in an injury.
OW17-1 Do not adjust the leveling bolt. If the machine is not level, report it to the supervisor.
OW17-2 The supervisor must instruct the person in charge of installation to adjust the level.

OW18 When the cable is hanging down or is not covered, you may stumble or slip and fall.
OW18-1 When the cable is hanging down or is not covered, report it to the supervisor.
OW18-2 The supervisor must instruct the person in charge of installation to correct the cable wiring and cover the cable.

OW19 Remodeling the machine may affect the safety device, rendering all given warnings invalid.
OW19-1 If the machine has been modified, do not operate the machine. Report it to the supervisor.

OW20 You may have your eyes hurt if coolant splashes into your eyes.
OW20-1 When adjusting the coolant nozzle (13), wear safety goggles.
OW20-2 When coolant has splashed into your eyes, wash your eyes with clean water, and see a doctor.

OW21 If you put your finger in the clearance of the machine, you may have your finger caught, resulting in an injury.
OW21-1 Do not put fingers between grip cover (14).
OW21-2 Do not put the finger in the clearance between the tool (15) or the tool holder (16) and the ATC magazine.

OW22 If coolant, oil, or chips are scattered, you may slip, fall down, or collide somewhere, resulting in an injury.
OW22-1 Turn off the power of the machine, clean inside and the surroundings of the machine, and then start operation.

OW23 When attaching and detaching tool holder (16), you may cut your hand on the edge of a tool (15) or hit your hand against the machine.
OW23-1 Do not hold the edge of the tool. Wear leather gloves.

OW24 The machine may suddenly move or tools may fall down.
OW24-1 Do not put your hands, feet, and body under the spindle head (17).

OW25 When machining workpiece using an oil type coolant, the machined part may heat up and catch fire.
OW25-1 Do not use oil type coolant when a fire alarm and automatic fire extinguisher are not installed.
OW25-2 When machining the workpiece, an operator must attend the machine.

OW26 If you lean on the machine, you may be caught or hit yourself against the machine when the machine moves, resulting in an injury.
OW26-1 Do not lean on the machine.

OW27 When objects are hung on the emergency stop switch (18), the emergency stop switch may not be pressed.
OW27-1 Do not hang any objects on the emergency stop switch.

OW28 When the table (19) moves, the cable cover (20) at the rear of the machine springs out. You may collide with it, resulting in an injury.
OW28-1 Cut the main power breaker (21) and then remove chips.

OW29 Because the coolant tank (22) is heavy, you may suffer from a herniated vertebral disk or drop the tank on your feet when lifting the tank.

OW29-1 Do not lift the coolant tank even when removing chips.

OW30 When entering the machine, you may slip and hit your body against something.

OW30-1 Do not enter the machine. When it is necessary to enter the machine, report it to the supervisor.

OW31 If the splash guard (2) side cover (23) is not attached, you may be caught in the machine or injured due to broken tools.

OW31-1 Before turning on the power ,visually check that the cover is attached.
If the side cover is not attached, report it to the supervisor.

OW31-2 The supervisor must instruct the operator to attach the side cover.

OW32 Tools (15), tool holder (16) whose weight and size exceed the specified limit may spring out while being used.

OW32-1 Use tools holder whose weight and size are within the specified limit.

OW32-2 For the limit of the tools, see the tool label or the operation manual attached on the machine.

OW33 If you touch the regenerative resistor, you may be burned because the regenerative resistor is heated during operation.

OW33-1 Do not remove the regenerative resistor cover (24).

OW34 If you touch the motor, you may be burned because the motor is heated during operation.
OW34-1 Do not touch the motor for 30 minutes after operation is finished.

OW35 If the ATC magazine (9) rotates, tools (15) may hit machined workpieces, jigs, or the machine, and may be broken.
OW35-1 Set the tool length so that the tools do not contact machined workpieces, jigs, or the machine even if the ATC magazine rotates.

OW36 If the control box (1) or the operation panel (25) are wet, you may get an electric shock.
OW36-1 Do not sprinkle coolant, water, or chips on the control box and the operation panel.
OW36-2 Do not touch the control box with wet hands.

OW37 If the power is turn on or workpieces are machined in an explosive atmosphere, an explosion may occur due to a spark from the machine.
OW37-1 Do not turn on the power and carrrout machining in an explosive atmosphere.

OW-38 If you operate the machine without the workpiece secured, the workpiece may spring out, resulting in injury.
OW-38-1 Secure the workpiece.

OW39 If you forget to mount the splash guard side cover (23), you may get caught in the machine, resulting in injury.
OW39-1 Before turning on the power, visually check that the splash guard side cover is mounted. If not mounted, report it to the supervisor.
OW39-2 When removing the splash guard side cover, turn off the main power breaker and padlock it so that the main power breaker cannot be turned on.
OW39-3 The supervisor must instruct the operator to mount the maintenance cover.

OW40 Cutting chips may catch fire or explode depending on the workpiece material (e.x. Magnesium).
OW40-1 Remove any cutting chips immediately.
OW40-2 Install a fire extinguisher near the machine when machining a workpiece made of such material, and never perform unmanned operation.

OW41 The milliing inserts may come off the tool, resulting in serious injury.
OW41-1 Check that the miling inserts is secured before mounting the tool to the machine.

OW42 When the plant is poorly illuminated, inside the machine is dark and you may injure your hands on jigs or cutters.
OW42-1 Install a machine light when the illumination inside the machine is 500 lux or below.

Description of safety label

Particularly important descriptions in the safety manual are printed on a safety label, and the label is attached to the machine. Carefully read and understand the descriptions on the label before operating the machine.

The safety labels are attached to the positions shown in the illustration below. Check that the labels are not damaged. If damaged, obtain a new label for replacement.

Position of safety label

230S00C02.doc

S2A00401.ai

1. Safety label , front and side

(1) Language: English, Japanese, Chinese

Part Code : 690373001
Part Name : PS LABEL,TC FRONT JCE

(2) Language: English, German, French

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

Diese Maschine birgt Gefahren.
Um Risiken zu erkennen und vermeiden, vor dem Einschalten die Betriebsanleitung lesen.

L'utilisation de cette machine comporte des risques.
Lisez les manuels d'instruction pour connaître les risques et les éviter avant d'utiliser cette machine.

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
GEFAHR	**WARNUNG**	**WARNUNG**
Maschine in Betrieb kann plötzlich laufen und Sie stoßen. Beim Betrieb der Maschine von allen bewegenden Teilen sich fernhalten, um Verletzungen zu vermeiden.	Gebrochene Werkzeuge oder Werkstücke könnten Sie treffen und verletzen. Vor dem Start der Maschine Tür schließen.	Umlaufende Teile könnten Sie fassen und verletzen. Von umlaufendem Werkzeug, Spindel und Magazin sich fernhalten. Rotierende Teile nicht berühren. Während des Bedienens keine Handschuhe tragen.
DANGER	**AVERTISSEMENT**	**AVERTISSEMENT**
En opération, cette machine bougera soudainement et provoquera des risques d'écrasement. Ne vous approchez jamais des parties mobiles.	Les outils cassés ou les pièces usinées peuvent être projetés et risquent de vous frapper et de vous blesser. Fermez la porte avant de faire démarrer la machine.	Les parties tournantes peuvent vous accrocher et vous blesser. Ne vous approchez jamais des outils tournant, de la broche et du magasin. Ne saisissez jamais les parties en mouvement. Ne portez pas de gants pendant l'utilisation.

691042001 / 0302 (2)

Part Code : 691042001
Part Name : PS LABEL,TC FRONT EGF

2. Tool label

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

Part Code : 653379001
Part Name : Tool LABEL250

3. Safety label, rear and High pressure coolant equipment

(1) Language: English, Japanese, Chinese

Part Code : 690730001
Part Name : PSLABEL, TC REARJCE

(2) Language: English, German, French

Part Code : 691045001
Part Name : PSLABEL, TC REAR EGF

4. Label, regenerative resistor

(1) Language: English, Japanese, Chinese

Part Code: 690729001
Part Name: LABEL, TC REGENERATIVE JCE

(2) Language: English, German, French

Part Code: 691058001
Part Name: LABEL, TC REGENERATIVE EGF

5. Label, removing tool

(1) Language: English, Japanese, Chinese

Part Code : 653080001
Part Name : LABEL, Removing Tool JCE

(2) Language: English, German, French

Part Code : 69104001
Part Name : LABEL, Removing Tool EGF

6. Label, side cover

(1) Language: English, Japanese, Chinese

Part Code : 690731001
Part Name : LABEL, TC MAINTENANCE DOOR JCE

(2) Language: English, German, French

Part Code : 690732001
Part Name : LABEL, TC MAINTENANCE DOOR EGF

7. “Keep Off” label 40

Part code : 693178001

693178001 / 0607 (1)

693178001.ai

DOOR INTERLOCK FUNCTION

1. General Precautions
2. Overall View
3. Inspection of Door Interlock
4. Function Details

1 General Precautions

⚠ DANGER

When the door interlock switch is invalid, the machine moves even when the work door is open. You may cut yourself on a rotating tool or be caught in the machine.
When the door interlock switch is invalid, do not put your hands, feet, and body in the machine. Report it to the supervisor.
When the door interlock is invalid, the supervisor must not allow anybody to operate the machine.
Visually check by yourself that the door interlock switch is valid before starting machine operation.
If the door interlock key is attached, report it to the supervisor.
The supervisor must always keep the door interlock key.

⚠ DANGER

When the door interlock switch is turned off, the table may move. Mechanical parts inside the inner door move even if the inner door is open. You may be caught and injured on the table.
You may be caught in the machine.
When the door interlock switch is invalid, do not put your hands, feet, and body inside the outer door.
When the door interlock is invalid, the supervisor must not allow anybody to operate the machine.
If the door interlock key is attached, report it to the supervisor.

⚠ DANGER

When the inner door is open, you may cut yourself on a rotating tool or have your hand caught in the machine.
The operator must not open the inner door.
When the inner door is open, do not put your hands and feet inside the machine. The supervisor must apply a padlock to the inner door. The supervisor must always keep the inner door key.
The supervisor should not allow the operator to use the machine when the inner door is not padlocked.
Visually check by yourself that the door interlock switch is valid before starting machine operation.
When you find that the inner door is not padlocked, you must inform your supervisor of it.

⚠ WARNING

Touching rotating tools results in injury.
Keep away from rotating tools.

⚠ WARNING

You may be caught in the rotating part, resulting in an injury.
Keep away from rotating tools, the spindle, and the ATC magazine.
Wear snug-fitting clothes. Put long hair up in cap.
Do not wear gloves except for set-up operations carried out with the machine stopped. Do not wear any accessories. Do not hold the rotating part.

Purpose

The door interlock function protects workers from being caught in the machine while tools are rotating and parts are moving.

Unit Description

The interlock is activated so that the outer door is locked and the maximum speed is limited to suit the situation.

Unit Structure

The door interlock unit is composed of the following:

1. Door limit switch
2. Door lock

Using the Door Interlock Function

1. During daily operation
   Always keep the door interlock function switch (1) on.
2. During set-up and maintenance
   Turn the switch off only when it is necessary to release the interlock function during set-up and maintenance.
   Read the “Safety manual for those who install and set-up the tapping center” and the “Safety manual for those qualified for tapping center maintenance” before starting set-up and maintenance.
   Please observe the following when the interlock function is off.
   - When the door interlock function is off, be extremely careful not to be caught on a rotating tool or any moving parts.
   - After set-up or maintenance, turn the switch on.
   - The supervisor is responsible for keeping the key (2).

230S00C03.Doc

2 Overall View

TC-S2A

250S00C04.doc

3 Door Interlock Inspection

Before starting machine operation, be sure to inspect the door interlock.

Inspection steps

Inspection of operation stoppage

1. Close the door completely, then turn the power on and conduct home position return.
   Check that the door interlock switch is validated.
2. Open the outer door.
3. If the door interlock is operating correctly, the machine does not move even when the **[-X]** key on the operation panel is pressed.
   At this time, an alarm indicating the door is open is output.
   If the alarm is not output, the interlock function is faulty. Repair it.
   After verifying that the door interlock is operating correctly, proceed to the next step.

Inspection of door lock

4. Close the outer door.
5. Rotate the spindle.
6. If the door lock operates correctly, the outer door is locked and cannot be opened. If the door can be opened, the door is not locked and the interlock function is faulty. Repair it.

Emergency stop inspection

7. Rotate the spindle in manual mode.
8. If the door interlock is operating correctly, the machine stops and the [*EMERGENCY SW ON] alarm is displayed when the emergency stop button is pressed. If the machine does not stop or no alarm message is displayed, the interlock function is faulty. Repair it.

4 Function Details

Door condition (*6)	Door interlock	Door lock (*6)	Machine operation
Closed	Invalid	Will not be locked.	All operations are possible.
	Valid	During machine operation (axis movement, spindle rotation, MDI operation, MEMORY operation, or when the manual pulse generator is on.) (*4)	
Open	Invalid	Will not be locked	• Spindle rotation, magazine swivel, ATC, and tapping are impossible. (*2) • Axis movement, spindle stop, and spindle orientation are possible. (*1) • MEMORY operation is possible only in single operation mode. • MDI operation stops at each block end. • Coolant is not supplied.
	Valid		• All operations are impossible. (*2) (*5) • Coolant is not supplied.
Closed ↓ Open	Invalid		• All operations (including spindle rotation) stop immediately. (*3) • Coolant stops immediately.
	Valid		• All operations (including spindle rotation) stop immediately. (*3) (*5) • Coolant stops immediately.
Open	Invalid ↓ Valid		

*1 The rapid traverse feed speed is preset by the MAX RAPID SPEED (DOOR OPEN) of machine parameter.
The cutting feed speed is restricted to the speed preset by the MAX RAPID SPEED (DOOR OPEN) of machine parameter.
Additional axes (A, B, C) are also restricted to the speed preset by the MAX H. SPD ROTN 4,5,6 (DOOR OPEN) of machine parameter.

*2 The "NOT CLOSING DOOR" error occurs when the front door is open when operation is attempted
The "SIDE DOOR OPEN" error occurs when the side door is open when operation is attempted.

*3 Operations, including tapping, spindle orientation, ATC, or magazine swivel, stop at each block end. When the door is opened during spindle rotation, the "DR OPEN SPNDL STOP" error occurs and the spindle stops. When the door is closed and operation is resumed, the rotating condition prior to stopping is recovered.
However, when the following operations are carried out, the "DR OPEN SPNDL STOP" error is reset. Even if the door is closed and operation is resumed, the rotating condition prior to stopping is not recovered when:

1) The [RESET] key is pressed.
2) Spindle operation is carried out in manual mode.

Note
When the door is opened during spindle rotation after the end mill tap first motion (XY-axes movement and spindle rotation), the spindle stops but the "DR OPEN SPNDL STOP" error does not occur. Even if the door is closed and operation is resumed, the rotating condition prior to stopping is not recovered. The spindle automatically rotates when the Z-axis moves while cutting from point "R".

*4 During machine operation
The term machine operation here includes both temporary stop and block stop
(it does not include when the program has finished and during program stop) for MDI operation and MEMORY operation.

*5 Special specifications
When the door is opened while the door interlock is activated, the servomotor turns off. When the door is opened before MEMORY operation or during program stop (M00), the "NOT CLOSING DOOR" error occurs and the servomotor turns OFF. Close the door or deactivate the door interlock to reset the error and turn the servo motor ON.
When the door is opened during MEMORY operation, however, the "SERVO MOTOR STOPPED" or "DR OPEN MACHINE STOP" error occurs.
This error cannot be reset even when the door is closed. Press the **[RST]** key.

Die Sicherheitsvorschrift für Personen, die die Maschine installieren und den Arbeitsprozeß aufstellen für Tapping Centre

Tapping Centre
TC-S2A

Lesen Sie bitte aufmerksam diese Sicherheitsvorschrift, bevor Sie die Tapping Centre benutzen.

Brother Industries, Ltd. Machinery & Solution Company.

Inhalt

Was ist die Sicherheitsvorschrift? ---------- 3
Bitte lesen Sie! ---------- 3
Zweck ---------- 3
Zusammenstellung der Sicherheitsvorschriften und der Zusammenhang mit anderen Manuals ---------- 3
Beziehung mit Sicherheitsschildern ---------- 4
Sprache ---------- 4
Kundendienst ---------- 4
Handhabung der Sicherheitsvorschrift ---------- 5
Gefahrenstufe ---------- 5
Reihenfolge der Erklärung ---------- 5
Bedeutung der Bildzeichen ---------- 6

Namen jedes Teils ---------- 8
Warnungen und Preventivmaßnahmen ---------- 10
Prüfen der Sicherheitsschilder ---------- 19

©1999-2007 BROTHER INDUSTRIES, LTD. Machinery & Solution Company
All Rights Reserved.
Printed in Japan.

Was ist die Sicherheitsvorschrift?

Bitte lesen Sie!

Alle Leute, die die Tapping Centre benutzen, einschließlich der Leute, die die Tapping Centre in einer Fabrik installieren, die mit der Tapping Centre arbeiten, und die die Tapping Centre warten oder reparieren, sind aufgefordert, diese Sicherheitsvorschrift zu lesen.
In der Sicherheitsvorschrift werden alle Leute, die die Tapping Centre benutzen, als Benutzer bezeichnet.

Zweck

Die Tapping Centre ist eine Hochspannungsstrommaschine mit schnell umlaufenden Werkzeugen, und einem Tisch und einem ATC-Magazin, die sich mit starker Kraft bewegen. Deshalb bestehen verschiedene Gefahren bei der Benutzung dieser Maschine.
Der Zweck dieser Sicherheitsvorschrift ist es, vor Gefahren die Benutzer zu schützen.
In der Sicherheitsvorschrift wird Folgendes erklärt:
Warnung: Welche Gefahren bestehen?
Preventivmaßnahme: Wie kann man die Gefahren vermeiden?

Zusammenstellung der Sicherheitsvorschriften und der Zusammenhang mit anderen Manuals

Jedem Manual (außer der Programmierungsanleitung) ist eine Sicherheitsvorschrift für die betreffenden Benutzer beigelegt.
Für die verschiedenen Funktionen oder das Betriebsverfahren der Maschine lesen Sie bitte das entsprechende Manual.

1.Betriebsanleitung (Für alle Benutzer)
"Die Sicherheitsvorschrift für Operateure"
"Die Sicherheitsvorschrift für Personen, die Maschine installieren und den Arbeitsprozeß aufstellen für Tapping Centre"
"Betriebsanleitung"
Notwendige für grundlegenden Betriebsverfahren für alle Benutzer.
Deutsch Teil-Code: 693076001

2.Betriebsanleitung (Für Fachpersonal)
"Die Sicherheitsvorschrift für Operateure"
"Die Sicherheitsvorschrift für Personen, die Maschine installieren und den Arbeitsprozeß aufstellen für Tapping Centre"
"TÜRVERRIEGELUNGSFUNKTION"
"Betriebsanleitung:
Notwendige Betriebsmaßnahmen für die Aufstellung und die Bearbeitung."

Dialogorientierte	Japanischer Teil-Code:	693312001
Programmierung	Englischer Teil-Code:	693307001
NC-Sprache	Japanischer Teil-Code:	693310001
	Englischer Teil-Code:	693305001

3.Installierungsanweisung "Die Sicherheitsvorschrift für Personen, die die Maschine installieren und den Arbeitsprozeß aufstellen

	Japanischer Teil-Code:	693311001
	Englischer Teil-Code :	693306001

4.Programmierungsanleitung "Programmierungsanleitung:
Programmierung der Bearbeitung"

Dialogorientierte	Japanischer Teil-Code:	693314001
Programmierung	Englischer Teil-Code:	693309001
NC-Sprache	Japanischer Teil-Code:	693313001
	Englischer Teil-Code:	693308001

5.Wartungsvorschrift "Die Sicherheitsvorschrift für qualifiziertes Wartungspersonal; Tapping Centreist der Für Wartungsvorschrift beigelegt."
"Wartungsvorschrift:
Nachstellung und Reparatur der Maschine"
Die Wartungsvorschrift wird an die Kunden nicht verteilt.

Beziehung mit Sicherheitsschildern

Die wichtigsten Vorschriften der Sicherheitsvorschriften sind in Form von Sicherheitsschild an der Maschine angebracht.
Eine Erklärung für die Sicherheitsschilder gibt es am Ende der Sicherheitsvorschrift. Falls sich die Sicherheitsschilder von der Maschine lösen sollten, informieren Sie uns. Wir schicken Ihnen sofort Ersatzschilder zu.

Sprache

Die Maschinen für den japanischen Markt werden mit den Sicherheitsvorschriften und den Sicherheitsschildern auf japanisch ausgestaltet. Aus Japan exportierte Maschinen sind mit Sicherheitsanweisungen und -schildern auf vier Sprachen ausgestattet: Englisch, Deutsch, Französisch und Chinesisch.
Fordern Sie deshalb die für Sie entsprechenden Vorschriften und Schilder, einschließlich dieser in anderen Sprachen, bei Ihrem Hädler an.

Kundendienst

Sollten die Sicherheitsvorschriften oder die Sicherheitsschilder verloren gehen, bekommen Sie diese bei Ihrem Händler.

Wenn Sie Ihren Händler nicht kennen sollten, rufen Sie beim nachfolgenden Büro an.

1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD. Machinery & Solution Company.
phone +81-52-824-2232
fax +81-52-811-0469

Handhabung der Sicherheitsvorschrift

Geben Sie acht, daßSie die Sicherheitsvorschriften nicht verlieren, und bewahren Sie diese immer griffbereit auf.
Sollte die Maschine den Besitzer wechseln, dann müssen auch die Sicherheitsvorschriften an den neuen Besitzer zusammen mit der Maschine üergeben werden.

Gefahrenstufe

Die auftretenden Schäden bei Nichteinhaltung der Sicherheitsvorschriften werden in drei Stufen klassifiziert.
1. GEFAHR

⚠ GEFAHR

Lebensgefahr odeiche Körperverletzungsgefahr.

2. WARNUNG

⚠ WARNUNG

Schwere Verletzungsgefahr.

3. ACHTUNG

⚠ ACHTUNG

Leichte Verletzungsgefahr.

Reihenfolge der Erklärung

Hier wird Folgendes erklärt:
1. Stichwörter (GEFAHR, WARNUNG, ACHTUNG), die die Gefahren anzeigen, und Bildzeichen
2. Gefahrengruppe
3. Möglicher Verletzungsgrad
4. Preventivmßnahme

Bedeutung der Bildzeichen

Auf den Sicherheitsschildern und in den Sicherheitsvorschriften werden die Gefahren und deren Preventivmaßnahmen mit Bildzeichen anschaulich erklärt. Hier wird ihre Bedeutung erklät.

1. Gefahr

Rutschen

Laufender Teil

Stolpern

Stromschlag

Stromschlag

Hineingezogen

Hand geklemmt

Heiß

Heiß

Sich schneiden

Sich schneiden

Explosion

Sich stechen

Fallender Gegenstand

Fallender Gegenstand

Umlaufender Gegenstand

Sturz

Spritzen

Spritzen

Feuer

2. Preventivmaßnahmen

Ohren schützen

Hände schützen

Füße schützen

Netzstecker abziehen

Nicht berühren

Kopf schützen

Erden

Nicht zerlegen

Augen schützen

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

Warnungen und Preventivmaßnahmen

Jede Zahl in Klammern wie (1)(2) entspricht der Nummer der Namen jedes Teils.

Gefahr ⚠ **GEFAHR**

SD1 In der Tapping Centre bestehen verschiedene Gefahren.

SD1-1 Vor Inbetriebnahme der Maschine die Sicherheitsvorschrift lesen, um die Risiken zu erkennen und die Preventivmaßnahmen zu verstehen.

SD1-2 Alle Benutzer müsen wissen, wo der Notfall-stop-Schalter(19) ist, und wie er benutzt wird.

SD2 Im Steuerschrank (1) gibt es einen Hochspannungsteil. Bei versehntlicher Berührung besteht die Gefahr, sich schwer oder lebensgefährlich zu verletzen.

SD2-1 Nur hochqualifizierte Elektriker dürfen die elektrischen Teile dieser Maschine warten und reparieren.

SD2-2 Vor Wartung den Hauptschalter (21) ausschalten. Für Dritte kenntlich machen, daß es gearbeitet wird.

SD2-3 Beim Verlassen der Maschine die Tür des Steuerschranks zumachen und zuschrauben.

SD3 Es besteht die Gefahr, von laufenden Maschinenteilen geklemmt zu werden und sich dabei schwer zu verletzen.

SD3-1 Während die Maschine in Betrieb ist, darf kein Körperteil in die innere Seite des Spitzblechs (2) gelangen.

SD3-2 Bevor man in die Maschine greift oder sich in die Maschine begibt, den stop-Einschalter (3) oder die reset-Taste drücken und sich mit eigenen Augen vergewissern, daß die stop-Lampe (4) leuchtet.

SD3-3 Vor Anwerfen der Maschine sich mit eigenen Augen vergewissern, daß niemand innerhalb des Spitzblechs ist.

SD3-4 Während die Maschine in Betrieb ist, von laufenden Teilen Hände, Füße und sonstige Körperteile fernhalten.

SD3-5 Wenn man in die Maschine eintreten muß, mu3 der Hauptschalter (21) ausgeschaltet und verschlossen werden, damit ihn niemand mehr einschalten kann.

SD4 Wenn die Tüverriegelung (5) deaktiviert ist, bewegt sich die Maschine sogar, wenn die Arbeitstür (6) offen ist. Es besteht deshalb die Gefahr, von einem umlaufenden Werkzeug (15) geschnitten, oder von den Maschinenteilen geklemmt und verlezt zu werden.

SD4-1 Während der Einstellung der Maschine auf die Bewegung der Maschine achtgeben, damit die Maschine zu jeder Zeit angehalten werden kann.Nach einer Einstellung der Maschine oder einer Aufstellung den Verriegelungsschalter wieder in Kraft setzen, den Verriegelungsschlüssel (7) abziehen und aufbewahren.

SD4-2 Bei nicht aktivierter Verriegelung darf die Maschine nicht verlassen werden.

SD5 Wenn die Türverriegelung (5) nicht aktiviert ist, kann sich der Tisch (20) bewegen. Es besteht die Gefahr, vom Tisch eingeklemmt und verletzt zu werden.

SD5-1 Während der Einstellung der Maschine auf die Bewegung der Maschine achtgeben, damit die Maschine zu jeder Zeit angehalten werden kann. Nach Beendigung der Einstellung den Verriegelungsschalter wieder aktivieren. Der Verriegelungsschlüssel (7) wird abgezogen und muss vom Betriebsleiter aufbewahrt werden.

Warnung **WARNUNG**

SW1 Wenn man umlaufende Werkzeuge (15) beührt, wird man verletzt.

SW1-1 Von umlaufenden Werkzeugen sich fernhalten.

SW2 Es besteht Verletzungsgefahr durch abgebrochene Werkzeuge (15) oder herausspringende Werkstüke.

SW2-1 Arbeitstür (6) schließen.

SW3 In umlaufenden Teil können die Finger hineingezogen und verletzt werden.

SW3-1 Von umlaufendem Werkzeug (15), dem Spindel (8) und dem ATC-Magazin (9) sich fernhalten.

SW3-2 Küperanliegende Bekleidung tragen. Lange Haare müsen in einem Hut aufgesteckt werden. Beim Arbeiten an der laufenden Maschine keine Handschuhe tragen. Keinen Schmuck tragen. Umlaufende Teile nicht berüren.

SW4 Wenn die Sicherheitsvorrichtung abgeändert wird, funktioniert sie nicht mehr richtig. Es besteht die Gefahr, einen Stromschlag zu erhalten, von den Maschinenteilen geklemmt zu werden oder sich zu stoßen.

SW4-1 Die Sicherheitsvorrichtung nicht abändern. Die Sicherheitsvorrichtung nicht unbeweglich festmachen.

SW5 Wenn Stahlspäne in die Augen hineinspringen, werden die Augen verletzt.Es besteht die Gefahr, die Sehkraft zu verlieren.

SW5-1 Einen Augenschutz gegen Stahlspäne tragen.

SW5-2 Stahlspäne nicht mit einer Luftdruckpistole wegfegen.

SW6 Wenn man Stahlspäne mit bloßen Händen berürt, kann man sich schneiden oder verbrennen.
SW6-1 Stahlspäne nicht mit bloßen Händen berühren. Die Spitze der Werkstücke nicht mit bloßen Händen berühren.
SW6-2 Beim Reinigen der Schneidechips Handschuhe tragen und eine Bürste benutzen.
SW6-3 Schneidechips nur bei angehaltener maschine reinigen.

SW7 Wenn man die Schneide der Werkzeuge (15) berührt, wird die Hand geschnitten.
SW7-1 Die Schneide der Werkzeuge nicht berühren. Die Werkzeuge immer am Schaft des Werkzeughalters (16) halten.

SW8 Wenn schwere Gegenstände auf die Füße fallen, besteht die Gefahr, sich den Fußzu brechen.
SW8-1 Beim Heben schwerer Gegenstände Schutzschuhe tragen.

SW9 Beim Heben schwerer Gegenstände besteht die Gefahr, sich einen Bruch zu heben.
SW9-1 Beim Heben schwerer Gegenstände immer jemanden um Hilfe bitten.
SW9-2 Beim Heben schwerer Gegenstände nicht die Rückenkraft sondern die Beinkraft benutzen.

SW10 Lange Zeit dauernder oder großer Lärm ist für die Ohren schälich.
SW10-1 Bei der Arbeit unter Lärm einen Gehörschutz, z.B. Stöpsel, tragen.

SW11 Hochdruckluft kann explodieren und Augen oder Ohren verletzen.
SW11-1 Nur hochqualifizierte Fachkräfte dürfen an dieser Maschine Hochdruckluftrohrleitungen installieren oder verändern.
SW11-2 Vor der Arbeit an den Hochdruckluftrohrleitungen die Druckquelle abtrennen und den Restdruck ablassen. Bekannt machen, daß an der Druckleitung gearbeitet wird.

SW12 Beim Aufstehen besteht die Gefahr, sich den Kopf anzustoßen und dabei zu verletzen.
SW12-1 Beim Arbeiten in der Maschine oder in ihrem Bereich einen Schutzhelm tragen.

SW13 Wenn Werkzeuge in der Maschine liegenbleiben sollten und die Maschine in Betrieb genommen wird, besteht die Gefahr, daß diese Werkzeuge herumgeschleudert werden und jemanden verletzen.

SW13-1 In der Maschine keine Werkzeuge bleibenlassen.

SW14 Es besteht die Gefahr, sich die Finger zu klemmen, wenn die Arbeitstür (6) nicht mit der Klinke (10) auf- und zugemacht wird.

SW14-1 Türgriff (11) beim Öffnen und Schließen der vorderen und der Seitentür festhalten.

SW15 Im Steuerschrank (1) gibt es einen heißen Teil. Deshalb besteht die Gefahr, daß sich die im Dokumentenbehälter (11) im Steuerschrank nicht ordentlich aufbewahrten Papiere entzünden.

SW15-1 Im Dokumentenbehälter im Steuerschrank dürfen keine größere Papiere als A4 aufbewahrt werden.

SW16 Wenn man Werkzeuge auf dem Steuerschrank (1) oder auf der Maschine liegenläßt, besteht die Gefahr, daßdiese wegen der Vibration der Maschine herunterfallen.

SW16-1 Auf dem Steuerschrank und auf der Maschine nichts liegenlassen.

SW17 Wenn man auf die Maschine oder auf den Kühlmittelbehälter (22) steigt, besteht die Gefahr, zu stürzen und sich zu verletzen.

SW17-1 Nicht auf die Maschine und den Kühlmittelbehälter steigen.

SW18 Wenn man unter den Nivellierbolzen (12) greift, besteht die Gefahr, sich zu klemmen und zu verletzen.

SW18-1 Nicht unter den Nivellierbolzen greifen. Nur mit zweckmäßigem Werkzeug den Nivellierbolzen einstellen.

SW19 Wenn das Kabel hängt oder nicht ordentlich verlegt ist, besteht die Gefahr, darüber zu stolpern.

SW19-1 Das Kabel darf nicht locker sein. Das Kabel auf dem Fußboden muß mit einem Schutz bedeckt werden.

SW20 Wenn an der Maschine Modifikationen vorgenommen werden, dann tritt die Sicherheitsvorrichtung außer Kraft, und alle angegebenen Warnungen gelten nicht mehr.

SW20-1 Die Maschine nicht modifizieren. Wenn eine Modifikation notwendig sein sollte, muß man die BROTHER INDUSTRIES.,LTD. vorher informieren und ihr schriftliches Einverstädnis einholen.

SW21 Kühlmittel ist augenschädlich.

SW21-1 Bei der Einstellung der Kühlmitteldüse (14) einen Augenschutz tragen.

SW21-2 Wenn die Augen mit dem Kühlmittel in Berührung kommen, dann die Augen mit sauberem Wasser auswaschen und den Arzt konsultieren.

SW22 In jeder Spalte der Maschine besteht Klemm- und Verletzungsgefahr.

SW22-1 Nicht zwischen die zellen (27) fassen.

SW22-2 Nicht mit den Fingern zwischen das Werkzeug (16) oder den Werkzeughalter (17) und das ATC-Magazin kommen (10).

SW23 Wenn Kühlmittel, Schmierstoff oder Stahlspäne auf dem Fußboden ist, kann man rutschen und sich verletzen.

SW23-1 Vor Inbetriebnahme bei ausgeschalteter Maschine deren Innenseite und den Fußboden um die Maschine herum sauber machen.

SW23-2 Bei der Installierung einen Schutzhelm und Schutzschuhe tragen.

SW24 Beim Einsetzen und Herausnehmen des Werkzeughalters (16) besteht die Gefahr, sich zu schneiden oder sonstig zu verletzen.

SW24-1 Beim Austausch der Werkzeuge Lederhandschuhe tragen und die Schneide der Werkzeuge nicht berühren. Immer mit beiden Händen die Werkzeuge halten.

SW25 Die Maschine kann plötzlich zum Laufen anfangen, und die Werkzeuge können aus der Haltung herausfallen.

SW25-1 Wenn die stop-Lampe (4) nicht leuchtet, darf man mit keinem Körperteil unter den Spindelkopf (18) kommen.

SW25-2 Bei der Aufstellung des Arbeitsprozesses den Tisch nach vorne ziehen oder die Säule ins Innere drüken.

SW25-3 Den Hauptschalter (21) ausschalten und so verschließen, dass er nicht eingeschaltet werden kann und dann s chmieren.

SW26 Bei der Bearbeitung der Werkstücke mit ÖlKühlmittel besteht Brandgefahr.

SW26-1 Wenn Werkstücke mit Ölkühlmittel bearbeitet werden, müssen ein Feueralarm und eine automatische Feuerlöschanlage installier erden.

SW26-2 Bei der Bearbeitung muß der Operateur an der Maschine sein.

SW27 Wenn man sich an die Maschine anlehnt, besteht die Gefahr, daß man beim Lauf der Maschine gequetscht oder gestoßen und verletzt werden kann.

SW27-1 Sich nicht an die Maschine anlehnen.

SW28 Wenn man etwas an den Notfall-stop-Schalter (18) hängt, besteht die Gefahr, bei Notfall den Schalter nicht drücken zu können.

SW28-1 Nichts an den Notfall-stop-Schalter hängen.

SW30 Der Kühlmitteltank (22) ist sehr schwer. Wenn man versucht zu heben, besteht die Gefahr, sich einen Bruch zu heben oder sich an die Füße durch Fallen des Tanks zu verletzen.

SW30-1 Auch beim Aufräumen der Stahlspäne darf der Kühlmitteltank nicht aufgehoben werden.

SW31 Beim Eintreten in die Maschine besteht die Gefahr, zu rutschen order von den Maschinenteilen geklemmt zu werden.

SW31-1 Vor dem Eintreten in die Maschine muß der Hauptschalter ausgeschaltet und verschlossen werden, damit ihn niemand mehr einschalten kann. Külmittel und Stahlspäne aufräumen.Külmittel und Stahlspäne aus dem Boden räumen. Schutzschuhe und einen Schutzhelm tragen. An der Betriebstafel der Maschine anzeigen, daß in der Maschine gearbeitet wird.

SW32 Wenn man vergißt, die Seitenabdeckung (23) des Spritzschutzes (2) aufzusetzen, besteht die Gefahr, geklemmt oder von einem gebrochenen Werkzeug verletzt zu werden.

SW32-1 Vor Einschalten der Maschine sich mit eigenen Augen vergewissern, daß der Seitenschutz aufgesteckt ist.

SW33 Wenn Werkzeuge (15) oder Werkzeughalter (16), deren Gewicht oder Größe die vorgeschriebene Beschränkung überschreitet, benutzt werden, besteht die Gefahr, daß die Werkzeuge herausspringen.

SW33-1 Die vorgeschriebene Gewicht- und Größebeschränkung der Werkzeuge und Halter einhalten.

SW33-2 Das auf den Werkzeugsschildren angegebene Vorschriften für die Beschränkung der Werkzeuge lesen, Betriebsanleitung.

SW34 Das Rückkopplungswiderstandsgerät wird während des Betriebs sehr heiß Es besteht die Gefahr, daß man sich die Finger bei Berührung verbrennt.

SW34-1 Den Rückkopplungswiderstandsschutz (24) nicht abnehmen.

SW35 Der Motor wird während des Betriebs sehr heiß. Es besteht die Gefahr, daßman sich die Finger bei Berührung verbrennt.

SW35-1 Innerhalb von 30 Minuten nach dem Ausschalten der Maschine den Motor nicht berühren.

SW36 Bei Verwendung eines falschen Schmelzdrahts funktioniert die Schutzvorrichtung nicht. Es besteht Feuergefahr.

SW36-1 Einen zerrissenen Schmelzdraht mit einem Draht der selben Norm austauschen.

SW37 Wenn der Sollwert des Thermorelais geändert wird, funktioniert die Schutzvorrichtung nicht. Es besteht Feuergefahr.

SW37-1 Das Sollwert des Thermorelais nicht ändem.

SW38 Beim Umlauf des ATC-Magazins (10) besteht die Gefahr, daß diese Werkzeuge (16) an das Werkstück, die Vorrichtung oder die Innenwand der Maschine anstoßen und abbrechen.

SW38-1 Die Länge der Werkzeuge mußgenau eingestellt werden, damit die Werkzeuge beim Umlauf des ATC-Magazins an das Werkstück, die Vorrichtung oder die Innenwand der Maschine nicht anstoßen.

SW39 Wenn der Steuerschrank (1) oder die Betriebstafel (25) naßist, besteht die Gefahr, einen Stromschlag zu erhalten.

SW39-1 Den Steuerschrank und die Betriebstafel vor Flüssigkeit wie Kühlmittel, Wasser und Stahlspäne schützen.

SW39-2 Mit naßen Händen den Steuerschrank nicht berühren.

SW40 Wenn die von außen verdrahtete Kraft-PE-Linie zu kurz ist, kann sie durch einen Ruck des Kabels abreißen, und es besteht die Gefahr, einen Stromschlag zu erhalten.

SW40-1 Die Kraft-PE-Linie länger als die anderen Linien (L1,L2,L3) halten und locker verbinden.

SW41 Wenn man beim Bestehen der Explosionsgefahr den Schalter der Maschine einschaltet oder Werkstücke bearbeitet, besteht die Gefahr, daß ein überspringender Funke eine Explosion auslösen.

SW41-1 Beim Bestehen der Explosionsgefahr nicht die Maschine installieren.

SW41-2 Bei Explosionsgefahr in der Luft die Maschine nicht einschalten und die Bearbeitung sowie Vorbereitung nicht ausführen.

SW42 Wird der Spritzseitenschutz (23) nicht angebracht, besteht die Gefahr, in der Maschine eingeklemmt und verletzt zu werden.

SW42-1 Vor dem Einschalten des Schalters sich mit eigenen Augen vergewissern, daßder Spritzseitenschutz richtig aufgesetzt ist.

SW44 Je nach Material des Werkstücks kann der Schneidesplitter Feuer fangen oder explodieren (z.B. Magnesium).

SW44-1 Schneidesplitter sofort entfernen.

SW44-2 Wenn mit feuergefährlichen Werkstücken gearbeitet wird, Feuerlöscher griffbereit halten. Betrieb niemals unbeobachtet lassen.

SW-45 Sollten die Fräsapparate vom Werkzeug abgehen, könnten sie schwere Verletzungen verursachen.

SW45-1 Setzen Sie die Fräsapparate in die Werkzeuge fest ein.

SW45-2 Vergewissern Sie sich, daß dies Fräpparate befestigt sind, bevor Sie die Werkzeuge in die Maschine fassen.

SW46 Es besteht Feuergefahr, wenn ein 3-Draht-Sensor mit einer Starkstromleitung verwendet wird.

SW46-1 Keinen 3-Draht- sondern einen 2-Draht-Sensor benutzen.

SW46-2 Falls ein 3-Draht-Sensor trotzdem notgedrungen benutzt werden muss, muss zusäzlich eine Sicherung (1 A oder geringer) an der Starkstromleitung jedes Sensors angebracht werden.

SW47 Wenn die Schrauben der Anschlussklemmleiste nach der Verdrahtung lose sind, kann durch den fehlerhaften Anschluss Hitze erzeugt werden und es besteht Feuergefahr.

SW47-1 Bei der Verdrahtung darauf achten, dass alle Schrauben fest angezogen sind.

SW48 Wenn die Anlage unzureichend beleuchtet ist, ist der Innenraum der Maschine dunkel, und es besteht die Gefahr, sich die Hände an den Vorrichtungen oder Schneiden zu verletzen.

SW48-1 Eine Maschinenleuchte anbringen, wenn die innere Beleuchtungsstärke der Maschine 500 Lux oder darunter ist.

Prüfen der Sicherheitsschilder

Die Sicherheitsschilder sind an der im Bild gezeigten Stelle der Maschine angebracht. Prüfen Sie, ob sie da fest angeklebt sind. Wenn sie sich von der Maschine lösen sollten, bekommen Sie Ersatzschilder und kleben Sie sie an die Maschine an.

Plazierung der Sicherheitsschilder

230S00C02.doc

S2A00401.ai

1. Sicherheitsschild, Vorderseite und Seite

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode : 690373001
Teilname : PS LABEL,TC FRONT JCE

(1) Sprache: Englisch, Deutsch, Französisch

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

Diese Maschine birgt Gefahren.
Um Risiken zu erkennen und vermeiden, vor dem Einschalten die Betriebsanleitung lesen.

L'utilisation de cette machine comporte des risques.
Lisez les manuels d'instruction pour connaître les risques et les éviter avant d'utiliser cette machine.

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
GEFAHR	**WARNUNG**	**WARNUNG**
Maschine in Betrieb kann plötzlich laufen und Sie stoßen. Beim Betrieb der Maschine von allen bewegenden Teilen sich fernhalten, um Verletzungen zu vermeiden.	Gebrochene Werkzeuge oder Werkstücke könnten Sie treffen und verletzen. Vor dem Start der Maschine Tür schließen.	Umlaufende Teile könnten Sie fassen und verletzen. Von umlaufendem Werkzeug, Spindel und Magazin sich fernhalten. Rotierende Teile nicht berühren. Während des Bedienens keine Handschuhe tragen.
DANGER	**AVERTISSEMENT**	**AVERTISSEMENT**
En opération, cette machine bougera soudainement et provoquera des risques d'écrasement. Ne vous approchez jamais des parties mobiles.	Les outils cassés ou les pièces usinées peuvent être projetés et risquent de vous frapper et de vous blesser. Fermez la porte avant de faire démarrer la machine.	Les parties tournantes peuvent vous accrocher et vous blesser. Ne vous approchez jamais des outils tournant, de la broche et du magasin. Ne saisissez jamais les parties en mouvement. Ne portez pas de gants pendant l'utilisation.

691042001 / 0302 (2)

Teilcode : 691042001
Teilname : PS LABEL,TC FRONT EGF

2. Werkzeugschild

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

Teilcode : 653379001
Teilname : Tool LABEL250

3. Sicherheitsschild, Rückseite und Hochdruckkühlmittelbehälter

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode : 690730001
Teilname : PSLABEL, TC REARJCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode : 691045001
Teilname : PSLABEL, TC REAR EGF

4. Schild, Regenerativwiderstand

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode: 690729001
Teilname: LABEL, TC REGENERATIVE JCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode: 691058001
Teilname: LABEL, TC REGENERATIVE EGF

5. Schild, Werkzeugausbau

(1) Sprache: Englisch, Japanisch, Chinesisch

Part Code : 653080001
Part Name : LABEL, Removing Tool JCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode : 69104001
Teilname : LABEL, Removing Tool EGF

6. Schild, Seitenverkleidung

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode : 690731001
Teilname : LABEL, TC MAINTENANCE DOOR JCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode : 690732001
Teilname : LABEL, TC MAINTENANCE DOOR EGF

7. Betreten-verboten Schild

Teilcode : 693178001

693178001 / 0607 (1)

693178001.ai

Die Sicherheitsvorschrift für Operateure

Tapping Centre
TC-S2A

Lesen Sie bitte aufmerksam diese Sicherheitsvorschrift, bevor Sie die Tapping Centre benutzen.

Brother Industries, Ltd. Machinery & Solution Company.

Inhalt

Was ist die Sicherheitsvorschrift? ---------- 3
Bitte lesen Sie! ---------- 3
Zweck ---------- 3
Zusammenstellung der Sicherheitsvorschriften und der Zusammenhang mit anderen Manuals ---------- 3
Beziehung mit Sicherheitsschildern ---------- 4
Sprache ---------- 4
Kundendienst ---------- 4
Handhabung der Sicherheitsvorschrift ---------- 5
Gefahrenstufe ---------- 5
Reihenfolge der Erklärung ---------- 5
Bedeutung der Bildzeichen ---------- 6

Namen jedes Teils ---------- 8
Warnungen und Preventivmaßnahmen ---------- 10
Prüfen der Sicherheitsschilder ---------- 19

©1999-2007 BROTHER INDUSTRIES, LTD. Machinery & Solution Company
All Rights Reserved.
Printed in Japan.

Was ist die Sicherheitsvorschrift?

Bitte lesen Sie!

Alle Leute, die die Tapping Centre benutzen, einschließlich der Leute, die die Tapping Centre in einer Fabrik installieren, die mit der Tapping Centre arbeiten, und die die Tapping Centre warten oder reparieren, sind aufgefordert, diese Sicherheitsvorschrift zu lesen.
In der Sicherheitsvorschrift werden alle Leute, die die Tapping Centre benutzen, als Benutzer bezeichnet.

Zweck

Die Tapping Centre ist eine Hochspannungsstrommaschine mit schnell umlaufenden Werkzeugen, und einem Tisch und einem ATC-Magazin, die sich mit starker Kraft bewegen. Deshalb bestehen verschiedene Gefahren bei der Benutzung dieser Maschine.
Der Zweck dieser Sicherheitsvorschrift ist es, vor Gefahren die Benutzer zu schützen.
In der Sicherheitsvorschrift wird Folgendes erklärt:
Warnung: Welche Gefahren bestehen?
Preventivmaßnahme: Wie kann man die Gefahren vermeiden?

Zusammenstellung der Sicherheitsvorschriften und der Zusammenhang mit anderen Manuals

Jedem Manual (außer der Programmierungsanleitung) ist eine Sicherheitsvorschrift für die betreffenden Benutzer beigelegt.
Für die verschiedenen Funktionen oder das Betriebsverfahren der Maschine lesen Sie bitte das entsprechende Manual.

1.Betriebsanleitung (Für alle Benutzer)
"Die Sicherheitsvorschrift für Operateure"
"Die Sicherheitsvorschrift für Personen, die Maschine installieren und den Arbeitsprozeß aufstellen für Tapping Centre"
"Betriebsanleitung"
Notwendige für grundlegenden Betriebsverfahren für alle Benutzer.
Deutsch Teil-Code: 693076001

2.Betriebsanleitung (Für Fachpersonal)
"Die Sicherheitsvorschrift für Operateure"
"Die Sicherheitsvorschrift für Personen, die Maschine installieren und den Arbeitsprozeß aufstellen für Tapping Centre"
"TÜRVERRIEGELUNGSFUNKTION"
"Betriebsanleitung:
Notwendige Betriebsmaßnahmen für die Aufstellung und die Bearbeitung."

Dialogorientierte	Japanischer Teil-Code:	693312001
Programmierung	Englischer Teil-Code:	693307001
NC-Sprache	Japanischer Teil-Code:	693310001
	Englischer Teil-Code:	693305001

3.Installierungsanweisung "Die Sicherheitsvorschrift für Personen, die die Maschine installieren und den Arbeitsprozeß aufstellen

	Japanischer Teil-Code:	693311001
	Englischer Teil-Code :	693306001

4.Programmierungsanleitung "Programmierungsanleitung:
Programmierung der Bearbeitung"

Dialogorientierte	Japanischer Teil-Code:	693314001
Programmierung	Englischer Teil-Code:	693309001
NC-Sprache	Japanischer Teil-Code:	693313001
	Englischer Teil-Code:	693308001

5.Wartungsvorschrift "Die Sicherheitsvorschrift für qualifiziertes Wartungspersonal; Tapping Centreist der Für Wartungsvorschrift beigelegt."
"Wartungsvorschrift:
Nachstellung und Reparatur der Maschine"
Die Wartungsvorschrift wird an die Kunden nicht verteilt.

Beziehung mit Sicherheitsschildern

Die wichtigsten Vorschriften der Sicherheitsvorschriften sind in Form von Sicherheitsschild an der Maschine angebracht.
Eine Erklärung für die Sicherheitsschilder gibt es am Ende der Sicherheitsvorschrift. Falls sich die Sicherheitsschilder von der Maschine lösen sollten, informieren Sie uns. Wir schicken Ihnen sofort Ersatzschilder zu.

Sprache

Die Maschinen für den japanischen Markt werden mit den Sicherheitsvorschriften und den Sicherheitsschildern auf japanisch ausgestaltet. Aus Japan exportierte Maschinen sind mit Sicherheitsanweisungen und -schildern auf vier Sprachen ausgestattet: Englisch, Deutsch, Französisch und Chinesisch.
Fordern Sie deshalb die für Sie entsprechenden Vorschriften und Schilder, einschließlich dieser in anderen Sprachen, bei Ihrem Hädler an.

Kundendienst

Sollten die Sicherheitsvorschriften oder die Sicherheitsschilder verloren gehen, bekommen Sie diese bei Ihrem Händler.

Wenn Sie Ihren Händler nicht kennen sollten, rufen Sie beim nachfolgenden Büro an.

1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD. Machinery & Solution Company.
phone +81-52-824-2232
fax +81-52-811-0469

Handhabung der Sicherheitsvorschrift

Geben Sie acht, daßSie die Sicherheitsvorschriften nicht verlieren, und bewahren Sie diese immer griffbereit auf.
Sollte die Maschine den Besitzer wechseln, dann müssen auch die Sicherheitsvorschriften an den neuen Besitzer zusammen mit der Maschine üergeben werden.

Gefahrenstufe

Die auftretenden Schäden bei Nichteinhaltung der Sicherheitsvorschriften werden in drei Stufen klassifiziert.
1. GEFAHR

⚠ GEFAHR

Lebensgefahr odeiche Körperverletzungsgefahr.

2. WARNUNG

⚠ WARNUNG

Schwere Verletzungsgefahr.

3. ACHTUNG

⚠ ACHTUNG

Leichte Verletzungsgefahr.

Reihenfolge der Erklärung

Hier wird Folgendes erklärt:
1. Stichwörter (GEFAHR, WARNUNG, ACHTUNG), die die Gefahren anzeigen, und Bildzeichen
2. Gefahrengruppe
3. Möglicher Verletzungsgrad
4. Preventivmßnahme

Bedeutung der Bildzeichen

Auf den Sicherheitsschildern und in den Sicherheitsvorschriften werden die Gefahren und deren Preventivmaßnahmen mit Bildzeichen anschaulich erklärt. Hier wird ihre Bedeutung erklät.

1. Gefahr

Rutschen

Laufender Teil

Stolpern

Stromschlag

Stromschlag

Hineingezogen

Hand geklemmt

Heiß

Heiß

Sich schneiden

Sich schneiden

Explosion

Sich stechen

Fallender Gegenstand

Fallender Gegenstand

Umlaufender Gegenstand

Sturz

Spritzen

Spritzen

Feuer

2. Preventivmaßnahmen

Ohren schützen

Hände schützen

Füße schützen

Netzstecker abziehen

Nicht berühren

Kopf schützen

Erden

Nicht zerlegen

Augen schützen

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

Warnungen und Preventivmaßnahmen

Jede Zahl in Klammern wie (1)(2) entspricht der Nummer der Namen jedes Teils.

Gefahr

GEFAHR

OD1 In der Tapping Centre bestehen verschiedene Gefahren.

OD1-1 Vor Inbetriebnahme der Maschine die Sicherheitsvorschrift lesen, um die Risiken zu erkennen und die Preventivmaßnahmen zu verstehen.

OD1-2 Alle Benutzer müssen wissen, wo der Notfall-stop-Schalter ist, (18) und wie er benutzt wird.

OD2 Im Steuerschrank (1) gibt es einen Hochspannungsteil. Bei versehntlicher Berührung besteht die Gefahr, sich schwer oder lebensgefährlich zu verletzen.

OD2-1 Nur hochqualifizierte Elektriker dürfen die elektrischen Teile dieser Maschine warten und reparieren. Der Operateur darf den Steuerschrank nicht aufmachen.

OD2-2 Bei Alarm den Betriebsleiter sofort verständigen.Der Maschinenbediener darf die Maschine nicht reparieren. Nur qualifizierte Personen dürfen die Maschine installieren und reparieren.

OD3 Es besteht die Gefahr, von laufenden Maschinenteilen geklemmt zu werden und sich dabei schwer zu verletzen.

OD3-1 Während die Maschine in Betrieb ist, darf kein Körperteil in die innere Seite des Spitzblechs (2) gelangen.

OD3-2 Vor Anwerfen der Maschine sich mit eigenen Augen vergewissern, daß niemand innerhalb des Spitzblechs ist.

OD3-3 Während die Maschine in Betrieb ist, von laufenden Teilen Hände, Füße und sonstige Körperteile fernhalten.

OD3-4 Bei Alarm den Betriebsleiter sofort verständigen. Nicht in die Maschine greifen.

OD4 Wenn der Verriegelungsschalter (5) außer Kraft sein sollte, laft die Maschine trotzdem weiter, wenn die Arbeitstür (6) geöffnet wird. Es besteht deshalb die Gefahr, von den Maschinenteilen geklemmt und verletzt zu werden.

OD4-1 Wenn der Verriegelungsschalter außer Kraft ist, darf man mit keinem Körperteil in die Maschine kommen. Der Maschinenbediener muß den Betriebsleiter verständigen. Der Betriebsleiter muß den Verriegelungsschalter in Kraft setzen und den Schlüssel aufbewahren.

OD4-2 Bei außer Kraft gesetzter Verriegelung darf der Betriebsleiter niemanden die Maschine benutzen lassen.

OD4-3 Vor Inbetriebnahme der Maschine sich mit eigenen Augen vergewissern, daß die Verriegelung in Kraft ist.

OD4-4 Sollte der Verriegelungsschlüssel (7) im Schloß stecken, muß der Betriebsleiter darüber informiert werden.

OD4-5 Den Verriegelungsschlüssel (7) mußder Betriebsleiter aufbewahren.

Warnung **WARNUNG**

OW1 Wenn man umlaufende Werkzeuge (15) beührt, wird man verletzt.
OW1-1 Von umlaufenden Werkzeugen sich fernhalten.

OW2 Es besteht Verletzungsgefahr durch abgebrochene Werkzeuge (16) oder herausspringende Werkstüke.
OW2-1 Arbeitstür (6) schließen.

OW3 In umlaufenden Teil können die Finger hineingezogen und verletzt werden.
OW3-1 Von umlaufendem Werkzeug (15), dem Spindel (8) und dem ATC-Magazin (9) sich fernhalten.
OW3-2 Körperanliegende Bekleidung tragen. Lange Haare müsen in einem Hut aufgesteckt werden. Beim Arbeiten an der laufenden Maschine keine Handschuhe tragen. Keinen Schmuck tragen. Umlaufende Teile nicht berühren.

OW4 Wenn die Sicherheitsvorrichtung abgeändert wird, funktioniert sie nicht mehr richtig. Es besteht die Gefahr, einen Stromschlag zu erhalten, von den Maschinenteilen geklemmt zu werden oder sich zu stoßen.
OW4-1 Wenn die Sicherheitsvorrichtung abgeändert oder unbeweglich festgemacht wird, die Maschine nicht benutzen.

OW5 Wenn Stahlspäne in die Augen hineinspringen, werden die Augen verletzt.Es besteht die Gefahr, die Sehkraft zu verlieren.
OW5-1 Einen Augenschutz gegen Stahlspäne tragen.
OW5-2 Stahlspäne nicht mit einer Luftdruckpistole wegfegen.

OW6 Wenn man Stahlspäne mit bloßen Händen berürt, kann man sich schneiden oder verbrennen.
OW6-1 Stahlspäne nicht mit bloßen Händen berühren. Die Spitze der Werkstücke nicht mit bloßen Händen berühren.
OW6-2 Beim Reinigen der Schneidechips Handschuhe tragen und eine Bürste benutzen.
OW6-3 Schneidechips nur bei angehaltener maschine reinigen.

OW7 Wenn man die Schneide der Werkzeuge (15) berührt, wird die Hand geschnitten.
OW7-1 Die Schneide der Werkzeuge nicht berühren. Die Werkzeuge immer am Schaft des Werkzeughalters (16) halten.

OW8 Wenn schwere Gegenstände auf die Füße fallen, besteht die Gefahr, sich den Fuß zu brechen.
OW8-1 Beim Heben schwerer Gegenstände Schutzschuhe tragen.

OW9 Beim Heben schwerer Gegenstände besteht die Gefahr, sich einen Bruch zu heben.
OW9-1 Beim Heben schwerer Gegenstände immer jemanden um Hilfe bitten.
OW9-2 Beim Heben schwerer Gegenstände nicht die Rückenkraft sondern die Beinkraft benutzen.

OW10 Lange Zeit dauernder oder großer Lärm ist für die Ohren schädlich.
OW10-1 Bei der Arbeit unter Lärm einen Gehörschutz, z.B. Stöpsel, tragen.

OW11 Hochdruckluft kann explodieren und Augen oder Ohren verletzen.
OW11-1 Nur hochqualifizierte Fachkräfte dürfen an dieser Maschine Hochdruckluftrohrleitungen installieren oder verändern.

OW12 Beim Aufstehen besteht die Gefahr, sich den Kopf anzustoßen und dabei zu verletzen.
OW12-1 Beim Arbeiten in der Maschine oder in ihrem Bereich einen Schutzhelm tragen.

OW13 Wenn Werkzeuge in der Maschine liegenbleiben sollten und die Maschine in Betrieb genommen wird, besteht die Gefahr, daß diese Werkzeuge herumgeschleudert werden und jemanden verletzen.

OW13-1 Wenn Werkzeuge in der Maschine liegenbleiben, darf die Maschine nicht benutzt werden. Den Betriebsleiter verständigen.

OW14 Es besteht die Gefahr, sich die Finger zu klemmen, wenn die Arbeitstür (6) nicht mit der Klinke (10) auf- und zugemacht wird.

OW14-1 Türgriff (10) beim Öffnen und Schließen der Arbeitstür festhalten.

OW15 Wenn man Werkzeuge auf dem Steuerschrank (1) oder auf der Maschine liegenläßt, besteht die Gefahr, daß diese wegen der Vibration der Maschine herunterfallen.

OW15-1 Auf dem Steuerschrank und auf der Maschine nichts liegenlassen.

OW16 Wenn man auf die Maschine oder auf den Kühlmittelbehälter (22) steigt, besteht die Gefahr, zu stürzen und sich zu verletzen.

OW16-1 Nicht auf die Maschine und den Kühlmittelbehälter steigen.

OW17 Wenn man unter den Nivellierbolzen (12) greift, besteht die Gefahr, sich zu klemmen und zu verletzen.

OW17-1 Den Nivellierbolzen nicht einstellen. Wenn die Maschine nicht waagerecht ist, muß der Betriebsleiter verständigt werden.

OW17-2 Der Betriebsleiter muß den verantwortlichen Installateur mit der Einstellung des Nivellierbolzens beauftragen.

OW18 Wenn das Kabel hängt oder nicht ordentlich verlegt ist, besteht die Gefahr, darüber zu stolpern.
OW18-1 Wenn das Kabel hängt oder nicht ordentlich verlegt ist, muß man den Betriebsleiter verständigen.
OW18-2 Der Betriebsleiter muß den verantwortlichen Installateur damit beauftragen, das Kabel fachgerecht zu verlegen.

OW19 Wenn an der Maschine Modifikationen vorgenommen werden, dann tritt die Sicherheitsvorrichtung außer Kraft, und alle angegebenen Warnungen gelten nicht mehr.
OW19-1 Wenn die Maschine modifiziert wird, darf die Maschine nicht in Betrieb genommen werden, und muß man den Betriebsleiter verständigen.

OW20 Kühlmittel ist augenschädlich.
OW20-1 Bei der Einstellung der Kühlmitteldüse (14) einen Augenschutz tragen.
OW20-2 Wenn die Augen mit dem Kühlmittel in Berührung kommen, dann die Augen mit sauberem Wasser auswaschen und den Arzt konsultieren.

OW21 In jeder Spalte der Maschine besteht Klemm- und Verletzungsgefahr.
OW21-1 Nicht zwischen die ngriffschutz (14) fassen.
OW21-2 Nicht mit den Fingern zwischen das Werkzeug (15) oder den Werkzeughalter (16) und das ATC-Magazin kommen.

OW22 Wenn Kühlmittel, Schmierstoff oder Stahlspäne auf dem Fußboden ist, kann man rutschen und sich verletzen.
OW22-1 Vor Inbetriebnahme bei ausgeschalteter Maschine deren Innenseite und den Fußboden um die Maschine herum sauber machen

OW23 Beim Einsetzen und Herausnehmen des Werkzeughalters (16) besteht die Gefahr, sich zu schneiden oder sonstig zu verletzen.

OW23-1 Beim Austausch der Werkzeug Lederhandschuhe tragen und die Schneide der Werkzeuge nicht berühren.

OW24 Die Maschine kann plötzlich zum Laufen anfangen, und die Werkzeuge können aus der Haltung herausfallen.

OW24-1 Auf keinem Fall mit einem Körperteil unter den Spindelkopf (17) kommen.

OW25 Bei der Bearbeitung der Werkstücke mit ÖlKühlmittel besteht Brandgefahr.

OW25-1 Wenn kein Feueralarm und keine automatische Feuerlöschanlage installiert wird, nicht Ölkülmittel benutzen.

OW25-2 Bei der Bearbeitung mußder Operateur an der Maschine sein.

OW26 Wenn man sich an die Maschine anlehnt, besteht die Gefahr, daß man beim Lauf der Maschine gequetscht oder gestoßen und verletzt werden kann.

OW26-1 Sich nicht an die Maschine anlehnen.

OW27 Wenn man etwas an den Notfall-stop-Schalter (19) hängt, könnte er bei Notfall nicht gedrückt werden.

OW27-1 Nichts an den Notfall-stop-Schalter hängen.

OW28 Wenn der Tisch (19) sich bewegt, dann kann der Kabelschutz (20) auf der Rückseite der Maschine aus der Maschine herausspringen. Es besteht die Gefahr, gestoßen und verletzt zu werden.

OW28-1 Vor Aufräumen der Stahlspäne den Hauptschalter (21) ausschalten.

OW29 Der Kühlmitteltank (22) ist sehr schwer. Wenn man versucht zu heben, besteht die Gefahr, sich einen Bruch zu heben oder sich an die Füße durch Fallen des Tanks zu verletzen.

OW29-1 Auch beim Aufräumen der Stahlspäne darf der Kühlmitteltank nicht aufgehoben werden.

OW30 Beim Eintreten in die Maschine besteht die Gefahr, zu rutschen oder von den Maschinenteilen geklemmt zu werden.

OW30-1 Nicht unnötigerweise in die Maschine eintreten. Wenn man in die Maschine eintreten muß, den Betriebsleiter verständigen.

OW31 Wenn man vergißt, die Seitenabdeckung (23) des Spritzschutzes (2) aufzusetzen, besteht die Gefahr, geklemmt oder von einem gebrochenen Werkzeug verletzt zu werden.

OW31-1 Vor Einschalten der Maschine sich mit eigenen Augen vergewissern, daß der Seitenschutz aufgesteckt ist.Wenn er nicht aufgesteckt ist, den Betriebsleiter verständigen.

OW31-2 Der Betriebsleiter muß den Seitenschutz aufsetzen lassen.

OW32 Wenn Werkzeuge (16) oder Werkzeughalter (17), deren Gewicht oder Größe die vorgeschriebene Beschränkung überschreitet, benutzt werden, besteht die Gefahr, daß die Werkzeuge herausspringen.

OW32-1 Die vorgeschriebene Gewicht- und Größebeschränkung der Werkzeuge und Halter einhalten.

OW32-2 Das an der Maschine angebrachte Warnschild für die Beschr änkung der Werkzeuge beachten, Betriebsanleitung .

OW33 Das Rückkopplungs0widerstandsgerät wird während des Betriebs sehr heiß Es besteht die Gefahr, daß man sich die Finger bei Berührung verbrennt.

OW33-1 Den Rückkopplungs widerstandschutz (24) nicht abnehmen.

OW34 Der Motor wird während des Betriebs sehr heiß. Es besteht die Gefahr, daßman sich die Finger bei Berührung verbrennt.

OW34-1 Innerhalb von 30 Minuten nach dem Ausschalten der Maschine den Motor nicht berühren.

OW35 Beim Umlauf des ATC-Magazins (10) besteht die Gefahr, daß diese Werkzeuge (16) an das Werkstück, die Vorrichtung oder die Innenwand der Maschine anstoßen und abbrechen.

OW35-1 Die Länge der Werkzeuge mußgenau eingestellt werden, damit die Werkzeuge beim Umlauf des ATC-Magazins an das Werkstück, die Vorrichtung oder die Innenwand der Maschine nicht anstoßen.

OW36 Wenn der Steuerschrank (1) oder die Betriebstafel (25) naßist, besteht die Gefahr, einen Stromschlag zu erhalten.

OW36-1 Den Steuerschrank und die Betriebstafel vor Flüssigkeit wie Kühlmittel, Wasser und Stahlspäne schützen.

OW36-2 Mit naßen Händen den Steuerschrank nicht berühren.

OW37 Wenn man beim Bestehen der Explosionsgefahr den Schalter der Maschine einschaltet oder Werkstücke bearbeitet, besteht die Gefahr, daß ein überspringender Funke eine Explosion ausllösen.

OW37-1 Bei Explosionsgefahr in der Luft die Maschine nicht einschalten und die Bearbeitung sowie Vorbereitung nicht ausführen.

OW-38 Beim Bedienen mit nicht befestigtem Werkstüc kann das Werkstück abspringen, und deshalb besteht Verletzungsgefahr.

OW-38-1 Das Werkstück muß befestigt werden.

OW39 Wenn man vergißt, den Spritzseitenschutz (23) aufzusetzen, besteht Verletzungsgefahr.

OW39-1 Vor dem Einschalten des Schalters sich mit eigenen Augen vergewissern, daß der Spritzseitenschutz richtig aufgesetzt ist. Wenn kein Deckel aufgesetzt sein sollte, muß man den Betriebsleiter davon benachrichtigen.

OW39-2 Vor dem Entfernen des Spritzseitenschutz den Hauptschalter ausschalten und verschließen, damit ihn niemand mehr einschalten kann.

OW39-3 Der Spritzseitenschutz muß vom Betriebsleiter aufgesetzt werden.

OW40 Je nach Material des Werkstücks kann der Schneidesplitter Feuer fangen oder explodieren (z.B. Magnesium).

OW40-1 Schneidesplitter sofort entfernen.
OW40-2 Wenn mit feuergefährlichen Werkstücken gearbeitet wird, Feuerlöscher griffbereit halten. Betrieb niemals unbeobachtet lassen.

OW41 Sollten die Fräsapparate vom Werkzeug abgehen, könnten sie schwere Verletzungen verursachen.
OW41-1 Vergewissern Sie sich, daß dies Fräpparate befestigt sind, bevor Sie die Werkzeuge in die Maschine fassen.

OW42 Wenn die Anlage unzureichend beleuchtet ist, ist der Innenraum der Maschine dunkel, und es besteht die Gefahr, sich die Hände an den Vorrichtungen oder Schneiden zu verletzen.
OW42-1 Eine Maschinenleuchte anbringen, wenn die innere Beleuchtungsstärke der Maschine 500 Lux oder darunter ist.

Prüfen der Sicherheitsschilder

Die Sicherheitsschilder sind an der im Bild gezeigten Stelle der Maschine angebracht. Prüfen Sie, ob sie da fest angeklebt sind. Wenn sie sich von der Maschine lösen sollten, bekommen Sie Ersatzschilder und kleben Sie sie an die Maschine an.

Plazierung der Sicherheitsschilder

230S00C02.doc

S2A00401.ai

1. Sicherheitsschild, Vorderseite und Seite

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode : 690373001
Teilname : PS LABEL,TC FRONT JCE

(1) Sprache: Englisch, Deutsch, Französisch

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

Diese Maschine birgt Gefahren.
Um Risiken zu erkennen und vermeiden, vor dem Einschalten die Betriebsanleitung lesen.

L'utilisation de cette machine comporte des risques.
Lisez les manuels d'instruction pour connaître les risques et les éviter avant d'utiliser cette machine.

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
GEFAHR	**WARNUNG**	**WARNUNG**
Maschine in Betrieb kann plötzlich laufen und Sie stoßen. Beim Betrieb der Maschine von allen bewegenden Teilen sich fernhalten, um Verletzungen zu vermeiden.	Gebrochene Werkzeuge oder Werkstücke könnten Sie treffen und verletzen. Vor dem Start der Maschine Tür schließen.	Umlaufende Teile könnten Sie fassen und verletzen. Von umlaufendem Werkzeug, Spindel und Magazin sich fernhalten. Rotierende Teile nicht berühren. Während des Bedienens keine Handschuhe tragen.
DANGER	**AVERTISSEMENT**	**AVERTISSEMENT**
En opération, cette machine bougera soudainement et provoquera des risques d'écrasement. Ne vous approchez jamais des parties mobiles.	Les outils cassés ou les pièces usinées peuvent être projetés et risquent de vous frapper et de vous blesser. Fermez la porte avant de faire démarrer la machine.	Les parties tournantes peuvent vous accrocher et vous blesser. Ne vous approchez jamais des outils tournant, de la broche et du magasin. Ne saisissez jamais les parties en mouvement. Ne portez pas de gants pendant l'utilisation.

691042001 / 0302 (2)

Teilcode : 691042001
Teilname : PS LABEL,TC FRONT EGF

2. Werkzeugschild

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

Teilcode : 653379001
Teilname : Tool LABEL250

3. Sicherheitsschild, Rückseite und Hochdruckkühlmittelbehälter

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode : 690730001
Teilname : PSLABEL, TC REARJCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode : 691045001
Teilname : PSLABEL, TC REAR EGF

4. Schild, Regenerativwiderstand

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode: 690729001
Teilname: LABEL, TC REGENERATIVE JCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode: 691058001
Teilname: LABEL, TC REGENERATIVE EGF

5. Schild, Werkzeugausbau

(1) Sprache: Englisch, Japanisch, Chinesisch

Part Code : 653080001
Part Name : LABEL, Removing Tool JCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode : 69104001
Teilname : LABEL, Removing Tool EGF

6. Schild, Seitenverkleidung

(1) Sprache: Englisch, Japanisch, Chinesisch

Teilcode : 690731001
Teilname : LABEL, TC MAINTENANCE DOOR JCE

(2) Sprache: Englisch, Deutsch, Französisch

Teilcode : 690732001
Teilname : LABEL, TC MAINTENANCE DOOR EGF

7. Betreten-verboten Schild

Teilcode : 693178001

693178001 / 0607 (1)

693178001.ai

TÜRVERRIEGELUNGSFUNKTION

1. Allgemeine Vorsichtsmaßnahmen
2. Äußere Ansicht
3. Inspektion der Türverriegelung
4. Einzelheiten der Funktion

1 Allgemeine Vorsichtsmaßnahmen

⚠ GEFAHR

Umlaufende Werkzeuge und Laufende Teile können Sie verletzen. Wenn der Verriegelungsschalter außer Kraft ist, darf man mit keinem Körperteil in die Maschine kommen. Den Betriebsleiter verständigen.
Bei außer Kraft gesetzter Verriegelung darf der Betriebsleiter niemanden die Maschine benutzen lassen.
Vor Inbetriebnahme der Maschine sich mit eigenen Augen vergewissern, daß die Verriegelung in Kraft ist.
Sollte der Verriegelungsschlüssel im Schloß stecken, muß der Betribsleiter darüber informiert werden.
Den Verriegelungsschlüssel muß der Betriebsleiter aufbewahren.

⚠ GEFAHR

Bei außer Kraft gesetzter Verriegelung kann sich der Tisch bewegen. Die Innenteile der Innentür bewegen sich, auch wenn die Innentür geöffnet ist. Es besteht die Gefahr, vom Tisch oder von anderen Maschinenteilen geklemmt und verletzt zu werden.
Bei außer Kraft gesetzter Verriegelung mit keinem Körperteil in die Innenseite der Außentür kommen.
Bei außer Kraft gesetzter Verriegelung darf der Betriebsleiter niemanden die Maschine benutzen lassen.
Sollte der Verriegelungsschlüssel im Schloß stecken, muß der Betriebsleiter darüber informiert werden.

⚠ GEFAHR

Bei offener Innentür besteht Verletzungsgefahr an rotierendem Werkzeug und anderen Maschinenteilen.
Der Maschinenbediener darf die Innentür nicht öffnen.
Bei offener Innentür mit keinem Körperteil in die Maschine kommen. Der Bediener muß den Betriebsleiter davon benachrichtigen, da die Innentür offen ist. Der Betriebsleiter muß die Innentür verschließen und den Schlüssel aufbewahren.
Bei nicht verschlossener Innentür darf der Betriebsleiter niemanden die Maschine bedienen lassen.
Vor Inbetriebnahme der Maschine sich mit eigenen Augen vergewissern, daß die Verriegelung in Kraft ist.
Wenn die Innentür nicht veschlossen sein sollte, muß der Betriebsleiter davon benachrichtigt werden.

⚠ WARNUNG

Umlaufende Werkzeuge könnten Sie verletzen.
Von umlaufenden Werkzeugen sich fernhalten.

⚠ WARNING

Umlaufende Teile könnten Sie hineinziehen und verletzen.
Von umlaufenden Teilen; Werkzeugen, der Spindel und dem ATC-Magazin, sich fernhalten.
Körperanliegende Bekleidung tragen.
Lange Haare müssen unter einem Hut aufgesteckt werden.
Beim Arbeiten an der laufenden Maschine keine Handschuhe tragen.
Keinen Schmuck tragen.
Umlaufende Teile nicht berühren.

Zweck

Die Türveriegelungsfunktion schützt die Benutzer der Maschine vor der Gefahr, durch umlaufende Werkzeuge oder laufende Teile verletzt zu werden, oder durch umlaufende Teile in die Maschine hineingezogen zu werden.

Einrichtungsbeschreibung

Bei in Kraft gesetzter Verriegelung wird die Außentür verriegelt, und die Höchstgeschwindigkeit entsprechend der Situation vermindert.

Einrichtungsaufbau

Die Türverriegelungseinrichtung besteht aus folgenden:

1. Türendschalter
2. Türschloß

Benutzung der Funktion

1. Beim täglichen Betrieb
   muß der Verriegelungsschalter (1) immer in Kraft gesetzt sein.
2. Beim Einstellen der Arbeitsprozesse und Warten darf man den Schalter nur notwendigenfalls außer Kraft setzen.
   Lesen Sie bitte vor dem Einstellen und Warten der Maschine "Sicherheitsvorschrift für Personen, die die Maschine installieren und den Arbeitsprozeß aufstellen" und "Sicherheitsvorschrift für qualifiziertes Wartungspersonal".

   Bitte halten Sie Folgendes bei außer Kraft gesetzter Verriegelung ein.
   - Umlaufende Werkzeuge und andere laufende Teile beachten.
   - Nach dem Einstellen und Warten den Schalter in Kraft setzen.
   - Den Schlüssel (2) muß der Betriebsleiter aufbewahren.

2 Äußere Ansicht

TC-S2A

3 Inspektion der Türverriegelung

Vor Inbetriebnahme der Maschine muß die Türverriegelungseinrichtung geprüft werden.

Inspektionsschritte

Inspektion von Betriebsstörungen

1. Die Tür gut schließen, den Strom anschalten und auf Nullstellung zurückführen.
   Überprühen, dass der Türverriegelungsschalter eingeschaltet ist
2. Die Außentür öffnen.
3. Wenn die Türverriegelung richtig aktiviert ist, bewegt sich die Maschine nicht; auch nicht, wenn der [-X] Schalter auf dem Schaltbrett gedrückt ist.
   Wird ein Alarm gegeben, wird angezeigt, dass die Tür offen ist.
   Wird der Alarm nicht angezeigt, ist die Türverriegelung defekt. Sie muss repariert werden.

   Nachdem geklärt ist, dass die Türverriegelung richtig arbeitet, zum nächsten Schritt weitergehen.

Inspektion der Türverriegelung

4. Die Außentür schließen
5. Die Spindel rotieren lassen.
6. Wenn die Außentürverriegelung richtig arbeitet, ist die Außentür verriegelt und kann nicht geöffnet werden. Wenn die Tür geöffnet werden kann, ist die Tür nicht verriegelt und die Türverriegelung ist defekt. Sie muss repariert werden.

Not Stopp Inspektion

7. Spindel im Handmodus rotieren.
8. Arbeitet die Türverriegelung richtig und die Maschine hält an, wobei der [*NOT STOP EIN] Alarm angezeigt wird, ist der Not Stopp Knopf gedrükt. Wenn die Maschine nicht anhält oder keinen Alarm anzeigt, ist die Verriegelungsfunktion fehlerhaft. Sie muss repariert werden.

4 Einzelheiten der Funktion

Türstellung (*6)	Türverriegelung	Tüschloß(*6)	Maschinenbedienung
Zu	außer Kraft	nicht verriegelt	Jeder Betrieb ist möglich.
	in Kraft	Verriegelt während des Maschinenbetriebs (Achsenverschiebung,Spindel rotation, Tastatureingabe-und Programmierbedienung oder wenn der manuelle Impuisgeber in Kraft gesetzt ist).(*4)	
Auf	außer Kraft	nicht verriegelt	・Spindelrotaition, Magazindrehung,ATC und Gewindebohren sind nicht möglich. (*2) ・Achsenverschiebung,Spindelhalt und Spindelausrichtung sind möglich.(*1) ・Programmierbedienung ist nur bei Einzelbetriebsart möglich. ・Tastatureingabebedienung hält an jedem Satzende. ・Kühlmittel wird nicht zugeführt.
	in Kraft		・Die ganze betrieb ist un möglich.(*2)(*5) ・Kühlmittel wird nicht zugeführt.
Zu ↓ Auf	außer Kraft		・Der ganze Betrieb (einschießlich der Spindelrotation) hält sofort an.(*3) ・Kühlmittel stoppt sofort.
	in Kraft		・Der ganze Betrieb (einschießlich der Spindelrotation) hält sofort an.(*3) (*5) ・Kühlmittel stoppt sofort.
Auf	außer Kraft ↓ in Kraft		

*1. Die Eilgangsgeschwindigkeit ist bei MAX EILGANG (TÜR AUF) vom Maschinenparameter voreingestellt.
Die Geschwindigkeit des Schneidevorschubs wird auf die Geschwindigkeit von MAX EILGANG (TÜR AUF) der Maschinenparameter eingeschränkt.
Die Drehzahl zusätzlicher Achsen (A, B, C) ist auch auf die voreingestellte Drehzahl MAX SCHNELLDREH-5,6 (TÜR AUF) der Maschinenparameter eingeschränkt.

*2. Beim Versuch zu bedienen, kommt der Fehler “TÜR SCHL. NICHT”, wenn die vordere Tür offen ist .Der Fehler “SEITENTÜR OFFEN” kommt, wenn die Seitentür beim Versuch zu bedienen offen ist.

*3. Bedienungsschritte, die Gewindebohren, Spindelausrichtung, ATC oder Magazindrehung beinhalten, halten an jedem Satzende. Wenn die Tür während der Spindelrotation geöfnet werden sollte, kommt der Fehler “TÜR OFFEN SP HALT” und die Spindel hält an. Wenn man die Tür zumacht und die Maschine wieder anlaufen lät, steigt die Spindelzahl wieder auf den vorprogrammierten Wert.
Mit folgenden Bedienungsschritten wird der Fehler “TÜR OFFEN SP HALT” ausgelöst. Auch wenn die Tür geschlossen ist und der Betrieb wieder angelaufen ist, steigt die Spindeldrehzahl nicht wieder auf den vorprogrammierten Wert.

1) Wenn die [RESET]-Taste gedrückt wird.
2) Wenn die Spindel manuell bedient wird.

Anmerkung
Wenn die Türwärend der Spindelrotation nach der ersten Bewegung vom Gewindebohrfräsen (XY-Achsenverschiebung und Spindelrotation) geöffnet wird, hält die Spindel an, aber der Fehler “TÜR OFFEN SP HALT” kann nicht vorkommen. Auch wenn die Tür zugemacht und der Betrieb wiederaufgenommen wird, wird der Rotationszustand von vor dem Stopp nicht wiederhergestellt. Die Spindel rotiert automatisch, wenn die Z-Achse sich während des Schnittes vom Punkt “R” entfernt.

*4. Während des Maschinenbetriebs
Der betreffende Maschinenbetrieb beinhaltet hier einen temporalen Stopp sowie einen Blockstopp (ausgenommen bei Programmende und beim Programmstopp) für die Tastatureingabe und Dateibedienung.

*5. Besondere Spezifikationen
Wenn die Tür geöffnet ist, während die Tüverriegelung aktiviert ist, werden die Servomotoren abgeschaltet. Wenn die Tür vor der Dateibedienung oder während des Programmstopps (M00) geöffnet ist, kommt der Fehler “TÜR SCHL. NICHT” und die Servomotoren schalten ab. Dann die Tür schließen oder die Türverriegelung deaktivieren. Dann werden die Servomotoren auf AN geschaltet und der Fehler wird gelöscht. Wenn die Tür während der Dateibedienung geöffnet wird, kommt der Fehler “SERVOMOTOR ABGESTELLT” oder "TÜR OFFN MACHIN STOP". Dieser Fehler kann nicht gelöscht werden, auch wenn die Tür geschlossen wird. Dann die [RESET]-Taste drücken.

Manuel de sûretéour eux qui installent et arrangent le centreur tapant

Centreur tapant
TC-S2A

Lisez ce manuel de sûretésoigneusement avant l'opération de le centreur tapant, s'il vous plaît.

Brother Industries, Ltd. Machinery & Solution Company.

Table des matiéres

Les grandes lignes du manuel de sûreté ---------- 3
Lisez ce manuel---------- 3
Intension ---------- 3
Le contenu de manuel de sûreté la relation avec les autres manuels ---------- 3
Relation à des instructions de sûreté ---------- 4
Langage ---------- 4
Comment d'acheter---------- 4
Maniement du manuel de sûreté ---------- 5
Degré de danger ---------- 5
Ordre d'explication ---------- 5
Significations des symbols---------- 6

Noms de sections---------- 8
Avertissements et mesures preventives ---------- 10
Vérification des instructions de sûreté---------- 19

©1999-2007 BROTHER INDUSTRIES, LTD.
MACHINERY & SOLUTION COMPANY
All Rights Reserved.
Printed in Japan

Les grandes lignes du manuel de sûreté

Lisez ce manuel

Tout le monde qui utilize le centreur tapant, y compris eux qui installent le centreur tapant dans l'usine, qui manient le centreur tapant et façnnent des pièces en travail, qui ajustent et réparent le centreur tapant, est requis de lire ce manuel de sûret.

Dans ce manuel de sûreté tout le monde qui utilise le centreur tapant s'exprime comme utilisateur.

Intension
Le centreur tapant consiste en circuits électriques de voltage haut, outils qui tournent avec une grande vitesse, et tables et ATC magasins qui se meuvent avec une force puissante. Pour cela, des hasards divers s'associent à la machine.
L'intension de ce manuel de sûreté est de protéger les utilisateurs contre ces hasards.
Le manuel de sûreté explique ci-dessous:
Avertissments: des types de hasards
Mesures préventives : des manières d'empêcher les hasards de surgir

Le contenu de manuel de sûreté et la relation avec les autres manuels

Chaque manuel d'instruction, sauf le manuel de programmation, contient le manuel de sûreté
Les manuels de sûreté sont donnés à chaque groupe de personnel.
Lisez le texte du manuel d'instruction pour connaître des fonctions et des méthodes d'opération de la machine.

1.Manuel de fonctionnement (A l'usage des opérateurs non-spécialisés)
"Manuel de sûreté pour opérateurs"
"Manuel de sûeté pour eux qui installent et arrangent le centreur tapant"
"Manuel de opération:(fonctionnements élémentaires de la machine à l'intention des opérateurs non-spécialisés ")
Code de parties pour français : 693077001

2.Manuel de fonctionnement (A l'intention des opérateurs spécialisés)
"Manuel de sûreté pour opérateurs"
"Manuel de sûeté pour eux qui installent et arrangent le centreur tapant"
"Fonction De L'enclenchement Avec Verrouillage De La Porte"
"Manuel de opération": (opération de la machine necessaire pour arrangement et faconnement.)
La machine de programmation à conversation Code de parties pour japonais : 693312001
Code de parties pour anglais : 693307001
NC langage Code de parties pour japonais : 693310001
Code de parties pour anglais : 693305001

3 Manuel d'installation "Manuel de sûreté pour eux qui installent et arrangent le centreur tapant"
"Manuel d'installation: Installation et assemblage de la machine et ces accessoires."
Code de parties pour japonais : 693311001
Code de parties pour anglais : 693306001

4. Manuel de programmation "Manuel de programmation:
création de programme de façonnement"
La machine de programmation à conversation Code de parties pour japonais: 693314001
Code de parties pour anglais : 693309001
NC langage Code de parties pour japonais : 693313001
Code de parties pour anglais : 693308001

5.Manuel de maintenance "Manuel de sûeté pour eux qui sont qualifiés pour maintenance de centreur tapanmaintenance."
" Manuel de maintenance:
Ajustement et réparation de la machine."
Le manuel de maintenance n'est pas distribué aux clients.

Relation à des instructions de sûreté

Les articles d'importance particulier qui apparaissent dans ce manuel de sûreté s'attachent aussi à la machine comme instructions de sûreté.
Une explication des instructions de sûreté se prépare à la fin de ce manuel de sûeté. Si des instructions de sûreté se sont déachées de la machine, obtenez des nouvelles instructions de sûeté et les attachez correctement.

Langage

Des machine envoyées à l'intérieur du Japon sont pourvues de manuels de sûreté et d'instructions de sûeté rits en japoinais. Les machines exportées du Japon sont fournies avec les manuels et les étiquettes de sécurité en quatre langues : anglais, allemand, français et chinois. Obtenez les manuels et les instructions écrits en un langage que vous pouvez comprendre.
Sur manuels et instructions en autres langages, consultez le vendeur auquel vous avez acheté la machine.

Comment d'acheter

Quand les manuels de sûreté et les instructions de sûeté ont été perdus, obtenez-les du vendeur auquel vous avez acheté la machine.
Si vous ne savez pas le vendeur, consultez les bureaux spécifiés ci-dessous.

1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD. Machinery & Solution Company.
phone +81-52-824-2232

Maniement du manuel de sûreté

Gardez-vous de perdre les manuels de sûreté et mettez-les sous la main toujours. Quand la machine change de main, passez les manuels de sûreté à la nouvelle propriétaire avec la machine.

Degré de danger

Les degré de danger se classent en trois catégories d'aprés le niveau de dommage qui peut surgir quand des instructions ne sont pas observées.

1.DANGER

⚠ DANGER

Dommage qui peut causer une mort ou une blessure sévère.

2. AVERTISSEMENT

⚠ AVERTISSEMENT

Dommage qui peut entraîner une blessure sérieuse.

3. ATTENTION

⚠ ATTENTION

Dommage moins sérieux que cela ci-dessus.

Ordre d'explication

Les instructions de sûreté s'expliquent dans l'ordre ci-dessous.

1. Mots de signal (DANGER, AVERTISSEMENT, ATTENTION) et symboles indiquant le degré de danger
2. Type de danger (Sujet)
3. Type de dommages prévus
4. Mesure préventive

Significations des symboles

Les symboles sont utilisés sur les instructions de sûreté et dans les avertissements du manuel de sûeté pour expliquer des dangers possibles et leurs mesures préventives.

1. Danger

Glissement

Parties se mouvant

Trébuchement

Commotionélectrique

Commotionélectrique

Pris

Main coincée

Température haute

Température haute

Coupe

Coupe

Eclatement

Pointe aigu

Objet tombant

Objet tombant

Objet tournant

Tomber

Jaillissement

Jaillissement

Feu

2. Mesures préventives

Protégez vos oreilles.

Protégez vos mains.

Protégez vos pieds.

Coupez la prise de courant.

Ne touchez pas.

Protégez votre tête.

Connectez le coupe-circuit.

Ne Désassemblez pas.

Protégez vos yeux.

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

Avertissements et mesures préventives

Les nombres dans ( ) tels que 1, 2 correspondent aux noms de chaque section.

Danger **DANGER**

SD1 Hasards divers s'associent au centreur tapant.
SD1-1 Lisez le manuel de sûetê avant l'opéation de la machine pour connaîre ces hasards et les mesures prêventives.
SD1-2 Tous les utilisateurs doivent connaître la position du bouton d'arrêt d'urgence(18) et l'opération.

SD2 Les sections de voltage haut sont presents dans l'armoire de commande(1). Si vous les touchez par erreur, vous pouvez se blesser sérieusement ou mourrir.
SD2-1 Personnes qui ont la connaissance suffisante sur les circuits électriques de cette machine et qualité d'elctromécanicien sont seulement admises à faire la maintenance et la révision des composants électriques.
SD2-2 Coupez le contacteur de l'alimentation principale (21) avant l'opération. Apposez une affiche spécifiant 'En train de maintenance.'
SD-2-3 Quand vous quittez la machine, fermez la porte de l'armoire de commande et fixez-la avec des vis.

SD3 Vous pouvez se prendre dans la machine en opération et se blesser sérieusement.
SD3-1 N'entrez pas dans le tôle-pare copeaux en opération.
SD-3-2 Appuyez sur la touche d'arrét (3) ou la touche de reproduction, assurez-vous visuellement que la lampe d'arrét allume, et mettez-vous les mains, les pieds, et le corps dans la machine.
SD3-3 Assurez-vous visuellement que personne n'ntre dans le tôle-pare copeaux avant de mettre la machine en marche.
SD3-3 Ne vous approchez pas les mains, les pieds, et le corps de sections se mouvant en opération.
SD3-4 Quand il est necéssaire d'entrer dans la machine, coupez le contacteur de l'alimentation principale et cadenassez-le pour que le contacteur de l'alimentation pricipale (21) ne soit pas mis en.

SD4 Quand le commutateur de la porte d'embrayage(5) est désactivé la machine marche quand même la porte de travail(6) ou la porte latérale (6)est ouverte. Vous pouvez se couper avec un outil tournant (15), ou se prendre dans la machine.
SD4-1 Pendant l'installation de la machine, faites extrêmement attention au mouvement de la machine de façon à pouvoir l'arrêter à tout moment. Lorsque l'installation de la machine est terminée, mettez l'interrupteur de verrouillage de la porte sur la position ON. Retirez la clé de verrouillage de la porte (7), que le superviseur devra ensuite toujours garder.
SD4-2 Ne quittez pas la machine oû l'interrupteur de la porte d'embrayage n'est pas valable.

SD5 La table (20) risque de se déplacer si l'interrupteur de verrouillage de la porte (5) est réglé sur la position OFF. Vous risquez de rester coincé dans la table et de vous blesser.

SD5-1 Pendant l'installation de la machine, faites extrêmement attention au mouvement de la machine de façon à pouvoir l'arrêter à tout moment. Lorsque l'installation de la machine est terminée, mettez l'interrupteur de verrouillage de la porte sur la position ON. Retirez la clé de verrouillage de la porte (8), que le superviseur devra ensuite toujours garder.

Avertissement AVERTISSEMENT

SW1 En touchant des outils tournant (15), vous vous blesserez.

SW1-1 Ne vous approchez pas d'utils tournant.

SW2 Des (15) outils cassés ou des pièces en travail frappant, vous pouvez se blesser.

SW2-1 Fermez la porte de travail (6) et mettez la machine en marche.

SW3 Vous pouvez être pris dans le section tournant et se blesser.

SW3-1 Ne vous approchez pas d'outiles tournant (15), de broche (8), et de ATC magasin (9).

SW3-2 Portez des vêtements tout justes. Mettez des cheveux longs dans un bonnet. Ne portez pas de gants sans que vous n'arrêtiez la machine et ni ne fassiez l'arrangement. Ne portez pas de bijoux. Ne tenez pas le section tonrnant.

SW4 Si le dispositif de sûreté est modifié il peut ne pas travailler préisement. Donc vous pouvez être happé par la machine, se heurter contre la machine, ou recevoir une commotion électrique.

SW4-1 Ne modifiez pas le dispositif de sûreté. Ne fixez pas le dispositif de sûreté pour que le dispositif de sûreté ne marche pas.

SW5 Quand des copeaux s'éarpillant vous sont mis dans les yeux, vous pouvez se blesser les globes oculaires et perdre la vue.
SW5-1 Portez des lunettes de protection.
SW5-2 Ne enlevez pas de copeaux en air.

SW6 Si vous touchez des copeaux de la main nue, vous pouvez se couper la main ou se brûler.
SW6-1 Ne touchez pas de copeaux de la main nue. Ne touchez pas de sections pointues de pièces en travail.
SW6-2 Quand vous enlevez des copeaux, utilisez une brosse.
SW6-3 Nettoyez copeaux de coupe quard machine est arrêtée.

SW7 Si vous tenez le tranchant d'outil (15), vous pouvez se couper la main.
SW7-1 Ne touchez pas le tranchant d'outil. Tenez le pied de la garde d'outil (16) toujours.

SW8 En laissant tomber un objet lourd sur vos pieds, vous pouvez se fracturer les pieds.
SW8-1 Quand vous levez des objets lourds, portez des chaussures de protection.

SW9 En levant des objets lourds, vous pouvez souffrir du lumbago.
SW9-1 Quand vous levez des objets lourds, demandez de l'aide.
SW9-2 Levez des objets avec la force de vos jambes au lieu de votre dos.

SW10 En travaillant dans un bruit infernal ou pendant de longues heures, vous pouvez avoir des légers troubles de l'audition.
SW10-1 Quand vous travaillez dans le bruit, portez des protections telles que les protège-oreilles.

SW11 Vous pouvez se blesser les yeux ou les oreilles dans un éclatement d'un air à haute pression.
SW11-1 Vous ne devez pas installer ou changer la tuyauteri d'un air àhaute pression, que vous ne soyez qualifiié pour manipuler l'air à haute pression et ne compreniez la tuyauterié de la machine.
SW11-2 Pour réparer la tuyauterié d'un air à haute pression, coupez la source de pression et enlevez la pression restant. Posez l'affiche qui dit d'en maintenance.

SW12 Vous pouvez se frapper la téte en levant.
SW12-1 Portez un casque de protection quand vous travaillez dans et autour de la machine.

SW13 Si vous faites fonctionner la machine en laissant des outils dans la machine, les outils peuvent jaillir et vous blesser.
SW13-1 Ne laissez pas des outils dans la machine.

SW14 Vous pouvez avoir la main pris dans la porte travail (6), si vous la ouvrez et fermez en tenant d'autres parties de la porte travail que la poignée (10).
SW14-1 Tenez la poignée de la porte travail , quand vous la ouvrez et fermez.

SW15 L'armoire de commande (1) a des sections de haute température. Pour cela, si des papiers d'epassez de la boîte â papiers (11) de l'armoire de commande, ils peuvent prendre feu.
SW15-1 Ne mettez pas de papiers excédant la grandeur de papiers de A4 ou de lettre.

SW16 Si des outils sont mis sur l'armoire de commande (1) ou la machine, ils peuvent tomber à cause de la vibration de la machine.
SW16-1 Ne mettez pas d'objets sur l'armoire de commande ou la machine.

SW17 Si vous montez sur la machine ou le tank d'huile de coupe (22), vous pouvez tomber et se blesser.
SW17-1 Ne montez pas sur la machine ou le tank d'huile de coupe.

SW18 Si vous vous mettez la main sous les boulons â régler le niveau de la machine (12), vous pouvez avoir la main pris et se blesser.

SW18-1 Ne mettez-vous pas la main sous le boulon à régler le niveau de la machine. Utilisez des outils pour ajuster le boulon à régler le niveau de la machine.

SW19 Si le câble pend ou n'est pas couvert, vous pouvez s'en prendre ou glisser et tomber.

SW19-1 Ne donnez pas de jeu au câble. Couvrez le câble, quand il est placé sur le plancher.

SW20 La modification de la machine peut affecter le dispositif de séurité et faire les expressions de tous les avertissements donnés inutiles.

SW20-1 Ne modifiez pas la machine.Si la modification est requise, contactez Brother Industries, Ltd. d'avance et demandez la permission par écrit.

SW21 Si de l'huile de coupe rejaillit dans vos yeux, vous pouvez se blesser les yeux.

SW21-1 Quand vous ajustez l'ajutage d'huile de coupe (13), portez les lunettes de protection.

SW21-2 Quand de l'huile de coupe rejaillit dans vos yeux, vous devez se laver les yeux à l'eau claire et consulter un médicin.

SW22 Si vous vous mettez les doigts dans un espace de la machine, vous pouvez avoir les doigts pris et se blesser.

SW22-1 Ne mettez pas les doigts entre couverture de jambe.

SW22-2 Ne vous mettez pas les doigts entre l'outil (15) ou le support à outil (16) et ATC magasin(9).

SW23 Si de l'huile de coupe, de l'huile, ou des copeaux sont dispersés, vous pouvez glisser, tomber, ou se heurter et se blesser.

SW23-1 Coupez le secteur de la machine, nettoyez dans et autour de la machine, et travaillez.

SW23-2 Portez un casque de protection et des chaussures de sûreté, pendant que vous installez la machine.

SW24 Quand vous attachez la garde d'outil (16) à la machine ou les en détachez, vous pouvez se couper à la main en un tranchant d'outil (15) ou se heurter la main contre la machine, se heurter la main coutre la machine.

SW24-1 Ne tenez pas le bout de l'outil. Portez des gants en cuir. Tenez l'outil et le support à outil des deux mains.

SW25 La machine peut marcher brusquement, ou des outils peuvent tomber.

SW25-1 Quand la lampe d'arrêt (4) n'allume pas, Ne vous mettez pas les mains, les pieds, et le corps sous la tête de la broche (17).

SW25-2 Quand vous arrangez la machine, tirez la table près de vous ou positionnez la colonneà l'écart de vous.

SW25-3 Tirez la cale près de vous, quand vous arrangez le changeur de cale.

SW25-4 Coupez le contacteur (21) de l'alimentation principale, cadenassez-le pour qu'il ne soit pas mis en, et appliquez graisse.

SW26 Quand vous façconnez des pièces en travail à la machine en utilisant de l'huile de coupe, la section façonnant peut chauffer et prendre feu.

SW26-1 En utilisant de l'huile de coupe, installez un avertisseur d'incendie et un extincteur automatique.

SW26-2 En façconnant des pièces en travail, il faut que un opérateur se tienne prêt de la machine.

SW27 En s'appuyant à la machine, vous pouvez se prendre dans la machine ou s'y heurter et se blesser.

SW27-1 Ne vous appuyez pas à la machine.

SW28 Si des objets s'accrochent au bouton d'arrêt d'urgence (18), vous pouvez ne pas appuyer le doigt sur le bouton d'arrrêt d'urgence.

SW28-1 Ne accrochez pas d'objet au bouton d'arrrêt d'urgence.

SW30 Comme le rêservoir d'huile de coupe (22) est lourd, en levant le réservoir d'huile de coupe vous pouvez souffrir du lumbago ou le laisser tomber sur les pieds.

SW30-1 Ne levez pas le réservoir d'huile de coupe, quand vous enlevez des copeaux même.

SW31 Quand vous entrez dans la machine, vous pouvez tomber en glissant et se happer dans la machine.

SW31-1 Avant d'entrer dans la machine, coupez le contacteur de l'alimentation principale, cadenassez-le pour qu'il ne soit pas mis en, et enlevez l'huile de coupe et les copeaux. Portez un casque de protection et des chaussures de sûreté Posez l'affiche qui dit d'en maintenance près de la panneau d'opération.

SW32 Si la couverture à càté (23) du tôle pare-copeaux (2) n'est pas attaché vous pouvez se prendre dans la machine ou se blesser en jaillissant des outils cassés.

SW32 Assurez-vous visuellement que le couvre côté du tôle pare-copeaux est attaché avant de mettre le contact.

SW33 Si des outils (15) ou la garde d'outil (16) dont le poids et la grandeur excédent la limite spéifiée sont utilisés, ils peuvent sauter.

SW33-1 Utilisez des outils et la garde d'outil dont le poids et la grandeur excédent la limite spécifid'e.

SW33-2 Pour connaître la limite d'outils, regardez l'instruction attachd'àl'outil manuel de operation.

SW34 Si vous touchez la résistance régénératrice, vous pouvez se brûler parce que la réistance chauffe en opétarion.

SW34-1 Ne enlevez pas la couverture pour a réistance ratrice (24).

SW35 Si vous touchez le moteur, vous pouvez se brûler parce que le moteur chauffe en opétarion.

SW35-1 Ne touchez pas le moteur dans 30 minutes après l'arrêt de la machine.

SW36 Si un plomb de séreté incorrect est disposé un feu peut éclater parce que le dispositif de protection ne marche pas.

SW36-1 Remplacez un plomb épuisé par le même plomb.

SW37 Si la disposition du relais thermique est incorrecte, un feu peut éclater parce que le dispositif de protection ne marche pas.

SW37-1 Ne changez pas la disposition du relais thermique.

SW38 Si le ATC magasin (10) tourne, des outils (16) peuvent heurter des piéces en travail, une gigue , ou la machine et casser.

SW38-1 Fixez la longueur des outils pour queles outils ne heurtent pas les piéces en travail, la gigue, ou la machine méme si le ATC magasin tourne.

SW39 Si l'armoire de commande (1) ou le panneau d'opération (25) sont mouillées, vous pouvez recevoir une commotion électrique.

SW39-1 Ne arrosez pas l'armoire de commande et le panneau d'opération d'huile de coupe, d'eau, et de copeaux.

SW39-2 Ne touchez pas l'armoire de commande de la main mouillée.

SW40 Si le fil de force motrice, fil de PE, installé à l'éxterieur est court, en cause du tirage du câble le fil de PE se décroche et vous pouvez recevoir une commotion électrique.

SW40-1 Utilisez le fil plus long que autres fils (L1, L2, L3) et connectez le fil en donnant le fil du jeu.

SW41 Si vous mettez le contact de la machine ou façonnez des pièces en travail dans une atmosphère explosible, une explosion peut survenir en cause d'une étincelle de la machine.

SW41-1 Ne installez pas dans une atmosphère explosible.

SW41-2 Ne mettez pas la machine sous tension, ne demarrez pas l'usinage ou ne reglez pas la machine dans une atmosphere explosive.

SW42 Si vous oubliez de monter le capot latéral de la tôle pare-copeaux (23), vous pouvez vous prendre dans la machine et vous blesser.

SW41-1 Avant une mise en alimentation, assurez-vous visuellement que le capot latéral de la tôle pare-copeaux est monté.

SW44 Copeaux de coupe peuvent prendre feu ou exploser selon matériel de piéce travaillée (cas. magnésium).

SW44-1 Enlevez touts copeaux de coupe immédiatement.

SW44-2 Installez extincteur auprés de la machine en usinant une pièce travaillée faite de tel matériel, et ne réalisez jamais opération inhabitée.

SW45 Si la appareil de fraisage n’est pas assurée à l’outil, elle peut se détacher de l’outil pendant rotation de broche, aboutissant à tort sérieux.

SW45-1 Contrôlez que la appareil de fraisage est assurée à l’outil et ensuite fixez l’outil.

SW46 Un feu risque de se déclencher si l'on utilise un capteur à 3 fils qui comprend une ligne d'alimentation exclusive.

SW46-1 Utiliser un capteur à 2 fils à la place d'un capteur à 3 fils.

SW46-2 Si l'on ne peut éviter d'utiliser des capteurs à 3 fils, ajouter un fusible (1A ou moins) à la ligne d'alimentation de chaque capteur.

SW47 Les mauvais contacts qui se produisent lorsque les bornes ne sont pas correctement serrées après la pose des fils électriques risquent de provoquer un incendie.

SW47-1 Après la pose des fils électriques, vérifier soigneusement le serrage des vis.

SW48 Attention de ne pas vous blesser avec les couteaux ou les dispositifs de serrage lorsque vous entrez dans la machine et que la pièce est mal éclairée.

SW48-1 Prévoir une lampe dans la machine lorsque l’éclairage ne dépasse pas 500 lux.

Vérification des instructions de sûreté

Les instructions de sûeté sont attacheés à la machine. Leurs positions sont indiquées dans le dession ci-dessous. Contrôlez que les instructions ne sont pas endommagées. Si elles sont endommagées, obtenez une nouvelle instruction pour remplacement.

Position des instructions de sûreté

230S00C02.doc

S2A00401.ai

1. Etiquette de sûreté, Avant et latéral

(1) Langue : Anglais, Japonais, Chinois

Code de partie : 690373001
Nom de partie : PS LABEL,TC FRONT JCE

(2) Langue : Anglais, Allemand, Français

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

Diese Maschine birgt Gefahren.
Um Risiken zu erkennen und vermeiden, vor dem Einschalten die Betriebsanleitung lesen.

L'utilisation de cette machine comporte des risques.
Lisez les manuels d'instruction pour connaître les risques et les éviter avant d'utiliser cette machine.

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
GEFAHR	**WARNUNG**	**WARNUNG**
Maschine in Betrieb kann plötzlich laufen und Sie stoßen. Beim Betrieb der Maschine von allen bewegenden Teilen sich fernhalten, um Verletzungen zu vermeiden.	Gebrochene Werkzeuge oder Werkstücke könnten Sie treffen und verletzen. Vor dem Start der Maschine Tür schließen.	Umlaufende Teile könnten Sie fassen und verletzen. Von umlaufendem Werkzeug, Spindel und Magazin sich fernhalten. Rotierende Teile nicht berühren. Während des Bedienens keine Handschuhe tragen.
DANGER	**AVERTISSEMENT**	**AVERTISSEMENT**
En opération, cette machine bougera soudainement et provoquera des risques d'écrasement. Ne vous approchez jamais des parties mobiles.	Les outils cassés ou les pièces usinées peuvent être projetés et risquent de vous frapper et de vous blesser. Fermez la porte avant de faire démarrer la machine.	Les parties tournantes peuvent vous accrocher et vous blesser. Ne vous approchez jamais des outils tournant, de la broche et du magasin. Ne saisissez jamais les parties en mouvement. Ne portez pas de gants pendant l'utilisation.

691042001 / 0302 (2)

Code de partie : 691042001
Nom de partie : PS LABEL,TC FRONT EGF

2. Etiquette d'outil

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

Code de partie : 653379001
Nom de partie : Tool LABEL250

3. Etiquette de sûreté, Arrière équipement à haute pression de liquide réfrigérant

(1) Langue : Anglais, Japonais, Chinois

Code de partie : 690730001
Nom de partie : PSLABEL, TC REARJCE

(2) Langue : Anglais, Allemand, Français

Code de partie : 691045001
Nom de partie : PSLABEL, TC REAR EGF

4. Etiquette, résistance régénératrice

(1) Langue : Anglais, Japonais, Chinois

Code de partie: 690729001
Nom de partie: LABEL, TC REGENERATIVE JCE

(2) Langue : Anglais, Allemand, Français

Code de partie: 691058001
Nom de partie: LABEL, TC REGENERATIVE EGF

5. Etiquette, retrait d'outil

(1) Langue : Anglais, Japonais, Chinois

Code de partie : 653080001
Nom de partie : LABEL, Removing Tool JCE

(2) Langue : Anglais, Allemand, Français

Code de partie : 69104001
Nom de partie : LABEL, Removing Tool EGF

6. Etiquette, Couverture latérale

(1) Langue : Anglais, Japonais, Chinois

Code de partie	: 690731001
Nom de partie	: LABEL, TC MAINTENANCE DOOR JCE

(2) Langue : Anglais, Allemand, Français

Code de partie : 690732001
Nom de partie : LABEL, TC MAINTENANCE DOOR EGF

7. Etiquette défense de monter

Code de partie : 693178001

693178001 / 0607 (1)

693178001.ai

Manuel de sûreté pour opérateurs

Centreur tapant
TC-S2A

Lisez ce manuel de sûretésoigneusement avant l'opération de le centreur tapant, s'il vous plaît.

Brother Industries, Ltd. Machinery & Solution Company.

Table des matiéres

Les grandes lignes du manuel de sûreté----------3
Lisez ce manuel----------3
Intension----------3
Le contenu de manuel de sûreté la relation avec les autres manuels----------3
Relation à des instructions de sûreté----------4
Langage----------4
Comment d'acheter----------4
Maniement du manuel de sûreté----------5
Degré de danger----------5
Ordre d'explication----------5
Significations des symboles----------6

Noms de sections----------8
Avertissements et mesures préventives----------10
Vérification des instructions de sûreté----------19

©1999-2007 BROTHER INDUSTRIES, LTD.
MACHINERY & SOLUTION COMPANY
All Rights Reserved.
Printed in Japan.

Les grandes lignes du manuel de sûreté

Lisez ce manuel

Tout le monde qui utilize le centreur tapant, y compris eux qui installent le centreur tapant dans l'usine, qui manient le centreur tapant et façnnent des pièces en travail, qui ajustent et réparent le centreur tapant, est requis de lire ce manuel de sûret.

Dans ce manuel de sûreté tout le monde qui utilise le centreur tapant s'exprime comme utilisateur.

Intension
Le centreur tapant consiste en circuits électriques de voltage haut, outils qui tournent avec une grande vitesse, et tables et ATC magasins qui se meuvent avec une force puissante. Pour cela, des hasards divers s'associent à la machine.
L'intension de ce manuel de sûreté est de protéger les utilisateurs contre ces hasards.
Le manuel de sûreté explique ci-dessous:
Avertissments: des types de hasards
Mesures préventives : des manières d'empêcher les hasards de surgir

Le contenu de manuel de sûreté et la relation avec les autres manuels

Chaque manuel d'instruction, sauf le manuel de programmation, contient le manuel de sûreté
Les manuels de sûreté sont donnés à chaque groupe de personnel.
Lisez le texte du manuel d'instruction pour connaître des fonctions et des méthodes d'opération de la machine.

1.Manuel de fonctionnement (A l'usage des opérateurs non-spécialisés)
"Manuel de sûreté pour opérateurs"
"Manuel de sûeté pour eux qui installent et arrangent le centreur tapant"
"Manuel de opération:(fonctionnements élémentaires de la machine à l'intention des opérateurs non-spécialisés ")
Code de parties pour français : 693077001

2.Manuel de fonctionnement (A l'intention des opérateurs spécialisés)
"Manuel de sûreté pour opérateurs"
"Manuel de sûeté pour eux qui installent et arrangent le centreur tapant"
"Fonction De L'enclenchement Avec Verrouillage De La Porte"
"Manuel de opération": (opération de la machine necessaire pour arrangement et faconnement.)
La machine de programmation à conversation Code de parties pour japonais : 693312001
Code de parties pour anglais : 693307001
NC langage Code de parties pour japonais : 693310001
Code de parties pour anglais : 693305001

3 Manuel d'installation "Manuel de sûreté pour eux qui installent et arrangent le centreur tapant"
"Manuel d'installation: Installation et assemblage de la machine et ces accessoires."
Code de parties pour japonais : 693311001
Code de parties pour anglais : 693306001

4. Manuel de programmation "Manuel de programmation:
création de programme de façonnement"
La machine de programmation à conversation Code de parties pour japonais: 693314001
Code de parties pour anglais : 693309001
NC langage Code de parties pour japonais : 693313001
Code de parties pour anglais : 693308001

5.Manuel de maintenance "Manuel de sûeté pour eux qui sont qualifiés pour maintenance de centreur tapanmaintenance."
" Manuel de maintenance:
Ajustement et réparation de la machine."
Le manuel de maintenance n'est pas distribué aux clients.

Relation à des instructions de sûreté

Les articles d'importance particulier qui apparaissent dans ce manuel de sûreté s'attachent aussi à la machine comme instructions de sûreté.
Une explication des instructions de sûreté se prépare à la fin de ce manuel de sûeté. Si des instructions de sûreté se sont déachées de la machine, obtenez des nouvelles instructions de sûeté et les attachez correctement.

Langage

Des machine envoyées à l'intérieur du Japon sont pourvues de manuels de sûreté et d'instructions de sûeté rits en japoinais. Les machines exportées du Japon sont fournies avec les manuels et les étiquettes de sécurité en quatre langues : anglais, allemand, français et chinois. Obtenez les manuels et les instructions écrits en un langage que vous pouvez comprendre.
Sur manuels et instructions en autres langages, consultez le vendeur auquel vous avez acheté la machine.

Comment d'acheter

Quand les manuels de sûreté et les instructions de sûeté ont été perdus, obtenez-les du vendeur auquel vous avez acheté la machine.
Si vous ne savez pas le vendeur, consultez les bureaux spécifiés ci-dessous.

1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD. Machinery & Solution Company.
phone +81-52-824-2232

Maniement du manuel de sûreté

Gardez-vous de perdre les manuels de sûreté et mettez-les sous la main toujours. Quand la machine change de main, passez les manuels de sûreté à la nouvelle propriétaire avec la machine.

Degré de danger

Les degré de danger se classent en trois catégories d'aprés le niveau de dommage qui peut surgir quand des instructions ne sont pas observées.

1.DANGER

⚠ DANGER

Dommage qui peut causer une mort ou une blessure sévère.

2. AVERTISSEMENT

⚠ AVERTISSEMENT

Dommage qui peut entraîner une blessure sérieuse.

3. ATTENTION

⚠ ATTENTION

Dommage moins sérieux que cela ci-dessus.

Ordre d'explication

Les instructions de sûreté s'expliquent dans l'ordre ci-dessous.

1. Mots de signal (DANGER, AVERTISSEMENT, ATTENTION) et symboles indiquant le degré de danger
2. Type de danger (Sujet)
3. Type de dommages prévus
4. Mesure préventive

Significations des symboles

Les symboles sont utilisés sur les instructions de sûreté et dans les avertissements du manuel de sûeté pour expliquer des dangers possibles et leurs mesures préventives.

1. Danger

Glissement

Parties se mouvant

Trébuchement

Commotionélectrique

Commotionélectrique

Pris

Main coincée

Température haute

Température haute

Coupe

Coupe

Eclatement

Pointe aigu

Objet tombant

Objet tombant

Objet tournant

Tomber

Jaillissement

Jaillissement

Feu

2. Mesures préventives

Protégez vos oreilles.

Protégez vos mains.

Protégez vos pieds.

Coupez la prise de courant.

Ne touchez pas.

Protégez votre tête.

Connectez le coupe-circuit.

Ne Désassemblez pas.

Protégez vos yeux.

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

Avertissements et mesures préventives

Les nombres dans ( ) tels que 1, 2 correspondent aux noms de chaque section.

Danger ⚠ DANGER

OD1 Hasards divers's associent au centreur tapant.
OD1-1 Lisez le manuel de sûreté avant l'opération de la machine pour connaître ces hasards et les mesures préventives.
OD1-2 Tous les utilisateurs doivent connaître la position du bouton (19) d'arrêt d'urgence et l'opération.

OD2 Les sections de voltage haut sont presents dans l'armoire de commande(1). Si vous les touchez par erreur, vous pouvez se blesser sérieusement ou mourrir.
OD2-1 Personnes qui ont la connaissance suffisante sur les circuits électriques de cette machine et qualité d'électromécanicien sont seulement admises à faire la maintenance et la révision des composants électriques.
OD2-2 Si une alarme est donnée, avertissez-en le superviseur immédiatement. Des opérateurs ne sont pas admis à réparer la machine. Des personnes qualifieés avec la connaissance suffisante sur la machine sont seulement admises à effectuer la réparation et l'installation.

OD3 Vous pouvez se prendre dans la machine en opération et se blesser sérieusement.
OD3-1 N'entrez pas dans le tôle-pare copeaux en opération.
OD3-2 Assurez-vous visuellement que personne n'entre dans le tôle-pare copeaux avant de mettre la machine en marche.
OD3-3 Ne vous approchez pas les mains, les pieds, et le corps de sections se mouvant en opération.
OD3-4 Si une alarme est donnée, avertissez-en le superviseur immédiatement.Ne vous mettez pas les mains, les pieds, et le corps dans la machine.

OD4 Quand l'interrupteur de l'enclenchement avec verrouillage de la porte(5) est invalable, la machine marche quand même la porte travail (6) ouvrirait. Vous pouvez se prendre dans la machine, aboutissant à tort.
OD4-1 Quand le commutateur de la porte d'embrayage est invalable, Ne vous mettez pas les mains, les pieds, et le corps dans la machine. L'opérateur doit en avertir le superviseur. Le superviseur doit mettre l'interrupteur de l'enclenchement avec verrouillage de la porte sur ON. Le superviseur doit toujours garder la clef.
OD4-2 Quand le commutateur de la porte d'embrayage est invalable,le superviseur ne doit pas admettre personne à travailler.
OD4-3 Assurez-vous visuellement que le commutateur de la porte d'embrayage est valable avant l'opération de la machine.
OD4-4 Si la clef de la porte d'embrayage (7) est attachée, avertissez-en le superviseur.
OD4-5 Le superviseur doit garder toujours la clef de la porte d'embrayage (7).

Avertissement **AVERTISSEMENT**

OW1 En touchant des outils tournant,vous (15) vous blesserez.
OW1-1 Ne vous approchez pas d'outils tournant.

OW2 Des outils cassés (15) ou des pièces en travail frappant, vous pouvez se blesser.
OW2-1 Fermez la porte de travail (6) et mettez la machine en marche.

OW3 Vous pouvez être pris dans le section tournant et se blesser.
OW3-1 Ne vous approchez pas d'outiles tournant (15), de broche (8), et de ATC magasin (9).
OW3-2 Portez des vêtements tout justes. Mettez des cheveux longs dans un bonnet. Ne portez pas de gants sans que vous n'arrêtiez la machine et ni ne fassiez l'arrangement. Ne portez pas de bijoux. Ne tenez pas le section tonrnant.

OW4 Si le dispositif de sûreté est modifié il peut ne pas travailler préisement. Donc vous pouvez être happé par la machine, se heurter contre la machine, ou recevoir une commotion électrique.
OW4-1 Si le dispositif de sûreté est modifié ou fixé pour ne pas marcher, ne mettez pas la machine en marche.

OW5 Quand des copeaux s'éarpillant vous sont mis dans les yeux, vous pouvez se blesser les globes oculaires et perdre la vue.
OW5-1 Portez des lunettes de protection.
OW5-2 Ne enlevez pas de copeaux en air.

OW6 Si vous touchez des copeaux de la main nue, vous pouvez se couper la main ou se brûler.
OW6-1 Ne touchez pas de copeaux de la main nue. Ne touchez pas de sections pointues de pièvces en travail.
OW6-2 Mettex des gants et utilisez une brosse quand vous nettoyez coupeaux de coupe.
OW6-3 Nettoyez copeaux de coupe quard machine est arrêtée.

OW7 Si vous tenez le tranchant d'outil (15), vous pouvez se couper la main.
OW7-1 Ne touchez pas le tranchant d'outil. Tenez le pied de la garde d'outil (16) toujours.

OW8 En laissant tomber un objet lourd sur vos pieds, vous pouvez se fracturer les pieds.
OW8-1 Quand vous levez des objets lourds, portez des chaussures de protection

OW9 En levant des objets lourds, vous pouvez souffrir du lumbago.
OW9-1 Quand vous levez des objets lourds, demandez de l'aide.
OW9-2 Levez des objets avec la force de vos jambes au lieu de votre dos.

OW10 En travaillant dans un bruit infernal ou pendant de longues heures, vous pouvez avoir des légers troubles de l'audition.
OW10-1 Quand vous travaillez dans le bruit, portez des protections telles que les protège-oreilles.

OW11 Vous pouvez se blesser les yeux ou les oreilles dans un éclatement d'un air à haute pression.
OW11-1 Vous ne devez pas installer ou changer la tuyauterié d'un air à haute pression, que vous ne soyez qualifié pour manipuler l'air à haute pression et ne compreniez la tuyauterié de la machine.

OW12 Vous pouvez se frapper la téte en levant.
OW12-1 Portez un casque de protection quand vous travaillez dans et autour de la machine.

OW13 Si vous faites fonctionner la machine en laissant des outils dans la machine, les outils peuvent jaillir et vous blesser.
OW13-1 Si vous découvrez des outils dans la machine, vous ne devez pas faire fonctionner la machine. avertissez-en le superviseur.

OW14 Vous pouvez avoir la main pris dans la porte travail (6), si vous la ouvrez et fermez en tenant d'autres parties de la porte travail que la poignée (10).
OW14-1 Tenez la poignée de la porte travail, quand vous la ouvrez et fermez.

OW15 Si des outils sont mis sur l'armoire de commande (1) ou la machine, ils peuvent tomber à cause de la vibration de la machine.
OW15-1 Ne mettez pas d'objets sur l'armoire de commande ou la machine.

OW16 Si vous montez sur la machine ou le tank d'huile de coupe (22), vous pouvez tomber et se blesser.
OW16-1 Ne montez pas sur la machine ou le tank d'huile de coupe.

OW17 Si vous vous mettez la main sous les boulons â régler le niveau de la machine (12), vous pouvez avoir la main pris et se blesser.
OW17-1 N'ajustez pas le boulon à régler le niveau de la machine. Si la machine n'est pas de niveau, avertissez le superviseur.
OW17-2 Le superviseur doit faire l'homme chargé de l'installation ajuster le niveau de la machine.

OW18 Si le câble pend ou n'est pas couvert, vous pouvez s'en prendre ou glisser et tomber.
OW18-1 Si le câble pend ou n'est pas couvert, avertissez-en le superviseur.
OW18-2 Le superviseur doit ordonner â l'homme qui a charge d'installer de corriger la pose du câble et couvrir le câble.

OW19 La modification de la machine peut affecter le dispositif de sécurité et faire les expressions de tous les avertissements donnés inutiles.
OW19-1 Si la machine a été modifiée, vous ne devez pas la faire marcher. avertissez-en le superviseur.

OW20 Si de l'huile de coupe gicle dans vos yeux, vous risquez de vous blesser les yeux.
OW20-1 Portez des lunettes de protection lorsque vous réglez l'ajutage d'huile de coupe (13).
OW20-2 Quand de l'huile de coupe rejaillit dans vos yeux, vous devez se laver les yeux à l'eau claire et consulter un médicin.

OW21 Si vous mettez les doigts dans un espace de la machine, vous pouvez avoir les doigts pris et se blesser.
OW21-1 Ne mettez pas les doigts entre couverture de jambe (14).
OW21-2 Ne vous mettez pas les doigts entre l'outil (15) ou le support à outil (16) et ATC magasin(9).

OW22 Si de l'huile de coupe, de l'huile, ou des copeaux sont dispersés, vous pouvez glisser, tomber, ou se heurter et se blesser.
OW22-1 Coupez le secteur de la machine, nettoyez dans et autour de la machine, et travaillez.

OW23 Quand vous attachez la garde d'outil (16) à la machine ou les en détachez, vous pouvez se couper à la main en un tranchant d'outil (15) ou se heurter la main contre la machine, se heurter la main coutre la machine.

OW23-1 Ne tenez pas le bout de l'outil. Portez des gants en cuir.

OW24 La machine peut marcher brusquement, ou des outils peuvent tomber.

OW24-1 Ne vous mettez pas les mains, les pieds, et le corps sous la tête de la broche (18).

OW25 Quand vous façconnez des pièces en travail à la machine en utilisant de l'huile de coupe, la section façonnant peut chauffer et prendre feu.

OW25-1 Ne utilisez pas d'huile de coupe quand un avertisseur d'incendie et un extincteur automatique ne sont pas installés.

OW25-2 En façconnant des pièces en travail, il faut que un opérateur se tienne prêt de la machine.

OW26 En s'appuyant à la machine, vous pouvez se prendre dans la machine ou s'y heurter et se blesser.

OW26-1 Ne vous appuyez pas à la machine.

OW27 Si des choses sont accrochées au bouton d'arrêt d'urgence(18),vous ne pouvez pas appuyer sur le bouton d'arrêt d'urgence.

OW27-1 Ne accrochez pas d'objet au bouton d'arrrêt d'urgence.

OW28 Le couvercle des câbles (20) à l'arrière de la machine ressort brusquement de la machine lorsque la table (19) avance. Le couvercle risque de vous heurter et de vous blesser.

OW28-1 Coupez le contacteur de la puissance principale (21) avant d'enlever les copeaux.

OW29 Comme le réservoir d'huile de coupe (22) est lourd, en levant le réservoir d'huile de coupe vous pouvez souffrir du lumbago ou le laisser tomber sur les pieds.

OW29-1 Ne levez pas le réservoir d'huile de coupe, quand vous enlevez des copeaux même.

OW30 Quand vous entrez dans la machine, vous pouvez tomber en glissant et se happer dans la machine.

OW30-1 Ne entrez pas dans la machine. Quand vous avez le besoin d'entrer dans la machine, avertissez-en le superviseur.

OW31 Si la couverture à côté (23) du tôle pare-copeaux (2) n'est pas attaché vous pouvez se prendre dans la machine ou se blesser en jaillissant des outils cassés.

OW31-1 Assurez-vous visuellement que le couvretureà côté du tôle pare-copeaux est attaché avant de mettre le contact. Si la couverture à côté du tôle pare-copeaux n'est pas attaché avertissez-en le superviseur.

OW31-2 Le superviseur doit faire l'opéreteur attacher la couverture à côté du tôle pare-copeaux.

OW32 Si des outils (15) ou la garde d'outil (16) dont le poids et la grandeur excédent la limite spéifiée sont utilisés, ils peuvent sauter.

OW32-1 Utilisez des outils et la garde d'outil dont le poids et la grandeur excédent la limite spécifid'ée.

OW32-2 Pour connaître la limite des outils, regardez les instructions des outils attachées à la machine, manuel de operation.

OW33 Si vous touchez la résistance régénératrice, vous pouvez se brûler parce que la réistance chauffe en opétarion.

OW33-1 Ne enlevez pas la couverture pour a résistance régénératrice (24).

OW34 Si vous touchez le moteur, vous pouvez se brûler parce que le moteur chauffe en opétarion.

OW34-1 Ne touchez pas le moteur dans 30 minutes après l'arrêt de la machine.

OW35 Si le ATC magasin (9) tourne, des outils (15) peuvent heurter des piéces en travail, une gigue, ou la machine et casser.

OW35-1 Fixez la longueur des outils pour queles outils ne heurtent pas les piéces en travail, la gigue, ou la machine même si le ATC magasin tourne.

OW36 Si l'armoire de commande (1) ou le panneau d'opération (25) sont mouillées, vous pouvez recevoir une commotion électrique.

OW36-1 Ne arrosez pas l'armoire de commande et le panneau d'opération d'huile de coupe, d'eau, et de copeaux.

OW36-2 Ne touchez pas l'armoire de commande de la main mouillée.

OW37 Si vous mettez le contact de la machine ou façonnez des pièces en travail dans une atmosphère explosible, une explosion peut survenir en cause d'une ètincelle de la machine.

OW37-1 Ne mettez le contact de la machine ou ni ne façonnez des pièces en travail dans une atmosphère explosible.

OW38 Si vous mettez en marche la machine sans fixer la pièce en travail, la pièce en travail peut faire ressort; par suite, vous pouvez vous blesser.

OW38-1 Fixez la pièce en travail.

OW39 Si vous oubliez de monter le capot latéral de la tôle pare-copeaux (23), vous pouvez vous prendre dans la machine et vous blesser.

OW39-1 Avant une mise en alimentation, assurez-vous visuellement que le capot latéral de la tôle pare-copeaux est monté. S'il n'est pas monté, avertissez-en le superviseur.

OW39-2 Quand vous enlevez le capot latéral de la tôle pare-copeaux, coupez le contacteur de l'alimentation principale et cadenassez-le pour que le contacteur de l'alimentation pricipale ne soit pas mis en.

OW39-3 Le superviseur doit instruire l'opérateur de monter le capot de maintenance.

OW40 Les copeaux de coupe risquent de prendre feu ou d'exploser, selon le matériau de la pièce que vous usinez (cas. magnésium).
OW40-1 Enlevez immédiatement tous les copeaux de coupe.
OW40-2 Installez extincteur auprès de la machine en usinant une pièce travaillée faite de tel matériel, et ne réalisez jamais opération inhabitée.

OW41 Si la appareil de fraisage n’est pas assurée à l’outil, elle peut se détacher de l’outil pendant rotation de broche, aboutissant à tort sérieux.
OW41-1 Contrôlez que la appareil de fraisage est assurée à l’outil et ensuite fixez l’outil.

OW42 Attention de ne pas vous blesser avec les couteaux ou les dispositifs de serrage lorsque vous entrez dans la machine et que la pièce est mal éclairée.
OW42-1 Prévoir une lampe dans la machine lorsque l’éclairage ne dépasse pas 500 lux.

Vérification des instructions de sûreté

Les instructions de sûeté sont attacheés à la machine. Leurs positions sont indiquées dans le dession ci-dessous. Contrôlez que les instructions ne sont pas endommagées. Si elles sont endommagées, obtenez une nouvelle instruction pour remplacement.

Position des instructions de sûreté

230S00C02.doc

S2A00401.ai

1. Etiquette de sûreté, Avant et latéral

(1) Langue : Anglais, Japonais, Chinois

Code de partie : 690373001
Nom de partie : PS LABEL,TC FRONT JCE

(2) Langue : Anglais, Allemand, Français

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

Diese Maschine birgt Gefahren.
Um Risiken zu erkennen und vermeiden, vor dem Einschalten die Betriebsanleitung lesen.

L'utilisation de cette machine comporte des risques.
Lisez les manuels d'instruction pour connaître les risques et les éviter avant d'utiliser cette machine.

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
GEFAHR	**WARNUNG**	**WARNUNG**
Maschine in Betrieb kann plötzlich laufen und Sie stoßen. Beim Betrieb der Maschine von allen bewegenden Teilen sich fernhalten, um Verletzungen zu vermeiden.	Gebrochene Werkzeuge oder Werkstücke könnten Sie treffen und verletzen. Vor dem Start der Maschine Tür schließen.	Umlaufende Teile könnten Sie fassen und verletzen. Von umlaufendem Werkzeug, Spindel und Magazin sich fernhalten. Rotierende Teile nicht berühren. Während des Bedienens keine Handschuhe tragen.
DANGER	**AVERTISSEMENT**	**AVERTISSEMENT**
En opération, cette machine bougera soudainement et provoquera des risques d'écrasement. Ne vous approchez jamais des parties mobiles.	Les outils cassés ou les pièces usinées peuvent être projetés et risquent de vous frapper et de vous blesser. Fermez la porte avant de faire démarrer la machine.	Les parties tournantes peuvent vous accrocher et vous blesser. Ne vous approchez jamais des outils tournant, de la broche et du magasin. Ne saisissez jamais les parties en mouvement. Ne portez pas de gants pendant l'utilisation.

691042001 / 0302 (2)

Code de partie : 691042001
Nom de partie : PS LABEL,TC FRONT EGF

2. Etiquette d'outil

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≦ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

Code de partie : 653379001
Nom de partie : Tool LABEL250

3. Etiquette de sûreté, Arrière équipement à haute pression de liquide réfrigérant

(1) Langue : Anglais, Japonais, Chinois

Code de partie : 690730001
Nom de partie : PSLABEL, TC REARJCE

(2) Langue : Anglais, Allemand, Français

Code de partie : 691045001
Nom de partie : PSLABEL, TC REAR EGF

4. Etiquette, résistance régénératrice

(1) Langue : Anglais, Japonais, Chinois

Code de partie: 690729001
Nom de partie: LABEL, TC REGENERATIVE JCE

(2) Langue : Anglais, Allemand, Français

Code de partie: 691058001
Nom de partie: LABEL, TC REGENERATIVE EGF

5. Etiquette, retrait d'outil

(1) Langue : Anglais, Japonais, Chinois

Code de partie : 653080001
Nom de partie : LABEL, Removing Tool JCE

(2) Langue : Anglais, Allemand, Français

Code de partie : 69104001
Nom de partie : LABEL, Removing Tool EGF

6. Etiquette, Couverture latérale

(1) Langue : Anglais, Japonais, Chinois

Code de partie	: 690731001
Nom de partie	: LABEL, TC MAINTENANCE DOOR JCE

(2) Langue : Anglais, Allemand, Français

Code de partie : 690732001
Nom de partie : LABEL, TC MAINTENANCE DOOR EGF

7. Etiquette défense de monter

Code de partie : 693178001

693178001 / 0607 (1)

693178001.ai

FONCTION DE LA FERMETURE DE SÉCURITÉ DES PORTES

1. Précautions générales
2. Vue d'apparence
3. Inspection of Door Interlock
4. Function Details

1 Précautions générales

⚠ DANGER

En touchant des outils tournant et des parties mobiles, vous vous blesserez.
Quand l'interrupteur de l'enclenchement avec verrouillage de la porte est invalable. Ne vous mettez pas les mains, les pieds, et le corps dans la machine. Avertissez-en le superviseur.
Quand l'interrupteur de l'enclenchement avec verrouillage de la porte est invalable, le superviseur ne doit pas admettre personne à travailler.
Assurez-vous visuellement que l'enclenchement avec verrouillage de la porte est valable avant l'opération de la machine.
Si la clef de l'enclenchement avec verrouillage de la porte est attachée, avertissez-en le superviseur.
Le superviseur doit garder toujours la clef de l'enclenchement avec verrouillage de la porte.

⚠ DANGER

Quand l'interrupteur de l'enclenchement avec verrouillage de la porte est tourney sur OFF, la table peut bouger. Les parties mécaniques dans la porte intérieure bougent même si la porte intérieure est ouverte. Vous pouvez être pris à la table et vous blesser. Vous pouvez être pris dans la machine.
Quand l'interrupteur de l'enclenchement avec verrouillage de la porte est OFF, ne vous mettez pas les parties du corps dans la porte extérieure.
Quand le commutateur de la porte d'embrayage est invalable,le superviseur ne doit pas admettre personne à travailler.
Si la clef de la porte d'embrayage est attachée, avertissez-en le superviseur.

⚠ DANGER

Quand la porte intérieure est ouverte, vous pouvez vous couper par l'outil tournant ou vous pouvez avoir la main pris dans la machine.
L'opérateur ne doit pas ouvrir la porte intérieure.
Quand la porte intérieure est ouverte, ne vous mettez pas les mains, les pieds dans la machine. Le superviseur doit cadenasser la porte intérieure. Le superviseur doit toujours garder la clef de la porte intérieure.
Le superviseur ne doit pas admettre l'opérateur à utiliser la machine, quand la porte intérieure n'est pas cadenassée.
Assurez-vous visuellement que le commutateur de la porte d'embrayage est valable avant l'opération de la machine.
Quand vous vous apercevez que la porte intérieure n'est pas cadenassée, vous devez en avertir le superviseur.

⚠ AVERTISSEMENT

En touchant des outils tournant, vous vous blesserez.
Ne vous approchez pas d'outils tournant.

⚠ AVERTISSEMENT

Vous pouvez être pris dans la section tournant et se blesser.
Ne vous approchez pas d'outils tournant, de broche, et de COA magasin.
Portez des vêtements touts justes. Mettez des cheveux longs dans un bonnet. Ne portez pas de gants sans que vous n'arrêtiez la machine et ni ne fassiez l'arrangement. Ne portez pas de bijoux.
Ne tenez pas la section tonrnant.

Intention

La Fonction de la fermeture de sécurité des portes vous évite d'être pris dans les outils tournant et les parties mobiles.

Description de la fonction

L'enclenchement avec verrouillage de la porte fonctionne pour que la porte extérieure est verrouillée et que le maximum de vitesse est limité selon les circonstances.

Structure de l'unit

L'enclenchement avec verrouillage de la porte est constitué par des éléments ci-dessous.

1.l'interrupteur de la limite de la porte
2.le verrou de la porte

Comment se servir de l'enclenchement avec verrouillage de la porte

1. en opération ordinaire
   L'interrupteur de la Fonction de la fermeture de sécurité des portes(1) doit toujours être place sur "on".
2. en réglage et maintenance
   Tournez l'interrupteur sur "off" seulement en cours de réglage et maintenance. Lisez le "Manuel de sûreté pour ceux qui installent et arrangent le centreur tapant" et le "Manuel de sûreté pour ceux qui sont qualifiés pour maintenance du centreur tapant" avant du réglage et de la maintenance.

   Observez cela ci-dessous, quand la Fonction de la fermeture de sécurité des portes est OFF.
   Prenez garde de ne pas étre pris dans l'outil tournant ou les parties mobiles.
   - Tournez l'interrupteur sur "on" après le réglage et la maintenance.
   - Le superviseur doit garder la clef(2).

2 Vue d'apparence

TC-S2A

3 Contrôle

Méthode de contrôle

Contrôle d'arrêt de fonctionnement

1. Fermer toutes les portes. Mettre ensuite sous tension afin de rétablir la position d'origine.
   Vérifier également la bonne marche du commutateur de verrouillage des portes.
2. Ouvrir la porte extérieure.
3. Si le verrouillage de la porte fonctionne normalement la machine ne doit passe déplacer quand on appuie sur la touche [-X].
   Normalement l'avertisseur d'ouverture de porte doit se déclencher.
   Si l'alarme ne se déclenche pas cela signifie que le verrouillage de porte ne fonctionne pas normalement et doit être réparé.

Procéder aux vérifications qui suivent si aucune anomalie n'est constatée à cette étape.

Contrôle du verrouillage de porte

4. Fermer la porte extérieure.
5. Faire tourner la broche.
6. Normalement, si le verrouillage fonctionne bien, on ne doit pas pouvoir ouvrir la porte. Si elle s'ouvre c'est que le système est d'éfectueux etnécessite une réparation.

Contrôle d'arrêt de secours

7. Faire tourner la broche en mode manuel.
8. Normalement si le verrouillage fonctionne bien la machine doit s'arrêter de tourner et l'avertissement [*ARRET URGCE ACTIF] s'affiche quand on appuie sur le bouton d'arrêt de secours. Si la machine ne s'arrête pas et que le message d'avertissement ne s'affiche pas c'est que le système est défectueux et nécessite une réparation.

4 Détails de la fonction

Condition de la porte(*6)	Verrouillage de la porte	Verrou de la porte(*6)	Opération de la machune
Fermèe	OFF	Ne sera pas verrouillè	Toutes les opérations sont possibles.
	ON	Verrouillè en cours opération de la machine quand (mouvement d'unaxe,rotation de la broche,opération par IMD,opération par mèmorie, ou quand l'impulseur manuel est mis sur ON).(*4)	
Ouverte	OFF	Ne sera pas verouillè	• Rotation de la broche ,pivotement du magasin, COA, action de tarauder sont impossibles.(*2) • Mouvement d'un axe, arrêt de la broche, et orientation de la broche sont possibles.(*1) • L'opération automatique est possible seulement en mode d'opération simple. • L'opération par IMD arrêt à chaque fin d'un bloc. • Le refroidissement n'arrive pas.
	ON		• Touts les opérations sont impossibles. (*2)(*5) • Le refroidissement n'arrive pas.
Fermèe ↓ Ouverte	OFF		• Toutes les opérations, y compris la rotation de la broche, arrètent immèdiatement. (*3) • Le refroidissement s'arrête instantanément.
	ON		• Toutes les opérations, y compris la rotation de la broche, arrètent immèdiatement. (*3)(*5) • Le refroidissement s'arrête instantanément.
Ouverte	OFF ↓ ON		

*1. La vitesse d'avance de course rapide est rélée par "MAX AVANCE RAP(PORTE OUVRE)" du paramètre mécanique.
La vitesse d'avance de coupe est restreinte à la vitesse réglée par "MAX AVANCE RAP(PORTE OUVRE)".
La vitesse de rotation des axes additionnels (A,B,C) est aussi restreinte à la vitesse réglée par "MAX VITESSE 4,5,6 AXE (PORTE OUVRE)"du paramètre mécanique.

*2. L'essai d'opération cause "PORTE OUVERTE" erreur quand la porte de devant est ouverte.
L'essai d'opération cause "PORTE LATERL OUVERTE" erreur quand la porte latérale est ouverte.

*3. Les opérations, y compris taraudage, orientation de la broche, COA, et pivotement du magasin, arrêtent à chaque fin d'un bloc. Quand la porte ouvre en cours de ratation de la broche, "OUV PTE ARRET BCHE" erreur apparaît et la broche arrête. Quand la porte ferme et l'opération est remise à la même vitesse rotation que precedent à l'arrêt de la broche, la condition de rotation précédant l'arrêt de la broche est recouvrée.

Cependant, quand les opérations ci-dessous sont effectuées, "OUV PTE ARRET BCHE" erreur est remise à zero. Même si la porte ferme et l' opération est remise à la même vitesse de rotation que précédent à l'arrêt de la broche, la condition de rotation précédent l'arrêt de la broche n'est pas recouvrée.
1) La clef [RAZ] est pressée.
2) L'arrêt de la broche est effectué en mode manuelle.
NOTE
Quand la porte ouvre en cours de rotation de la broche après le premier mouvement de fraise en bout taraud (XY-axes mouvement et rotation de la broche), la broche arrête mais "OUV PTE ARRET BCHE" erreur n'pparaît pas. Même si la porte ferme et l'opèration est remise, la condition de rotation précédent l'arrêt de la broche n'est pas recouvrée.

*4. En cours d'opération de la machine
L'opération de la machine mentionnée ici contient l'arrêt temporaire et l'arrêt de bloc (exculant quand le programme a fini et en cours d'arrêt du programme) pour l' opération par IMD et l'opération par mémoire.

*5. Caractéistiques techniques spéciales
Quand la porte est ouverte pendant que verrouillage de la porte est active, le servomoteur est mis sur OFF.
Quand la porte est ouverte avant l'opération par mémoire ou pendant arrêt de programme (M00), "PORTE OUVERT" erreur apparaît et le servomoteur est mis sur OFF.
Fermez la poete ou désactivez le verrouillage de la porte, et le servomoteur sera mis sur ON et l'erreur est remise à zéro.
Quand la porte est ouverte pendant l'opération par mémoire, cependant, "SERVO EST ARRETE", "STOP MACH. PTE/OUV". erreur apparaît. Cette erreur ne peut pas être remise à zéro quand bien même la porte est fermée. Pressez la clef [RAZ].

安装作业人员以及准备作业人员的安全操作规程

攻丝中心
TC-S2A

请在接触攻丝中心前仔细阅读本安全操作规程。

兄弟工业公司
玛西纳丽和苏琉雄公司

目录

什么是安全操作规---------- 3
务必阅读本规程 ---------- 3
目的 ---------- 3
安全操作规程的内容以及和其他规程的关系---------- 3
和安全签条的关系 ---------- 4
语言 ---------- 4
索取方法 ---------- 4
安全操作规程的使用 ---------- 5
危险程度 ---------- 5
说明的顺序 ---------- 5
象形图的意思 ---------- 6
各部件名称---------- 8
警告和回避方法---------- 10
安全签条的说明---------- 18

©1999-2007 BROTHER INDUSTRIES, LTD.
MACHINERY & SOLUTION COMPANY
All Rights Reserved.
Printed in Japan.

什么是安全操作规程

务必阅读本规程

凡接触攻丝中心的人员,诸如在工厂安装攻丝中心的人员、使用攻丝中心进行加工的人员和调整修理攻丝中心的人员,务必阅读本安全操作规程。
本规程把接触攻丝中心的所有人员称为「使用者」。

目的

攻丝中心由使用高电压的电器回路、高速旋转机具、大功率移动台和 ATC 送料装置组成。所以该机器带有许多危险因素。
制订本规章的目的是保护使用者免受攻丝中心所带危险因素的伤害。
为此本安全操作规程对下述问题进行说明。

警告: 有什么危险
回避方法:如何回避其危险

安全操作规程的内容以及和其他规程的关系

安全操作规程按使用对象进行分类,附在各说明书里(程序控制缝纫机除外)。您想知道机器的功能和操作方法,请阅读说明书本篇。

1 操作说明书(面向一般操作人员) 「操作人员安全操作规程」
「安装和做准备作业人员的安全操作规程」
「操作说明书」(基本作业所需要的机械操作方法)
中文零件编码 : 693271001

2 操作说明书(面向专门操作人员) 「操作人员安全操作规程」
「安装和做准备作业人员的安全操作规程」
「机门连动机能」
「操作说明书」(准备和加工所需要的机械操作方法)
(对话) 日文零件编码 : 693312001 英文零件编码 : 693307001
(NC 语言) 日文零件编码 : 693310001 英文零件编码 : 693305001

3 安装说明书 「安装作业人员和准备作业人员的安全操作规程」
「安装说明书」(机械和配件的安装及其组装方法)
日文零件编码 : 693311001 英文零件编码 : 693306001

4 编制程序说明书 「编制程序说明书」(加工程序的制作方法)
(对话) 日文零件编码 : 693314001
英文零件编码 : 693309001
(NC 语言) 日文零件编码 : 693313001
英文零件编码 : 693308001

5 维修说明书 「受过培训的维修作业人员安全操作规程」
「维修说明书」(机械的调整和修理方法)
对顾客不发维修说明书。

和安全签条的关系

安全操作规程中特别重要的部分被制作成安全标签，贴在机器上。
安全操作规程的最后部分是关于安全标签的说明。如果机器上的安全签条脱落，请设法索取签条后重新贴上。

语言

日本国内销售的机器，所贴的安全操作规程和安全签条均用日文。
销售到国外的机器，用的是英文、德文、法文和中文四国文字。
请设法取得所懂语言的安全操作规程和安全签条。
关于其他国家的安全操作规程和语言签条，请询问您所购买的机器销售店。

索取方法

如果安全操作规程或安全签条遗失，请到您所购买的机器销售店索取。
如销售店无法解决，请向下列单位咨询。

日本国外联系地址
1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD.
phone +81-52-824-2232
fax +81-52-811-0469

安全操作规程的使用

安全操作规程应注意妥善保存,做到随时可以阅读。如机器更换所有人,请转交机器的新持有人。

危险程度

如无视警告,所引起的危险的程度按受害程度可分 3 种。

1. 危险

⚠ 危　险

招致死亡或不可复原的严重疾患的危险。

2. 警告

⚠ 警　告

招致重伤的危险。

3. 注意

⚠ 注　意

轻度危险

说明的顺序

按下列顺序进行说明。

1. 表示危险程度的文字标记(危险、警告、注意)和象图
2. 危险的种类
3. 伤害的预测
4. 回避方法

象形图的意思

安全签条和安全操作规程的警告语言使用象图,形象地说明其危险程度和回避方法。现将图像的意义说明如下。

1. 危险

当心滑倒

活动部件

当心绊倒

注意触电

当心触电

当心夹入

夹进手里

注意高温

注意高温

谨防割断

谨防断裂

注意破裂

当心刺伤

有物落下

有物落下

旋转物体

当心坠落

注意飞散

注意飞散

谨防火灾

2. 回避方法

保护耳朵

保护双手

保护双脚

拔掉电源

严禁触摸

保护头部

需接地线

不准分解

保护眼睛

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

警告和回避方法

(　)中的数字 1,2 与各部分的名称号码相对应。

危险　⚠ 危　险

SD1　在攻丝中心里隐藏着许多危险。
SD1-1　为了熟知危险的内容和回避方法,请在操作机器前阅读安全操作规程。
SD1-2　所有使用者均须知道紧急停止开关(19)的位置和操作方法。

SD2　控制箱(1)中有高电压装置,不慎触模该装置,会引起重大伤亡事故。
SD2-1　电气系统的维修检查作业,只允许具有本机械电气回路知识、持有电工执照的人员才能能操作。
SD2-2　应关掉主电源总开关(21)后进行作业,并设置「正在作业」的表示牌
SD2-3　运转中的机器,都有被其夹住而受重伤的危险。

SD3　运转中的机器,都有被其夹住而受重伤的危险。
SD3-1　机器在运转时,不能将身体伸入火花防溅箱(2)中去。
SD3-2　只有在按了停止开关(3)或按了回零按钮并确认停止指示灯(4)已经点亮后,才能将身体或手伸入火花防溅箱中。
SD3-3　亲眼确认火花防溅箱中确实无人后,才能开动机器。
SD3-4　在机器运转时,手足和身体不能靠近机器的转动部分。
SD3-5　在万不得已必须进入机器进行操作时,应切断主电源控制板(21)的电源,并加铁锁保护,以免电源接入。

SD4　门互锁开关(5)处于无效状态时，即使打开作业门(6)，机械也会运行。有被机械夹伤的危险。
SD4-1　在准备作业中,应留心机械的运转情况,做到能随时停机。准备作业结束以后,应将门互锁开关置于有效位置。并应拔去门互锁键(7),交由监督人员保管。
SD4-2　不应将门互锁开关置于无效位置的状态下离开机器。

SD5　门互锁开关(5)置于无效位置时，工作台 (20)会发生移动,作业人员有可能被平台夹伤。
SD5-1　在准备作业中,应留心机械的运转情况,做到能随时停机。准备作业结束以后,应将门互锁开关置于有效位置。并应拔去门互锁键(7),交由监督人员保管。

警告 **警 告**

SW1 触摸转动中的加工机具(15)会受伤。
SW1-1 不准靠近转动中的加工机具。

SW2 折断的加工机具(15)和工件弹出会造成伤害。
SW2-1 应关闭作业门(6)后再运行机械。

SW3 夹进转动部件而受伤。
SW3-1 勿靠近转动部件(15)、主轴(8)和 ATC 刀库(9)
SW3-2 应穿合身服装。长发应拢入工作帽内。除非停机作准备工作,不能戴手套。不能戴首饰。勿模弄转动部件。

SW4 改装安全装置,会带来安全装置失灵、触电、被夹和被打等危险。
SW4-1 勿改装安全装置。勿固定安全装置,以免安全装置失灵。

SW5 切削碎屑飞入眼内,会伤及眼球而失明。
SW5-1 应戴用铁屑防护眼镜。
SW5-2 勿用压缩空气清扫切削碎屑。

SW6 用手触摸切削碎屑,会造成外伤或烫伤。
SW6-1 勿用手触摸切削碎屑。勿用手触摸加工件的尖厉部分。
SW6-2 清理切削碎屑应戴手套,使用刷子。
SW6-3 应在停机后清理切削碎屑。

SW7 勿握模刀具(16)的刀刃,以免手被割破。
SW7-1 勿握模刀具的刀刃。拿取刀具时应拿住刀具夹(16)部分。

SW8 重物跌落脚上,会造成足部骨折。
SW8-1 抬拿重物时应穿安全鞋。

SW9 抬拿重物时,注意闪腰。
SW9-1 抬拿重物时,应请他人协助。
SW9-2 抬拿重物时,应双脚用力而非腰部用力。

SW10 长时间身处噪音之中或巨大的噪声之中,会造成双耳失聪。
SW10-1 在噪音中作业时,应戴耳塞等保护器具。

SW11 高气压设备有可能爆裂而伤及眼目。
SW11-1 没有接受过高气压设备使用方法培训、不懂该机器配管的人员,不能安装和改装高气压设备。
SW11-2 在进行高气压设备的配管作业时,应切断高压电源,放去残留高压空气后再进行作业。并设置「正在作业」的表示牌。

SW12 站起时注意碰伤头。
SW12-1 在机器内部或周围进行作业时应戴安全帽。

SW13 开机时,机器中有未取出的加工工具时, 加工工具有可能飞散而造成工伤。
SW13-1 勿将加工工具遗忘在机器中。

SW14 握取把手(10)以外的部分开关作业门(6)的话，有手被夹伤的危险。
SW14-1 开关作业门(6)时，应握取把手(10)。

SW15 控制箱(1)中有些机具处于高温状态,如控制箱内部的文件架(12)上的资料露出文件架,有起火燃烧的危险。
SW15-1 文件架上不能放置超过 A4 尺寸或信笺尺寸的资料。

SW16 在控制箱(1)和机器上放置工具时,工具会震落。
SW16-1 在控制箱和机器上勿放置物品。

SW17 攀登机器和冷却液罐(22),须注意坠落受伤。
SW17-1 勿攀登机器和冷却液罐。

SW18 把手伸进调平螺栓(12)的下面,须注意手被夹伤。
SW18-1 勿将手伸进调平螺栓的下面去。调节水平调节螺栓应使用工具。

SW19 缆绳下垂或不加缆绳护罩,会发生绊滑跌倒等工伤事故。
SW19-1 应收紧缆绳的松余部分,沿地板拖放时应加缆绳护罩。

SW20 擅自改装机器,会使安全装置失灵,安全操作规程和安全签条的警告事项将失去作用。
SW20-1 勿改装机器。需要改装时,应事先和兄弟工业公司联系,取得兄弟工业公司的书面允许。

SW21 冷却液进入眼睛,会损伤眼睛。
SW21-1 调整冷却液喷嘴 (13)时,应配戴防护眼镜。
SW21-2 冷却液进入眼睛后,应用清水洗眼,接受医生诊治。

SW22 手指伸入机器夹缝,应注意手被夹伤。
SW22-1 勿将手指伸入固定具的罩子中去。
SW22-2 勿将手指伸入刀具(15)或刀具夹(16)与 ATC 刀库(9)之间的空隙中去。

SW23 如冷却液、机油或切削碎屑被打翻,会因滑脚、跌倒、碰撞而受伤。
SW23-1 应切断电源,并清扫机器内部和机器周围以后,再进行作业。
SW23-2 安装作业应戴安全帽和穿安全鞋。

SW24 拆卸刀具夹(16)时,须注意手可能会被刀具(15)的刀刃所伤或手被机器打着。
SW24-1 不持拿刀具的刀刃部。持拿工具应使用皮制手套。应双手持拿刀具夹。

SW25 机器可能突然停机,刀具可能突然脱落。
SW25-1 停止指示灯(4)不亮时,不要将手脚、身体伸到主轴头(18)下面去。
SW25-2 应将工作台拉到身前再安排工作。
SW25-3 切断主电源开关(21),加锁以防止总开关打开,然后补充润滑液。

SW26 如使用油性冷却液加工,加工部位可能受热起火。
SW26-1 使用油性冷却液时,应设置火警预报器和自动灭火装置。
SW26-2 加工时,操作人员不得离开机器。

SW27 机器开动时,人傍靠在机器上,会有被夹、被打致伤的危险。
SW27-1 勿傍靠在机器上。

SW28 紧急停止开关(18)上挂有物品时,紧急停止开关会按不进去。
SW28-1 不得在紧急停止开关上钩挂物品。

SW29 工作台(19)移动,机器后背的Y轴后罩会跳弹出来,碰到人会造成工伤。
SW29-1 应切断主电源开关(21),再清扫切削碎屑。

SW30 冷却液罐(22)很重,抬拿时须注意闪腰或脚被砸伤。
SW30-1 清理切削铁屑时也不得抬拿冷却液罐。

SW31 进入机器时,须注意滑倒或被机器夹住。
SW31-1 进入机器前,应先切断主电源开关(21), 加锁以防止总开关被打开。清扫冷却液和铁屑时。应穿戴安全鞋和安全帽。并在操作盘附近置放「正在作业」的标牌。

SW32 别忘记安装火花防溅箱(2)的侧面护板(23),以免操作人员被夹或被断裂的刀具打伤。
SW32-1 在打开电源前应亲自确认是否装上了侧面护板。

SW33 如果使用超重超大的刀具(15),刀具夹(16),该刀具或该刀具的套柄有可能飞脱。
SW33-1 应使用重量和尺寸都在规定以内的刀具和套柄。
SW33-2 刀具的限制条件请见刀具签条和操作说明书。

SW34 机器在运转过程中,再生电阻会发热,须注意触摸再生器会被烫伤。
SW34-1 勿拆卸再生电阻罩(24)。

SW35 机器在运转过程中,马达会发热,须注意触摸马达可能会被烫伤。
SW35-1 在停止运转后的 30 分钟内不要触摸马达。

SW36 使用规定以外的保险丝,会使保护装置失灵,可能攘成火灾。
SW36-1 调换保险丝时,使用的保险丝规格应和刚用完的相同。

SW37 当改变热传导器的设定时,保护装置将失灵,有可能发生火灾。
SW37-1 勿改变热传导器的设定值。

SW38 当 ATC 刀库(9)转动时,须注意刀具(15)有可能碰到加工物件、夹具或机器而断裂。
SW38-1 应妥善设定裴恶的长度,以免在 ATC 刀库机转动时,刀具碰到加工物件、夹具或机器。

SW39 如控制箱(1)和操作盘(25)潮湿,须注意有可能触电。
SW39-1 不能将冷却液、水、切削铁屑撒到控制箱和操作盘上。
SW39-2 不能用潮湿的手触摸控制箱。

SW40 从外部引进的动力线的 PE 线过短的话,当拉动电缆线时,PE 线有可能松脱而触电。
SW40-1 接续 PE 线时,应留有余地,长于其他电线(L1、L2、L3)。

SW41 如果在有爆炸危险的环境下打开机器电源,或进行加工作业,有可能因机器的火花而引起爆炸。
SW41-1 不要将机器安装在有爆炸危险的环境下。
SW41-2 不应在有发生爆炸可能的环境中打开机器电源,进行加工或做准备作业。
SW41-3 不在有爆炸危险的环境下打开机器电源,或进行加工作业。

SW42 如忘加火花防溅板一侧的护板(23),将有可能被夹伤。

SW43 在打开电源前,应亲自确认维修罩是否已经装好。

SW44 有些被加工件的材料的切削碎屑有可能引火或爆炸。
SW44-1 切削碎屑应立即清除。
SW44-2 在加工上述材料时,机器附近应放置灭火设备或进行无人作业。

SW45 使用脱卸式固定斜楔的刀具时, 如固定斜楔安装不牢固,主轴旋转时,有可能飞脱砸人,造成工伤。
SW45-1 务必先确认固定斜楔是否安装牢固以后再安装刀具。

SW46 使用设有电源线专用的配线的 3 线式感应器的时候,有引火的危险。
SW46-1 请不要使用 3 线式感应器,应使用 2 线式感应器。
SW46-2 不得已使用 3 线式感应器的时候,应在电源线部处追加个别保险丝(1A 以下)。

SW47　配线时，端子台的螺丝锁得不紧的话，会导致由于接触不良引起发热、起火的危险。

SW47-1　配线时，螺丝应无松缓。

SW48　如果工厂内照明光线昏暗的话，有因机械内光线变暗而导致夹具及刀具弄伤手的危险。

SW48-1　机械内照明度低于 500 勒克斯以下的场合，应设置照明灯。

安全签条的说明

机器上贴有安全签条，安全签条是安全操作规程中特别重要的部分。
请在充分理解了安全签条的内容以后再进行机器的操作。
安全签条贴在机器的下述位置，请确认安全签条有否脱落。如有脱落，请索取后重贴。

230S00C02.doc

S2A00401.ai

[1] 前面安全签条

语言	零件编码
和中英文	690723001

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

危険の内容と回避方法を理解するため、取扱説明書を読んでから、機械を操作してください。

由于有必要了解危险的内容和避免的方法，请仔细读完使用说明书后，再操作机器。

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
危 険	警 告	警 告
機械が、とつぜん、動き、はさまれて大けがをする。 動くところに、手足や、からだを近づけないこと。	おれた工具や工作物がとびだし、ぶつかって、けがをする。 とびらをしめてから運転すること。	回転部分にまきこまれて、けがをする。 回転している工具、スピンドル、マガジンに近づかないこと。 回転部分を、つかまないこと。 運転作業中は手ぶくろをしないこと。
危 险	警 告	警 告
被机器突然运行所夹住，会致人重伤。 在机器运转时，手足切勿靠近。	折损的刀具或工件飞出，会伤人。 请务必关上门之后，运行机器。	被回转部分夹住，会受伤。 不要靠近正在运行中的主轴，旋转头。 不要抓住回转部分。在操作时不许戴手套。

690723001 / 9411 (1)

[2] 前面面刀具标签

根据刀库的最大刀具收纳把数及主轴回转次数, 更改记载内容。

零件编码

653379001 **刀具标签** 250

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≧ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≧ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

[3] 背面安全签条

语言	零件编码
和中英文	690730001

⚠ DANGER

Hazardous voltage
will cause severe injury or death.

Never attempt to adjust or repair electrical circuits unless you are familiar with circuits and qualified to work safely on electrical circuits.

Turn off main power before working.

Post notice you are working.

⚠ WARNING

Spilt coolant, lubricant, or chips are slippery and can cause injury.

Turn off main power and clean in and around machine before servicing.

Wear head protector and safety shoes while servicing.

⚠ 危　険

高 電 圧
感電死することがある。

電気の保守・点検作業は、この機械の電気回路の知識があり、電気安全の教育をうけた人間だけが、おこなうこと。

主電源を切ってから、作業すること。

作業中であることを表示すること。

⚠ 警　告

切削液、油、または切りくずのこぼれで、ころんだり、ぶつかって、けがをする。

機械の電源を切り、機械の中やまわりをそうじしてから、作業すること。

すえつけ作業のときは、ヘルメットと安全靴を使うこと。

⚠ 危　险

高 压 电
触电会致死。

电器的保养，检查的实施，仅限于了解该机器电路知识，受过电器安全教育的人员。

主电源切断之后，进行作业。

要做好正在作业的标志。

⚠ 警　告

切削液，机油，切削粉末溢出后，迭倒碰撞会受伤。

切断机器的电源，把机内和四周打扫干净之后，再工作。

安装作业时，要戴上安全帽，穿上防护鞋。

690730001 / 9709 (1)

[4]　再生阻抗器罩签条

语言	零件编码
和中英文	6907290001

[5]　刀具装脱签条

语言	零件编码
和中英文	65308001

[6] 侧面维修罩安全签条

语言	零件编码
和中英文	690731001

[7] 远离勿踏标签

零件编码
693178001

693178001 / 0607 (1)

693178001.ai

操作人员安全操作规程

攻丝中心
TC-S2A

请在接触攻丝中心前仔细阅读本安全操作规程。

兄弟工业公司
玛西纳丽和苏琉雄公司

目录

什么是安全操作规---------- 3
务必阅读本规程 ---------- 3
目的 ---------- 3
安全操作规程的内容以及和其他规程的关系---------- 3
和安全签条的关系 ---------- 4
语言 ---------- 4
索取方法 ---------- 4
安全操作规程的使用 ---------- 5
危险程度 ---------- 5
说明的顺序 ---------- 5
象形图的意思 ---------- 6
各部件名称---------- 8
警告和回避方法---------- 10
安全签条的说明---------- 18

©1999-2007 BROTHER INDUSTRIES, LTD.
MACHINERY & SOLUTION COMPANY
All Rights Reserved.
Printed in Japan.

什么是安全操作规程

务必阅读本规程

凡接触攻丝中心的人员,诸如在工厂安装攻丝中心的人员、使用攻丝中心进行加工的人员和调整修理攻丝中心的人员,务必阅读本安全操作规程。
本规程把接触攻丝中心的所有人员称为「使用者」。

目的

攻丝中心由使用高电压的电器回路、高速旋转机具、大功率移动台和 ATC 送料装置组成。所以该机器带有许多危险因素。
制订本规章的目的是保护使用者免受攻丝中心所带危险因素的伤害。
为此本安全操作规程对下述问题进行说明。

警告: 有什么危险
回避方法:如何回避其危险

安全操作规程的内容以及和其他规程的关系

安全操作规程按使用对象进行分类,附在各说明书里(程序控制缝纫机除外)。您想知道机器的功能和操作方法,请阅读说明书本篇。

1 操作说明书(面向一般操作人员) 「操作人员安全操作规程」
「安装和做准备作业人员的安全操作规程」
「操作说明书」(基本作业所需要的机械操作方法)
中文零件编码 : 693271001

2 操作说明书(面向专门操作人员) 「操作人员安全操作规程」
「安装和做准备作业人员的安全操作规程」
「机门连动机能」
「操作说明书」(准备和加工所需要的机械操作方法)
(对话) 日文零件编码 : 693312001 英文零件编码 : 693307001
(NC 语言) 日文零件编码 : 693310001 英文零件编码 : 693305001

3 安装说明书 「安装作业人员和准备作业人员的安全操作规程」
「安装说明书」(机械和配件的安装及其组装方法)
日文零件编码 : 693311001 英文零件编码 : 693306001

4 编制程序说明书 「编制程序说明书」(加工程序的制作方法)
(对话) 日文零件编码 : 693314001
英文零件编码 : 693309001
(NC 语言) 日文零件编码 : 693313001
英文零件编码 : 693308001

5 维修说明书 「受过培训的维修作业人员安全操作规程」
「维修说明书」(机械的调整和修理方法)
对顾客不发维修说明书。

和安全签条的关系

安全操作规程中特别重要的部分被制作成安全标签，贴在机器上。
安全操作规程的最后部分是关于安全标签的说明。如果机器上的安全签条脱落，请设法索取签条后重新贴上。

语言

日本国内销售的机器，所贴的安全操作规程和安全签条均用日文。
销售到国外的机器，用的是英文、德文、法文和中文四国文字。
请设法取得所懂语言的安全操作规程和安全签条。
关于其他国家的安全操作规程和语言签条，请询问您所购买的机器销售店。

索取方法

如果安全操作规程或安全签条遗失，请到您所购买的机器销售店索取。
如销售店无法解决，请向下列单位咨询。

日本国外联系地址
1-1-1 Kawagishi, Mizuho-ku, Nagoya 467-8562, JAPAN
BROTHER INDUSTRIES, LTD.
phone +81-52-824-2232
fax +81-52-811-0469

安全操作规程的使用

安全操作规程应注意妥善保存,做到随时可以阅读。如机器更换所有人,请转交机器的新持有人。

危险程度

如无视警告,所引起的危险的程度按受害程度可分 3 种。

1. 危险

⚠ 危　险

招致死亡或不可复原的严重疾患的危险。

2. 警告

⚠ 警　告

招致重伤的危险。

3. 注意

⚠ 注　意

轻度危险

说明的顺序

按下列顺序进行说明。

1. 表示危险程度的文字标记(危险、警告、注意)和象图
2. 危险的种类
3. 伤害的预测
4. 回避方法

象形图的意思

安全签条和安全操作规程的警告语言使用象图,形象地说明其危险程度和回避方法。现将图像的意义说明如下。

1. 危险

当心滑倒

活动部件

当心绊倒

注意触电

当心触电

当心夹入

夹进手里

注意高温

注意高温

谨防割断

谨防断裂

注意破裂

当心刺伤

有物落下

有物落下

旋转物体

当心坠落

注意飞散

注意飞散

谨防火灾

2. 回避方法

保护耳朵

保护双手

保护双脚

拔掉电源

严禁触摸

保护头部

需接地线

不准分解

保护眼睛

TS2ASA01-1.ai

No.	各部の名称	Section names	Namen jedes Teils	Noms de sections	各部件名称
	日本語	English	Deutsch	Français	中文
1.	制御箱	control box	Steuerschrank	armoire de commande	控制箱
2.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞ	splash guard	Spitzblech	tôle pare-copeaux	火花防溅箱
3.	停止ｽｲｯﾁ	stop switch	stop Einschalter	bouton d'arrét	停止开关
4.	停止ﾗﾝﾌﾟ	stop lamp	stop Lampe	lampe d'arrêt	停止指示灯
5.	ﾄﾞｱｲﾝﾀﾛｯｸｽｲｯﾁ	door interlock switch	Verriegelungsschalter	interrupteur de la porte d'verrouillage	门互锁开关
6.	作業扉	work door	Arbeitstür	porte de travail	作业门
7.	ﾄﾞｱｲﾝﾀﾛｯｸｷｰ	door interlock key	Verriegelungsschlüssel	clef de la porte d'verrouillage	门互锁键
8.	ｽﾋﾟﾝﾄﾞﾙ	spindle	Spindel	broche	主轴
9.	ATC ﾏｶﾞｼﾞﾝ	ATC magazine	ATC Magazin	ATC magasin	ATC 刀库
10.	取手	handle	Griff	poignée	把手
11.	制御箱内部書類入れ	control box document	Dokumentenbehälter im Steuerschrank	boîte à papiers de l''armoire de commande	控制箱内书架
12.	ﾚﾍﾞﾘﾝｸﾞﾎﾞﾙﾄ	leveling bolt	Nivellierbolzen	boulon à régler le niveau de la machine	调平螺栓
13.	ｸｰﾗﾝﾄﾉｽﾞﾙ	coolant nozzle	Kühlmitteldüse	ajutage d'huile de coupe	冷却液喷嘴
14.	ｸﾞﾘｯﾌﾟｶﾊﾞｰ	grip cover	Griffschutz	couverture de jambe	夹钳套
15.	工具	tool	Werkzeug	outil	刀具
16.	工具ﾎﾙﾀﾞ	tool holder	Werkzeughalter	support à outil	刀具夹
17.	ｽﾋﾟﾝﾄﾞﾙﾍｯﾄﾞ	spindle head	Spindelkopf	tête de la broche	主轴头
18.	非常停止ｽｲｯﾁ	emergency stop switch	Notfall-stop-Schalter	bouton d'arrêt d'urgence	紧急停止开关
19.	ｹｰﾌﾞﾙｶﾊﾞｰ	cable cover	kabelschutz	couvre cable	揽绳套
20.	ﾃｰﾌﾞﾙ	table	Tisch	table	工作台
21.	主電源ﾌﾞﾚｰｶ	main power breaker	Hauptschalter	disjoncteur d’alimentation principale	主电源开关
22.	ｸｰﾗﾝﾄﾀﾝｸ	coolant tank	Kühlmitteltank	réservoir d'huile de coupe	冷却液罐
23.	ｽﾌﾟﾗｯｼｭｶﾞｰﾄﾞｻｲﾄﾞｶﾊﾞｰ	splash guard side cover	Spitzblechseitenschutz	couverture à côté du tôle pare-copeaux	火花防溅板一侧的护罩
24.	回生抵抗ｶﾊﾞｰ	regenerative resistor cover	Rückkopplungs- widerstandsschutz	couverture pour la résistance régénératrice	再生电阻罩
25.	操作ﾊﾟﾈﾙ	operation panel	Betriebstafel	panneau d'opéation	操作面板

警告和回避方法

(　)中的数字 1,2 与各部分的名称号码相对应。

危险　⚠ 危　险

OD1　在攻丝中心里隐藏着许多危险。
OD1-1　为了熟知危险的内容和回避方法,请在操作机器前阅读安全操作规程。
OD1-2　所有使用者均须知道紧急停止开关(18)的位置和操作方法。

OD2　控制箱(1)中有高电压装置,不慎触模该装置,会引起重大伤亡事故。
OD2-1　不具该机械的电气回路知识、没有电工执照的人员不准进行电气的维修和检查作业。操作人员不准打开控制箱。
OD2-2　如警报器报警,应立即向管理人员报告。操作人员不得擅自修理。
修理和安装应由具备专门知识的人员进行。

OD3　运转中的机器,都有被其夹住而受重伤的危险。
OD3-1　机器在运转时,不能将身体伸入火花防溅箱(2)中去。
OD3-2　亲眼确认火花防溅箱中确实无人后,才能开动机器。
OD3-3　在机器运转时,手足和身体不能靠近机器的转动部分。
OD3-4　如警报器报警,应立即向管理人员报告。不准将手脚和身体伸入机械。

OD4　门互锁开关(5)处于无效状态时，即使打开作业门(6)，机械也会运行。
有被旋转的刀具(15)切伤或被机械夹伤的危险。
OD4-1　门互锁开关(5)处于无效状态时,勿将手足和身体伸入机器内部。作业人员要向管理人员汇报。管理人员应将门互锁开关拨到有效位置。钥匙(8)由管理人员保管。
OD4-2　门互锁无效时,管理人员不得让操作人员进行作业。
OD4-3　操作人员应亲自确认门互锁开关(5)确已拨到有效位置后,才能开始作业。
OD4-4　如果门互锁上挂有钥匙,应向管理人员汇报。
OD4-5　门互锁的钥匙由管理人员保管。

警告 警告

OW1 触摸转动中的刀具(15)会受伤。
OW1-1 不准靠近转动中的刀具。

OW2 折断的刀具(15)和工件弹出会造成伤害。
OW2-1 应关闭作业门(6)后再运行机械。

OW3 夹进转动部件而受伤。
OW3-1 勿靠近转动部件(15)、 主轴(8)和 ATC 刀库(9)。
OW3-2 应穿合身服装。长发应拢入工作帽内。除非停机作准备工作,不能戴手套。不能戴首饰。勿模弄转动部件。

OW4 改装安全装置,会带来安全装置失灵、 触电、被夹和被打等危险。
OW4-1 勿改装安全装置。勿固定安全装置,以免安全装置失灵。

OW5 切削碎屑飞入眼内,会伤及眼球而失明。
OW5-1 应戴用铁屑防护眼镜。
OW5-2 勿用压缩空气清扫切削碎屑。

OW6 用手触摸切削碎屑,会造成外伤或烫伤。
OW6-1 勿用手触摸切削碎屑。勿用手触摸加工件的尖厉部分。
OW6-2 清理切削碎屑应戴手套,使用刷子。
OW6-3 应在停机后清理切削碎屑。

OW7 勿握模刀具(15)的刀刃,以免手被割破。
OW7-1 勿握模刀具的刀刃。拿取加工机具时应拿住刀具夹(17)部分。

OW8 重物跌落脚上,会造成足部骨折。
OW8-1 抬拿重物时应穿安全鞋。

OW9 抬拿重物时,注意闪腰。
OW9-1 抬拿重物时,应请他人协助。
OW9-2 应用脚力抬起而不是背上及腰间的力气。

OW10 长时间身处噪音之中或巨大的噪声之中,会造成双耳失聪。
OW10-1 在噪音中作业时,应戴耳塞等保护器具。

OW11 高气压设备有可能爆裂而伤及眼目。
OW11-1 没有接受过高气压设备使用方法培训、不懂该机器配管的人员,不能安装和改装高气压设备。

OW12 站起时注意碰伤头。
OW12-1 在机器内部或周围进行作业时应戴安全帽。

OW13 开机时,机器中有未取出的加工工具时，加工工具有可能飞散而造成工伤。
OW13-1 如有工具遗忘在机器中,不应继续操作机器,并向监督人员报告。

OW14 握取把手(10)以外的部分开关作业门(6)话，有手被夹伤的危险。
OW14-1 开关作业门(6)时，应握取把手(10)。

OW15 在控制箱(1)和机器上放置工具时,工具会震落。
OW15-1 在控制箱和机器上勿放置物品。

OW16 攀登机器和冷却液罐(22),须注意坠落受伤。
OW16-1 勿攀登机器和冷却液罐。

OW17 把手伸进调平螺栓(12)的下面,须注意手被夹伤。
OW17-1 不应将手伸入调平螺栓的下方。应使用工具调节调平螺栓。
OW17-2 管理人员应让安装人员调节水平调节螺栓。

OW18 缆绳下垂或不加缆绳护罩,会发生绊滑跌倒等工伤事故。
OW18-1 电缆线下垂或未加盖罩时,应向管理人员汇报。
OW18-2 管理人员应让安装人员拉线,在电缆线上加罩。

OW19 擅自改装机器,会使安全装置失灵,安全操作规程和安全签条的警告事项将失去作用。

OW19-1 不应改造机械。如有必要改造时，应事先与兄弟公司联系，获取书面上的许可。

OW20 冷却液进入眼睛会伤及眼睛。

OW20-1 调整冷却液喷嘴(13)时,应戴保护眼镜。

OW20-2 冷却液进入眼睛以后,应用清水冲洗眼睛,请医生检查。

OW21 手指伸入机器夹缝,应注意手被夹伤。

OW21-1 勿将手指伸入固定具的罩子(14)中去。

OW21-2 勿将手指伸入刀具(15)或刀具夹(16)与 ATC 刀库(9)之间的空隙中去。

OW22 如冷却液、机油或切削碎屑被打翻,会因滑脚、跌倒、碰撞而受伤。

OW22-1 应切断电源,并清扫机器内部和机器周围以后,再进行作业。

OW22-2 安装作业应戴安全帽和穿安全鞋。

OW23 拆卸刀具夹(16)时,须注意手可能会被刀具(15)的刀刃所伤或手被机器打着。

OW23-1 不得握模刀具夹的刀刃。拿刀具时应戴皮手套。应用双手持拿刀具。

OW24　机器可能突然停机，刀具可能突然脱落。
OW24-1　不要将手脚和身体伸进主轴头(17)下面。

OW25　如使用油性冷却液加工，加工部位可能受热起火。
OW25-1　使用油性润滑液时，应设置火警预报器和自动灭火装置。
OW25-2　加工时，操作人员不得离开机器。

OW26　机器开动时，人傍靠在机器上，会有被夹、被打致伤的危险。
OW26-1　勿傍靠在机器上。

OW27　紧急停止开关(18)上挂有物品时，紧急停止开关会按不进去。
OW27-1　不得在紧急开关上钩挂物品。

OW28　工作台(19)移动，会使机器背后的电缆护罩(20)飞脱，而砸伤作业人员。
OW28 -1　应先切断主电源闸(21)，再清扫切削碎屑。

OW 29　冷却液罐(22)很重，抬拿时须注意闪腰或脚被砸伤。
OW 29-1　清理切削铁屑时也不得抬拿冷却液罐。

OW30　进入机器时，须注意滑倒或被机器夹住。
OW30-1　不得进入机器。有必要进入机器时，应向管理人员报告。

OW31 别忘记安装火花防溅箱(2)的侧面护罩(23),以免操作人员被夹或被断裂的刀具打伤。

OW31-1 在打开电源前应亲自确认是否装上了侧面护板。侧面护板(23)尚未安装,应向管理人员报告。

OW31-2 管理人员应令其安装好侧面护罩。

OW32 如果使用超重超大的刀具(15),刀具夹(16),该机具或该机具的套柄有可能飞脱。

OW32-1 应使用重量和尺寸都在规定以内的刀具和套柄。

OW32-2 刀具的限制条件请见刀具条和操作说明书。

OW33 机器在运转过程中,再生电阻会发热,须注意触摸再生器会被烫伤。

OW33-1 勿拆卸再生电阻罩(24)。

OW34 机器在运转过程中,马达会发热,须注意触摸马达可能会被烫伤。

OW34-1 在停止运转后的 30 分钟内不要触摸马达。

OW 35 当 ATC 刀库(9)转动时,须注意刀具(15)有可能碰到加工物件、夹具或机器而断裂。

OW 35-1 应妥善设定刀具的长度,以免在 ATC 刀库转动时,刀具碰到加工物件、夹具或机器。

OW36 如控制箱(1)和操作盘(25)潮湿,须注意有可能触电。

OW36-1 不能将冷却液,水,切削铁屑撒到控制箱和操作盘上。

OW36-2 不能用潮湿的手触摸控制箱。

OW37 如在有爆炸危险的环境下打开机器电源开关或进行加工作业,有可能因机器的火花引起爆炸。

OW37-1 不得在有爆炸危险的环境下打开机器电源开关或进行加工作业。

OW38 不将加工物件妥善固定便进行加工时，有可能因加工物件飞脱而使操作人员致伤。
OW38-1 应将加工物件妥善固定。

OW39 忘记安装火花防溅侧面护罩(23)的话，有被夹伤的危险。
OW39-1 在开电源以前,应亲自确认是否已经安装了护罩。
OW39-2 应先切断主电源,加上铁锁防止开关跳入,然后拆卸护罩。
OW39-3 管理人员应自己安装护罩。

OW40 有些被加工件的材料的切削碎屑有可能引火或爆炸。
OW40-1 切削碎屑应立即清除。
OW40-2 在加工上述材料时,机器附近应放置灭火设备或进行无人作业。

OW41 带有可换固定斜楔的加工机具,如斜楔未妥善固定,在固定主轴的过程中,有可能卸脱而造成伤害。
OW41-1 务必先确认固定斜楔是否妥善固定,然后再安装刀具。

OW42 如果工厂内照明光线昏暗的话，有因机械内光线变暗而导致夹具及刀具弄伤手的危险。
OW42-1 机械内照明度低于 500 勒克斯以下的场合，应设置照明灯。

安全签条的说明

机器上贴有安全签条，安全签条是安全操作规程中特别重要的部分。
请在充分理解了安全签条的内容以后再进行机器的操作。
安全签条贴在机器的下述位置，请确认安全签条有否脱落。如有脱落，请索取后重贴。

230S00C02.doc

S2A00401.ai

[1] 前面安全签条

语言	零件编码
和中英文	690723001

This machine has hazards.
Read instruction manuals to understand hazards and avoid them before operation.

危険の内容と回避方法を理解するため、取扱説明書を読んでから、機械を操作してください。

由于有必要了解危险的内容和避免的方法，请仔细读完使用说明书后，再操作机器。

DANGER	WARNING	WARNING
Machine in operation will suddenly move and crush you. Keep away from moving parts.	Broken tool or workpiece can hit and wound you. Shut door before starting machine.	Rotating parts can catch and injure you. Keep away from rotating tool, spindle, and magazine. Never hold moving parts. Do not wear gloves while operating machine.
危 険	警 告	警 告
機械が、とつぜん、動き、はさまれて大けがをする。 動くところに、手足や、からだを近づけないこと。	おれた工具や工作物がとびだし、ぶつかって、けがをする。 とびらをしめてから運転すること。	回転部分にまきこまれて、けがをする。 回転している工具、スピンドル、マガジンに近づかないこと。 回転部分を、つかまないこと。 運転作業中は手ぶくろをしないこと。
危 险	警 告	警 告
被机器突然运行所夹住，会致人重伤。 在机器运转时，手足切勿靠近。	折损的刀具或工件飞出，会伤人。 请务必关上门之后，运行机器。	被回转部分夹住，会受伤。 不要靠近正在运行中的主轴，旋转头。 不要抓住回转部分。在操作时不许戴手套。

690723001 / 9411 (1)

[2] 前面面刀具标签

根据刀库的最大刀具收纳把数及主轴回转次数, 更改记载内容。

零件编码

653379001 **刀具标签** 250

工具、主軸回転数の制限を超えて使用すると、機械が破損する場合があります。操作前に、取扱説明書で詳細を確認して下さい。
If use beyond the limitation of the tool and spindle speed, machine may be broken.
Check the detailes by the operation manual before operation.

最高主軸回転速度	10000 min^{-1} / 16000 min^{-1}		Max Spindle Rotation Speed
主軸テーパ	7 / 24 No.30		Spindle Taper
ツールシャンク	MAS-BT30		Tool Shank
プルスタッド	MAS-P30T-2 (30°)		Retension Knob
マガジン全工具合計	M total 25 kg (14Tools) / 35 kg (21Tools)		Total in Magazine
工具の制限	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 80 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≧ 30 mm M ≦ 3 kg MxH ≦ 180 kgmm	D1 ≦ 40 mm L1 ≦ 200 mm D2 ≦ 55 mm L2 ≦ 160 mm D3 ≦ 46 mm L3 ≧ 30 mm M ≦ 2 kg MxH ≦ 100 kgmm	Limitation of Tool
工具バランス制限	100 grmm	50 grmm	Limitation of Tool Balance
主軸回転数制限	10000 min^{-1}	16000 min^{-1}	Limitation Spindle Rotation Speed

653379001 / 0210 (2)

[3] 背面安全签条

语言	零件编码
和中英文	690730001

⚠ DANGER

Hazardous voltage
will cause severe injury or death.

Never attempt to adjust or repair electrical circuits unless you are familiar with circuits and qualified to work safely on electrical circuits.

Turn off main power before working.

Post notice you are working.

⚠ WARNING

Spilt coolant, lubricant, or chips are slippery and can cause injury.

Turn off main power and clean in and around machine before servicing.

Wear head protector and safety shoes while servicing.

⚠ 危　険

高 電 圧
感電死することがある。

電気の保守・点検作業は、この機械の電気回路の知識があり、電気安全の教育をうけた人間だけが、おこなうこと。

主電源を切ってから、作業すること。

作業中であることを表示すること。

⚠ 警　告

切削液、油、または切りくずのこぼれで、ころんだり、ぶつかって、けがをする。

機械の電源を切り、機械の中やまわりをそうじしてから、作業すること。

すえつけ作業のときは、ヘルメットと安全靴を使うこと。

⚠ 危　险

高 压 电
触电会致死。

电器的保养，检查的实施，仅限于了解该机器电路知识，受过电器安全教育的人员。

主电源切断之后，进行作业。

要做好正在作业的标志。

⚠ 警　告

切削液，机油，切削粉末溢出后，迭倒碰撞会受伤。

切断机器的电源，把机内和四周打扫干净之后，再工作。

安装作业时，要戴上安全帽，穿上防护鞋。

690730001 / 9709 (1)

[4]　再生阻抗器罩签条

语言	零件编码
和中英文	6907290001

[5]　刀具装脱签条

语言	零件编码
和中英文	65308001

[6] 侧面维修罩安全签条

语言	零件编码
和中英文	690731001

[7] 远离勿踏标签

零件编码
693178001

693178001 / 0607 (1)

693178001.ai

机门连动器机能

1. 操作注意事项
2. 外观图
3. 检查
4. 规格的详细内容

1 操作注意事项

⚠ 危险

机门连动器开关无效时，即使门呈开启状态机器依然运转。手可能会被旋转的机具划破、夹住和受伤。机门连动器开关无效时，手脚和身体不能伸进机器。
应向管理员汇报情况。
机门连动器开关无效时，管理员不能让作业人员操作机器。
应亲眼确认机门连动器开关有效后，才能进入操作。
发现机门连动器上挂有钥匙时，应向管理员汇报。
机门连动器钥匙应由管理员保管。

⚠ 危险

机门连动器开关无效时，手脚和身体不能伸进机器。应向管理员汇报情况。
管理员应将机门连动器开关调到有效位置。
机门连动器无效时，管理员不能让作业人员操作机器。
发现机门连动器上挂有钥匙时，应向管理员汇报。

⚠ 警告

小心转动工具伤人。
别靠近转动工具。

⚠ 危险

小心卷进转动机件而受伤。
别靠近转动中的机具、机轴和送料装置。
服装要合身。
长发应梳理进工作帽内。
除非停机做准备工作，不准戴用手套。
不戴首饰。
不用手抓摸转动机件。

目的
机门连动器机能是保护作业人员，避免卷入转动的机具、可动部

装置说明
在外门关闭状态下能锁机或 限制机器动作，但视情况不同而各异。

结构
机门连动器由下列部件构成。
1. 机门限位开关
2. 机门锁定装置

用法
1. 平时
机门连动器机能开关(1)置于有效位置。

2. 准备作业和维修作业时
在做准备作业和维修作业时，如确有必要，才可把开关置于无效位置。
请先阅读「在安装和 做准备工作时操作人员安全操作规程」「经培训后的操作人员安全操作规程」后，再进行准备工作和维修作业。

机门连动器开关无效时需遵守下列事 项。
注意别卷入转动的机具、可动部件和转动部件中去。
作业结束后应将开关回复到有效位置。
钥匙(2)请管理员保管。

T20ADoor1-1.doc

2 外观图

TC-S2B

3 检查

开机前,务必先检查机门连动器。

检查方法

发生停机时的检查

1. 关闭全部机门。然后打开开关, 回复原点。再确认机门连动装置开关是否有效。
2. 打开外门。
3. 如机门连动装置机能正常,按下X轴的移动钮[—X],机器不应该发生移动。此时如果有表示机门已经关闭的音 响信号属情况正常。如情况异常,属故障,应予修理。
   如机门连动装置机能正常,可继续下述检查。

机门闭锁检查

4. 关闭外门。
5. 让主轴转动。
6. 如机门闭锁机能正常,因外门已经闭锁,应无法打开。如外门没有闭锁,还能够打开,属故障,应予修理。

紧急停止开关的点检

7. 以手动运转方式运转主轴。
8. 联锁开关如果正常的话, 一钦紧急SW机器就会停止运转, 画面上出示「*紧急停止开关关上」的警报。如果运转不停止, 或者画面上不出示警报的话, 则为出现故障,需要修理。

4 规格的详细内容

<table>
<tr><th>门</th><th>机门连动器开关</th><th>机门锁定</th><th>动作</th></tr>
<tr><td rowspan="2">关闭</td><td>无效</td><td>未锁定</td><td rowspan="2">全部动作正常</td></tr>
<tr><td>有效</td><td>而处于工作状态(机轴移动、主轴转动、MDI、计量器呈工作状态、手动脉冲发生器有效)(※4)</td></tr>
<tr><td rowspan="2">开启</td><td>无效</td><td rowspan="2">未锁定</td><td>主轴旋转、送料装置转动、ATC、不能作攻丝动作。(※1)
轴移动、主轴停止、主轴可定位。(※2)
计量功能只有单一计量功能
MDI运转,整个指令停止执行
不供应冷却液</td></tr>
<tr><td>有效</td><td>所有动作停止(※2)(※5)
不供应冷却液</td></tr>
<tr><td rowspan="2">关闭
↓
开启</td><td>无效</td><td rowspan="3"></td><td>动作(包括主轴转动)立即停止(※3)
立即停止供应冷却液</td></tr>
<tr><td>有效</td><td rowspan="2">动作(包括主轴转动)立即停止(※3)(※5)
立即停止供应冷却液</td></tr>
<tr><td>开启</td><td>无效
↓
有效</td></tr>
</table>

*1. 快速递送的移动速度即变为机器参数的「高速移动速度(机门开启状态)」所设定的速度。

切削移动速度也受「高速移动速度(机门开启状态)」所设定的速度的限制(同样附加轴 (A,B,C轴) 的速度也受机器参数的「第４、5、6轴高速转动速度(机门开启状态)」速度的限制。

*2. 想使其动作时、即发生「＊门未关」故障。

*3. 丝锥、主轴定位、ATC、送料装置转动时，整个指令停止执行。主轴正在转动而机门开启后,发出「门开 主轴停转」故障,主轴停转。再关闭机门,重新起动后，回复主轴停止前的转动状态。

但在进行了下列操作后,「门开 主轴停转」故障消失,即使关闭机门,再次起动,仍不能回复到主轴停转前的状态。

1) 撤回复键
2) 用手动方式进行主轴操作

(注意)
在立铣刀丝锥的XY轴移动的同时主轴也在转动时,开启机门后,主轴会停止,但不会发生「门开 主轴停转」的故障。
此外,即使关闭机门再次起动,也不能回复主轴停转前的状态。
再从R点进行切削移动时,主轴会自动转动。

*4. 机器工作状态

MDI、计量功能暂停、整个指令处于停止执行状态(程序结束时、不包括程序暂停)也包括在机器工作状态中。

*5. 机门连动器有效时，打开门，他全部机轴的随动马达。
在运转前关闭随动马达时,只须关闭机门即能复原,出现「＊机门未关」故障。
此时,如关闭机门或将机门连动器拨至无效,则随动马达开动,故障消失。

此时即使关闭机门,随动马达也不会起动，故障也不 消失。(如不关闭机门或将机门连动器拨至无效,重按回复键,无法回复原状。)

但在运转中打开门出现「＊随动马达关闭」,「＊门开 主轴停转」故障(停机)。
此时即使关闭机门,随动马达也不会起动，故障也不 消失。(如不关闭机门或将机门连动器拨至无效,重按回复键,无法回复原状。)

（此頁空白。）

TC-S2A OPERATION MANUAL

For Advanced Personnel

Please read this manual carefully before starting operation.

brother®

This manual describes the NC-operation of the TC-S2A.
The tapping centre is able to perform drilling, tapping, and facing.
We shall not bear any responsibility for accidents caused by user's special handling or handling deviating from the generally recognized safe operation.

The relation between the manuals is as follows.
· OPERATION MANUAL (For general operators)
This manual describes the basic operations of the machine.

· OPERATION MANUAL (For advanced personnel)
This manual describes the advanced operations of the machine.

· INSTALLATION MANUAL
This manual describes the installation of the machine.

· PROGRAMMING MANUAL
This manual describes the programming of the machine.

Keep this manual for future reference.
Please include this manual when reselling this product.
When this manual or labels are lost or damaged, please replace them (charged) from your nearest agency.

INTRODUCTION

Congratulations on your purchase of the Brother CNC tapping center. Correct usage of the machine is of most importance to assure the expected machine capabilities and functions as well as operators's safety. Read this Manual thoroughly before starting operation.

* All rights reserved: No part of this manual may be reproduced, stored in a retrieval system, or transmitted in any form without prior permission of the manufacturer.

* The contents of this Manual are subject to change without notice.
* This manual are complied with utmost care. If you encounter any question or doubt, please contact your local dealer.

©Copyright 1999-2007 BROTHER INDUSTRIES, LTD. ALL RIGHTS RESERVED.

HOW TO USE THE MANUAL

This Instruction Manual consists of the following elements:

(1) General description ------ Is an outline of the description given in the section.

(2) Alarm ---------- Is a alert given against a danger which may cause serious damage or death to human being or may damage the machine.
The hazards are explained in this order:
degree of danger,
subject of danger,
expected damage,
preventive measure,

(3) Operation procedure ----- Is a procedure of activating a function.

(4) Screen ---------- Is given to describe important points of a procedure given.
NOTE: This screen is only a representation of the information displayed on the actual screen and therefore differs somewhat from the actual screen layout and screen fonts.

(5) Illustration ---------- Is a sketch, figure, view, etc. indicating dimensions, position or zone, given in the points where it is necessary to provide complementary information to the text description.

Chapter 1 General precautions ---------- 1-1

1.1 Precautions of First Importance ---------- 1-2

1.1.1 When feeding an axis ---------- 1-2
1.1.2 When indexing the magazine ---------- 1-2
1.1.3 When performing an automatic operation ---------- 1-2
1.1.4 When performing a maintenance work or setup ---------- 1-2
1.1.5 In case of machine trouble or danger ---------- 1-3
1.1.6 Operate the machine correctly ---------- 1-4

1.2 Precautions on Safety ---------- 1-4

1.2.1 Before turning on the machine ---------- 1-6
1.2.2 Before starting an operation ---------- 1-6
1.2.3 During an operation ---------- 1-6
1.2.4 If a machine trouble occurs during an operation ---------- 1-7
1.2.5 When turning off the machine ---------- 1-7
1.2.6 Other precautions ---------- 1-7

1.3 Person Allowed for Operation ---------- 1-8

1.3.1 Operation Qualifications ---------- 1-8
1.3.2 Working area ---------- 1-8

Chapter 2 General system description -------- 2-1

2.1 Main Features ---------- 2-2

2.1.1 ATC (Automatic tool changer) ---------- 2-2
2.1.2 Tapping cycle ---------- 2-2

2.2 Basic Configuration ---------- 2-3

2.2.1 Basic configuration ---------- 2-3
2.2.2 Machine rear ---------- 2-4

2.3 Table Size and Machining Volume ---------- 2-4

2.3.1 Table top surface dimensions ---------- 2-4
2.3.2 Machining volume ---------- 2-5

2.4 CNC unit specifications ---------- 2-8

2.5 Machining capability ---------- 2-10

2.6 Safety devices ---------- 2-9

2.6.1 Main safety devices ---------- 2-9

2.7 Coolant ---------- 2-10

Chapter 3 Operation ---------- 3-1

3.1 Turning on the Power ---------- 3-2

3.1.1 Preliminary checks ---------- 3-3
3.1.2 Turning on the power ---------- 3-3

3.2 Turning off the Power ---------- 3-4

3.2.1 Checks before turning off the power ---------- 3-4
3.2.2 Turning off the power supply ---------- 3-4

3.3 Operation Panel Overview ---------- 3-6

3.4 Screen Layout ---------- 3-7

3.5 Switches ---------- 3-7

3.6 Keys ---------- 3-10

3.7 Cautions on Workpiece and Tool Setting ---------- 3-16

3.7.1 Limitations on workpiecec, jig height and tool length ---------- 3-16
3.7.2 Limitation of tool holder ---------- 3-18

3.8 Setting and removing a tool on and from the magazine 3-20

3.8.1 Setting a tool on magazine ---------- 3-21
3.8.2 Removing a tool from the magazine ---------- 3-22

Chapter 4 Screen display ---------- 4-1

4.1 Position screen ---------- 4-2

4.1.1 Present position screen ---------- 4-2
4.1.2 Screen of modal information ---------- 4-4
4.1.3 Enlarged display ---------- 4-8

4.2 Program display ---------- 4-9

4.3 Conditions of manual operation ---------- 4-9

4.4 Magazine ---------- 4-10

4.5 Alarm display ---------- 4-11

4.5.1 Alarm screen ---------- 4-11
4.5.2 Alarm log screen ---------- 4-12

4.5.2.1 Log list screen ---------- 4-12
4.5.2.2 Detailed display screen ---------- 4-13

4.6 Production monitor display ---------- 4-17

4.6.1 Work counter screen setting ---------- 4-17
4.6.1.1 Work counter screen setting ---------- 4-17
4.6.1.2 Setting items ---------- 4-19
4.6.1.3 Work counter activating command in a program ---------- 4-23
4.6.2 Time display ---------- 4-26
4.6.2.1 Time display ---------- 4-26
4.6.2.2 Operation log ---------- 4-28
4.6.3 Communication status display ---------- 4-28
4.6.4 Thermal measurement data ---------- 4-29
4.6.5 Measurement results ---------- 4-30
4.6.5.1 Deletion of measurement results ---------- 4-31
4.6.5.2 Previous measurement results ---------- 4-32
4.6.6 Automatic thermal displacement compensation ---------- 4-33
4.6.6.1 Changing operation status ---------- 4-34
4.6.6.2 Deleting automatic thermal displacement compensation data ---------- 4-35

4.7 Data bank ---------- 4- 36

4.8 Erasing screen ---------- 4- 36

Chapter 5 Manual operation ---------- 5-1

5.1 Manual operation ---------- 5-2

5.2 Zero point return ---------- 5-3

5.3 Axis feed ---------- 5-6

5.3.1 Rapid traverse ---------- 5-6
5.3.2 Jog feed rate ---------- 5-7
5.3.3 Step feed ---------- 5-8

5.4 Starting and stopping spindle ---------- 5-9

5.5 Tool change ---------- 5-10

5.6 Magazine rotation ---------- 5-12

5.7 Axis movement and stroke ---------- 5-13

5.8 Release + zero point return ---------- 5-14

Chapter 6 Auto operation ---------- 6-1

6.1 Outline of MDI Operation and Its Procedure ---------- 6-2

6.2 Operation by Data Entered ---------- 6-4

6.2.1 Setting a coordinate system ---------- 6-4
6.2.2 Providing an output of external signal ---------- 6-5
6.2.3 Setting a tool in the spindle ---------- 6-5
6.2.4 Turning on and off coolant supply ---------- 6-7
6.2.5 Running and stopping the spindle ---------- 6-7
6.2.6 Feeding an axis ---------- 6-8

6.3 Setting Tools to be Mounted on the Magazine (1) ------- 6-9

6.4 Drilling ---------- 6-12

6.5 Tapping ---------- 6-14

6.6 Outline of Memory Operation and Its Procedure -------- 6-16

6.6.1 Types of memory operation ---------- 6-16
6.6.2 Memory operation procedure ---------- 6-17

6.7 Setting Tools to be Mounted on the Magazine (2) ---- 6-18

6.7.1 Assigning the main tool ---------- 6-18
6.7.2 Setting the spare tool ---------- 6-19
6.7.3 Setting tool type ---------- 6-21

6.8 Test Operation ---------- 6-23

6.8.1 Dry run ---------- 6-23
6.8.2 Single operation ---------- 6-25
6.8.3 Machine lock ---------- 6-25

6.9 Cycle Operation ---------- 6-26

6.10 Memory Operation ---------- 6-27

6.11 Setting the Starting Point ---------- 6-31

6.11.1 Display of start point setting ---------- 6-32
6.11.2 Start point setting procedure ---------- 6-33
6.11.3 Cautions on startng point setting ---------- 6-35

6.12 Running a Schedule Program ---------- 6-38

6.13 Setting a Schedule Program Number ---------- 6-39

6.14 Feed Hold and Emergency Stop ---------- 6-40

6.14.1 Feed hold ---------- 6-40
6.14.2 Emergency ---------- 6-40

6.15 Reset ---------- 6-42

Chapter 7 Data bank ---------- 7-1

7.1 Overview of Data Bank ---------- 7-2

7.2 Data Input, Modification and Reference ---------- 7-4

7.3 Tool Registration ---------- 7-5

7.3.1 Tool Registration with Auxiliary Code ---------- 7-20
7.3.2 Setting Tool Length ---------- 7-21
7.3.3 Setting Tool Life ---------- 7-24

7.4 Setting Tool Pattern ---------- 7-26

7.5 Setting Primary Hole Drilling Diameter for Tapping ---------- 7-29

7.6 Setting Cutting and Tool Conditions ---------- 7-32

7.7 Setting User Parameters ---------- 7-37

7.8 Setting Machine Parameters ---------- 7-39

7.9 Data Bank ---------- 7-41

7.9.1 Tool pattern ---------- 7-41
7.9.2 Drill diameters for tapping primary hole ---------- 7-43
7.9.3 Drill diameters for tapping primary hole by rolled tap ---------- 7-47
7.9.4 Cutting conditions 1 (hole producing tools) ---------- 7-49
7.9.5 Cutting conditions 2 (milling tools) ---------- 7-59
7.9.6 Cutting conditions 3 (except tool) ---------- 7-64
7.9.7 User parameter 1 (switch1) ---------- 7-78
7.9.8 User parameter 2 (switch2) ---------- 7-94
7.9.9 User parameter 3 (Communication) ---------- 7-100
7.9.10 User parameter 4 (Extrl In Signal) ---------- 7-104
7.9.11 User parameter 5 (Extrl Out Signal) ---------- 7-105
7.9.12 User parameter 6 (Z measurement) ---------- 7-106
7.9.13 User parameter 7 (Zero measurement) ---------- 7-111
7.9.14 User Parameter 8 (Auto THRM DISP CMP) ---------- 7-113
7.9.15 User Parameter 9 (Quick Table) ---------- 7-114
7.9.16 List of external input signals and functions ---------- 7-116
7.9.17 Details of external input signals ---------- 7-125
7.9.18 List of external output signals and functions ---------- 7-127
7.9.19 Details of external output signals ---------- 7-139
7.9.20 Machine parameter ---------- 7-148

7.10 Data Bank (default value list) ---------- 7-149

Chapter 8 Alarm message ---------- 8-1

8.1 Display of alarm messages ---------- 8-2

8.2 Battery Fault alarm ---------- 8-2

8.3 Alarm stop level and reset level ---------- 8-3

8.3.1 Alarm stop level ---------- 8-3

8.3.2 Alarm reset level ---------- 8-4

8.4 Axis display ---------- 8-4

8.5 Alarm message ---------- 8-5

8.6 Servo error message ---------- 8-43

8.7 Resetting ATC ---------- 8-45

8.8 Resetting procedure for tool clamp error ---------- 8-53

Chapter 9 Option

9.1 COOLANT UNIT ---------- 9-1-1

1 Cautions for Handling 9-1-2
2 Sketch Drawing 9-1-3
3 Operation Procedure 9-1-4

9.2 MANUAL PULSE GENERATOR ---------- 9-2-1

1 Cautions 9-2-2
2 Overall view 9-2-2
3 Operation procedure 9-2-3

9.3 INDICATION LAMP ---------- 9-3-1

1 ExternalView 9-3-2
2 Function of indicator lamps 9-3-3

9.4 AUTOMATIC CENTERING UNIT ---------- 9-4-1

1 Cautions 9-4-2
2 Shapes Measured 9-4-2
3 Mounting the automatic centering tool 9-4-4
4 Motion check 9-4-5
5 Dismounting an automatic centering tool 9-4-6
6 Setting Data Banks of Automatic Centering 9-4-7
6.1 Tool menu 9-4-7
6.2 Magazine tools 9-4-8
6.3 Parameter 9-4-9

7 Checking before Starting 9-4-12
8 Operating Procedure 9-4-13
8.1 Automatic centering menu 9-4-13
8.2 Corner 9-4-14
8.3 Parallel 9-4-18
8.4 Center of a circle (groove) 9-4-22
8.5 Center of a circle (boss) 9-4-26
8.6 Z level 9-4-32
8.7 Probe Offset 9-4-36
8.7.1 Probe Offset Value 9-4-36
8.7.2 Probe Offset Value (CORNER) 9-4-36
8.8 Probe Offset Value (CIRCLE-3POINTS) 9-4-42
8.9 Automatic coordinate setting with [F4] key 9-4-50
9 Motion Switchover and Motion Display 9-4-51
9.1 Mode switchover 9-4-51
9.2 Motion display 9-4-51

9.5 AUTOMATIC DOOR ---------- 9-5-1

1 Outline 9-5-2
2 Functions 9-5-2
3 Operation Switches 9-5-2
4 Automatic Operation 9-5-2
5 Door Controller Parameter Settings 9-5-3
6 Alarm messages 9-5-3
7 Automatic Door Safety Device 9-5-4
8 Door Stop Conditions 9-5-4

9.6 AUTOMATIC INTERMITTENT LUBRICATING UNIT ---------- 9-6-1

1 Cautions for Handling ---------- 9-6-2
2 General View 9-6-2
3 Recommended Lubricant 9-6-3
4 Alarm (External Error 23) 9-6-3

9.7 TOOL BREAKAGE DETECTION UNIT ---------- 9-7-1

1 Precautions for Handling 9-7-2
2 Sketch Drawing 9-7-2
3 User Parameter (Switch 1) Setting 9-7-3
3.1 Tool breakage detection option 9-7-3
3.2 Tool breakage detection return position. 9-7-4
3.3 Tool breakage detection position on X (Y) axis 9-7-5
3.4 Tool breakage detection execute cycle (the number of operation). 9-7-4
4 How to Use the Tool Breakage Detection Unit 9-7-7
4.1 MDI operation 9-7-7

4.2 Memory operation 9-7-8
4.3 Precautions for programming 9-7-10
4.4 When an alarm has occurred 9-7-10
5 Trouble shooting 9-7-10

9.8 ZERO MEASUREMENT ---------- 9-8-1

1 Before zero measurement 9-8-5
2 Setting of data on zero measurement 9-8-5
3 Operation of zero measurement 9-8-10
3.1 Corner 9-8-10
3.2 Parallel 9-8-15
3.3 Circle 9-8-18
3.4 Z LEVEL 9-8-23
3.5 Rotation 9-8-24
4 Handling of Measurements 9-8-26
4.1 Measurement display 9-8-26
4.2 Reflecting measurements in working coordinate system 9-8-28
5 Mounting and dismounting of probe 9-8-28

9.9 ROTATION AXIS (Index Table) ---------- 9-9-1

1 Manual Operation 9-9-2
1.1 Manual operation mode 9-9-3
1.1.1 High-speed operation 9-9-3
1.1.2 Low-speed operation 9-9-4
1.1.3 Step rotation 9-9-4
1.2 Machine and Index Table zero returns 9-9-5
1.2.1 Machine zero return 9-9-5
2 MDI Operation 9-9-9
2.1 Input data for MDI operation 9-9-9
2.2 Execution of MDI operation 9-9-13
2.2.1 Setting the working zero position 9-9-13
2.2.2 Arbitrary Indexing (rotation axis (Index table) positioning) 9-9-14
2.2.3 Arbitrary Indexing (cutting movement) 9-9-15
3 Rotation axis (Index Table)Parameter Setting 9-9-16
4 Program To Use Index Table 9-9-17
4.1 Creation of machining data to use index table 9-9-17
4.2 Rotation axis (Index Table) working zero position 9-9-17
4.3 Rotation axis (Index Table)indexing plane setting job 9-9-20
4.3.1 Angle 9-9-21
4.3.2 Working zero position 9-9-21
4.3.3 Indexing return height 9-9-23
4.3.4 Tool return 9-9-25
4.3.5 Return for tool change 9-9-27
4.3.6 Job 10 AXIS MOVEMENT and rotation axis 9-9-30
4.4 Motion program 9-9-31

4.4.1 Classification of rotation axis (Index Table) operations 9-9-31
4.4.2 Rotation axis (Index Table) cutting specification in motion 9-9-33

9.10 Z-AXIS MEASUREMENT SYSTEM ---------- 9-10-1

1 Cautions 9-10-2
2 Installation 9-10-4
2.1 Installation of the tool length measurement device 9-10-4
2.2 Installation of reference tool 9-10-6
3 Parameter 9-10-6
3.1 Setting 9-10-7
4 Z-axis thermal displacement offset 9-10-11
4.1 Offset capacity 9-10-11
4.2 For correct thermal displacement offset 9-10-13
4.3 Command 9-10-11
4.4 Operation 9-10-15
4.5 Thermal measurement data screen 9-10-19
4.6 Outputting thermal displacement measurement data to the computer 9-10-20
4.7 Example parameter setting and alarm 9-10-21
4.8 Example offset 9-10-22
5 Tool breakage detection 9-10-28
5.1 Command 9-10-28
5.2 Operation 9-10-29
6 Automatic tool length measurement 9-10-31
6.1 Command 9-10-31
6.2 Operation 9-10-33

9.11 OIL HOLE SYSTEM ---------- 9-11-1

1 Cautions for handling 9-11-2
2 System outline 9-11-4
3 How to use the Oil Hole System 9-11-6
3.1 Oil hole holder installation to the magazine 9-11-5
3.2 Starting oil hole pump 9-11-5
3.3 Cautions for stopper block handling 9-11-6

(This page is blank.)

QUICK INDEX

Chpt. 1	GENERAL PRECAUTIONS	1
Chpt. 2	GENERAL SYSTEM DESCRIPTION	2
Chpt. 3	OPERATION	3
Chpt. 4	SCREEN DISPLAY	4
Chpt. 5	MANUAL OPERATION	5
Chpt. 6	AUTO OPERATION	6
Chpt. 7	DATA BANK	7
Chpt. 8	ALARM SCREEN	8
Chpt. 9	OPTION	9

(This page is a blank.)

1

CHAPTER 1

GENERAL PRECAUTIONS

1.1 Precautions of First Importance
1.2 Precautions on Safety
1.3 Person Allowed for Operation

1

1.1 Precautions of First Importance

⚠ WARNING

Touching rotating tools results in injury.
Keep away from rotating tools.

⚠ WARNING

You may be caught in the rotating part, resulting in an injury.
Keep away from rotating tools, the spindle, and the ATC magazine.
Wear snug-fitting clothes. Put long hair up in cap. Do not wear gloves except for set-up operations carried out with the machine stopped. Do not wear any accessories. Do not hold the rotating part.

Take the following precautions in order to assure safe machine operation.

1.1.1 When feeding an axis

The table or spindle of the machine moves rapidly. Before starting an axis feed, make sure that there is no obstacle in the axis motion range and that there is no interference among tools, workpiece and jigs.
Never enter inside the splash guard during operation.

1.1.2 When indexing the magazine

The magazine rotates at a high speed.
Mount tools securely on the magazine.
Never enter inside the splash guard while the magazine rotates.

1.1.3 When performing an automatic operation

Before starting an operation make sure that both the control unit doors and the splash guard door are securely closed.
Never touch directly or undirectly any mobile parts during operation.

1.1.4 When performing a maintenance work or setup

When making an access to machine motion area, be sure to open the power supply circuitry with the handle of the main power breaker on the control panel.

Fig.1-1 Main power breaker handle (OFF)

1-2.doc

Lock the handle with a padlock.

Fig.1-2 Main power breaker OFF lock

01L01.ai

1.1.5 In case of machine trouble or danger

The EMERGENCY STOP switch, if pressed, stops on the spot all of machine motions. Press this pushbutton immediately when there is any indication of machine trouble or danger.

Fig.1-3 Emergency stop switch

230E01C01.DOC

1

1.1.6 Operate the machine correctly

The machine is designed to process iron and aluminum workpieces by drilling, tapping, and facing. Operating the machine for purposes not mentioned in the manual or in a way that deviates from the general safety standards may result in an injury or machine failure. Operate the machine correctly.

1.2 Precautions on Safety

⚠ WARNING

You may be injured due to broken tools or parts flung out. Close the work door and start machine operation.

⚠ WARNING

Hearing ability is reduced when ears are exposed to excessive noise for a long period of time.
Use protection such as earplugs when working in a noisy environment.

⚠ WARNING

If you operate the machine without the workpiece secured, the workpiece may spring out, resulting injury. Secure the workpiece.

⚠ WARNING

You may have your eyes hurt if coolant splashes into your eyes.
When adjusting the coolant nozzle, wear safety goggles.
When coolant has splashed into your eyes, wash your eyes with clean water, and see a doctor.

⚠ WARNING

When machining workpiece using an oil type coolant, the machined part may heat up and catch fire.
When using an oil type coolant, install a fire alarm and an automatic fire extinguisher.
When machining the workpiece, an operator must attend the machine.

⚠ WARNING

When objects are hung on the emergency stop switch, the emergency stop switch may not be pressed.
Do not hang any objects on the emergency stop switch.

⚠ WARNING

If the splash guard side cover is not attached, you may be caught in the machine or injured due to broken tools. Visually check that the side cover is attached before turning on the power. Report to the supervisor. The supervisor must instruct the operator to attach the side cover.

⚠ WARNING

If the control box or the operation panel are wet, you may get an electric shock. Do not sprinkle coolant, water, or chips on the control box and the operation panel.
Do not touch the control box with wet hands.

⚠ WARNING

If the power is turn on or workpieces are machined in an explosive atmosphere, an explosion may occur due to a spark from the machine.
Do not turn on the power of the machine, machine workpieces, or carry out set-up in an explosive atmosphere.

These are the basic precautions to be taken to assure operation safety when handling the machine.

1.2.1 Before turning on the machine

(1) Make sure that the control unit doors are closed and that no obstacle is around the machine.

(2) Make sure that nobody is in and around the machine motion range.

1.2.2 Before starting an operation

(1) Make sure that parts are sufficiently lubricated with grease (replenish grease to guideways and Ball screws every 6 monthes, and oil to Magazine chain).

(2) Make sure that inside and around the machine are cleaned.

(3) Make sure that no hand tool remains inside the machine.

(4) Make sure that the tapers on spindle nose and tools are clean and without damage and that the tools are not worn.

(5) Make sure that tools are securely set on the magazine and that pullstuds are not loosened.

(6) Make sure that no object is hung on the EMERGENCY STOP button.

(7) Make sure that the safety unit is mounted correctly.

(8) Make sure that the safety unit operates correctly.

(9) Make sure that the inner door is padlocked.

1.2.3 During an operation

(1) When the door interlock function switch is off, the machine moves even if the work door is open.

(2) Do not run the machine without splash guard and side cover and be sure to close its door when running the machine.

(3) Move the table toward you before set-up.

(4) After changing machine setup or when machining the first workpiece, check the machine motions with the part program to see if there is no interference between workpiece, jigs etc. and the machine.

(5) Pay utmost attention to safety while the spindle rotates and an axis moves and while changing tools.

(7) Do not put your hands inside the splash guard while the spindle rotates, do not put your hands on chips or workpiece and do not stop spindle rotation by hand or tool.

(8) Wear safety shoes.

(9) Wear ear plugs, or you may suffer from difficulties in hearing.

(10) Do not put your hands or body under the spindle head.

(11) Do not put your fingers between the ATC grip cover and the machine body.

(12) Fix securely a workpiece and jig on the table.

(13) When using oil type coolant, a fire may occur due to heat at the machining section. To conduct unmanned operation, install a fire detector and automatic extinguisher.

(14) Coolant may splash into your eyes. Wear protective goggles.

1.2.4 If a machine trouble occurs during an operation

(1) To activate an emergency stop, press the red EMERGENCY STOP switch provided on the operation panel.
(2) Before taking measures, check and identify the cause of the trouble.
(3) When 2 or more operators are working together, alert each other by voice.

1.2.5 When turning off the machine

(1) Store the data displayed on the screen, if necessary.
(2) Be sure to turn off the main power breaker before leaving it.

1.2.6 Other precautions

Do not allow the coolant to splash onto the spindle frange.

Do not allow water, oil, or chips to splash onto the control box and operation panel.

If the machine has been left idle for more than 3 days, be sure to warm it up for about 15 minutes before starting its operation.
Warming-up procedure
1.Spindle speed:
Increase progressivelly
speed:500rpm(min^{-1}) → 1000 rpm(min^{-1})→ max. speed
2.Feeding stroke:
Full stroke on each axis
3.Perform tool change.

Stop the machine and turn off the main power breaker before cleaning the machine.

Do not use compressed air and washing gun to cleaning and removing cutting chips to the working part of a machine such as ball screws, guides, magazines, ATC, spindles, control unit and operation panel.

Do not touch switches by wet hand or soaked material.

If a tool is stuck with chips, be sure to stop the spindle first, then remove the chips.

Registered programs or data may be damaged due to hardware problems.
Record important programs and data on paper and store them.

1.3 Person Allowed for Operation

1

This manual is prepared for personnel who under take tapping centre operation.

1.3.1 Operation Qualifications

Children cannot operate this device.
Only those who have completed compulsory training are allowed to operate the machine.

1.3.2 Working area

Secure the area shown in the drawing for machine operation.

S2AOP1-1-1.doc

2

CHAPTER 2

GENERAL SYSTEM DESCRIPTION

2.1 Main Features
2.2 Basic Configuration
2.3 Table Size and Machining Volume
2.4 CNC Unit Specifications
2.5 Machining Capability
2.6 Safety Devices
2.7 Coolant

2.1 Main Features

This sections describes the features of the tapping centre.

2.1.1 ATC (Automatic tool changer)

(1) The unique armless mechanism allows simple and quick tool change, thus reducing non-cutting time.
(2) The magazine rotates fast and takes the shorter way to reach the tool searched.
(3) X- and Y-axis positionning, which is made while the magazine rotates, reduces non-cutting time.

23002C01.doc

2.1.2 Tapping cycle

Fully synchronized control of spindle rotation and Z-axis feed makes use of a tapping holder unnecessary, therefore reduces unignorable air cut amount, that conventional tapping required, to such a level as a drilling requires.

2.2 Basic Configuration

This section gives a description of the basic configuration of the machine.

2.2.1 Basic configuration

1 Vertical spindle head.
2 X and Y axes:Table traverse.
3 Z axis: Spindle head feed.
4 Shortest path random access mechanism and unique double arms ATC mechanism allowing quick tool change.
5 Integrated control unit on the back of the machine minimizing floor space required for installation.
6 X-, Y-, and Z-axis moving direction.

Fig.2-3 Front view and parts of the machine

TS2A0203-1.doc

2

2.2.2 Machine rear

Fig.2-4 Rear view and parts of the machine

TS2A0204-1.doc

2.3 Table Size and Machining Volume

2.3.1 Table top surface dimensions

Fig.2-4 Table surface dimensions

TS2A0205-1.doc

TS2A0205-2.doc

2.3.2 Machining volume

TS2A0206-1.doc

2

2.4 CNC Unit Specifications

Table 2-1 CNC unit specifications (1)

Function	Description
Controlled axes	6 axes (X, Y, Z, A, B and C axes)
Simultaneously controlled axes	X, Y, Z, Aand B axes (during positionning) Positioning Linear: 3axis (X,Y,Z) For circular interpolation, simultaneous two axis (X, Yor Z) control. Simultaneous two axes control, selective from the combination of XA, XB, YA, YB,ZA and ZB.
Least input increment	0.001mm
Least command increment	0.001mm
Programming method	Absolute/Incremental programming (motion program)
Max. programmable value	±999.999mm
Display	10.4 inch LCD
Decimal point input	Available for data input
MDI	NC program data input via keyboard
Zero point return	Automatic zero point return by input via keyboard
Working zero point return	Automatic working zero point return by input via keyboard
Current position display	Display of current coordinates of each axis
Coordinate system setting	A coordinate system can be set in a specified position on X, Y and Z axes.
Strokelimit	Motion range can be set by parameter for each axis.
Emergency stop	All commands and machine motions are immediately stopped
Rapid traverse (In manual operation)	Axes move at 10%, 25%, 50%, 75% or 100% of the max. speed. Feedrate is clamped at 4000mm/min.
Cutting feedrate (In manual operation)	Axes moves at a rate within the range from 50 to4000mm/min.
Step feed (In manual operation)	Axes move by steps: 4 different steps within the range from 0.001mm to 1.0mm are available.
Feed hold	Axis feed is temporalily stopped. Pressing the START switch allows the stopped operation to resume.
Automatic acceleration/ deceleration	Axis motion is autmatically accelerated or decelerated.
Synchronized tapping	Screw pitch is completely synchronized with 1 revolution of spindle.
Interpolation function	Linear and circular interpolations
Canned cycle	Boring, tapping and other operations are automatically executed in a fixed sequence.
Setting of machining start point	An operation can be started at a midpoint in a program.

Table 2-2 CNC unit specifications (2)

Function	Description
Pitch error compensation	Mechanical error resulting from screw feed on X, Y and Z axes is compensated. 50 points can be set at maximum at 20mm interval.
Dry run	Cutting feedrate is switched over rapid traverse for manual operation, allowing an easy program check.
Dwell	Memory operation is stopped for a specified time.
Backlash comensation	Lost motion caused in a mechanical system, within the range from 0 to 0.127mm, is compensated by pulses on each axis.
Tool length setting	Tool length measured on the machine is stored as tool list menu data.
Background programming	A program can be edited while a memory operation is performed.
Program number search	Any program stored in memory is called with 4-digit program number. (NC only)
Self-diagnosis alarm	CNC unit performs a various types of checks and, if a trouble is found, displays its status on the screen.
External program/data call	External program/data is transferred or deleted by External communication unit (option).
Restart	A program is repeated in memory mode.
Block skip	The block whitch contains slash (/) code is ignored when operation is executed. (NC only)
Optional stop	The program can be stopped at the M01 block. (NC only)
Machine lock	Program can be checked without moving the machine.
Conversational programming	Programming is made interactiveiy with menues. (conversation only)
Automatic spindle speed setting	Spindle speed is automatically determined according to workpiece material, cutting conditions and tool diameter. (conversation only)
Automatic tool selection	The tools necessary for a program given are automatically chosen from among the tools registered. (conversation only)
Scheduled program	Up to 99 programs are combined and consecutively executed. (conversation only)
Motion program	A motion sequence meeting customer's machining requirements can be registered. This sequence allows such a machining as conversational programs or data bank does not allow. (conversation only)

2

2.5 Machining Capability

Type of tool, tool status, coolant conditions, environmental conditions and other factors largely affect the machining capability. Use therefore the following data for just your reference.

2

Table 2-3 Machining capability

Machining	Condition	Unit	Material		
			Steel	Casting Iron	Aluminum
Drilling	Diameter	mm(in.)	23(0.91)	25(0.984)	25(0.984)
	Feedrate	mm/rev (in./rev)	0.1(0.004)	0.15(0.006)	0.2(0.008)
Tapping	Diameter	mm(in.)	16(0.63)	20(0.79)	24(0.944)
	Pitch	mm/rev (in./rev)	2.0(0.08)	2.5(0.098)	3(0.118)
Facing	Rate	cm3/min (in.3/min)	48(2.93)	69(4.21)	286(11.26)
	Depth of cut	mm(in.)	2.5(0.098)	3(0.118)	3.5(0.14)
	Feedrate	mm/min (in./min)	484(19.1)	573(22.6)	2040(80.3)

Spindle 16000 min^{-1}type

Machining	Condition	Unit	Material		
			Steel	Casting Iron	Aluminum
Drilling	Diameter	mm(in.)	15(0.59)	16(0.63)	18(0.709)
	Feedrate	mm/rev (in./rev)	0.1(0.004)	0.15(0.006)	0.2(0.008)
Tapping	Diameter	mm(in.)	12(0.472)	14(0.551)	16(0.63)
	Pitch	mm/rev (in./rev)	1.75(0.069)	2(0.08)	2(0.08)
Facing	Rate	cm3/min (in.3/min)	39(1.535)	69(2.717)	204(8.031)
	Depth of cut	mm(in.)	2(0.08)	3(0.118)	2.5(0.098)
	Feedrate	mm/min (in./min)	485(19.1)	573(22.6)	2040(80.3)

2.6 Safety Devices

Tapping centre have several sefety features for both operations and the machine.

2.6.1 Main sefety devices

(1) Cover (splash guard)
Prevents chip splash during operation, therefore protects operators.
Do not perform machine operation with the protection cover removed.

(2) Door limit swicth
Stops machine motion if the door is opened during an automatic operation and disables automatic operation while the door is open.

(3) Emergency stop switch
When pressed, stops on the spot all machine motions.
If there is an indication of machine trouble or danger, press immediately this pushbutton.

For the resetting method, refer to Feed Hold and Restart.

(4) Alarm message display
In case of machine error, the alarm message is displayed on the operation panel screen.
When multiple errors have occurred simultaneously, What is displayed here is the alarm message of first importance.

To make all alarm messages, press the **[ALARM]** key on the operation panel.
Up to 9 most important alarm messages are displayed.

2

2.7 Coolant

(Caution1)	**To select the proper coolant, ask the coolant dealer about the coolant's lubrication quality, corrsion prevention, bubbling prevention and safety.** **Do not use the chemical solution type coolant (synthetic type). This type has poor lubrication and will strip the machine's coating, possibly leading to machine damage.**
(Caution2)	**Do not use any coolant that harden or swell the nitrile rubber (NBR) or fluorocarbon rubber.**
(Caution3)	**Foul water soluble coolant causes a bad smell and environmental deterioration.** **It may also cause rusting which leads to machine damage.** **When coolant goes bad, stop using it and replace all the coolant with new coolant.**

3

CHAPTER 3

OPERATION

3.1 Turning on the Power
3.2 Turning off the Power
3.3 Operation Panel Overview
3.4 Screen Layout
3.5 Switches
3.6 Keys
3.7 Cautions on Workpiece and Tool Setting
3.8 Setting and Removing a Tool on and from the Magazine

3.1 Turning on the Power

⚠ WARNING

When chips scatter and get into the eyes, you may damage your eyeballs and lose your eyesight.
Wear safety goggles against the chips.
Do not blow the chips by air.

3

⚠ WARNING

If you touch chips with bare hands, you may have your hand cut or burnt.
Do not touch chips with bare hands. Do not touch sharp edges of workpieces.
Use a brush to remove chips.

⚠ WARNING

If coolant, oil, or chips are scattered, you may slip, fall down, or collide somewhere, resulting in an injury.
Turn off the power of the machine, clean inside and the surroundings of the machine, and then start operation.

⚠ WARNING

If you forget to mount the maintenance cover, you may get caught in the machine, resulting in injury.
Before turning on the power, visually check that the maintenance cover is mounted. If not mounted, report it to the supervisor.
When removing the maintenance cover, turn off the main power breaker and padlock it so that the main power breaker cannot be turned on.
The supervisor must instruct the operator to mount the maintenance cover.

Following are the power-on procedure.

3.1.1 Preliminary checks

1. Check if the main power breaker handle operation panel is on OFF.
2. Check if the machine and its surroundings are free from obstacles.
3. Check if nothing is left on the table and saddle.
4. Check if the door of the CNC is firmly closed.
5. Check if the taper on the spindle nose is clean and without damaged.
6. Check if the taper of the tools are clean, without pitching and wear and if pullstuds are securely tightened.
7. Check if tools are securely mounted in magazine grippers.
8. Check if no chip is left in the splash guard.
9. Check if no chip is left in the chip pan.
10. Check if oil level is with in the marks.
11. Check if coolant amount is sufficient.
12. Check if the air source for air blast unit is ready for operation.

3.1.2 Turning on the power

1. Plug the power supply cord firmly into the primary power supply receptacle and turn on the primary power supply.
2. Set the main breaker handle on the control unit to ON.
3. Make sure that the POWER lamp on the operation panel comes on.

Fig. 3-1 Handle of the main power breaker set to ON position

T20A3-1-1.doC

3

4 Turn on the power supply to the operation panel. When the POWER switch is pressed, the green lamp comes on and the initial screen will appear on the display.
At the same time, the fan of the CNC unit starts working and the X-, Y- and Z-axis motors are servo-locked.

When the power is once turned off, wait at least for 3 seconds before turning it on again.
When turning on the power to the CNC unit and operation panel, make sure that the fan on the CNC unit works.
In certain cases, depending on machine status, the power-on screen may appear some 15 seconds after turning on the power. (POWER switch lamp blinks.)

Check items

(1) If the magazine rotates smoothly and if tools are properly mounted are removed.
(2) If the CNC unit and the cooling fan function proper.
(3) If the spindle does not give off unusual noise.
(4) If the spindle is properly oriented.

Fig. 3-2 Turning on the power supply to the operation panel.

230E01C01.doc

3.2 Turning off the Power

This section describes the power-off procedure.

3.2.1 Checks before turning off the power

(1) Make sure that all the mobile parts are stopped.
(2) Make sure that all the operations such as program edit, data modification, I/O from and to external equipments, have completed.

3.2.2 Turning off the power supply

1 When the POWER switch on the operation panel is pressed, the green lamp will go out and the screen on the EL display will disappear.

Fig. 3-3 Turning off the power supply to the operation panel

230E01C01.doc

2 Turn off the handle of the main power breaker on the control unit at the back of the machine.

Fig. 3-4 Handle of the main power breaker handle turned set to OFF position

3 Unplug the power cord for machine from the primary power supply receptacle or turn off the switch board of the factory.
In case the machine has stopped by a power failure, first turn off the main power breaker on the control unit and take the remedy.
After taking the remedy, turn on again the power supply by following the procedure described in 3-1-2.

3

3.3 Operation Panel Overview

NC operation panel consists of an operation panel and model panel.

Fig.3-5-1 Operation panel overview

TS2A03C05-1.doc
03C05-4.ai

3.4 Screen Layout

This section describes the screen layout and the information displayed on it.

Fig. 3-6 Screen layout

Program (data) display area

Data and contents of a program, necessary for machine operation, are displayed.

Data input area

When data is to be entered, this area will show what type of data should be entered: Enter the data required by the machine, with numerical keys or selecting an option of choice from among those displayed on the teach data area.

Teach data area

This area shows options of choice for machine operations.

3.5 Switches

This section describes the function of the switches on the operation panel.

(1) POWER switch

This switch turns on and off the machine. When the switch is pressed once, the power is turned on and its green lamp comes on. When the switch lit green is pressed, the power is turned off and the lamp goes out.

If the green lamp flashes when the power switch is pressed , this means that the continuous interval circuit for in-rush current is activated.

The interval circuit is generally activated when power is turned off and then on again within 15 seconds after power was turned on the first time , thus power may not be supplied immediately after the power switch is pressed.

(2) START / HOLD switch

START

This switch starts MDI operation or memory operation. Once operation is started, this lamp remains on until the operation is completed.

HOLD

This switch holds MDI operation or memory operation.

The lamp remains on while an operation remains stopped. This switch cannot stop spindle rotation. Also, this switch does not stop an ongoing machine operation before a tool change and tapping, if they are ongoing, are completed.

(3) PROTECT switch

This switch enables and disables program input or edit, in other words, turns off and on program protection. Be sure to set this switch on OFF position unless a program is edited or memorized data undergoes modification, addition or deletion.

PROGRAM

MODEON... Protects memorized programs and data against alteration or deletion. Also disables mode switch (manual operation, MDI operation, memory operation and program edit).

OFF... Enables program edit and data input and modification.

PROGRAMON... Protects memorized programs and data against alteration or deletion. Enables however mode switch.

(4) EMERGENCY switch

This switch stops any machine motion in case of emergency or improper operation resulting from wrong data input. When pressed, it stops all the machine motions on the spot, with the message "EMERGENCY STOP" displayed on the screen. When the machine is turned on or off or in case of emergency stop, Z axis drops by about 0.5mm (this stroke depends more or less on the status of brake, guide, ball screw and machine).For resetting method, refer to Feed Hold and Restart.

(5) DOOR INTERLOCK switch

This switch is associated with the door interlock.

For further details, refer to the section describing the door interlock.

ON... Valiates the door interlock.

OFF... Disvalidates the door interlock.

(6) MAIN PWR lamp

This comes on green when the main power breaker on the control unit is turned on. The lamp flashes when a voltage that may cause a POWER ALARM is being input. Immediately turn off the main power circuit breaker inside the control box.

(7) PWR ALM lamp

When this lamp comes on, the power supply is automatically turned off.

This lamps comes on red if the input voltage exceeds the rated voltage by more than 15%.

This lamp flashes when the voltage between the input voltage phase and ground is excessively high. Turn off the main power circuit breaker inside the control box.

(8) RAPID TRAVERSE OVERRIDE switch

Override is applied to the positioning speed.
Feedrate 1 to 3 can be set by User parameter (SWITCH 2).

(9) FEEDRATE OVERRIDE switch

Override is applied to machine feed from 0 to 200% in 21 steps of 10% increments.

(10) NC LANG - CONV. switch

Used to switch the program language to ‘NC language’ or ‘Conversation.’
The selected program language is validated when power is turned off and then on again.
The desired program language cannot be validated even if the switch position is changed over when power is already on.

3.6 Keys

This section gives a functional description of the keys on the operation panel.

(1) [RST] key

This key resets the control unit to its initial status:

Resets alarm status (resets any alarm with or without asterisk (*) on the screen).
If pressed during data input, makes all the entered data invalid.
If pressed during a memory operation, stops immediately X , Y , Z , 4 , 5 , 6 axis motion and the spindle, except ongoing tool change or tapping, upon completion of which the switch stops the abovementioned operation.

(2) [RELSE] key

This key releases magazine rotation error or ATC motion error.

(3) [MANU] key

This key validates manual operation mode, which allows the following operations:

* Zero point return
* Single tool change
* Magazine rotation
* Rapid traverse
* Jog feedrate
* Step feedrate
* Spindle normal rotation and stop
* Manual pulse generator

(4) [Z.RTN] key

This key returns X, Y, Z , 4 , 5 , 6 axes to the machine zero point in manual operation mode.
The machine coordinates after zero point return are as follows: X, Y , 4 , 5 , 6 axes: 0, Z axis: Z-axis zero point set with the Machine parameter (SYSTEM 1). 4- axis machine coordinates position is 0.000 and in this time pallet 1 is indexed to outside.

(5) [P.IDX] key

Not use.

(6) [ATC] key

This key executes tool change in manual operation mode.
Each time this key is pressed, Z-axis zero point return and spindle orientation, then Z-axis positioning to the ATC zero point, ATC rotation and finally positioning to Z-axis zero point are executed one by one.

(7) [MAGZ] key

This key turn the magazine in manual operation mode.
Each time this key is pressed, the magazine rotates clockwise to the next index position.

(8) [RPD] key

This key feeds X, Y, Z , 4 , 5 , 6 axes either in + or - direction at rapid feedrate in manual operation mode.
The max. rapid feedrate can be overridden in the following 5 steps according to the setting of the Machine parameter (SYSTEM 1) : 10%, 25%, 50%, 75% and 100%.
The override is set at 10% when the power is turned on.

(9) [JOG] key

This key feeds X, Y, Z , 4 , 5 , 6 axes either in + or - direction at jog feedrate in manual operation mode.
Jog feedrate can be changed in the following 22 steps within the range from 50 to 4000mm/min.
Feedrate is set at 50mm/min when the power is turned on. C-axis is also set at 0.1 rpm.

(10) [STEP] key

This key feeds X, Y, Z , 4 , 5 , 6 axes either in + or - direction. Step by step (by the predetermined amount) in manual operation mode.
The increment per step of X, Y and Z axes can be changed in the following 4 steps : 0.001mm,0.01m,0.1mand1.0mm.
Increment is set at 0.001mm when the power is turned on.
The 4 , 5 , 6 axis can be turned in 11 steps ranging from 0.001° to 180.0°.

(11) [S.CW] key

This key turns the spindle in the normal direction.
It provides 24 steps within the range from 100 to 12000rpm($min^{-1)}$.
Spindle speed is set 100rpm (min^{-1})for all models when the power is turned on.
Normal direction is referred to as right or clockwise viewed from the spindle top.

(12) [S.STOP] key

This key stops spindle rotation in manual operation mode.

(13) [+] key

This keys increases step by step the setting value of a rapid traverse, jog feedrate, step feed and spindle speed in manual operation mode.

(14) [-] key

This keys decreases step by step the setting value of a rapid traverse, jog feedrate, step feed and spindle speed in manual operation mode.

(15) [+X], [-X], [+Y], [-Y], [+Z], [-Z], [+4], [-4] keys

[+X] and [-X] keys are used to move the X axis ; [+Y] and [-Y] keys to move the Y axis ; [+Z] and [-Z] keys to move the Z axis ; [+4] and [-4] keys to move axes 4 , 5 and 6 in the + and - directions , respectively , in MANU (manual) mode.

(16) [MDI] key

This key validates MDI operation mode.

(17) [MEM] key

This key validates memory operation mode. Operation can be executed by calling a required program stored in the memory.

(18) [SINGL] key

This key runs motion by motion the program called in memory operation mode. When the lamp is off, a cycle operation is executed.

(19) [DRY] key

This key activates dry run for machine check.
In this mode, a rapid traverse and automatic tool change are executed as programmed, whereas cutting feed is executed at a high speed in manual operation mode.
The Z axis can operate in a higher position set by the dry run offset set by the User parameter (SWITCH 1).

(20) [EDIT] key

This key validates program edit mode

(21) [E.STA] key

This key has the following usages:
As start key for communication with external equipments during external program I/O.
This key has the following usages in conversation:
1. Automatic selection of the available tools from the tool menu during tool assignment
2. Automatic calculation of items marked with "?" during tool assignment

(22) [POS] key

This key provides display of current X-, Y-, Z-, 4, 5, 6, axis coordinates, remaining distance of each axis motion with respect to the target position, tool number list, tool name and tool length. Also provides display of current feedrate and spindle speed.

(23) [MONITR] key

This key is used to display or set the value for the product counter, communication monitor , and Z axis measurement data.

(24) [MAGAZ] key

This sets and displays the assignment of the magazine pot numbers for 99 tools registered on the tool menu in the data bank. This operation is available only in MDI operation mode. In other modes, only current tool name and its pot number can be displayed.

(25) [ALARM] key

This key provides display of all the current alarms on the screen:
while only a typical alarm is displayed on the screen at once, up to 10 alarms, if any, can be displayed by pressing this key.

(26) [PRGRM] key

This key provides display of block operation screen in memory operation and MDI block operation for program edit.

(27) [I/O] key

This key provides display of machine control status during troubleshooting.

(28) [MANU COND] key

This key provides display of feedrate and spindle speed in manual operation mode:

Rapid traverse... 5 steps (10, 25, 50, 75 and 100%)
Cutting feedrate... 22 steps (50, 62, 77, 95, 115, 140, 170, 205, 245, 290, 340, 400, 500, 625, 700, 800, 1000, 1250, 1575, 2000, 3150 and 5000mm/min)
Step feedrate 4 steps... (0.001, 0.01, 0.1 and 1.0mm)
Spindle speed... 100, 125, 155, 190, 230, 280, 340, 410, 490, 580, 680, 800, 1000, 1250, 1400, 1600, 2000, 2500, 3150, 4000, 6000, 8000, 10000, 12000, 14000, 16000rpm(min^{-1})

(29) [DATA BANK] key

Change the screen to display the data necessary for operating the machine.

(30) [CLEAR] key

This key deletes the information displayed on the screen. Pressing one of the screen selection keys allows its screen to be displayed.

Screen selection keys:
* **[POS]** key
* **[ALARM]** key
* **[PRGRM]** key
* **[I/O]** key
* **[DATA BANK]** key
* **[MANU COND]** key

(31) [CURSOR] key

This key shifts the cursor to the previous input item.

(32) [PAGE UP] key

This key displays the previous page if a program or data lies on several pages.

(33) [PAGE DOWN] key

This key displays the next page if a program or data lies on several pages.

(34) Numerical keys , Character keys

Used to enter the data (numerical values).
Be sure to enter the decimal point when setting values such as length and angle.
Unless the decimal point is entered , the set value differs as below.
[1] [.] [ENT] - > 1.000
[1] [ENT] - > 0.001

(35) [EOB/ENT] key

This key sets the data in the data input area in the program display area.
Also used to input the end of block code (;) while inputting a program.

(36) [CAN] key

This key cancels the data in the data input area. The data for which the **[EOB/ENT]** key has been already pressed cannot be cancelled with this key.

(37) [DEL] key

This key deletes a data pointed by cursor in the program edit mode.
Data can be deleted through the editing function on the MDI screen.

(38) [INS] key

This key adds data to a program in the program edit mode.
Data can be added through the editing function on the MDI screen.

(39) [EXTEND/SEARCH] key

In NC language , edits programs such as copying each block , deleting , cursor jumping and searching for a character string.
In conversation , this key searches the required process number or subprogram number , etc.

(40) [SHIFT] key

This key changes character set , while pressing this key press another key to enter the upper character of the key top.

(41) [F0] to [F4] keys

Various functions keys (Contents of these keys vary according to each screen)
Details of each function are displayed on the screen when required.

(42) [OP.STP] key (NC only)

Stop the program when a block contains the M01 command.

(43) [M. LCK] key

Executes the program without operating the machine. This function is used for checking the program contents.
Also, forbids the Spindle, Tool change, and M code functions.

(44) [B.SKP] key (NC only)

Ignores the commands in all the blocks containing a slash (/).

(45) [TL. LNG] key (Conversation only)

This key allows automatic measurement and input of length of a tool mounted in the spindle while editing the data in the tool menu.

(46) [Z. WRK] key (Conversation only)

This key, if pressed during machining data edit, sets current X, Y ,Z, A and B-axis coordinates as working zero point.

(47) [TL. CHK] key (Conversation only)

This key checks, if tooling is modified or changed by forced assignment, to see if the newly adopted tools allow a machining as
programmed by the data.

(48) [?] keys (Conversation only)

This allows data input if position, length or angle is unknown in
contouring or chamfering.

(49) [CLT. P]key

This switch turns the pump on and off.
When this switch is set on OFF, no coolant is available even if coolant supply is commanded in MDI or memory operation.
The switch may automatically turn off depending on the setting for [AUTOMATIC COOLANT OFF TIME] (user parameter - switch 1). See the data bank for details.

Press once Turns on the coolant pump and the lamp.
Press again Turns off the coolant pump and the lamp.

(50) [LIGHT] key (opiton)

This switch is associated with the machine light (option). On a standard machine, this location is fitted with a blind plug.
For further details, refer to the section describing the machine light.
The switch may automatically turn off depending on the setting for [AUTOMATIC MACHINE LIGHT OFF TIME] (user parameter -switch 1).
See the data bank for details.

Press once The machine lamp comes on.
Press again The machine lamp goes out.

(51) [CHP.F] key (opiton)

This switch is associated with the coolant unit equipped with a chip flow (option).

Press once Delivers M400 signal, starts the chip flow motor and lights the lamp.
Press again Turns off the chip flow motor and the lamp.

3.7 Cautions on Workpiece and Tool Setting

⚠ WARNING

If you grip the tool blade, you may cut your hand.
Do not touch the edge of the tool. Always hold the shank of the tool.

3

⚠ WARNING

If you operate the machine without the workpiece secured, the workpiece may spring out, resulting injury.
Secure the workpiece.

⚠ WARNING

The milling inserts may come off the tool, resulting in serious injury.
Firmly secure the milling inserts tip on tools. Check that the milling inserts is secured before mounting the tool to the machine.

Workpieces and tools to be mounted are subject to certain dimensional limitations such as workpiece and jig height, tool length, tool holder setting.
Check these limitations following the procedure below before setting a workpiece or tool.

3.7.1 Limitation on work piece and jig height and tool lenghth

Before setting a workpiece on the machine, make sure that there is no interference between tools, workpiece and during a tool change, with the folowing formurla.

Apply the dimensions of a workpiece to be used to LL,C and H in the figure below.

Fig.3-7 Limitation on a work piece and jig height and tool length

LL:Max. length of the tools in the magazine.
C:Z-axis zero point in the parameter 2 (system).
H: Max. height of workpiece and jigs.

03C01.ai

IF H ≦ C-LL-50 mm	IF H > C-LL-10 mm
↓	↓
NO interference	Interference may occur
Mount the work piece	Depending on magazine rotation direction, tool mountiong position or machining order, a toolmay interfere with work piece or jigs. Check the iterference before mounting the workpiece.

3.7.2 Limitation of tool holder

Caution: Using a tool while exceeding the limitations of tool holder, tool balance or spindle speed may damage the machine. Incorrect selection of a standard tool and large tool will damage the machine.

(1) Tool dimensional limitations and spindle speed

Limitations of spindle speed vary depending on the tool, as shown below. Set the tool so that the requirements are met. If not, decrease the spindle speed.

M: Overall tool mass(kg)

H: Distance from gauge line to center of gravity of entire tool

TS2A0322-1.doc

Spindle Taper	7/24 No.30	
Tool Shank	MAS - BT30	
Retention Knob	MAS - P30T-2 (30º)	
Limitation of Tool	D 1 ≦ 40mm L 1 ≦ 200mm D 2 ≦ 80mm L 2 ≦ 160mm D 3 ≦ 46mm L 3 ≧ 30mm M ≦ 3kg M×H ≦180Kgmm	D 1 ≦ 40mm L 1 ≦ 200mm D 2 ≦ 55mm L 2 ≦ 160mm D 3 ≦ 46mm L 3 ≧ 30mm M ≦ 2kg M×H ≦100Kgmm
Limitation of Tool Balance	100grmm	50grmm
Limitation of Spindle Rotation Speed	10000min^{-1}	16000min^{-1}
Total in Magazine	M total≦ 25Kg	

(2) Balance of tool holder

Caution
Using poorly balanced tools may damage the spindle.
Always use well balanced tools.

Use the tool and tool holder symmetric to the spindle rotation center.

Pay particular attention to the tool balance because the spindle rotates at high speed.
Using poorly balanced tools may damage the spindle.

TS2A0322-1.doc

Consult BROTHER or the nearest dealer authorized by BROTHER for further information on tool balance.
Tool holders made by UKIWA (BT30*-DMC**-**HS) are recommended as tool holders with good balance.

Refer '(1) Tool dimensional limitations and spindle' and set the tool so that the requirements are met. Using an incorrect tool holder may
cause the tool holder to detach from the spindle, resulting in machine damage.

3.8 Setting and Removing a Tool on and From the Magazine

⚠ WARNING

If you put your finger in the clearance of the machine, you may have your finger caught, resulting in an injury.
Do not put your fingerin the clearance of the grip cover.
Do not put the finger in the clearance between the tool or the tool holder and the ATC magazine.

⚠ WARNING

When attaching and detaching tools, you may cut your hand on the edge of a tool or hit your hand against the machine.
Do not hold the edge of the tool. Wear leather gloves.
Hold the tool with both hands.

⚠ WARNING

Tools whose weight and size exceed the specified limit may spring out while being used.
Use tools whose weight and size are within the specified limit.
For the limit of the tools, see the tool label attached on the machine.

⚠ WARNING

If the ATC magazine rotates, tools may hit machined workpieces, jigs, or the machine, and may be broken.
Set the tool length so that the tools do not contact machined workpieces, jigs, or the machine even if the ATC magazine rotates.

To remove the tool, use the leather gloves.
Be careful not to hold the tool blade.
Incorrect tool attachment may cause the tool to drop or to be damaged.

3.8.1 Setting a tool on magazine

1. Press the **[MANU]** key to select manual mode.
2. Press the **[SINGL MAGZ]** key : Z axis moves up to the machine zero point and the spindle is oriented.
3. Press again **[SINGL MAGZ]** key : Z axis moves to the ATC zero point
4. Press **[ATC]** key : the magazine rotates.
   Replace the position.
5. Set the tool on the magazine. When mounting a tool on the magazine, fit the gripper key into the keyway of a tool holder and the gripper pin into the V groove of the tool holder, push the tool to the bottom of the gripper and clamp this tool.
   When tool mounting is completed, press **[SINGL MAGZ]** key to set Z axis at the machine zero point.

To allow the magazine well balanced, mount tools of roughly same weight on each facing grippers.

Fig. 3-9 Setting a tool

230S00C09.doc

To allow the magazine well balanced, mount tools of roughly same weight on each facing pots.

<EXAMPLE> Tool storagew capacity 14 pieces

Magazine pot Number	Tool Weight	Magazine Pot Number	Tool Weight (kg)
1	3.0	8	3.0
2	3.0	9	3.0
3	2.5	10	2.5
4	1.0	11	1.0
5	1.0	12	1.0
6	0.5	13	0.5
7	1.0	14	1.0
		Total	24.0

3

Fig. 3-10 Pot and Tool holder

230S00C08.doc

3.8.2 Removing a tool from the magazine

1. Move the magazine number to witch the tool is mounted to the replacement position, For magazine rotation, refer to Setting a tool on the magazine.

2. Remove the tool from the magazine.
   To remove a tool from the machine withdraw tool holder in the direction of the arow as shown in the figure.

Fig. 3-11 Removing a tool

59.pm6

CHAPTER 4

SCREEN DISPLAY

4.1 Position screen
4.2 Program display
4.3 Conditions of manual operation
4.4 Magazine
4.5 Alarm display
4.6 Production monitor display
4.7 Data bank
4.8 Erasing screen

4.1 Position screen

4.1.1 Present position screen

The present position of each axis, spindle load meter, feed rate, and spindle speed during operation can be displayed on the screen.

Pressing the **[POS]** key displays the present position screen as shown below:

Double-arm ATC display

```
(PROGRAM 3000)                    PRESENT POS

●MACHINE POS                      ●RESIDUAL MOVEMENT
X     −260.777                    X        0.777
Y     −271.198                    Y        1.198
Z      298.000                    Z        0.000
C        0.000                    C        0.000
A1                                A1
B2                                B2
●WORKING POS                      ●SPINDLE LOAD METER
X      39.223                       ■■■■■□□□□□□□□□□□
Y      48.802                       |            |
Z      48.000 (H01)                0%          100%
C       0.000                     ●MAGAZINE
A1                                TOOL NO.          01
B2                                NEXT TOOL NO.     03
●CUTTING                          POT NO.           02
FEED R. 476 mm/min
S. SPEED 183 min⁻¹
●INNR PLT NO. 2
        PREVIOUS PAGE  :ENLARGEMENT
        NEXT PAGE      :MODAL
   F0      F1      F2      F3      F4
```

DISPLAY OF PROGRAM NUMBER

When the present position is displayed during memory operation, the program No. currently executed can be checked. The previous program No. is displayed after the operation is finished and before the new program is started.

MACHINE POSITIONS

The X and Y positions are indicated based on the distance from the machine zero point. The Z position is indicated based on the distance between the table top surface and spindle nose.

WORKING POSITIONS

The position from the workpiece zero point which is set as required.
When the Z working coordinates is displayed in consideration of the tool length, the tool length offset No. is displayed.

RESIDUAL MOVEMENT AMOUNT

Residual movement (which is not executed yet) of the movement command value in the memory or MDI operation is displayed.

FEEDRATE

The feedrate executed in the memory or MDI operation is displayed.
When the movement in execution is for positioning, the message "POSTNG" is displayed.
The display is available only while the movement is in execution.

SPINDLE SPEED

The spindle speed in execution in the memory, MDI or manual operation mode is displayed.

SPINDLE LOAD METER

Displays the spindle load. (One graduation is 10 %, max.150 %).

MAGAZINE

The display for [MAGAZINE] differs depending on the ATC mechanism.
The display for models with a double-arm ATC (TC-31A, 22A, 32A, 20A) is shown in Double-arm ATC display, and that for other models is shown below.

```
MAGAZINE      TOOL NO.        01
              MAGAZINE NO.  02
```

INNER PALLET

The [INNR PLT] (inner pallet) is only displayed for models equipped with a quick table. It is not displayed for other models.

The screen changes in the following sequence by pressing the page keys.

4.1.2 Screen of modal information

The machine status is displayed in memory operation.

```
(PROGRAM   3103)                                MODAL

●WORKING  POS              JOB 01  MOTION  CALL
       X   200.000
       Y   200.000         COORD   NO  JOB
       Z   100.000         COMMD   ABS
       C                   MOTION  POSTNG
       A                   MODE    POS  CHK
       B                   CUT  MD  STANDAR
                           D
                           TOOL  01  C.DRIL
                           L
                           T.LEN
                           SPINDLE  CW
 COORD.  ROT               WORK  OFST
 CNT  X        0.000       OFST  T  LNG
      Y        0.000       R.COMP  CENTER
               0.000       OFST  T  DIA
 ANGL

●NOW  MOTION                ●NEXT  MOTION
                            ATC  TOOL  NO.01
                            POS    X    100.000
                                   Y    100.000
                                   Z    100.000

   F0      F1      F2      F3      F4
```

Contents of MODAL screen

1) ABSOLPOS: Displays the programmed coordinates when machining.

2) JOB: Displays the name of the jog to be executed.
(Cursor position on MEMORY RUN screen.)
The job number and the job type are displayed.

3) COORD: Displays the job number for coordinate setting .
[NO JOB] or job number is displayed.

e.g.1 After job with coordinate system preset is executed.....COORD 01
e.g.2 When job with coordinate system preset is not present.....COORD NO JOB

(Notes)

When a job with the coordinate system preset is attempted to be executed, the job number is displayed until the next job with the coordinate system preset is executed.

4) COMMD: Displays the traveling status of axis. ABS (absolute) or INC (increment) is displayed.

5) MOTION: Displays the operation status.
POSTNG, LINE, ARC, ARC CW, ARC CCW, DRILLING, TAP, or THRED is displayed.

Note: Feed speed is displayed for all items other than POSTNG.

6) MODE: Displays the operation mode.
POS CHK or CUT MODE is displayed.

7) CUTMODE: STANDARD or HIGH ACCURACY is displayed.

8) TOOL: Displays information for the tool attached to the spindle.
Tool number and tool name are displayed.

9) T.LEN: Displays the length of the tool attached to the spindle.

10) SPINDLE: Displays the spindle status.
STOP, SERVO ON, CW, CCW, or ORIENT is displayed.

Note: The spindle speed is also displayed in CCW and CW.

e.g. CCW (10000)
Spindle speed

Angle is also displayed for ORIENT

e.g. ORIENT (180.000)
Angle

11) WORKHEIGHT: Displays the workpiece height compensation value preset to RUNNING PREPARATION in each program.

12) OFST T LNG: Displays the tool's fine compensation value (length) preset to RUNNING PREPARATION in each program.

13) R.COMP: Displays the spindle tool diameter compensation amount.
RIGHT (***.***), LEFT (***.***), or CENTER is displayed.

. . Amount of compensation

14) OFST T DIA: Displays the tool's fine compensation value (diameter) preset to RUNNING PREPARATION in each program.

15) COORDROT: Displays [0] before perfoming coordinate rotation.
When coordinate rotation is performed, the actual value is displayed.
The center coordinate means the center position (X, Y) of the machine coordinate.

Note: This is maintained until the next coordinate rotation is performed.

16) NOW MOTION/NEXT MOTION:
Displays the same contents as for operations on the <MEMORY RUN> screen.

When changing program numbers, resetting, turning power ON, or quitting program is executed on the MEMORY RUN screen.

ABSOL POS, TOOL, SPINDL:	The current status is maintained.
COORD:	NO JOB
COMMD:	ABS
MODE:	POS CHK
COORDROT:	All cleared

NOW MOTION, R. COMP. WORK HEIGHT OFST T LNG, OFST T DIA:
Cleared.
JOG, MOTION, NEXT MOTION:
Displayed by the program number on the MEMORY RUN screen.

When magazine has been swiveled in manual or MDI mode.The tool indication varies as the magazine swivels.
The values set to R. COMP, OFST T LNG, and OFST T DIA are cleared.

4.1.3 Enlarged display

The absolute coordinates on the <POSITION DISPLAY> screen can be increased.

```
(PROGRAM 0001)                    ENLARGEMENT

      X      200.000
      Y      200.000
      Z      100.000
      C
      A 1
      B 2

PREVIOUS PAGE   :MODAL
NEXT PAGE       :PRESENT POS

   F0    F1    F2    F3    F4
```

4.2 Program display

Details of display changes according to the mode selector key setting.

1. When the memory or MDI operation mode is selected, each operation program are displayed.

2. When the manual operation mode is selected, there is no display.

3. When the MDI MAN mode is entered, the <MDI MODE> screen is displayed.

4. When the EDITING mode is entered, the <PROGM EDIT MODE> screen is displayed.

4.3 Conditions of manual operation

Pressing the **[MANU COND]** key displays the screen for setting each feedrate and spindle speed.

(Note) When the manual operation mode is not selected, checking of data only is available, modification is not possible.

4.4 Magazine

When the **[MAGAZ]** key is pressed, the screen below appears for tool settings such as the position in the magazine or tool type.

Double-arm ATC display

```
                                                    MAGAZN
 ○SP 01          ■GROUP NO. 03  ■STANDARD TL
     TL LIFE     *******
 × ●01 CAP       ■GROUP NO. **  ■STANDARD TL
     TL LIFE     *******
 ●02 03          ■GROUP NO. 05  ■LARGE TOOL
     TL LIFE     3000F
 × ●03           ■GROUP NO.     ■STANDARD TL
     TL LIFE
 ●04 05          ■GROUP NO.     ■STANDARD TL
     TL LIFE         0M
 ●05 09          ■GROUP NO. 15  ■STANDARD TL
     TL LIFE         30H
 ●06             ■GROUP NO.     ■STANDARD TL
     TL LIFE
 TOOL NO. →_
 0:CAP SETTING
 F0   F1   F2   F3   F4
```

Armless ATC display

```
                                                    MAGAZN
 ○01  01         ■GROUP NO. 03  ■STANDARD TL
      TL LIFE    *******
 ●02  02         ■GROUP NO. 01  ■STANDARD TL
      TL LIFE        0M
 ●03  03         ■GROUP NO. 05  ■STANDARD TL
      TL LIFE    3000F
 ●04             ■GROUP NO.     ■STANDARD TL
      TL LIFE
 ●05  05         ■GROUP NO.     ■STANDARD TL
      TL LIFE        0M
 ●06  09         ■GROUP NO. 15  ■STANDARD TL
      TL LIFE        30H
 ●07             ■GROUP NO.     ■STANDARD TL
      TL LIFE

 TOOL NO. →_
 F0   F1   F2   F3   F4
```

Note: When the MDI mode is not selected, only checking of data is possible.Data modification is not possible.

4.5 Alarm display

4.5.1 Alarm screen

Pressing the **[ALARM]** key displays details of alarms as shown below:

```
                                                    ALARM
 NO.            MESSAGE

 1050          **TURN  OFF  POWER
 1851           *PRESS  RESET  KEY
 2523             INPUT DATA ERROR

 ALARM
 LOG
 F0      F1      F2      F3      F4
```

* The alarm numbers and relative messages are displayed.
* When more than one alarm is generated, the most critical ones are displayed in order of importance.
* Max.10 alarms are displayed.
* If an alarm is generated in other screen, the most critical alarm message blinks.

4.5.2 Alarm log screen

Among critical errors that have occurred, the information of up to the latest 50 errors is retained, and able to be referred to on this screen.

4.5.2.1 Log list screen

The error list is displayed on this screen.
Pressing the **[F0]** key with the <ALARM> screen displayed brings up the alarm log as below:


```
ALARM LOG                                                ALARM
  NO.          MESSAGE                        DATE    TIME
●1279  *NO TOOL IN MAGAZINE                  07/28   08:06
●3201  *NO TOOL DATA                         07/28   08:06
●1154  *EDIT ERROR 2                         07/28   08:07
●1050**TURN OFF POWER                        07/28   08:07
●1279  *NO TOOL IN MAGAZINE                  07/28   08:10
●1152  *EDITING                              07/28   08:54
●1279  *NO TOOL IN MAGAZINE                  07/28   08:56
●1279  *NO TOOL IN MAGAZINE                  07/28   09:09
●1279  *NO TOOL IN MAGAZINE                  07/28   09:09
●1279  *NO TOOL IN MAGAZINE                  07/29   00:33
●1279  *NO TOOL IN MAGAZINE                  07/29   00:33
●1279  *NO TOOL IN MAGAZINE                  07/29   00:35
●0500  *NO TOOL IN MAGAZINE                  07/29   01:24
●0500  *EMERGENCY SW ON                      07/29   01:25
●1165  *ORG POS ERROR Z                      07/29   02:14

DETAIL DISP. : MOVE CURSOR AND PRESS SET.

  ALARM
  DISPLY
  F0      F1      F2      F3      F4
```

4.5.2.2 Detailed display screen

Use the arrow key to select the desired error on the <Log List> screen, and press the **[ENT]** key.
The screen changes in the following sequence by pressing the page keys.

Detailed display

```
DETAILED DISPLAY                                ALARM LOG
 0500  *EMERGENCY SW ON      07/06 17:45
 ●MODE   MEM                 ●DISPLAY POS
 ●EDIT PRGRM 0015
 ●OPE PROGRAM3100
 ●MACHINING                  ●MOTION
  JOB NO. ---- 01             FEED Z   23.000
  TOOL NO. --- 01                     47mm/min
  POS NO. --- 001
  PIECE NO. -- 01
  LINE NO. --- 01
  INFEED NO. - 01
 ●MACHINE POS
  X        -200.000
  Y        -200.000
  Z         223.616
  A           0.000
  B           0.000
  C           0.000
  MAGZN     952.500
  PREVIOUS PAGE : I/O DSP(DEVIATION)
  NEXT PAGE     : I/O DSP(MAIN 1)
  LIST
  DISP.
  F0   F1   F2   F3   F4
```

4

Main 1

```
I/O DSP(MAIN 1)                                   ALARM LOG
IN                                      OUT
   FEDCBA9876543210                        FEDCBA9876543210
1  0000000011100000                     1  0000101110000101
2  0010000000000000                     2  0000000000011011
3  0000000011000100                     3  0000000000000000
4  0000000000000000                     4  0000011000000001
5  0110000000000000                     5  0000000100000000
6  1010010000000000                     6  0000000000000000
7  0000001111110101                     7  0000000000010000
8  0000000001100000                     8  0000000000000000
9  1011111100001100                     9  0000001100100110
   FEDCBA9876543210                        FEDCBA9876543210

      PREVIOUS PAGE  :DETAILED DISPLAY
      NEXT PAGE      :I/O DSP(MAIN 2)
   LIST
   DISP.
   F0   F1   F2   F3   F4
```

Main 2

```
I/O DSP(MAIN 2)                                   ALARM LOG
IN                                      OUT
   FEDCBA9876543210                        FEDCBA9876543210
1  0101000000000000                     1  0000000000000000
2  0000000000010101                     2  0000100000011111
3  0000000000001000                     3  0000000000000000
4  0000000000000000                     4  0000000000000000
5  1111111111111111                     5  0000000000000000
6  0000000000000000
7  0000000000000000

   FEDCBA9876543210                        FEDCBA9876543210

      PREVIOUS PAGE  :I/O DSP(MAIN 1)
      NEXT PAGE      :I/O DSP(SLAVE)

   LIST
   DISP.
   F0   F1   F2   F3   F4
```

Slave

```
I/O  DSP (SLAVE)                                   ALARM  LOG
IN                                   OUT
    FEDCBA98 7654 3210                   FEDCBA98 7654 3210
 1  0001101 0000 10000                1  0001101 0000 10000

 2  0000000 0000 11011                2  0000000 0000 11011

 3  0000001 1111 11110

 4  0000000 0000 00000

    FEDCBA98 7654 3210                   FEDCBA98 7654 3210

      PREVIOUS  PAGE  : I/O DSP (MAIN  2)
      NEXT  PAGE      : I/O  DSP (LOCAL)

   LIST
   DISP.
   F0      F1      F2      F3      F4
```

Local

```
I/O   DSP (LOCAL)                                  ALARM  LOG
IN                                   OUT
    FEDCBA98 7654 3210                   FEDCBA98 7654 3210
 1  1111000 01111 1100                1  1111000 01111 1100

 2  0000000 0000 00000

    FEDCBA98 7654 3210                   FEDCBA98 7654 3210

  PREVIOUS  PAGE  : I/O  DSP (SLAVE)
  NEXT  PAGE      : I/O  DSP (DEVIATION)
   LIST
   DISP.
   F0      F1      F2      F3      F4
```

Deviation

```
I/O   DSP(DEVIATION)                    ALARM LOG

  DEVIATION

   SPINDLE          -1

   X  AXIS           0

   Y  AXIS          25

   Z  AXIS        3010

   A  AXIS        -210

   B  AXIS           0

   C  AXIS           0

   MAGAZINE         42

   PREVIOUS PAGE  :I/O  DSP(LOCAL)
   NEXT  PAGE     :DETAILED  DISPLAY

  LIST
  DISP.
   F0      F1      F2      F3      F4
```

4.6 Production monitor display

4.6.1 Work counter screen setting

4.6.1.1 Work counter screen setting

The work counter is used for accumulation and control of the production quantity, number of lots and consumables such as tools.

1. Press the [MONITR] key to display the <PRODUCTION MONITOR MENU> screen.


```
                    PRODUCTION MONITOR
PRODUCTION MONITOR MENU
  1. WORK COUNTER
  2. TIME DISPLAY
  3. COMMUNICATION STATUS DISPLAY
  4. THERMAL MEASUREMENT DATA
  5. MEASUREMENT RESULTS
  6. AUTO THRM DISP CMP
  7. MISCELLANEOUS
MENU →
F0   F1   F2   F3   F4
```

2. Enter [1] (1. WORK COUNTER) using the numerical key, or move the cursor to [1. WORK COUNTER] and press the **[ENT]** key.

```
WORK COUNTER          PRODUCTION MONITOR

          ●CNTR1  ●CNTR2  ●CNTR3  ●CNTR4
COUT NR   □       ■       ■       ■

PRESENT   ■       ■       ■       ■

END       ■       ■       ■       ■

NOTICE    ■       ■       ■       ■

 COUNT NR → 1__

0～999
0：NO COUNT

  PROD
 MONITR
 MENU
 F0      F1      F2      F3      F4
```

3. Set the required items sequentially.

Data entry is not possible during programmed operation.
Only data reference is possible.

4.6.1.2 Setting items

COUNT NR (0~999)

Set the number to be counted in response to the program end operation (M30).
No count-up when 0 is set.

```
WORK COUNTER          PRODUCTION MONITOR

            ●CNTR1  ●CNTR2  ●CNTR3  ●CNTR4

COUT NR     □       ■       ■       ■

PRESENT     ■       ■       ■       ■

END         ■       ■       ■       ■

NOTICE      ■       ■       ■       ■

 COUNT NR → 1_

0～999
0：NO COUNT

  PROD
  MONITR
  MENU
  F0      F1      F2      F3      F4
```

PRESENTCOUNT(0~99999)

When a number other than 0 is set for the counter number and that the work counter is effective in a program, the specified count number is added in response to program end operation(M30)

1. When a schedule program is used, the count number is added in response to its end.

2. No adding when RESTART of the user parameter 1 (switch 1) is set to 1:RESTART, and also WORK COUNTER WHEN RESTART is set to 0:INVALID.

Refer to the Operation Manual Data Bank Parameter Settings.

```
WORK COUNTER          PRODUCTION MONITOR

          ●CNTR1  ●CNTR2  ●CNTR3  ●CNTR4
COUT NR   ■     1 ■     ■     ■

PRESENT   □       ■     ■     ■

END       ■       ■     ■     ■

NOTICE    ■       ■     ■     ■
PRESENT COUNT → 0
0～99999

  PROD
  MONITR
  MENU
  F0    F1    F2    F3    F4
```

ENDCOUNT(0-99999)

Set the number at which the counting is to be stopped.
When the current number exceeds this number, the alarm message “COUNTER 1-4 END” win be displayed. At the same time the external signal (count signal) is activated with the message “END” on the screen.

When lamps are provided, the yellow or red lamp is lit by setting [INDICATION SELECT AT COUNT-UP] of USER PARAMETER 1 (SWITCH 1).

```
WORK COUNTER          PRODUCTION MONITOR

          ●CNTR1  ●CNTR2  ●CNTR3  ●CNTR4
COUT NR   ■     1 ■     ■     ■
PRESENT   ■     0 ■     ■     ■
END       □       ■     ■     ■
NOTICE    ■       ■     ■     ■
 COUNT NR → 100
0～99999
0：NO END
 PROD
 MONITR
 MENU
F0  F1  F2  F3  F4
```

Pressing RESET key allows the alarm “COUNTER 1-4 END” to be reset. However, as the count end signal remains active, restart of the memory operation activates the alarm again. To disactivate the count end signal, perform any of the following steps:

*Set a smaller value for “PRESENT COUNT” than for “END COUNT”.
*Set a larger value for “END COUNT” than for “PRESENT COUNT”.
*Set 0 for “END COUNT”.
*Set 0 for “COUNT NR”.

ENDNOTICECOUNT(O-99999)
Set the counted number at which the alarm message “COUNTER 1-4 END NOTICE” is to be dis played. The message “END NOTICE” is also displayed on the screen.

```
WORK COUNTER          PRODUCTION MONITOR

            ●CNTR1  ●CNTR2  ●CNTR3  ●CNTR4

COUT NR     ■     1 ■       ■       ■

PRESENT     ■     0 ■       ■       ■

END         ■   100 ■       ■       ■

NOTICE      □       ■       ■       ■

 COUNT NR → 90_

0～99999
0:NO END NOTICE

 PROD
 MONITR
 MENU
 F0    F1    F2    F3    F4
```

Pressing CAN key allows the alarm “COUNTER 1-4 END NOTICE” to be reset. but the count end prediction signal remains active.
Memory operation is possible even when the alarm is activated.
To disactivate the count end prediction signal, perform any of the following steps:

*Set a smaller value for “PRESENT COUNT” than for “END NOTICE COUNT”.
*Set a larger value for “END NOTICE COUNT” than for “PRESENT COUNT”.
*Set 0 for “COUNT NR”.

4.6.1.3 Work counter activating command in a program

The following signal output codes are set in the signal output step of the machining data.

M211 work counter 1 effective
M212 work counter 2 effective
M213 work counter 3 effective
M214 work counter 4 effective

JOB01 SIGNAL OUT ● CODE 211

Signal output codes can be also set to [M. FUNC] of [1. TOOL ASSIGN] on the <RUNNING PREPARATION MENU> screen.

1. As long as M211 to 214 are set even once after memory run was initiated until the time program operation is ended, the work counter is activated.
Multiple counters can be activated by setting M211 to 214 multiple times.

2. The work counter becomes inactive when the power is turned on, the [RST] key is pressed,
start point is set, or program end operation is executed.

To display the work counter at the time the program starts, set step 01 to display work counter.
If displaying work counter is set during program operation, the order of the active counters to be displayed varies depending on the machining sequence.
When using the <TOOL ASSIGN> screen, set the tool to be used first in machining.
In the example below, the counter is not active until [02 DRILL] is used.

```
(PROGRAM 1000) ********?????      TOOL ASSIGN
●JOB01 TAPPING

 ■1  C.HOLE      01 C. DRILL
     OFFSET ■LEN      1■DIA      **
     M. FUNC      ■BEFORE 8■AFTER  9
     DWELL  ■TIME 10
 ■2  HOLE        02 DRILL  5.100
     OFFSET       ■LEN      ■DIA      **
     M. FUNC      ■BEFORE   ■AFTER  211
     DWELL  ■TIME
 ■3  HOLE        03 S. TAP  M6.000
     OFFSET       ■LEN      ■DIA      **
     M. FUNC      ■BEFORE   ■AFTER
     DWELL  ■TIME
●JOB02 TAPPING
 ■1  C.HOLE      01 C. DRILL
     OFFSET ■LEN      ■DIA      **

 TOOL NO.  →

 −9999 EDIT:NEW ASSIGN
 −9999 EDIT:NOW TL FIRST
 EDI       :NO ASSIGN
                   TOOL ASSIGN END
                   ? CALCULATION END

  EDIT    PREV.    NEXT    FUNC    CALC
  END     TOOL     TOOL    EX−     RESLT
  MODE             CHANG   DISP.
  F0      F1       F2      F3      F4
```

3. When executing M211 to M214, the counter number on the <WORK COUNTER> screen is highlighted. When the work counter becomes inactive, the highlighted display returns to the normal display.

```
WORK COUNTER          PRODUCTION MONITOR

            ●CNTR1  ●CNTR2  ●CNTR3  ●CNTR4
COUT NR   □      1  ■        ■        ■

PRESENT   ■     30  ■        ■        ■

END       ■    100  ■        ■        ■

NOTICE    ■     90  ■        ■        ■
 COUNT NR →_
0～999
0：NO COUNT

  PROD
  MONITR
  MENU
  F0      F1      F2      F3      F4
```

To deactivate the work counter, set the following signal output codes.

M221 work counter 1 ineffective
M222 work counter 2 ineffective
M223 work counter 3 ineffective
M224 work counter 4 ineffective

4

4.6.2 Time display

4.6.2.1 Time display

Press the **[2]** and **[ENT]** keys at the production monitor menu screen,or shift the cursor to the No.2 and press the **[ENT]** key. The following items are displayed on the screen.

When machine is equipped with quick table

```
TIME DISPLAY                    PRODUCTION MONITOR
● PAL1 CYCLE TIME(1000)          0002:30:54
  CUTTING TIME                   0001:26:13
  NON CUTTING TIME               0001:04:41
  CUTTING TIME/CYCLE TIME                57%

● PAL2 CYCLE TIME(1200)          0002:13:00
  CUTTING TIME                   0001:05:36
  NON CUTTING TIME               0001:07:24
  CUTTING TIME/CYCLE TIME                49%

● OPERATION TIME                 0006:13:42

● POWER ON TIME                 00135:07:01

● RUNNING TIME                  00054:41:35

● DATE                 1997/07/10   14:20:16
            NEXT PAGE        : OPERATION LOG

  PROD
  MONITR
  MENU
  F0      F1      F2      F3      F4
```

Descriptions

The above screen displays the cycle time of the [PAL1 CYCLE TIME(****)] program.
The quick table corresponding to PAL 1 or PAL 2 is displayed.
Figures in brackets indicate the program number.

When machine is not equipped with quick table

```
TIME DISPLAY                    PRODUCTION MONITOR
● PAL1 CYCLE TIME(1000)          0002:30:54
  CUTTING TIME                   0001:26:13
  NON CUTTING TIME               0001:04:41
  CUTTING TIME/CYCLE TIME                57%

● OPERATION TIME                 0006:13:42

● POWER ON TIME                 00135:07:01

● RUNNING TIME                  00054:41:35

● DATE                1997/07/10    14:20:16



            NEXT PAGE        : OPERATION LOG

  PROD
  MONITR
  MENU
  F0      F1      F2      F3      F4
```

CUTTING TIME:	Displays the time cutting is performed in the program.
NON CUTTING TIME:	Displays the time cutting is not performed in the program.
CUTTING TIME/ CYCLE TIME:	Displays the ratio of cutting time to cycle time.
OPERATION TIME:	Displays the accumulated operation time.
POWER ON TIME:	Displays the accumulated power supply time.
RUNNING TIME:	Displays the accumulated running time.
DATE:	Displays the current date and time.

CAUTION:
The passed time may differ from the actual machining time when the [M.LCK] key is valid.

4

4.6.2.2 Operation log

The record of operation time and running frequency are displayed.
Press the NEXT PAGE key on the <TIME DISPLAY> screen.

```
OPERATION   LOG                PRODUCTION MONITOR

                OPERT  TIME        NO. OF OP
 ●97／07／06    10：13：24            102
 ●97／07／07    09：15：45             96
 ●97／07／08    07：58：13             45
 ●97／07／09    08：05：23             35
 ●97／07／10    06：13：42             12

          PREVIOUS PAGE  :  TIME DISPLAY

 PROD
 MONITR
 MENU
 F0    F1    F2    F3    F4
```

4.6.3 Communication status display

Press the **[3]** and **[ENT]** keys at the production monitor menu screen,or shift the cursor to the No.3 and press the **[ENT]** key. The following items are displayed on the screen.

```
COMMUNICATION DISP      PRODUCTION MONITOR
 RECEIVE MEMORY LIST
 SND MEMORY LIST            05／13  13：45
 RECEIVE USER PARM2 M IN    05／13  13：45
 END USER PARM2 M IN.       05／13  13：46
 RECEIVE THRM MSR DT1 DEL   05／13  13：47
 END THRM MSR DT1 DEL       05／14  10：25
 WAITING COMMAND            05／14  10：25

 SIGNAL MONITOR   RS   CS   ER   DR

 PROD
 MONITR
 MENU
 F0    F1    F2    F3    F4
```

4.6.4 Thermal measurement data

Press the **[4]** and **[ENT]** keys at the production monitor menu screen,or shift the cursor to the No.4 and press the **[ENT]** key. The following items are displayed on the screen.

```
THRM MESRMENT DATA        PRODUCTION MONITOR
●PRT POS COMP                ■ −0.061

●PRST NO. OF CMND            ■ 3

●MSR FRQ        ●TL OFST NO.  ●DISPMT AMT
                ●NO. OF CMND  ●TOTL DISPMT

＊3             ■ 01          ■ 0.030
                ■ 3           ■ 0.060

●2              ■ 01          ■ 0.020
                ■ 2           ■ 0.030

●1              ■ 01          ■ 0.010
                ■ 1           ■ 0.010

●               ■             ■
                ■             ■

●               ■             ■
                ■             ■
 PROD
 MONITR
 MENU
 F0   F1   F2   F3   F4
```

Description of items

PRT POS COMP: Displays the amount of compensation for the Z axis at the current position.
The position compensation is -0.061 on this screen.

PRST NO. OF CMND: Displays the present number of commands.
3 is specified on this screen.

MSR FRQ: Displays the number of actual measurements.

TL OFST NO.: Represents the tool length offset number used for measurement.

DISPMT AMT: Displays the measured displacement.

TOTL DISPMT: Displays the total displacement.

*Measurement data is displayed.

(Note) All data is lost when the power is turned off.

4

4.6.5 Measurement results

Press the **[5]** and **[ENT]** keys at the production monitor menu screen,or shift the cursor to the No.5 and press the **[ENT]** key. The following items are displayed on the screen. To change the value of the measurement results, select the desired item and enter a numerical value. Note that the type of the measurement cannot be changed.

4.6.5.1 Deletion of measurement results

Unnecessary measurement results can be deleted.

1. Press the **[F4]** key on the <Measurement Results> screen, and a deletion confirmation screen appears.

2. Press the function key corresponding to the measurement results to be deleted.
   To cancel deletion, pless the **[F4]** key.
   The rerationship between the function keys and measurement results to be deleted is as follows.

[F0] key	No.1 is deleted.
[F1] key	No.2 is deleted.
[F2] key	No.3 is deleted.
[F3] key	No.4 is deleted.
[F4] key	Measurement results are not deleted.

When the function key is pressed, the corresponding measurement results are deleted(nothing is deleted when **[F4]** is pressed) and the display returns to the < Measurement Results > screen.

Note: When the machine unit system of user parameter 1 (Switch1) is changed, all measurement results are deleted.

4.6.5.2 Previous measurement results

The previous measurement results are displayed.

1. Press the [F2] key on the <CUR MEASMNT RESULT> screen and the <PREV MEASMNT RESULT> screen appears.
Press the [F2] key again and the display returns to the <CUR MEASMNT RESULT> screen.

Note: The previous measurement results cannot be changed or deleted.

4.6.6 Automatic thermal displacement compensation

Press the **[6]** and **[ENT]** keys at the production monitor menu screen,or shift the cursor to the No.6 and press the **[ENT]** key. The following menu is displayed on the screen.

```
AUTO THRM DISP CMP                    PRODCUTION MONITOR

        AUTO THERMAL DISP COMP MENU
        1. X COMPENSATION
        2. Y COMPENSATION
        3. Z COMPENSATION

  MENU→_

   PROD
   MONITR
   MENU
   F0      F1      F2      F3      F4
```

Enter the number of the desired axis on the <AUTO THRM DISP CMP> screen and press the [ENT] key, or move the cursor to the menu number and press the [ENT] key. The following items are displayed on the screen.

```
Z COMPENSATION                        AUTO THRM DISP CMP

●OPE  STATUS        ■OPERATION
●PRT  POS  COMP     ■Z                  ■SP
●NO.  OF  DATA      ■

●NO.  OF  CALC.     ●Z  TRV  DIST       ●Z  DISP  AMT
                    ●S  ROTATION        ●S  DISP  AMT

●                   ■                   ■
                    ■                   ■

●                   ■                   ■
                    ■                   ■

●                   ■                   ■
                    ■                   ■

●                   ■                   ■
                    ■                   ■

●                   ■                   ■
                    ■                   ■

   THRM
   DISP COMP                CHANGE                      DELETE
   MENU                     OPE                         DATA
                            STATUS
   F0      F1      F2      F3      F4
```

4

4.6.6.1 Changing operation status

When **[F2]** is pressed with the < AUTO THRM DISP CMP > screen displayed, the following screen appears.
Set whether to enable or disable the automatic thermal displacement compensation function.

```
Z COMPENSATION                    AUTO THRM DISP CMP

AUTO THERM DISPLCMNT COMPENSATION･･･ ＊
(0:INVALID  1:VALID)

AUTO THRM DISP CMP →_

AUTOMATIC THRMAL DISPLACEMENT
COMPENSATION DATA IS LOST
WHEN DATA IS CHANGED

 EDIT
 END
 MODE

F0   F1   F2   F3   F4
```

4.6.6.2 Deleting automatic thermal displacement compensation data

When **[F4]** is pressed with the < AUTO THRM DISP CMP > screen displayed, the following screen appears.
Press **[F0]** to delete the automatic thermal displacement compensation data; press **[F1]** to ccancel delection.

```
Z COMPENSATION                    AUTO THRM DISP CMP

    DELECTING AUTOMATIC THERMAL
    DISPLACEMENT COMPENSATION DATA
    HAMPERS CORRECT COMPENSATION.
    DO YOU DELETE?

    YES       NO
    F0        F1        F2        F3        F4
```

4.7 Data bank

The screens of data bank display have the followings:
* TOOL MENU
*TOOL PATTERN
* HOLE SIZE BEFORE TAPPING
* CUTTING COND
*User parameter screen
*Machine parameter screen

Refer to "Data bank" for details.

4.8 Erasing screen

Pressing the **[CLEAR]** key erases the screen.
Press any of the display keys to display the screen again.
Further, once [AUTO DISPLAY CLEAR TIME] of user parameter 1 is set, the display can be automatically cleared when no operation is performed during the designated time.

CHAPTER 5

MANUAL OPERATION

5

5.1 Manual Operation
5.2 Zero Point Return
5.3 Axis Feed
5.4 Starting and stopping Spindle
5.5 Tool Change
5.6 Magazine Rotation
5.7 Axis movement and stroke
5.8 Release + zero point return

5.1 Manual Operation

This section describes the manual operation for axis feed, spindle orientation, tool change and magazine rotation.

The initial screen as shown below appears on the display when power supply is turned on or when manual operation mode is active.

By pressing **[RPD]**, **[JOG]**, **[STEP]**, **[S.CW]** or **[S.STOP]** key, the cursor moves to the corresponding item on the screen.
Pressing once cursor key allows also the cursor to move upward or downward by 1 item.

When optional axes are not provided, the cursor does not move to the items related to 4th axis.

5.2 Zero Point Return

Zero point return here is referred to as action of returning X, Y,Z,A,B and C axes to machine zero point.
The coordinates of the zero point are 0 for X, Y, Z, A, B and C axes and the value set by the machine parameter (system1) for Z axis.

Zero point return allows a reference point of axis feed to be established.

1 Press **[MANU]** key to validate manual operation mode.
2 Press **[POS]** key to make the machine position screen appear.
3 Press **[Z.RTN]** key.
First Z axis moves upward to return to zero point, then X and Y axes return simultaneously to zero point. Optional axes return to their zero points according to the order of setting parameters. Then C -axis return to its zero point. (Pallet 1 index to outside) C axis zero point return is only acted once when the power switch is turned on.

The origin return sequence of the additional axes, including the C axis, is set to machine parameter 2 (system 2).

(Note 1)
Zero position return function is available. Therefore, after turning the power on, it is not necessary to move the axis for the first zero position return.

(Note 2) (only NC)
If the automatic coordinate setting is selected by the user parameter 2, the coordinates are set as specified by the user parameter 2 when the initial zero point return after the power ON is finished.

(Note 3) (only NC)
Note that "G92 X_Y_Z_A_B_C_" is automatically executed in the working coordinates setting is selected.
Refer to "Chapter 3" of the Programming manual for details of G92.

[Reference Example of B axis] B axis stroke (user parameter 2)

The motion of the B axis zero return varies depending on the setting of STROKE * (0: NO, 1: YES) of user parameter 2 (switch 2). (Below is the explanation assuming that *-AXIS DOG ZERO RETURN DIRECTION and *-AXIS DOG ZERO RTN DISPMT. of user parameter 2 (switch 2) is set to 0: + and 20.000 deg. respectively.)

1) When STROKE * is set to 0: NO

The B-axis machine coordinate value varies from 0 to 359.999 degrees. Therefore, multiple B-axis machine zero points exist every 360 degrees from the B-axis dog type zero return point.

1-1) Dog type zero return

Generally, the B axis returns in the positive direction to its zero position. However, when the B-axis machine coordinate value is between 340 and 360 degrees, the B-axis retracts 20 degrees in the negative direction and then returns in the positive direction to its zero position.

1-2) Positioning type zero return

The B axis rotates and returns to its zero position in the direction closer to 0 degree of the B-axis machine coordinate value.

When the returning angle is the same in either positive or negative direction (e.g.,180˚), the axis rotates toward positive.

2) When STROKE * is set to 1: YES

The B-axis machine coordinate value varies from -9999.999 to 9999.999.
Therefore, only one B-axis machine zero point exists at zero for B-axis dog type zero return.

2-1) Dog type zero return

- When the B-axis machine coordinate value is larger than 0 degree, the B axis retracts to -20 degrees point in the negative direction and then returns in the positive direction to its zero position.
- When the B-axis B-axis coordinate value is between -20 and 0 degree, the B axis retracts 20 degrees in the negative direction and then returns in the positive direction to its zero position.
- When the B-axis machine coordinate value is smaller than -20 degrees, the B-axis moves to -20 degrees point in the positive direction and then returns in the positive direction to its zero position.

2-2) Positioning type zero return

The B-axis rotates toward the B-axis machine zero point (0 º).

* The same operation applies to A and C axes.

5.3 Axis Feed

Axis feed key allows X, Y, Z, A, B and C axis to be fed at rapid traverse or low speed, or over a predetermined stroke.

5.3.1 Rapid traverse

X, Y, Z, A, B and C axes move at a high speed.

The rapid feed is carried out at a speed selected from the five steps; - 10%, 25%, 50%, 75% and 100% either of the maximum hi-speed rotation set by machine parameter 2 (A, B and C axes).

In the example below, suppose the following conditions:
Maximum manual feed speed : 4000mm/min Set by the machine parameter (system1)
Feedrate override: 10%

The axis moves at 400 mm/min (4000 mm/min × 10%)

1 Press **[MANU]** key to validate manual operation mode and make the manual operation condition screen appear.
2 Press **[RAPID]** key to set the cursor on "RAPID FEEDRATE" on the screen. The lamp on **[RAPID]** key comes on. Default rapid traverse rate is 10%.

```
●RAPID FEEDRATE          10 %
```

3 Using axis feed keys, move the X, Y, Z, A, B and C in the desired direction.

The rapid feed rate can be adjusted by pressing the **[UP]** or **[DOWN]** key.
To adjust the rapid feedrate of the additional axis, move the cursor to RAPID FEED (4).

(Note 1)

The feedrate can be changed even during the axis movement.

5.3.2 Jog feedrate

X, Y, Z, A, B and C axes move at a low speed.

The jog feedrate of the X, Y and Z axes can be selected from 22 within the range of 50 to 4000 mm/min (2.0 to 157.4 inch/min).
The jog rotation speed of the additional axis can be selected from 19 steps within the range of 0.1 to 7.5 rpm.

In the example below, suppose that X, Y and Z axes moves at 1000m/min.

1 Press **[MANU]** key to validate manual operation mode and make the manual operation condition screen appear.
2 Press **[JOG]** key to set the cursor on "JOG FEEDRATE" on the screen. The lamp on **[JOG]** key comes on.


```
●JOG FEEDRATE          50 mm/min
```

3 Press **[INC]** key and select 1000m/min.

```
●JOG FEEDRATE          1000 mm/min
```

4 The jog feedrate can be adjusted by pressing the **[UP]** or **[DOWN]** key.
To adjust the jog feedrate of the additional axis, move the cursor to HOG FEED (4).

(Note)
The feedrate can be changed even during axis movement.

5.3.3 Step feed

X, Y, Z, A, B and C axes moves in predetermined increments.

The step amount of the X, Y and Z axes can be selected from 4 steps; 0.001, 0.01, 0.1 or 1.0 mm/step (0.0001, 0.001, 0.01, 0.1 inch/step).

The step amount of the additional axis can be selected from 11 steps from 0.001 to 180.0 degrees.

In the example below, suppose that X, Y and Z axes are to be fed at 0.1mm/step.

1 Press **[MANU]** key to validate manual operation mode and make the manual operation condition screen appear.
2 Press **[STEP]** key to set the cursor on "STEP LENGTH" on the screen. The lamp on **[STEP]** key comes on.


```
● TEP LENGTH          0. 001 mm
```

3 Press **[INC]** key and select 0.1mm/step.

```
●STEP LENGTH          0. 1 mm
```

4 Move the X, Y, Z, A, B and C axes in the desired direction by pressing the corresponding axis feed key.

The step amount can be adjusted by pressing the **[UP]** or **[DOWN]** key.
To adjust the step amount of the additional axis, move the cursor to STEP FEED (4).

5.4 Starting and Stopping Spindle

The spindle rotates CW , or is stopped. Never touch the machine while the spindle rotates.

Speed is increased in increments of 20 min^{-1} from 100 to 4000 min^{-1}, and in increments of 2000 min^{-1} afterward.

In the example below, suppose that the spindle is to rotate at 1000rpm (min^{-1}).

1 Press **[MANU]** key to validate manual operation mode and make the manual operation condition screen appear.

2 Set the cursor on "SPINDLE SPEED" on the screen with cursor keys

3 Press **[UP]** key and select 1000rpm (min^{-1}).

4 If **[S.CW]** key is pressed, the spindle rotates CW at 1000rpm(min^{-1}). The lamp on **[S.CW]** key comes on.
If **[S. STOP]** key pressed, the spindle stops. The lamp on **[S.CW]** key goes out.

5.5 Tool Change

CASE 22A, 31A

1 Press **[MANU]** key and select the manual operation mode.
2 Press **[ATC]** key:The Z axis will return to the ATC zero-position.
The spindle will be positioned at a designated point and the pot for the next tool will rotate by 90˚ .
3 Press **[ATC]** key:The arm will move downward and rotate by 180˚ , then move upward again.
4 Press **[ATC]** key: The pot will return to the original position by 90˚ , and the Z axis will return to the machine zero position.

Even if the key is kept pressed, only action is executed.
Press the key when the current action is completed.
When the lamp on **[ATC]** key goes out, the next action can be executed.

* The arm will move down by 80mm when starting rotation. Therefore, change tools by pressing **[MAGZ]** while keeping a clearance of more than 80mm between the tool tip and workpiece at the Z-axis ATC zero position.

CASE S2A, R2A, S2B

Tool in the spindle is changed for another set in the spindle.

1 Press **[MANU]** key to validate manual operation mode.

2 Press **[ATC]** key: Z axis moves upward to zero-point and the spindle is positioned at the predetermined position. .
The predetermined position is referred to as the position where the 2 keyways on the spindle become parallel with Y axis.

3 Press **[ATC]** key:Z axis moves upward and is positioned at the ATC zero point.

4 Press **[ATC]** key: The magazine is indexed to the next position.
During this motion, the magazine rotates CW.

5 Press **[ATC]** key: Z axis moves downward to zero point.

CASE 32A

1 Press **[MANU]** key and select the manual operation mode.

2 Press **[ATC]** key: The Z axis will return to the ATC position.
The spindle will return to origin position (spindle orientation) and the pot for the next tool will tilt. The origin position is where the tool can be replcaed.

3 Press the **[ATC]** key. The X axis will move to maching zero position.
The Y axis will move to the ATC position.
(When the axes are already at the above positions, this operation is omit ted.)

4 Press the **[ATC]** key.
The ATC shutter (magazine cover)will open, the X axis will move to the ATC position.

5 Press **[ATC]** key:
The arm will swivel, move downward, and then upward.
Upon completion of this cycle, the tool will have been changed.

6 Press **[ATC]** key:
The pot to be up, and theX, Zaxis will return to the machine zero position and the ATC shutter will close.

CASE 20A

1 Press **[MANU]** key and select the manual operation mode.

2 Press **[ATC]** key:The Z axis will return to the machine zero-position. The spindle will be positioned at a designated point and the pot for the next tool will rotate by 90˚ .

3 Press **[ATC]** key:The arm will move downward and rotate by 180˚ , then move upward again.

4 Press **[ATC]** key: The pot will return to the original position by 90˚ .

* The arm will move down by 50mm when starting rotation. Therefore , change tools by pressing **[MAGZ]** while keeping a clearance of more than 50mm between the tool tip and workpiece at the Z-axis ATC zero position.

Even if the key is kept pressed, only action is executed.
Press the key when the current action is completed.
When the lamp on **[ATC]** key goes out, the next action can be executed.

5.6 Magazine Rotation

Rotate the magazine for tool indexing.

CASE 22A, 31A, 32A, 20A

1 Press **[MANU]** key and select the manual operation mode.

2 Press **[MAGZ]** key. The next tool pod raises if not yet raised.
The magazine will rotate in the CW direction and indexes to the position to mount a next toll. Earth time the key is pressed, the magazine rotates to the next pot.

* The magazine swivels for one pod even if the key is held down. Press the key each time upon completion of swiveling for one pod.
When the **[MAGZ]** key lamp goes out, the next swiveling operation is possible.

5

CASE TC-32A

* The magazine can also be swiveled by pressing the **[SINGLE MAGAZINE]** switch on the right door instead of pressing the **[MAGZ]** key.

CASE S2A, R2A, S2B

1 Press **[MANU]** key to validate manual operation mode.

2 Press **[ATC]** key: Z axis moves upward to zero-point and the spindle is

3 Press **[ATC]** key:Z axis moves upward and is positioned at the ATC zero point.

4 **[MAGZ]** key is effective only while Z axis is at ATC zero point.
If the key is pressed when Z axis is not that point, the alarm 168* MAGAZINE POSITION ERROR is displayed.
Press **[MAGZ]** key : the magazine is indexed to the next tool.
When **[MAGZ]** key pressed, the magazine rotates CW.
Each time this key pressed, the magazine is indexed by tool.
Attempt of an operation other than a magazine rotation with Z axis kept at the ATC zero point may cause an alarm.

5 After this series of operation, press **[ATC]** key to return Z axis to machine zero point.

5.7 Axis movement and stroke

The allowable axis movement range in the manual operation is as shown below.

1. X and Y axes

0501.doc

2. Z axis

0502.doc

3. Optional axes **Example : B axis**
When STROKE * is set to 1: YES

0503.doc

Even if the axis feed key is pressed to move the relative axis beyond this range, an alarm is not generated and the axis does not move.

5.8 Release + zero point return

The alarm lowering the servo motor level occurred from like the emergency stop during the machining.
If the power is turned off, not to reset the error, each axis of the machine coordinate position will be difference with real machine position.
When power is turned on again to operate the dog type zero return in that situation, the error such as the "STROKE OVER" occurs.
Please follow steps bellow to restore the machine.

1. Press the **[MANU]** key to be the manual operation mode.

2. Move A,B,C axes to the position where the zero position limit switch for each axis is turned on by the jog mode. (Refer to the alarm message, page13-50.)

3. Move X,Y,Z axes to near the stroke center by the jog mode.

4. Press the **[RELSE]** and the **[Z.RTN]** keys.
   (Pressing the **[Z.RTN]** key while holding down the **[RELSE]** key.)

X,Y,Z axes return to the positive direction, A,B,C axes are moved to the direction which is set by the [* axis dog type zero return direction] of machine parameter 2 (system 2).
All axes return to the zero point in dog type.

(Note 1)
When push the [RELSE] and the [Z.RTN] keys and A, B, C axes of the zero position limit switch are turned off, alarm [zero point LS is not turned on] is occur.

(Note 2)
When push the [RELSE] and the [Z.RTN] keys and X,Y,Z axes are near the zero position limit switch, the error "OVER RUN" may occur.

(Note 3)
This operation is effective only when the dog type zero return is operated right after turning on the power.

CHAPTER 6

AUTO OPERATION

6

6.1 Outline of MDI Operation and Its Procedure
6.2 Operation by Data Entetered
6.3 Setting Tools to Be Mounted on the Magazine (1)
6.4 Drilling
6.5 Tapping
6.6 Outline of Memory Operation and Its Procedure
6.7 Setting Tools to Be Mounted on The Magazine (2)
6.8 Test Operation
6.9 Cycle Operation
6.10 Memory Operation
6.11 Setting the Starting Point
6.12 Running a Schedule Program
6.13 Setting a Schedule Program Number
6.14 Feed Hold and Emergency Stop
6.15 Reset

6.1 Outline of MDI Operation and Its Procedure

This section describes the data setting method in block operation.
Block operation is referred to as 1 cycle of motions including axis feed and cutting.

Double-arm ATC display

```
                                    MDI  OPERATION

★COORDINATE      ■  (1:ON)
●EXT  SIGNAL   ■■■
●TOOL            ■■  (1～26:POT  NO.)
●COOLANT         ■  (0:OFF  1:ON)
●SPINDLE         ■  (0:STOP  1:CW  2:CCW)
●S. SPEED    ■■■■■   MIN⁻¹
●AXIS  MOVE      ■  (0:DESIGNATE  POS
                     1:W. ZERO  2:M. ZERO
                     3:M. ZERO (NO. 2)
                     4:M. ZERO (NO. 3))
●X  ■■■■■■■■  ●Y  ■■■■■■■■  ●Z  ■■■■■■■■
●A  ■■■■■■■■  ●B  ■■■■■■■■  ●RAD  ■■■■■■
●FEED            ■  (0:POSITIONING
                     1:CUTTING  2:TAPPING)
●FEEDTATE  ■■■■■  mm/min
COORDINATE →_


  CENTR   AUTO
  ALIGN   T. LEN
  F0      F1      F2      F3      F4
```

1 Press**[MDI]**key to validate MDI mode and make the block operation screen appear on the display.
2 The blinking cursor prompts to enter data for the item displayed in the data input area.
3 To move the cursor downward from an item to another, press **[↑]** cursor key.
4 Press the START switch, the START lamp comes on and the operation is executed according to the data entered.
5 When the operation is completed, the START lamps goes out and the cursor returns to the item "COORDINATE".

* Each time the cursor is set on another item, the item substitutes the one displayed currently.
* If 2 or more items are set, the items displayed upper on the screen have the priority of execution.
*When MDI mode is activated, the block operation screen appears and the lamp on **[PRGRM]** key comes on.
* To return from a screen other than block operation screen to the block operation screen, press **[PRGRM]** key.

Setting items for block operation:

COORDINATE: Setting of coordinate system:
X,Y and B axes..... Current machine coordinates are the working zero point.
Z axis..... The working zero point is set on the table top surface.

EXT.SIGNAL: Signal of actuation deliverred to an external device (preset counter for example). Should in principle be specified by customer.

The following are the reserved code:

Internal code

05: Spindle start
08: Coolant valve on
09: Coolant valve off
19: Spindle orientation
111: Spindle orientation (180°)

Setting-prohibited code

00: Feed hold
03: Spindle CW rotation
04: Spindle CCW rotation
30: Program end

TOOL : The tool of the specified magazine number is changed.
A number from 1 to 26 is displayed in [POT NO.] for models with a double-arm ATC, and a number from 1 to 14 is displayed in [MAGAZN NO.] for models with an armless ATC.
(The maximum number differs depending on the machine specifications.)

COOLANT: Coolant valve open/close

SPINDLE: Spindle rotation/stop

S.SPEED: Spindle speed up to the max. speed set with the Mashine Parameter 1(system1) can be freely specified. For a tapping, tap revolving speed is specified.

AXISMOVE :
X :
Y :
Z :
A :
B :
Positioning of X, Y, Z, A and B axes to a point given, the machine zero point or the working zero point. When 0 : POS is specified, up to 3 axes can be fed simulatenously, whereas, when[CUTTING] is designated, simultaneous movement of three axes(X, Y, and Z) or two axes(any two out of X, Y, Z, A, or B, but excluding combination of A and B) is possible.

RAD : Sets the radius when A and B axes move for cutting.

FEED : Select axis feed mode from the following 3:

0:POS Axis moves at the rapid feedrate set with the machne parameter. Up to 3 axes can be positioned simultaneously.

1:CUTTING Axis moves at a cutting feedrate specified.

2: TAP Feedrate is determined by spindle speed and tap pitch.

FEEDRATE: Feedrate of cutting
Spindle rotation and coolant supply do not stop even if a machine operation is completed. To stop them, set the cursor on SPINDLE or COOLANT and perform a setting for stop.

6.2 Operation by Data Entered

This section describes the data input and block operation procedures .

6.2.1 Setting a coordinate system

1 Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.
2 Enter **[1]** and press **[EOB/ENT]** key.

```
                                    MDI  OPERATION
●COORDINATE      1  (1：ON)
```

Setting a coordinate system stands for setting a working zero point.

3. Press the START switch.
For X and Y axes, current machine coordinates are the working zero point and for Z axis, the working zero point is set on the table top surface.

6.2.2 Providing an output of external signal

Eample of output: external signal 25

1 Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.
2 Set the cursor on "EXT. SIGNAL" with **[↓]** cursor key.

```
●EXT  SIGNAL  25
```

3 Enter **[25]** and press **[EOB/ENT]** key.
4 Press the START switch.

For the details on the external signals, refer to the External input/output signals.

6.2.3 Setting a tool in the spindle

If the tool has been already set in the spindle, no tool setting on the screen is needed.

Double-arm ATC display

```
●TOOL■■  (1～26：POT  NO.)        50  mm/min
```

Armless ATC display

```
●TOOL■■  (1～14：MAGAZINE  NO.)  50  mm/min
```

If the tool is not mounted on the magazine, mount it properly.
When the tool is mounted on the magazine, follow the procedure below to set this tool in the spindle.

Example: Setting the tool of magazine No. 3 in the spindle

1. Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.

```
●TOOL              3  (1～26：POT  NO.)
```

2 Set the cursor on "TOOL" with **[↓]** cursor key.
3 Enter **[3]** and press **[EOB/ENT]** key.
4 Press the START switch:
Z axis returns to tha machine zero point, then goes to the ATC zero point, the magazine rotates and the tool No. 3 is set in the spindle.

The magazine rotates bidirectionally to take the shorter path.
*Never the touch the machine while tools are changed.
*Before starting tool change, make sure that the tool is firmly mounted on the magazine.

6.2.4 Turning on and off coolant supply

Before performing this operation, be sure to set the **[CLT .P]** key on ON position.
When no coolant is used, be sure to set the **[CLT .P]** key on OFF position.

1 Set the **[CLT .P]** key on ON position.
2 Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.

```
●COOLANT          1  (0:OFF  1:ON)
```

3 Set the cursor on "COOLANT" with **[↓]** cursor key.
4 Enter **[1]** and press **[EOB/ENT]** key.
5 Press the START switch:
Coolant supply is turned on.
6 Set again the cursor on "COOLANT", enter **[0]** and press **[EOB/ENT]** key.

```
●COOLANT          0  (0:OFF  1:ON)
```

7 Press the START switch.
Coolant supply is turned off.

6.2.5 Running and stopping the spindle

Example: Spindle CW rotation at 4000rpm(min^{-1})

1 Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.
2 Set the cursor on "SPINDLE" with **[↓]** cursor key.
3 Enter **[1]** and press **[EOB/ENT]** key.
CW: Normal rotation CCW: Reverse rotation
The cursor then moves to **[S. SPEED]**.

```
●SPINDLE          1  (0:STOP  1:CW  2:CCW)
★S. SPEED    ■■■■■  min-1
```

4 Enter **[4000]** and press **[EOB/ENT]** key.
5 Press the START switch:
The spindle starts revolving CW at 4000rpm(min^{-1}).

```
●SPINDLE          1  (0:STOP  1:CW  2:CCW)
●S. SPEED      4000  min-1
```

6 Set again the cursor on "SPINDLE", enter **[0]** and press **[EOB/ENT]** key.

```
●SPINDLE          0  (0:STOP  1:CW  2:CCW)
```

7 Press the START switch:
The spindle stops.

6.2.6 Feeding an axis

Example: Feeding X axis to -50.000mm position

1 Press **[MDI]** key to validate MDI mode.
2 Press **[POS]** key to make the current position screen appear, and check the current position.
3 Press **[PRGRM]** key to make the block operation screen appear and move the cursor "AXIS MOVE" with **[↓]** cursor key.
4 The axis is to be fed up to the specified position, enter **[0]** and press **[EOB/ENT]** key.

```
●AXIS MOVE        0  (0:DESIGNATE POS)
                     (1:W. ZERO  2:M. ZERO
                      3:M. ZERO (NO. 2)
                      4:M. ZERO (NO. 3))
```

5 Make sure that the cursor blinks on **[X]**, enter **[-50.]** and press **[EOB/ENT]** key.
Be sure to enter also a decimal point when entering a value.
A figure with or without decimal point has a totally different meaning:
Example)
With decimal point
[-50.]→-50mm
Without decimal point
[-50]→-0.050mm

```
●X   -50.000  ★Y ■■■■■■■■  ●Z ■■■■■■■■
```

6 Set the cursor on "FEED" with **[↓]** cursor key, enter **[0]** and press **[EOB/ENT]** key.

```
●FEED             0  (0:POSITIONING)
                     (1:CUTTING)
                     (2:TAPPING))
```

7 Press the START switch:
X axis moves.
8 Press **[POS]** key and check the position.

6.3 Setting Tools to Be Mounted on the Magazine (1)

This section desribes the magazine tool setting procedure, that is, which tool, from among those registered as tool list, should be set in what magazine number.
The setting method differs according to the mode of operation, manual operation, MDI operation and memory operation.

(1) In case of manual operation or MDI operation

1 Set the PROTECT switch on ' 0 ' position.
2 Press **[MDI]** key to validate MDI mode.
3 Press **[MAGZ]** key to make the magazine tool screen appear.
Among 01 to 26 and magazine numbers, highlighted ones indicate the number of the magazine that is positioned where tool replacement is possible.
The program number is displayed in the data input area.
4 Press **[F0]** key.
Tool setting mode is activated and the tool number is set in the data input area.
The cursor moves to spindle for models with a double-arm ATC.
The cursor moves to No.1 for models with an armless ATC.
5 Move the cursor to the magazine number for which a tool is to be set or of which tool is to be changed, with page and cursor keys.

Double-arm ATC display

```
                                        MAGAZN

●SP  01  C. DRILL   0. 000×90. 000  ■STD  TL
     TL  LIFE  *******  ■MAIN  TOOL

●01  02  DRILL      5. 000          ■STD  TL
     TL  LIFE  *******  ■MAIN  TOOL

●02  03  CBDRILL    5. 000          ■LRG  TL
     TL  LIFE  *******  ■MAIN  TOOL

●03                                 ■STD  TL
     TL  LIFE           ■MAIN  TOOL

●04                                 ■STD  TL
     TL  LIFE           ■MAIN  TOOL

PROGRAM  NO. →_

 0:CAP  SETTING

 TOOL
 NO.
 F0    F1    F2    F3    F4
```

Armless ATC display

```
                                                MAGAZN
●01  01 C. DRILL 0. 000×90. 000 ■STD TL
     TL LIFE ******* ■MAIN TOOL
●02  02 DRILL    5. 000         ■STD TL
     TL LIFE ******* ■MAIN TOOL
●03  03 CBDRILL 5. 000          ■LRG TL
     TL LIFE ******* ■MAIN TOOL
●04                             ■STD TL
     TL LIFE         ■MAIN TOOL
○05                             ■STD TL
     TL LIFE         ■MAIN TOOL
PROGRAM NO. →_
 0:CAP SETTING

    TOOL
    NO.
    SET

 F0   F1   F2   F3   F4
```

6 Enter one of the tool numbers registered on the tool list with **[numerical]** keys and press **[EOB/ENT]** key.
This operation validates the data entered.
The screen below shows that the tool number 4 is set in the magazine number 3.

7 Set the PROTECT switch on PRGRM position.

Double-arm ATC display

```
                                                MAGAZN
●SP  01 C. DRILL   0. 000×90. 000 ■STD TL
     TL LIFE ******* ■MAIN TOOL
●01  02 DRILL    5. 000         ■STD TL
     TL LIFE ******* ■MAIN TOOL
●02  03 CBDRILL  5. 000         ■LRG TL
     TL LIFE ******* ■MAIN TOOL
●03  04 S. TAP     M6. 000×1. 000 ■STD TL
     TL LIFE         ■MAIN TOOL
○04                             ■STD TL
     TL LIFE         ■MAIN TOOL
PROGRAM NO. →_

 0:CAP SETTING

 TOOL
 NO.

 F0   F1   F2   F3   F4
```

8 Mount the tool on the magazine number which has been set on the screen.

*If the tool is not registered on the tool list, be sure to register it in advance.
*If the dimensions and shape of the tools registered are different from those of the tools actually mounted on the magazine, there may be collision of tools, workpiece and jigs or an accident.
* Be sure therefore to make these 2 sets of data identical.
The cutting conditions are the following:

6.4 Drilling

This section describes the drilling setting procedure, taking an example:aluminum workpiece, ϕ 3.9mm hole at 145.0mm in Z axis.

Spindle speed: 2000rpm(min^{-1}), CW rotation
Feedrate : 200mm/min
Tool number : Drill No. 2, ϕ 3.9mm

1. Make sure that the coordinate system and coolant supply are correctly set.
2. Move in advance Z-axis (tip of the tool) at 155mm position.

Tool number is a number assigned to a tool registered on the tool list in the data bank and not a magazine number.

Fig. 6-1 Example of a workpiece undergoing a drilling

1 Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.
2 Set the cursor on "SPINDLE" with **[↓]** cursor key.
3 Enter **[1]** and press **[EOB/ENT]** key.
Make sure that the cursor blinks on "SPINDLE S." on the screen.

```
●SPINDLE        1  (0:STOP  1:CW  2:CCW)
★S. SPEED    ■■■■■  min⁻¹
```

4 Enter **[2000]** for spindle speed and press **[EOB/ENT]** key.
Make sure that the cursor blinks on "AXIS MOVE".

```
●S. SPEED     2000  min⁻¹
★AXIS MOVE       ■  (0:DESIGNATE POS
                     1:W. ZERO  2:M. ZERO
                     3:M. ZERO (NO. 2)
                     4:M. ZERO (NO. 3))
```

5 Enter **[0]** and press **[EOB/ENT]** key.

```
●AXIS MOVE        0  (0:DESIGNATE POS
                      1:W. ZERO  2:M. ZERO
                      3:M. ZERO (NO. 2)
                      4:M. ZERO (NO. 3))
```

6 Set the cursor on "Z" with **[↓]** cursor key.

7 Enter **[145.]** and press **[EOB/ENT]** key.

```
●AXIS MOVE        0  (0:DESIGNATE POS
                      1:W. ZERO  2:M. ZERO
                      3:M. ZERO (NO. 2)
                      4:M. ZERO (NO. 3))
●X ■■■■■■■■  ●Y ■■■■■■■■  ●Z   145.000
```

8 Set the cursor on "FEED" with **[↓]** corsor key.

9 Enter **[1]** and press **[EOB/ENT]** key.

Make sure that the cursor blinks on "FEEDRATE".

```
●FEED             1  (0:POSITIONING)
                     (1:CUTTING)
                     (2:TAPPING)
★FEEDRATE ■■■■■  mm/min
```

10 Enter **[200]** and press **[EOB/ENT]** key

```
●FEEDRATE      200  mm/min
```

11 Press the START switch.

The spindle starts revolving and then the cutting starts in Z axis.

12 Press **[POS]** key to make the current position screen appear and make sure that Z-axis position is 145.0.

6.5 Tapping

This section describes the tapping setting procedure, taking an example
:M4.5 × P0.75 hole at 145.0mm in Z axis.

The cutting conditions are the following:

Spindle speed: 2000rpm(min^{-1})
Tool number : No. 4 P tap, M4.5, Pitch=0.75mm
Primary hole : ϕ 3.9mm, 5mm deep

1. Make sure that the coordinate system and coolant supply are correctly set.
2. Move in advance Z-axis (tip of the tool) at 155mm position.
3. Before starting the operation, set the tap in the spindle.

Fig. 6-2 Example of a workpiece undergoing a tapping

1 Press **[MDI]** key to validate MDI mode and make the block operation screen appear on the display.
2 Set the cursor on "S. SPEED" with **[↓]** cursor key.
3 Enter **[1]** and press **[EOB/ENT]** key.
Make sure that the cursor blinks on "AXIS MOVE" on the screen.

```
●S. SPEED     2000 min⁻¹
★AXIS MOVE      ■  (0:DESIGNATE POS
                    1:W. ZERO  2:M. ZERO
                    3:M. ZERO (NO. 2)
                    4:M. ZERO (NO. 3))
```

4 Enter **[0]** and press **[EOB/ENT]** key.

```
●AXIS MOVE      0  (0:DESIGNATE POS
                    1:W. ZERO  2:M. ZERO
                    3:M. ZERO (NO. 2)
                    4:M. ZERO (NO. 3))
```

5 Set the cursor on "Z" with **[↓]** cursor key.

6 Enter **[145.]** and press **[EOB/ENT]** key.

```
●AXIS MOVE        ■  (0:DESIGNATE POS
                      1:W. ZERO 2:M. ZERO
                      3:M. ZERO(NO. 2)
                      4:M. ZERO(NO. 3))
●X ■■■■■■■■■ ●Y ■■■■■■■■■ ●Z   145.000
●A ■■■■■■■■■ ●B ■■■■■■■■■ ●RAD ■■■■■■
★FEED             ■  (0:POSITIONING)
                     (1:CUTTING)
                     (2:TAPPING)
```

7 Set the cursor on "FEED" with **[↓]** corsor key.

```
●FEED             2  (0:POSITIONING)
                     (1:CUTTING)
                     (2:TAPPING)
```

9 Press the START key.
The tapping starts in Z axis.
Upon completion of the operation, the tap returns automatically to the tapping starting position.

*During the tapping cycle, the tap is fed synchronously according to the tap pitch set in the tool list.
*Tapping step is exclusively of reducing type (step ratio: 100%).

6.6 Outline of Memory Operation and Its Procedure

This section describes the outline of the memory operation and its procedure.

6.6.1 Types of memory operation

(1) Cycle operation

Fully automatic execution of the works according to the instructions given in the program called. This cycle is used generally used to machine workpieces.

(2) Dry run operation

Automatic execution of the works according to the instruction given in the program called but with Z axis ordinate shifted toward its + direction.
This cycle allows a check of interference between tool, workpiece and jig to be made in ample safety. The shift amount is set with the user- parameter 1 (switch 1) in the data bank.

(3) Single operation

Execution of 1 action each time when the START switch is pressed.
This allows motion-by-motion program check.

(4) Machine lock

Although the machine does not actually operate at all, the machine operation can be simulated on the screen.
This function is used to check the program without operating the machine.

Precautions for models with quick table:
In case of pallet operation, the PALLET START switch should be pressed instead of the START switch for starting operation.

6.6.2 Memory operation procedure

Follow the procedure below to perform a memory operation correctly:
Before starting the operation, make sure:

that the tools and workpiece are correctly set.
that the doors and covers are firmly closed.
that there is no obstacle in the amchine motion area.
that there is no interference among tools, workpiece and jigs.

Register necessary data in the data bank.

Correctly register the tools on the tool list.

Machining data preparation

Tool reservation

Reserve the tools necessary for machining to the machining data. Refer to Tool Assignment Procedure in the Programming Manual.

Setting tools to be mounted on the magazine and installation

Set the tools necessary for machining on the magazine tool screen and set these tools correctly on the magazine.

Test operation

Check if the machining data is correct with respect to the operations required and if there is no interference among tool, workpiece and jigs. Refer to Test Operation. Refer to Cycle Operation.

*Dry run operation
* Single operation
* Machine lock

Machining (cycle operation)

6.7 Setting Tools to Be Mounted on The Magazine (2)

This section describes the tool setting procedure for the tools to be mounted on the magazine.

6.7.1 Assigning the main tool

1 Set the PROTECT switch on OFF position.
2 Press **[MDI]** key to validate the MDI operation mode.
3 Press **[MAGAZ]** key to make the magazine tool screen appear.
The cursor blinks on the number of the tool which is set in the spindle.

Double-arm ATC display

```
                                                    MAGAZN
●SP 01 C. DRILL5   0. 000×00. 000  ■STD TL
    TL LIFE      90M ■MAIN TOOL

●01 02 DRILL        5. 000         ■STD TL
    TL LIFE     500H ■MAIN TOOL

●02 03 S. TAP      M2. 000×0. 500  ■STD TL
    TL LIFE     100P ■MAIN TOOL

●03 04 P. TAP5     M1. 000×0. 250  ■STD TL
    TL LIFE  ******* ■MAIN TOOL

●04 05 P. TAP5     UNC1/2-13       ■STD TL
    TL LIFE  ******* ■MAIN TOOL

PROGRAM NO. →_

  TOOL
  NO.
  SET
  F0   F1   F2   F3   F4
```

PROGRAM NO. → is displayed in the data input area.

4 Enter a program number and press **[EOB/ENT]** key.

```
TOOL  NO. →

PROGRAM  1  01  C. DRILL     6
    1000 2  20  DRILL        7
         3  60  TOUCH  P     8
         4                   9
         5
                                        NEXT  MENU
```

The cursor moves to spindle for models with a double-arm ATC.
The cursor moves to No.1 for models with an armless ATC.
The tool names and the tool numbers registered on the tool list, necessary for a machining specified in a program, are displayed in the teach data area. If the tool is not registered on the tool list, be sure to register it in advance.
Refer to Setting Tools.

5 Move the cursor to the required magazine number, with page and cursor keys.
If the dimensions and shape of the tools registered are different from those of the tools actually mounted on the magazine, there may be collision of tools, workpiece and jigs or an accident.
Be sure therefore to make these 2 sets of data identical.

6 Enter the required tool numbers by referring to the tool names and the tool numbers registered on the tool list displayed in the teach data area and press **[EOB/ENT]** key.

7 Set the PROTECT switch on ON position.

8 Mount the tool in the magazine number for which the tool has been set.

6.7.2 Setting the spare tool

Spare tool is referred to as tool which, in case of expiration of the life of the main tool, substitutes the main tool without issueing alarm to resume the same operation as did the main tool.
This parameter cannot be set for the TC-S2A and TC-R2A, TC-20A, TC-S2B.

1 Set the PROTECT switch on OFF position.
2 Press **[MDI]** key.
3 Press **[MAGAZ]** key to make the magazine tool screen appear.
Move the cursor to the required main tool in the magazine number, with page and cursor keys.
The screen below shows that the tool No. 02 in the magazine No. 01 is taken as main tool and that the tool No. 15 in the magazine No. 05, as spare tool.

Double-arm ATC display

```
                                                    MAGAZN
●SP02 DRILL        3.900                ■STD TL
    TL LIFE      500H ■MAIN TOOL

●0104 P.TAP       M5.000×0.800          ■STD TL
    TL LIFE  ******* ■MAIN TOOL

●0203 DRILL        4.000                ■STD TL
    TL LIFE  ******* ■MAIN TOOL

●0311 DRILL        5.000                ■STD TL
    TL LIFE  ******* ■MAIN TOOL

●0415 DRILL        3.900                ■STD TL
    TL LIFE      500H □MAIN TOOL 02

MAIN TOOL NO.→_

  TOOL
  NO.
  SET
  F0    F1    F2    F3    F4
```

The number of the main tool is displayed in the data input area and main tool can be set.

4 Enter the number of the tool registered on the tool list, that is 02,with numerical keys and press **[EOB/ENT]** key.
The data is set in the MAIN TOOL on the screen.

```
●04 15 DRILL        3.900                ■STD TL
    TL LIFE      500H □MAIN TOOL 02

MAIN TOOLNO. →
```

* It is after the curent program is all completded that a main tool is replaced with a spare tool, in other words, a main tool is not replaced during a machining.
* The conditions before and after the machining, auxiliary functions, micro compensation (tool length and tool diameter) and swell remain all effective for a spare tool.

6.7.3 Setting tool type

Designate whether the tool to be registerde is large (55 mm or more in diameter) or standard. When a large tool is registered, the check boxes of the adjacent pots are marked with the prohibition symbol (X) and no tool can be registered to the adjacent pots.

1 Set the PROTECT switch on OFF position.
2 Press **[MDI]** key to validate the MDI operation mode.
3 Press **[MAGAZ]** key to make th emagazine tool screen appear.
4 When **[PROGRAM NO.→]** is displayed in the data entry area, enter the number of the desired program to be run using the numerical keys, and press the **[EOB/ENT]** key or **[F0]** key.
5 Move the cursor to the desired magazine tool type using th epage and cursor keys.
6 Enter **[1]** (standard tool) or **[2]** (large tool) and press the **[EOB/ENT]** key.
Standard tools: Tools with outer diameter smaller than 55 mm.
Large tools: Tools with outer diameter of 55 mm or larger.

```
                                                    MAGAZN
 ●SP 02 DRILL        3.900                          ■STD TL
     TL LIFE      500H  ■MAIN TOOL

 ●05 06 P.TAP5      UNC1/2-13                       ■STD TL
     TL LIFE  *******  ■MAIN TOOL

■●06                                                ■STD TL
     TL LIFE           ■MAIN TOOL

 ●07 26 EMIL.R      90.000                          □LRG TL
     TL LIFE  *******  ■MAIN TOOL

■●08                                                ■STD TL
     TL LIFE           ■MAIN TOOL

TOOL TYPE →_

 1:STANDARD TOOL
 2:LARGE AND HEAVY TOOL


  PROD
  NO.
  SET
  F0      F1      F2      F3      F4
```

6

7 Set the PROTECT switch on ON position.

When setting a large tool, check that no tools are registered to the adjacent pots.

When changing a large tool, be careful so that it does not make contact with other tools.

*** Function keys**

[F0]: PROG. NO. SET

This key has 2 functions depending on the current mode.

<In program request mode>

Tool number setting mode is selected.

<In tool, main tool number setting mode>

Program request mode is selected.

6.8 Test Operation

This section describes program and motion checks to be made before starting a cycle operation.
Be sure to perform a test operation before starting a memory operation.
After turning on the power supply, make sure that zero point return is performed.

Steps of test operation

1 Dry run and single operation
2 Single operation
3 Cycle operation

6.8.1 Dry run

Dry run allows a check of automatic operation in safety.
Dry run shifts any Z axis motion in absolute mode by the dry run offset amount set with the User-Parameter 1 from the programmed position.

Cutting feedrate is (max. speed of rapid traverse rate ~ max. rate of rapid traverse in manual conditions.)

* If the cutting feedrate calculated for dry run is smaller than the actual cutting feedrate, it is the latter that is effective.
* Even if the cutting speed calculated in dry run mode exceeds the value present for maximum cutting speed of each axis, accessed from Machine Parameter 1 (system 1), the preset value is considered maximum.

(1) Absolute motion

Suppose that dry run offset amount is 50mm. All Z-axis motions are shifted in the + direction by this value.
While the position to be reached is 13,000 on the screen, its actual value is 63.000.

Suppose also that the max. speed of rapid traverse set with the Machine Parameter 1 (system 1) is 50000mm/min and that max. rate of rapid traverse in manual conditions is 25%.

While the axis feedrate is 238mm/min on the screen, its actual value is 12500mm/min (25 % of 50000 mm/min).

```
●NOW MOTION                ●NEXT MOTION

DRL        Z    13.000     POS      Z    17.000
FEED         238mm/min
```

(2) Incremental motion

Incremental motion is not shifted by the dry run offset amount.

On the screen below, the title is reversed because it concerns an incremental motion. Z axis is fed downward by 27mm as programmed.

```
●NOW MOTION                ●NEXT MOTION

ATC TOOL NO. 42            INC MODE
POS     X    −10.000       SP CW      8000min⁻¹
        Y     −8.000       POS    Z    −27.000
```


(3) Dry run procedure

1 Press **[MEM]** key.
The program screen appears on the screen.

2 Enter "A PROGRAM NUMBER" and press **[EOB/ENT]** key.

3 Press **[DRY RUN]** key. When **[DRY RUN]** key is pressed, the lamp on it comes on.

4 Press the START switch.

(4) Dry run feedrate in tapping

Dry run feedrate in tapping is the max. tap revolving speed but is clamped by Z-axis max. rapid traverse set by the Machine Parameter 1 (system 1).

Example: Max. tapping speed : 4000rpm(min^{-1})
Z-axis max. feedrate : 3000mm/min
Pitch : 1mm

Tap feedrate in dry run
= Max. tap speed ×Pitch = 4000 ×1 = 4000mm/min

But dry run feedrate in tapping is clamped by Z-axis max. rapid traverse which is 3000mm/min, the resulting spindle speed is tapping feedrate/pitch = 3000/1 = 3000rpm(min^{-1})

6.8.2 Single operation

Each time the START switch is pressed, the program is executed motion by motion.1.

1 Press **[MEM]** key.

The program screen appears on the display.

2 Press **[SINGL RUN]** key. When **[SINGL RUN]** key is pressed, the lamp on it comes on.

3 Enter "A PROGRAM NUMBER" and press **[EOB/ENT]** key.
4 Each time the start switch is pressed, a motion of the program is executed.
(For pallet operation, press PALLET START switch only once for starting.)

6.8.3 Machine lock

This function is uesd to check the program without operating the machine.
Press the **[MACHINE LOCK]** key. The key lamp lights.
To release the **[MCHINE LOCK]** key, press the key again. The key lamp goes out.

Note

1. **When the [MCHINE LOCK] key is pressed, operation is reset. (The reset lamp lights, but edit and communication functions are not reset.)**
2. **The machine position on the <PRESENT POSITION> screen does not change.**
3. **Auxiliary functions are not executed.**
4. **The magazine tool cannot be changed even when tool changed even when tool change operation is performed.**
5. **The spindle does not move.**

6.9 Cycle Operation

All the motions programmed are executed consecutively.
This section describes the starting procedure of cycle operation.

1 Press **[MEM]** key.
The program screen appears on the display.

```
(PROGRAM 5000)                                MEMORY RUN
 ZERO    ■Z          100.000
         ■A                ?   ■B                    ?
●TOOL RETURN HEGHT               ■Hj            50.000
●NO. OF WORK PIECES              ■NO.                1
●WORKPIECE MATERIAL              ALUMINUM
■JOB 01 TAP                      ■TORSION           RH
 ●THRAD M5.000×0.800             ■DRLD           0.000
         ■CHAMFR       0.500
 ●PATRN SQUARE
         ■X         −150.000     ■Y          −120.000
 ●ZPOS   ■B.H.      THROUGH      ■DEP           15.000
         ■HGT         15.000     ■Ht            17.000
 ●XYPOS  ■X            0.000     ■Y              0.000
 ●P.F.   ■P.S.R.         100%    ■FEED.R.         100%

PROGRAM NO.  →_

   ●NOW MOTION                   ●NEXT MOTION
                                 COORDINATE SET
                                        X −200.000
                                        Y −100.000
                                        Z  100.000
                                 NEXT TOOL NO. 49
 START   PROG
 SET     LIST
 F0      F1      F2      F3      F4
```

2 Enter "A PROGRAM NUMBER" and press **[EOB/ENT]** key.
3 Before pressing the START switch, make sure that the lamps on **[SINGL RUN], [MACHINE LOCK]** and **[DRY RUN]** keys are off.
Press the START switch and all the processes programmed are automatically executed.

6.10 Memory Operation

This section describes the memory operation screen. The memory operation screen icludes 2 types of screens and they can be switched from one to another by pressing **[NEXT MENU]** key.

(1) Single operation

*** Execution point display mode**

Current position is displayed.

```
(PROGRAM  5000)                          MEMORY  RUN
 ZERO        ■Z          100.000
             ■A                   ?   ■B                 ?
●TOOL  RETURN  HEGHT                   ■Hj          50.000
●NO. OF  WORK  PIECES                  ■NO.              1
●WORKPIECE  MATERIAL                   ALUMINUM
■JOB  01  TAP                          ■TORSION         RH
 ●THRAD  M5.000×0.800                  ■DRLD         0.000
             ■CHAMFR      0.500
 ●PATRN  SQUARE
             ■X        −150.000   ■Y        −120.000
 ●ZPOS       ■B.H.      THROUGH   ■DEP        15.000
             ■HGT        15.000   ■Ht         17.000
 ●XYPOS      ■X           0.000   ■Y           0.000
 ●P.F.       ■P.S.R.        100%  ■FEED.R        100%

PROGRAM  NO.  →_
                                 ●NEXT  MACHINING
                                 JOB  NO. ------01
                                 TOOL  NO. -----01
                                 POS  NO. -----001
                                 PIECE  NO. ----01
                                 LINE  NO. -----01
                                 INFEED  NO. ---01
   START   PROG
   SET     LIST
   F0      F1      F2      F3      F4
```

6

When **[NEXT MENU]** key is pressed, machine motions are displayed in the lower part of the screen.

*** Motion display mode**

```
(PROGRAM  5000)                                MEMORY  RUN
 ZERO        ■Z          100.000
             ■A                ?   ■B                    ?
●TOOL  RETURN  HEGHT                ■Hj          50.000
●NO. OF  WORK  PIECES               ■NO.               1
●WORKPIECE  MATERIAL                ALUMINUM
□JOB  01  TAP                       ■TORSION          RH
 ●THRAD  M5.000×0.800               ■DRLD         0.000
             ■CHAMFR      0.500
 ●PATRN  SQUARE
             ■X        −150.000     ■Y        −120.000
 ●ZPOS       ■B. H.     THROUGH     ■DEP         15.000
             ■HGT        15.000     ■Ht          17.000
 ●XYPOS      ■X           0.000     ■Y            0.000
 ●P. F.      ■P. S. R.      100%    ■FEED. R       100%

PROGRAM  NO.  →_

                          ●NEXT  MOTION
                          COORDINATE  SET
                                X   −200.000
                                Y   −100.000
                                Z    100.000
                          NEXT  TOOL  NO. 49
   START   PROG
   SET     LIST
   F0      F1      F2      F3      F4
```

6

(2) Cycle operation

*** Execution point display mode**

```
(PROGRAM  5000)                                MEMORY  RUN
 ZERO        ■Z          100.000
             ■A                ?   ■B                  ?
●TOOL  RETURN  HEGHT                ■Hj          50.000
●NO. OF  WORK  PIECES               ■NO.              1
●WORKPIECE  MATERIAL                ALUMINUM
■JOB  01  TAP                       ■TORSION         RH
  ●THRAD  M5.000×0.800              ■DRLD         0.000
             ■CHAMFR       0.500
  ●PATRN  SQUARE
             ■X         −150.000     ■Y         −120.000
  ●ZPOS      ■B.H.       THROUGH     ■DEP         15.000
             ■HGT         15.000     ■Ht          17.000
  ●XYPOS     ■X            0.000     ■Y            0.000
  ●P.F.      ■P.S.R.        100%     ■FEED.R        100%
PROGRAM  NO.  →_

   ●NOW  MACHINING
   JOB  NO. ------01
   TOOL  NO. -----01
   POS  NO. -----001
   PIECE  NO. ----01
   LINE  NO. -----01
   INFEED  NO. ---01
    START    PROG
    SET      LIST
    F0       F1       F2       F3       F4
```

Pressing **[NEXT MENU]** key activates motion display mode and the data same as that for a single operation is displayed. Depending on the current command mode, absolute or incremental, the data under the titles NOW MOTION and NEXT MOTION changes automatically.

*** Absolute mode**

```
(PROGRAM  5000)                                MEMORY  RUN
 ZERO        ■Z          100.000
             ■A                ?   ■B                  ?
●TOOL  RETURN  HEGHT                ■Hj          50.000
●NO. OF  WORK  PIECES               ■NO.              1
●WORKPIECE  MATERIAL                ALUMINUM
■JOB  01  TAP                       ■TORSION         RH
  ●THRAD  M5.000×0.800              ■DRLD         0.000
             ■CHAMFR       0.500
  ●PATRN  SQUARE
             ■X         −150.000     ■Y         −120.000
  ●ZPOS      ■B.H.       THROUGH     ■DEP         15.000
             ■HGT         15.000     ■Ht          17.000
  ●XYPOS     ■X            0.000     ■Y            0.000
  ●P.F.      ■P.S.R.        100%     ■FEED.R        100%

PROGRAM  NO.  →_

   ●NOW  MOTION            ●NEXT  MOTION
   FEED   Z      13.000    POS    Z      17.000
            238mm/min

    START    PROG
    SET      LIST
    F0       F1       F2       F3       F4
```

***Incremental mode**

[NOW MOTION] and **[NEXT MOTION]** are highlighted.

```
(PROGRAM  5000)                                MEMORY  RUN
 ZERO  P  ■X        −100.000  ■Y        −100.000
          ■Z         100.000
          ■A                ?  ■B                ?
●TOOL  RETURN  HEGHT            ■Hj        100.000
●NO. OF  WORK  PIECES           ■NO.               1
●WORKPIECE  MATERIAL            SOFT  STEEL
■JOB  01  COOLANT               ■ON/OFF           ON
■JOB  02  MOTION  CALL          ■PATARN           ON
          ■TOOL  NO.        42
 ■BLK  01  POS−PATTERN
 ■BLK  02  ABS/INC−INC
 ■BLK  03  POS−Z+Sp             ■Ht        −27.000
          ■DROTN            CW  ■Y             8000
 ■BLK  04  ABS/INC−ABS

PROGRAM  NO.  →_

  ●NOW  MOTION                  ●NEXT  MOTION
  ATC  TOOL  NO. 42             INC  MODE
  POS     X      10.000         SP  CW      8000min⁻¹
          Y      10.000         POS     Z    −27.000
          Z     200.000

   START    PROG
   SET      LIST
   F0       F1       F2       F3       F4
```

6

6.11 Setting the Starting Point

This section describes how to start an operation at a mid-point of the program called.

Press **[NEXT MENU]** key to validate execution point display mode.

To set a starting point in the middle of a program, enter the necessary data in the items marked with l at the bottom left of the screen.

```
(PROGRAM 5000)                                MEMORY RUN
 ZERO     ■Z          100.000
          ■A                ?   ■B                    ?
●TOOL RETURN HEGHT               ■Hj            50.000
●NO. OF WORK PIECES              ■NO.                1
●WORKPIECE MATERIAL              ALUMINUM
□JOB 01 TAP                      ■TORSION           RH
 ●THRAD M5.000×0.800             ■DRLD           0.000
          ■CHAMFR      0.500
 ●PATRN SQUARE
          ■X         −150.000    ■Y          −120.000
 ●ZPOS    ■B.H.       THROUGH    ■DEP           15.000
          ■HGT         15.000    ■Ht            17.000
 ●XYPOS   ■X            0.000    ■Y              0.000
 ●P.F.    ■P.S.R.        100%    ■FEED.R          100%
PROGRAM NO. →_

 ●NOW MACHINING
 JOB NO. ------01
 TOOL NO. -----01
 POS NO. -----001
 PIECE NO. ----01
 LINE NO. -----01
 INFEED NO. ---01

  START   PROG
  SET     LIST
 F0      F1      F2      F3      F4
```

6.11.1 Display of start point setting

1) JOB NO. : Indicates the process currently executed.
2) TOOL NO. : Indicates the number of the tool currently used in the process. These numbers are different from the tool sequence in the tool pattern registered in the data bank.
3) POS NO. : Indicates the number of the position currently machined according to the hole machining pattern (periphery, square etc.).
4) PIECE NO. : Indicates the number of the workpiece currently machined on the table.
5) LINE NO. : Indicates the specified number of the motion in MOTION CALL process, the number of the line currently machined as shown below in FACING POCKET process, and the number of the connection currently executed in CONTOURING/CHAMFERING process.

Fig. 7-1 Line number-facing

Fig. 7-2 Line number-pocketing

6) INFEED : Indicates the number of the infeed currently executed in facing, contouring or pocketing.

Fig. 7-3 Infeed

6.11.2 Start point setting procedure

1 Press **[MEM]** key.
2 Enter "a program number" and press **[EOB/ENT]** key.
3 Press **[F0]** key.

```
START
SET
F0   F1   F2   F3   F4
```

4 Move the cursor to "JOB" with cursor key or enter a process number and press **[EOB/ENT]**key.
Data can be set for "JOB" with cursor keys even while setting other items. All the items other than the currently executed one will become 1.
5 Enter numbers for the machining start position with numerical keys for the items such as "TOOL NO.", "POS NO.", "PIECE NO.", "LINE NO." and "INFEED NO." and press **[EOB/ENT]** key.
6 Press the START switch.

```
(PROGRAM  5000)                          MEMORY  RUN
 ZERO        ■Z          100.000
             ■A                    ?    ■B                ?
●TOOL  RETURN  HEGHT                     ■Hj          50.000
●NO. OF  WORK  PIECES                    ■NO.              1
●WORKPIECE  MATERIAL                     ALUMINUM
■JOB  01  TAP                            ■TORSION         RH
 ●THRAD  M5.000×0.800                    ■DRLD         0.000
             ■CHAMFR      0.500
 ●PATRN  SQUARE
             ■X        −150.000           ■Y        −120.000
 ●ZPOS       ■B.H.      THROUGH           ■DEP         15.000
             ■HGT         15.000          ■Ht          17.000
 ●XYPOS      ■X            0.000          ■Y            0.000
 ●P.F.       ■P.S.R.        100%          ■FEED.R.       100%

PROGRAM  NO.  →_
  ●NOW  MACHINING
  JOB  NO. ------01
  TOOL  NO. -----01
  POS  NO. -----001
  PIECE  NO. ----01
  LINE  NO. -----01
  INFEED  NO. ---01

   START   PROG
   SET     LIST
F0   F1   F2   F3   F4
```

It is possible to search process, tool, machining position and workpiece number by specifying **[JOB] [/] [TOOL NO.] [/] [POS NO.] [/] [PIECENO.]**SERCH.

* This search is effective both in the program number setting mode and in the starting point setting mode.
* TOOL NO. is the order of the tools used in the process and not a real tool number.
* When a search is completed, the starting point setting mode is activated and the item set last is displayed in the data input area:

When the items up to JOB are specified → JOB
When the items up to TOOL NO.are specified → POS NO.
When the items up to POS NO. are specified → PIECE NO.
When the items up to PIECE NO. are specified → LINE NO.

* If [-] and a subprogram number are suffixed to the head of a sentense, the subprogram is searched.

6.11.3 Cautions on startng point setting

(1) Coordinate system setting

While it is possible to move the cursor to COORDINATE SET when setting the starting point, the operation cannot be started at the middle of a program even if the START switch is pressed.
If the START switch is pressed, the error occurs.
It is however possible to set the starting point in the following cases:

There is no cutting after the starting point is set in a coordinate system:

Coordinate system setting
Axis feed
■ End of main program

← Starting point can be set.

Coordinate system setting
Tapping
■ End of main program

← Starting point cannot be set.
The error occurs because the control cannot specify the tool with a tapping is to be started.
In such a case, set a starting point in the tapping. The information on coordinate system setting (coordinate system setting, return and signal output) is automatically added.

The data marked with code in the coordinate system setting is automatically added when a starting point is set.

Coordinate systemsetting ■Code 81
Tapping

← Setting a starting point here and pressing the START switch causes the signal of the code 81 to be sent to an external equipment.

Pay utmost care when starting an operation at the middle of a program by using an index table and making use of output signals in coordinate system setting.

(2) Motion call

1. It is safer to call individually a JOB and not to set a starting point in the motion call process.
2. When setting a starting point in the motion call process, pay utmost care to the motions before and after the starting point.

A motion call process sometimes includes absolute/incremental motion, tool diameter offset etc. which affect the following motions and processes. If a starting point is set for such motions, the resulting motions may differ from the ones programmed.

```
(PROGRAM 5000)                                MEMORY RUN
 ZERO P ■X        -100.000 ■Y        -100.000
        ■Z         100.000
        ■A                ? ■B                ?
●TOOL RETURN HEGHT          ■Hj        100.000
●NO. OF WORK PIECES         ■NO.              1
●WORKPIECE MATERIAL         SOFT STEEL
■JOB 01 COOLANT             ■ON/OFF          ON
■JOB 02 MOTION CALL         ■PATARN          ON
        ■TOOL NO.       42
 ■BLK 01 POS-PATTERN
 ■BLK 02 ABS/INC-INC
 ■BLK 03 POS-Z+Sp           ■Ht        -27.000
        ■DROTN          CW  ■Y            8000
 ■BLK 04 ABS/INC-ABS
 PROGRAM NO.  →_
 ●NOW MACHINING
 JOB NO. ------02
 TOOL NO. -----01
 POS NO. -----001
 PIECE NO. ----01
 LINE NO. -----03
 INFEED NO. ---01
  PROG.    PROG.
  NO.      LIST
  F0       F1       F2       F3       F4
```

"BLK3" on the screen above is an incremental motion but this motion becomes absolute if the starting point is set in "BLK3".
Tool diameter offset is executed in the line/center mode if a starting point is set in the following motions.

(3) Contouring and chamfering

In a contouring and chamfering, several consecutive blocks are set.
If a machining starting point is set at the middle of a consecutive block, the machining starts according to the approaching method initially set.
Check again that there is no interference between the tools and workpiece. It is safer to call individually a "JOB" and not to set a starting point in the motion call process.

Fig. 7-4 Normal tool path

07C02.doc

Fig. 7-5 Tool path when a starting point is set in the consecutive block 2.

07C01.doc

6.12 Running a Schedule Program

This section describes the schedule program running procedure.

1 Press **[MEM]** key. The program screen appears on the display.
Program numbers displayed on the screen have the following meaning:
(Program 9901/5000/01)
9901: Schedule program number
5000: Machining program number
01: Order of registration on schedule program

```
(PROGRAM 9901/5000/01)                    MEMORY RUN
 ZERO        ■Z          120.000
             ■A                   ?      ■B                    ?
●TOOL RETURN HEGHT                       ■Hj            80.000
●NO. OF WORK PIECES                      ■NO.                1
●WORKPIECE MATERIAL                      ALUMINUM
 JOB 01 TAP                              ■TORSION           RH
  ●THRAD M5.000×0.800                    ■DRLD           0.000
             ■CHAMFR     0.500
  ●PATRN SQUARE
             ■X        −150.000          ■Y         −120.000
  ●ZPOS      ■B.H.     THROUGH           ■DEP          15.000
             ■HGT       15.000           ■Ht           17.000
  ●XYPOS     ■X          0.000           ■Y             0.000
  ●P.F.      ■P.S.R.       100%          ■FEED.R          100%

PROGRAM NO.  →_

   ●NOW MOTION                  ●NEXT MOTION
                                COORDINATE SET
                                      X    −200.000
                                      Y    −100.000
                                      Z     100.000
                                NEXT TOOL NO.49
   START   PROG.
   SET     LIST
   F0      F1      F2      F3      F4
```

2 Enter a required schedule program number with numerical keys and press **[EOB/ENT]**key.

3 The memory operation starts when the START switch is pressed.
The machining programs registered in the schedule program are consecutively executed.

6.13 Setting a Schedule Program Number

This section describes 3 methods of schedule program number setting.

(1) Setting only a schedule program number

program number → **[9900] [EOB/ENT]**

In this setting, the operation starts with the first machining program in the schedule progam 9900.
Examples (2) and (3) show when a multiple number of 1002 are registered in schedule program 9900.

(2) Setting a specified machining program in a schedule program

program number → **[9900] [/] [1002] [EOB/ENT]**

In this setting, the operation starts with the machining program number 1002 registered first in the schedule program 9900.

(3) Setting programs in a specially registered order

program number → **[9900] [/] [1002] [/] [8] [EOB/ENT]**

In this setting, the operation is started with the machining program number 1002 registered eighth.
If it is not registered eighth, alarm occurs.
When the number identical to the machining program number registered in the schedule program does not exist, settings of (2) are acceptable.

6.14 Feed Hold and Emergency Stop

This section describes the feed hold and emergency during a memory operation.

6.14.1 Feed hold

Pressing the STOP switch causes a machine operation to stop temporarily and the lamp on the STOP switch to come on.
The STOP switch, if pressed during a tool change or tapping, does not cause a temporary stop.

(1) Temporary stop during a tool change

Temporary stop takes place when the tool change is completed.
If the tool change is programmed to be executed simultaneously with XY positionning, the XY positionning stops on the spot.

(2) Temporary stop during a tapping

* Temporary stop takes place when the tapping is completed.
* During any other operation except spindle rotation, temporary stop takes place immediately.

Pressing the START switch allows the operation to restart.

6.14.2 Emergency

(1) If the EMERGENCY STOP switch is pressed

If the EMERGENCY STOP switch is pressed, all the motions are stopped immediately. To restart, follow the procedure below:

1 Eliminate the cause of the emergency stop.
2 Reset the EMERGENCY STOP switch (by turning it in the direction of RESET).
3 Press **[RESET]** key.

(2) Restarting method for emergency stop caused during a tool change

1 Eliminate the cause of the emergency stop.
(If the EMERGENCY STOP switch is pressed, reset the EMERGENCY STOP switch (by turning it in the direction of RESET).
2 Press **[MANU]** key to validate the manual operation mode.
3 Press **[RESET]** key

<When the magazine rotates>

4 Press **[RESET]** key with **[RLSE]** key kept pressed.

5 Press **[SINGL MAGAZ]** key with **[RLSE]** key kept pressed.
The magazine is indexed to the next position.

6 Press **[-Z]** key with **[RLSE]** key kept pressed to position the spindle some lower than the machine zero point.

<During a motion other than magazine rotati.>

4 Press **[-Z]** key with **[RLSE]** key kept pressed to position the spindle some lower than the machine zero point.

(3) Restarting method for EMERGENCY STOP switch activation with a tap engaged in a workpiece

1 Loosen the tap holder.
2 Release the EMERGENCY STOP switch (by turning it in the direction of RESET).
3 Press **[MANU]** key to validate the manual operation mode.
4 Press **[RESET]** key.
5 Press and withdraw the tap from the tap holder.When the tap is set again in the spindle, be sure to measure its length.

Follow-up check

Even if the servo power supply is turned off for example by activating the EMERGENCY STOP switch, there is no need to perform again the zero point return.

Note

Refer to the "Alarm. Resetting ATC" for reset the ATC arm during rotation.

6.15 Reset

When an operation is reset, edit of machining data or other, memory operation, data input, block operation and automatic alignment are stopped.

Pressing **[RESET]** key during a memory operation, the operation stops temporarily, and when the operation is restarted, the machine starts again the machining at the head of the same program.

when the **[RESET]** key is pressed in schedule program operation mode, whether to return to the beginning of thecurrent macining program or the beginning of the schedule program can be designated by user parameter 1 (switch 1).

(1) Reset during a tool change

Reset takes place immediately after the tool change is completed.
If the tool change is programmed to be executed simultaneously with XY positionning, the XY positionning stops on the spot.

(2) Reset during a tapping

Reset takes place when the tapping is completed.

(3) Reset during a motion other than the motions above

The motion is stopped on the spot. The spindle is also stopped.

If **[RESET]** key is pressed in the schedule program operation mode, the head of the current program is taken again.

CHAPTER 7

DATA BANK

7.1 Overview of Data Bank
7.2 Data Input, Modification and Reference
7.3 Tool Registration
7.4 Setting Tool Pattern
7.5 Setting Primary Hole Drilling Diameter for Tapping
7.6 Setting Cutting and Tool Conditions
7.7 Setting User Parameters
7.8 Setting Machine Parameters
7.9 Data bank
7.10 Data bank (default value list)

7.1 Overview of Data Bank

The data bank is a repository for basic data for conversational programming and for machine operation.

(1) TOOL LIST

It is possible to register detailed data such as type, dimensions, shape and auxiliary code for up to 99 tools.If the tools necessary for a cutting given are not registered on the "TOOL MENU", the alarm is displayed on the screen and the memory operation cannot be performed. (Common to all the machining data)

(Example of use)

For a memory operation, "TOOL MENU" allows automatic selection of tools required for a type of cutting given.

(2) TOOL PATTERN

The types of tools and their order of use are stored.

(Example of use)

When a tapping is to be made, specifying only the tapping process allows automatic selection of types of tools and their order of use for that tapping.

Tapping 1 Center drill
2 Drill
3 Tap

(3) TAP PRIMARY HOLE DRILL DIAMETER

The primary hole diameters by type of screw are stored.

(Example of use)

When a tapping is to be made, specifying only the type of screw and its size allows automatic selection of tools for that tapping.

Metric unified screw

Tap primary hole drill diameter → M3.0 x 0.5 2.500 Tool list 2.500 diameter → drill

(4) CUTTING CONDITIONS

The cutting conditions other than peripheral speed, feedrate and tool condtions are stored by material and by tool.

(Example of use)

When a drilling is to be made, specifying only the material and type of the drill allows automatic determination of peripheral speed and feedrate.

S45C 2.5 diameter drill → Cutting condition 1 (drill) Peripheral speed 10m/min Feedrate 0.05mm/rev

(5) USER PARAMETER MACHINE PARAMETER

The parameters necessary for machine operation are stored.
Machining order, tool pattern, and cutting conditions of the machining data can be changed independently in program edit mode.(Individualization of machining data possible)
Refer to machining order,tool pattern and cutting cond in the Programming Manual.
The common machining order is set by switch 1 of the user parameters.
When the drill for primary tapping hole diameter is not registered in the <TOOL MENU> screen, an alarm appears and the memory operation cannot be performed. (Common to all machining data)

7.2 Data Input, Modification and Reference

This section desribes how to enter, modify and refer to the data stored in the data bank.

The data bank is a repository for different data necessary for machine operation.
Press **[DATA BANK]** key to make the data bank menu screen appear on the display.

Refer to TOOL PATTERN and CUTTING CONDITIONS in the Programming Manual.

7.3 Tool Registration

This section describes how to register the type, dimensions, shape and life of the tools necessny for a cutting given on the data bank.
While there are 20 types of tools and up to 99 tools can be registered, tools for the number of pots are available in memory operation.

1 Set the PROTECT switch on OFF position.
2 Press **[DATA BANK]** key to make the data bank menu screen appear on the display.
3 Enter **[1]** and press **[EOB/ENT**] key.
On the menu screen, it is also possible to select an option of the menu by setting the cursor on the required menu nurnber and pressing **[EOB/ENT]** key.
The cursor blinks on “TOOL NO”.
4 Set the cursor on a tool number required with Page and cursor keys. Numerical keys are also available for this purpose.

Searching function
[EXTEND/SEARCH] : Allows the cursor to be set on a tool in the tool list.
*Is available in both tool setting mode and tool number setting mode.
*When the search is completed, tool setting mode is validated and the cursor is positioned on “TOOL”.

*In tool number setting mode, the cursor can move to any tool number desired.
*In tool setting mode, the cursor can move to TYPE, DIMENSIONS and LIFE.

5 Press **[F1]** key: the cursor moves to “TOOL” on the screen and tool setting mode is validated. And 20 types of tools are displayed in the teach data area. Tools can be registered from now on.
*When **[NEXT]** key is pressed, 13th to 20th tools are displayed in the teach area.

```
TOOL →■

1. C. DRILL    6. H. TAP      11. STPDDRL
2. DRILL       7. R. TAP      12. DRLTAP
3. CBDRILL     8. CHFTOOL
4. S. TAP      9. CBRTOOL            NEXT MENU
5. P. TAP     10. CHFDRL      SERCH:TOOL NO.
```

6 Select a type of tool: enter its number with numerical keys and press **[EOB/ENT]** key.
Example: When selecting "2. DRILL", enter **[2]** key and then **[EOB/ENT]** key.

The cursor skips the *-marked items.
Be sure to enter also a decimal point when entering a value.
A figure with or without decimal point has a totally different meaning.

```
                                                TOOL MENU
TOOL NO.   ●10          ●11          ●12
TOOL       ■DRILL       ■            ■
```

7 According to the type of tool selected, the input items required are displayed on the screen. Enter the data on dimensions and shape with numerical keys and press **[EOB/ENT]** key.

Note: The tool data can be copied, pasted, or added using the corresponding function keys. See “Description of function keys” for details.

```
                                                TOOL MENU
TOOL NO.   ●10          ●11          ●12
TOOL       ■DRILL       ■            ■
POINT ANG■118.000       ■            ■
SMALL DIA■*             ■            ■
SMALL D. L■*            ■            ■
C. ANGLE   ■*           ■            ■
INEF L     ■*           ■            ■
DIAMETER   ■   5.000    ■            ■
PCH THR/I■*             ■            ■
FLUTE L    ■  45.000    ■            ■
TORSION    ■*           ■            ■
TEETH      ■*           ■            ■
OVERALL L■  80.000      ■            ■
INIT LIFE■   9999M      ■            ■
EXPIRING   ■   9999M    ■            ■
TOOL LIFE■   9999M      ■            ■
```

8 When the data entry is completed, press **[F0]** key.
The instruction for end mode is displayed in the teach data area. Follow this instruction to end the operation.
Press **[F0]** to register the data entered.

```
EDIT        CANCL       EDIT
END         EDIT        MODE
F0          F1          F2          F3          F4
```

9 The data bank menu screen appears again on the screen, which means thant the tool registration is completed and that the data has been registered.

10 Set PROTECT switch on ON position.

If tool dimensions or shape are modified, be sure to correct the data accordingly. And, in parallel with this correction, perform tool assignment check to see if the tool is usable.

Refer to Tool Assignment Procedure in the Programming manual

・If the dimensions and shape of the tools registered are different from those of the tools actually mounted on the magazine, there may be collision of tools, workpiece and jigs or an accident.
Be sure therefore to make these 2 sets of data identical.
・When storing the tools, apply an indentification label on them so as to make the actual tools identical with the tool data registered.

Description of function keys

(Functions assigned to the function keys in tool menu)

```
                                                TOOL MENU
TOOL NO.   10          11          12
TOOL       DRILL
POINT ANG  118. 000
SMALL DIA  *
SMALL D. L *
C. ANGLE   *
INEF L     *
DIAMETER     5. 000
PCH THR/I  *
FLUTE L     45. 000
TORSION    *
TEETH      *
OVERALL L   80. 000
INIT LIFE    9999M
EXPIRING     9999M
TOOL LIFE    9999M

TOOL NO. →_

                                SERCH:TOOL NO.

   EDIT     TOOL
   END      SET
   MODE
   F0       F1       F2       F3       F4
```

Tool number setting mode screen

```
                                                TOOL MENU
TOOL NO.   10          11          12
TOOL       DRILL
POINT ANG  118. 000
SMALL DIA  *
SMALL D. L *
C. ANGLE   *
INEF L     *
DIAMETER     5. 000
PCH THR/I  *
FLUTE L     45. 000
TORSION    *
TEETH      *
OVERALL L   80. 000
INIT LIFE    9999M
EXPIRING     9999M
TOOL LIFE    9999M

TOOL →_

 1. C. DRILL   6. H. TAP     11. STPDDRL
 2. DRILL      7. R. TAP     12. DRLTAP
 3. CBDRILL    8. CHFTOOL
 4. S. TAP     9. CBRTOOL          NEXT MENU
 5. P. TAP    10. CHFDRL     SERCH:TOOL NO.

   EDIT     TOOL
   END      NO.
   MODE     SET       COPY      PASTE
   F0       F1        F2        F3        F4
```

Tool number setting mode screen

(Functions assigned to the function keys in tool menu edit end mode)

```
                                                TOOL MENU
TOOL NO.   10          11          12
TOOL       DRILL
POINT ANG  118. 000
SMALL DIA  *
SMALL D. L *
C. ANGLE   *
INEF L     *
DIAMETER     5. 000
PCH THR/I  *
FLUTE L     45. 000
TORSION    *
TEETH      *
OVERALL L   80. 000
INIT LIFE    9999M
EXPIRING     9999M
TOOL LIFE    9999M

   EDIT              CANSEL            EDIT
   END               EDIT              MODE
   F0       F1       F2       F3       F4
```

[F0] : EDIT END MODE

This key validates the edit termination mode.
Terminate the edit according to the instruction of the function keys.

[F0] : EDIT END

Edited data is stored in memory.

[F2] : CANCEL EDIT

Edited data becomes ineffective and is not stored in memory.

[F4] : EDIT MODE

Edit mode is resumed.

[F1] : TOOL/TOOL NO. SET

This key validates the tool number setting mode, in which the cursor can be moved to a specified number in the tool list, or validates the tool setting mode, in which types and dimensions of tools are actually entered.

When the tool list is selected from the data bank menu screen, the tool number setting mode is displayed first. Set the tool number to edit and press **[F1]** key to enter the types and dimensions of tools.
When the cursor is placed at [TOOL] in tool setting mode

[F2]: COPY

The selected tool data can be copied.
In addition, the tool data can be cut using the **[DEL]** key on the operation panel and then copied using this key.
The copied data is retained until other data is copied or power is turned off.

[F3]: PASTE

The copied data can be pasted.
When the cursor is placed at any item other than [TOOL] in tool setting mode.

[F2]: ADD

Enter the value and press **[F2]**. The value is added to the current setting.
This function is not effective when the cursor is placed at [INIT LIFE], [EXPIRING], [TOOL LIFE], [DIAMETER], [TORSION], and [TEETH] on the <TOOL MENU> screen.

Data registration

Item	Description	Tool registration
TOOL NO.	Tool Registration No.: A maximum of 99 tools, From 1 to 99, can be registered.	
TOOL	Type of tool: Required tools can be selected of 20 types displayed in the teach data area.	
POINT ANGLE:a	Tool point angle	Center drill, Drill, Carbide drill, Chamfered Drill, Stepped drill, Drill Tap, Drill reamer
SMALL DIA: b	Tool point OD	Center drill, Chamfering drill, Couterboring tool, Chamfered drill, Stepped drill, Drill tap, Drill reamer, Chamfering mill, Centering tool
SMALL D.L: L	Extent of tool point OD	Center drill, Counterboring tool, Chamfered drill, Stepped drill, Drill tap, Drill reamer
INEFL: θ	Large diameter angle of center drill or tip angle of chamfering tool or chamferingmill	Center drill, Chamfering tool, Chamfered drill, Chamfering mill
C.ANGLE: L_o	Chamfer length *For a tap, specify the pitch or number of threads	Spiral tap, Point tap, Hand tap, Rolled tap, Drill tap, Reamer, Drill reamer, Chamfering tool
DIAMETER: D	Tool OD *For atap, specify the type of thread and size (OD)	All the tools except centering tool

Item	Description	Tool registration
PCH THR/I: P	Tap: Pitch Metric thread Number of threads Inch thread Number of threads per inch	Spiral tap, Point tap, Hand tap, Rolled tap, Drill tap
FLUTE: L	Cutter flute length	Drill, Carbide drill, Spiral tap, Point tap, Hand tap, Rolled tap, Counter-boring tool, Chamfered drill, Stepped drill, Drill tap, Reamer, Drill reamer, End mill R, End mill F, Carbide end mill R, Carbide end mill F
TORSION	Hand of thread: Specify the hand (right or left)	Spiral tap, Point tap, Hand tap, Rolled tap
TEETH	Number of cutter flutes for end mill or chamfring mill	End mill R, End mill F, Carbide end mill R, Carbide end mill F, Chamfering mill
OVERALL L: LL	Length from tool holder gauge line to tool end	All tools
INITIAL LIFE	Initial life of registered tool in minutes Four selections: 1 NO COUNT 2 TIME (MINUTES)(M) 3 NUMBER OF HOLES TO MACHINE(H) 4 NUMBER OF WORK PIECES(P)	All the tools except centering tool

7

Item	Description	Tool registration
EXPIRING	Set the value that alerts as to tool life expiration. When the tool life reaches this value, the **[TL LF EXPIRING]** alarm is displayed. When **[0]** is entered, tool life expiration is not alerted.	All the tools except centering tool
TOOL LIFE	Real life: If tool life expires during memory operation, the alarm is issued.	All the tools except centering tool

List of input items for tool registration

Item \ Tool	Chamfered drill	Chamfering tool	Counterboring tool	Rolled tap	Hand tap
POINT ANG α	○	○	○	○	＊
SMALL DIA b	○	＊	＊	＊	＊
SMALL D.L L	○	＊	＊	＊	＊
C.ANGLE θ	○	＊	＊	＊	＊
INEF L Lo	＊	＊	＊	○	○
DIAMETER D	○	○	○	○	○
PCH THR/I P	＊	＊	＊	○	○
FLUTE L L	＊	○	○	○	○
TORSION	＊	＊	＊	○	○
TEETH	＊	＊	＊	＊	＊
OVERALL L LL	○	○	○	○	○
INIT LIFE	○	○	○	○	○
EXPIRIG	○	○	○	○	○
TOOL LIFE	○	○	○	○	○

Item \ Tool	Point tap	Spiral tap	Carbide Drill Drill Center drill	Stepped tool	Center drill
POINT ANG α	＊	＊	＊	＊	○
SMALL DIA b	＊	＊	○	○	○
SMALL D.L L	＊	＊	＊	○	○
C.ANGLE θ	＊	＊	○	＊	○
INEF L Lo	○	○	○	＊	＊
DIAMETER D	○	○	○	○	○
PCH THR/I P	○	○	＊	＊	＊
FLUTE L L	○	○	＊	○	○
TORSION	○	○	＊	＊	＊
TEETH	＊	＊	＊	＊	＊
OVERALL L LL	○	○	○	○	○
INIT LIFE	○	○	○	○	○
EXPIRIG	○	○	○	○	○
TOOL LIFE	○	○	○	○	○

Tool / Item	Stepped drill	Drill tap	Remer	Drill reamer	End mill R (for rough finish)
POINT ANG α	○	○	＊	○	＊
SMALL DIA b	○	○	＊	○	＊
SMALL D.L L	○	○	＊	○	＊
C.ANGLE θ	＊	＊	＊	＊	＊
INEF L Lo	＊	○	○	○	＊
DIAMETER D	○	○	○	○	○
PCHTHR/I P	＊	○	＊	＊	＊
FLUTE L L	○	○	○	○	○
TORSION	＊	○	＊	＊	＊
TEETH	＊	＊	＊	＊	○
OVERALL L LL	○	○	○	○	○
INIT LIFE	○	○	○	○	○
EXPIRIG	○	○	○	○	○
TOOL LIFE	○	○	○	○	○

Tool / Item	End mill F (for finish)	Carbide end mill R (for rough finish)	Carbide end mill F (for finish)	Chamfering mill	Centering tool
POINT ANG α	＊	＊	＊	＊	＊
SMALL DIA b	＊	＊	＊	○	○
SMALL D.L L	＊	＊	＊	＊	＊
C.ANGLE θ	＊	＊	＊	○	＊
INEF L Lo	＊	＊	＊	＊	＊
DIAMETER D	○	○	○	○	＊
PCHTHR/I P	＊	＊	＊	＊	＊
FLUTE L L	○	○	＊	＊	＊
TORSION	＊	＊	＊	＊	＊
TEETH	○	○	○	○	＊
OVERALL L LL	○	○	○	○	○
INIT LIFE	○	○	○	○	＊
EXPIRIG	○	○	○	○	＊
TOOL LIFE	○	○	○	○	＊

Tool shape and dimensions

1. Center drill

2. Drill

3. Carbide drill

4. Spiral tap

5. Point tap

6. Hand tap

7. Rolled tap

8. Chamfering tool

9. Stepped tool

10. Chamfered drill

11. Counterbored drill

12. Drill tap

13. Reamer

14. Drill reamer

15. End mill R (rough finishing tool)

16. End mill F (finishing tool)

17. Carbide end mill R (rough finishing tool)

18. Carbide end mill F (finishing tool)

19. Chamfering mill

20. Centering tool

Tool length

7.3.1 Tool Registration With Auxiliary Code

This section desribes how to register tools with auxilary code.

When there are a same type of tools in plurality, these tools can be indentified with auxiliary code from 1 to 9.

1 Set the PROTECT switch on OFF position.
2 Press **[DATA BANK]** key to make the data bank menu screen appear on the screen. Suppose that we add an axiliary code 1 to a drill.
3 Enter **[1]** and press **[EOB/ENT]** key to make the tool list screen appear.
4 Move the cursor to the tool number to which the auxiliary code is to be added, with page or cursor key or by entering the tool number with numerical keys. Then press **[F1]** key to validate tool setting mode.

```
TOOL →_

1. C. DRILL    6. H. TAP      11. STPDDRL
2. DRILL       7. R. TAP      12. DRLTAP
3. CBDRILL     8. CHFTOOL
4. S. TAP      9. CBRTOOL            NEXT MENU
5. P. TAP     10. CHFDRL      SERCH:TOOL NO.
```


5 Set a drill with an auxiliary code.
The figure below shows that a drill is set for the tool number 11 and that the auxiliary code 1 set. According to the instruction, enter **[2]** (drill), **[-]** and **[1]** (auxiliary code), and press **[EOB/ENT]** key.

```
                                          TOOL MENU
TOOL NO.   ●10          ●11          ●12
TOOL       ■DRILL       ■DRILL1      ■
```

6 Register the dimensions and shape according to the tool list registration method.
7 Press **[F0]** key and end the edit mode according to the instruction given by the function key.
8 Set the PROTECT switch on ON position.

When an auxiliary code is set both in the tool list and the cutting conditions 1 and 2, the tools with the auxiliary code are assigned in tool assignment process.

7.3.2 Setting Tool Length

This section describes the procedure allowing automatic tool length calculation and automatic registration on the tool list.

Tool length can be calculated from the current position and the tool length compensation set in the User parameter 1, with the tool set in the spindle.

1 Set the PROTECT switch on OFF position.
2 Press **[MDI]** key to validate MDI mode.
3 Press **[MAGAZ]** key to make the magazine tool screen appear. Check if the tool, of which length is to be measured, is set in the spindle.
Refer to Setting Tools to Be Mounted on Magazine.
4 Set a tool of which length is to be measured in the spindle.
Refer to Changing tools.
5 Press **[DATA BANK]** key to make the data bank menu screen appear on the screen.
6 Enter **[5]** and press **[EOB/ENT]** key. The parameter menu screen appears.
7 Enter **[1]** and press **[EOB/ENT]** key.
The SWITCH screen appears on the display.
On menu screen, a required of the menu can be selected by moving the cursor to the required menu number with cursor key and by pressing **[EOB/ENT]** key.
8 Move the cursor to "TOOL LENGH OFFSET VALUE" with I **[B]** cursor key.


```
SWITCH1                                  USER PARAMETER

●MACHINING ORDER ····· 2
  (1:INDV JOB−1pc 2:INDV TOOL−1pc)
  (3:INDV JOB     4:INDV TOOL     )
  (5:INDV TOOL−COORD              )
●MODE SELECT (0:MANUAL 1:MEMORY) ···· 0

●MANUAL FEED(0:RAPID 1:JOG 2:STEP) ·· 0

●RESTART (0:STOP 1:RESTART) ····· 0

●WORK COUNTER WHEN RESTART ····· 0
  (0:INVALID 1:VALID)
●TOOL LIFE MANAGE WHEN RESTART ····· 0
  (0:NO 1:YES)
●TOOL LENGTH OFFSET VALUE ····· 50.000

MACHINING ORDER →_

  EDIT
  END
  MODE
  F0   F1   F2   F3   F4
```

Then enter the size A (height of the height presetter) and press **[EOB/ENT]** key.
This operation allows the tool length compensation to be set.
In the example below, tool length compensation is 50.
Be sure to enter also a decimal point when entering a value.
A figure with or without decimal point has a totally different meaning.
If the dimensions and shape of the tools registered are different from those of
The tools actually mounted on the magazine, there may be collision of tools, workpice and jig or an accident.
Be sure therefore to make these 2 sets of data identical.

```
●TOOL LENGTH OFFSET VALUE ·····50.000
```

9 When the operation is completed, press **[F0]** key and terminate the edit according to the instuction given in the teach data area by the function key.
10 Press **[MANU]** key to validate manual operation mode.
11 Move Z axis downward until the tip of the tool touches slightly the surface of the height presetter where tool length is measured.

12 Press **[TL.LNG]** key .
The lamp on **[DATA BANK]** key comes on.

```
TOOL LENGTH SETTING                    TOOL MENU

●MACHINE POS              TOOL NO.  ●01
                          TOOL      ■C. DRILL
    Z   152.000           POINT ANG■  90.000
                          SMALL DIA■   3.000
●TOOL LENGTH              SMALL D. L■   1.000
 OFFSET VALUE             C. ANGLE  ■  90.000
                          INEF L    ■*
         50.000           DIAMETER  ■  10.000
                          PCH THR/1 ■*
●TOOL LENGTH              FLUTE L   ■*
 AFTER SETTING            TORSION   ■*
                          TEETH     ■*
        102.000           OVERALL L ■150.000
                          INIT LIFE ■999999M
 SETTING OK?              EXPIRING  ■    100M
                          TOOL LIFE ■999999M

  YES      NO
 F0       F1       F2       F3       F4
```

7

13 Check the value of "TOOL LENGTH AFTER SETTING" on the screen.
To vali date this value, press **[F0]** key and not to validate, press **[F1]** key. In both cases, the data bank menu screen appears again.

14 Set the PROTECT switch on ON position.

7.3.3 Setting tool Life

Set LIFE TIME UNIT at first.

```
INIT LIFE□          ■          ■
EXPIRING ■          ■          ■
TOOL LIFE■          ■          ■

LIFE TIME UNIT →_

 1. NO COUNT
 2. TIME(MINUTES) (M)
 3. NUMBER OF HOLES TO MACHINE(H)
 4. NUMBER OF WORK PIECES(P)
                          SERCH:TOOL NO.
```

Each tool can have LIFE TIME UNIT.

Select the one among four items.

1. NO COUNT ———————— No tool managemnt is needed.
   (* is shoval on both INIT LIFE,TOOL LIFE EXPIRING and TOOL LIFE)
2. TIME(MINUTES) (M) ——— Managed by minutes.
   TOOL life is calculated down, minutes by minutcs as cutting feed time going on.
3. NUMBER OF HOLES TO MACHINE(H) —— Managed by holes Machined.
   Tool life is calculated down a hole by hole.
4. NUMBER OF WORK PIECES(P) ——— Managed by number of work pieces.
   After machining, Tool life is calculated down by totality.

After setting of LIFE TIME UNIT, cursol moves to INTIAL LIFE.

```
INIT LIFE■        M  ■          ■
EXPIRING ■       0M  ■          ■
TOOL LIFE■        M  ■          ■

INIT LIFE →_
```

INITIAL LIFE

Set the initial value of tool life.This value is not calulated down while machining.

The same value is set antomatically on “TOOL LIFE”.

After setting of INITIAL LIFE, cursol moves to TOOL LIFE EXPIRING.

TOOL LIFE EXPIRING

Set the value for **[EXPIRING]** so that an alarm is displayed before the tool life expires.

```
INIT LIFE■   8000M  ■          ■
EXPIRING        0M  ■          ■
TOOL LIFE■ ■ 8000M  ■          ■

TOOL LIFE EXPIRING →_
```

When '0' is entered for **[EXPIRING]**, no alarm is displayed.

After setting of TOOL LIFE EXPIRING, cursol moves to TOOL LIFE.

```
INIT LIFE■   8000M  ■          ■
EXPIRING ■     10M  ■          ■
TOOL LIFE□   8000M  ■          ■

TOOL LIFE →_
```

TOOL LIFE

Set real TOOL LIFE. It is calculated down while on maching, and at last alarm will occur when the tool has lost its life.

7.4 Setting Tool Pattern

This section describes how to set types and sequence of the tools to be used for machining. For one machining process, 2 machining patterns are available: with and without chamfer.

When assigning tools, the tools necessary for each cutting are automatically selected according to what is stored as tool pattern.

1 Set the PROTECT switch on OFF position.
2 Press **[MDI]** key to validate MDI mode.
3 Press **[DATA BANK]** key to make the data bank menu screen appear on the screen.
4 Enter **[2]** and press **[EOB/ENT]** key.
5 Move the cursor to the item to be modified, with page and cursor keys. In the example below, the cursor on "1.C.DRILL" with HOLE and W/CHAMFER. Perform one the operations below, next to the operation 5.

```
●HOLE        □ 1 C. DRILL    ■ 1 C. DRILL
             ■ 2 DRILL       ■ 2 DRILL
             ■ 3 CHFTOOL
```

<Deletion> The tool on the cursor is deleted.

6-1 Press **[DEL]** key. The tools indicated by the cursor is deleted and the next set of data comes in place of that tool.

```
●HOLE        □ 1 DRILL       ■ 1 C. DRILL
             ■ 2 CHFTOOL     ■ 2 DRILL
             ■ 3  * *
```

<Change> The tool indicated by the cursor is replaced with another type of tool.

6-1 Select the tool to be replaced in the teach data area: enter the tool number with numerical keys and press **[EOB/ENT]** key.

```
TOOL →

 1. C. DRILL   6. CHFTOOL    11. REAMER
 2. DRILL      7. CBRTOOL    12. DRLRMR
 3. CBDRILL    8. CHFDRL
 4. TAP        9. STPDDRL
 5. R. TAP    10. DRLTAP          NEXT MENU
```

On the screen below, change the 2 DRILL for TAP and W/ CHAMFER into 3 CARBIDE DRILL in the teach data area.

6-2 Enter **[3]** and press **[EOB/ENT]** key. This tool has been replaced.

When **[NEXT]** key is pressed, the tool numbers from 13 to 17 are displayed in the teach data area.

```
                 w／ CHAMFER      w／0 CHAMFER
●TAP             ■ 1 C. DRILL     ■ 1 C. DRILL
                 ■ 2 CBDRILL      ■ 2 DRILL
                 □ 3 CHFTOOL      ■ 3 TAP
                 ■ 4 TAP          ■ 4 ＊ ＊
                 ■ 5 ＊ ＊
```

<Insertion> A new tool is inserted right before the line indicated by the cursor.

6-1 Press **[INS]** key. The data is shifted forward by 1 line.

```
●HOLE            □ 1 ＊ ＊         ■ 1 C. DRILL
                 ■ 2 DRILL        ■ 2 DRILL
                 ■ 3 CHFTOOL
```

6-2 Select the tool to be inserted in the teach data area: enter the tool number with numerical key and press **[EOB/ENT]** key.

6-3 In the example above, a center drill is inserted. Enter **[1]** and press **[EOB/ENT]** key. The tool has been inserted.

```
●HOLE            ■ 1 C. DRILL     ■ 1 C. DRILL
                 □ 2 DRILL        ■ 2 DRILL
                 ■ 3 CHFTOOL
```

7 When <Deletion>, <Change> and <Insertion> are completed, press **[F0]** key and terminate the edit according to the instruction given by the function keys.

8 Set the PROTECT switch on ON position.

While the tools are automatically selected according to the initial setting pattern, this pattern should be modified in some cases according to the machining process.

Description of the function keys
(Functions assigned to the function keys in tool pattern edit)

```
                                TOOL PATTERN
          w/ CHAMFER            w/o CHAMFER

●C. HOLE                        ★ 1 C. DRILL

●HOLE     ■ 1 C. DRILL          ■ 1 C. DRILL
          □ 2 DRILL             ■ 2 DRILL
          ■ 3 CHFTOOL

●TAP      ■ 1 C. DRILL          ■ 1 C. DRILL
          ■ 2 CBDRILL           ■ 2 DRILL
          ■ 3 CHFTOOL           ■ 3 TAP
          ■ 4 TAP               ■ 4 * *
          ■ 5 * *

●R. TAP   ■ 1 C. DRILL          ■ 1 C. DRILL
          ■ 2 DRILL             ■ 2 DRILL

TOOL →

   EDIT   PREV.  NEXT
   END    PATRN  PATRN
   MODE
   F0     F1     F2     F3     F4
```

[F0]: EDIT END MODE
This key validates the edit termination mode.

[F1]: PREV. PATRN
The cursor moves to the head of the previous machining process.

[F2]: NEXT PATRN
The cursor moves to the head of the next machining process.

(Functions assigned to the function keys in tool menu edit end mode)

```
                                TOOL PATTERN
          w/ CHAMFER            w/o CHAMFER

●C. HOLE                        ★ 1 C. DRILL

●HOLE     ■ 1 C. DRILL          ■ 1 C. DRILL
          □ 2 DRILL             ■ 2 DRILL
          ■ 3 CHFTOOL

●TAP      ■ 1 C. DRILL          ■ 1 C. DRILL
          ■ 2 CBDRILL           ■ 2 DRILL
          ■ 3 CHFTOOL           ■ 3 TAP
          ■ 4 TAP               ■ 4 * *
          ■ 5 * *

●R. TAP   ■ 1 C. DRILL          ■ 1 C. DRILL
          ■ 2 DRILL             ■ 2 DRILL

TOOL →

   EDIT          CANCL         EDIT
   END           EDIT          MODE
   F0     F1     F2     F3     F4
```

[F0]

[F4]

[F0]: EDIT END
Edited data is stored in memory.

[F2]: CANCEL EDIT
Edited data becomes ineffective and is not stored in memory.

[F4]: EDIT MODE
Edit mode is resumed.

[F0] **[F2]**

DATA BANK MENU SCREEN

7

7.5 Setting Primary Hole Drilling Diameter for Tapping

This section describes how to set the drill diameter for a primary hole for tapping. Primary hole drill diameters are set for cutting and rolled tap and by type of thread, clasified by nominal diameters, pitches and number of threads.

1 Set the PROTECT switch on OFF position.
2 Press **[DATA BANK]** key to make the data bank menu screen appear on the display.
3 Enter **[3]** and press **[EOB/ENT]** key, and the TAP HOLE screen appears.
  8 types of screws have been registered.

On the menu screen, a menu number can be selected also by moving the cursor to the required number and by pressing **[EOB/ENT]** key.

```
TAP HOLE                                   DATA BANK

        SCREW THREADS MENU

        1. MC
        2. MF
        3. UNC
        4. UNF
        5. NPS
        6. BSP
        7. BSW
        8. BSF
        9. BA
       10. NPT
       11. SM
       12. S



MENU →_

   DATA
   BANK
   MENU

   F0      F1      F2      F3      F4
```

7

4 Enter the menu number of a screw required with numerical keys and press **[EOB/ENT]**key.
The screen below shows that "1. MC" is selected.

● M 1.0 × 0.25
↓ ↓ ↓
Type of thread / Nominal diameter / Pitch

● (Drilling) 0.750 ↓ Primary hole drill diameter for cutting tap
(Rolling) 0.880 ↓ Primary hole drill diameter for rolled tap

```
MC−SCREW THREAD                                TAP HOLE

                                  CUTTING      ROLLING
● M 1.0×0.25                      □ 0.750      ■ 0.800
● M 1.1×0.25                      ■ 0.850      ■ 0.980
● M 1.2×0.25                      ■ 0.950      ■ 1.080
● M 1.4×0.3                       ■ 1.110      ■ 1.260
● M 1.6×0.35                      ■ 1.300      ■ 1.440
● M 1.7×0.35                      ■ 1.400      ■ 1.540
● M 1.8×0.35                      ■ 1.500      ■ 1.640
● M 2.0×0.4                       ■ 1.650      ■ 1.820
● M 2.2×0.45                      ■ 1.800      ■ 1.990
● M 2.3×0.4                       ■ 2.000      ■ 2.120
● M 2.5×0.45                      ■ 2.100      ■ 2.300
● M 2.6×0.45                      ■ 2.200      ■ 2.400
● M 3.0×0.5                       ■ 2.500      ■ 2.770
● M 3.5×0.6                       ■ 3.000      ■ 3.210

DRILL DIA(CUT) →_

  END
  MODE
  F0      F1      F2      F3      F4
```

5 Move the cursor to the value to be modfified, with page and cursor keys.
6 Enter the primary hole drill diameter with numerical keys and press **[EOB/ENT]**key.
The screen below shows that the primary hole drill diameter for the metric coarse thread M1.1 x 0.25 is changed: from 0.850 to 0.900.

```
● M 1.1×0.25                      ■ 0.900      ■ 0.980
```

7 When the modification is completed, press **[F0]** key and end the edit according to the instruction given the function keys.
8 Set the PROTECT switch on ON position.

Description of the function keys
(Functions assigned to the function keys when editting tap primary hole drill diameter)

```
MC−SCREW THREAD                          TAP HOLE
                              CUTTING    ROLLING
● M 1.0×0.25                  ■ 0.750    ■ 0.880
● M 1.1×0.25                  ■ 0.850    □ 0.980
● M 1.2×0.25                  ■ 0.950    ■ 1.080
● M 1.4×0.3                   ■ 1.100    ■ 1.260
● M 1.6×0.35                  ■ 1.300    ■ 1.440
● M 1.7×0.35                  ■ 1.400    ■ 1.540
● M 1.8×0.35                  ■ 1.500    ■ 1.640
● M 2.0×0.4                   ■ 1.650    ■ 1.820
● M 2.2×0.45                  ■ 1.800    ■ 1.990
● M 2.3×0.4                   ■ 2.000    ■ 2.120
● M 2.5×0.45                  ■ 2.100    ■ 2.300
● M 2.6×0.45                  ■ 2.200    ■ 2.400
● M 3.0×0.5                   ■ 2.500    ■ 2.770
● M 3.5×0.6                   ■ 3.000    ■ 3.210

DRILL DIA(ROLL) →_

EDIT
END
MODE
F0   F1   F2   F3   F4
```

[F0]: EDIT END MODE
This key validates the edit termination mode.

(Functions assigned to the function keys in end mode for tap primary hole drill diameter)

```
MC−SCREW THREAD                          TAP HOLE
                              CUTTING    ROLLING
● M 1.0×0.25                  ■ 0.750    ■ 0.880
● M 1.1×0.25                  ■ 0.850    □ 0.980
● M 1.2×0.25                  ■ 0.950    ■ 1.080
● M 1.4×0.3                   ■ 1.100    ■ 1.260
● M 1.6×0.35                  ■ 1.300    ■ 1.440
● M 1.7×0.35                  ■ 1.400    ■ 1.540
● M 1.8×0.35                  ■ 1.500    ■ 1.640
● M 2.0×0.4                   ■ 1.650    ■ 1.820
● M 2.2×0.45                  ■ 1.800    ■ 1.990
● M 2.3×0.4                   ■ 2.000    ■ 2.120
● M 2.5×0.45                  ■ 2.100    ■ 2.300
● M 2.6×0.45                  ■ 2.200    ■ 2.400
● M 3.0×0.5                   ■ 2.500    ■ 2.770
● M 3.5×0.6                   ■ 3.000    ■ 3.210

EDIT      CANSEL      EDIT
END       EDIT        MODE
F0   F1   F2   F3   F4
```

[F0]
[F4]

[F0]: EDIT END
Edited data is stored in memory.

[F2]: CANCEL EDIT
Edited data becomes ineffective and is not stored in memory.

[F4]: EDIT MODE
Edit mode is resumed.

In an actual drilling, however, drilling allowance, depending on tool setting on tool holder, tool runout and tool shape, must be taken into consideration. Check carefully tool diameter and primary hole diameter.

[F0] [F2]

TAP PRIMARY HOLE DRILL DIAMETER MENU SCREEN

[F0]

DATA BANK MENU SCREEN

7.6 Setting Cutting and Tool Conditions

This section gives a description of how to set the cutting conditions and tool conditions according to workpiece material.
Cutting conditions can be set for the maximum of 19 types of tools.
Up to 10 types of workpiece materials can be set. Of these 10 types, 1 to 5 are preregistered and 6 to 10 remain free and can be set by user.

1 Set the PROTECT switch on OFF position.
2 Press **[MDI]** key to validate MDI mode.
3 Press **[DATA BANK]** key to make the data bank menu screen appear on the display.
4 Enter **[4]** and press **[EOB/ENT]** key: the workpiece material menu screen appears on the display.
5 Select the workpiece material for which the cutting conditions are to be set: enter its number with numerical keys and press **[EOB/ENT]** key.
For example, **[4]** (4.ALUMINUM) is selected here.

```
                                    CUTTING COND
    MATERIAL MENU

    1. SOFT STEEL
    2. HARD STEEL
    3. CAST BRASS
    4. ALUMINUM
    5. STAINLESS S.
    6. SPECIAL-1
    7. SPECIAL-2
    8. SPECIAL-3
    9. SPECIAL-4
   10. SPECIAL-5

  MENU →
```

6 The 3 types of cutting conditions, namely "HOLE TOOL, MILLING TOOL" and EXCEPT TOOL, appear on the display.

```
                                    CUTTING COND
  MATERIAL ALUMINUM


    CUTTING CONDITION MENU

    1. CUT COND 1 (HOLE TOOL)
    2. CUT COND 2 (MILLING TOOL)
    3. CUT COND 3 (EXCEPT TOOL)



MENU →
```

The setting procedure of these 3 conditions (1) to (3) are explained below:
On the menu screen, it is also possible to select an option of the menu by setting the cursor on the required menu number and pressing **[EOB/ENT]** key.

(1) CUT COND 1 (HOLE TOOL)

Enter tool name and its cutting conditions for holes.
Perform the following operations in succession to the procedure above 1 to 3.

7 Enter **[1]** and press **[EOB/ENT]** key.
The cursor on "C.DRILL".

```
                                    CUTTING COND
 1
  MATERIAL ALUMINUM
                                  m/min   mm/rev
 ●C. DRILL TRV□C. DRILL          ■ 30.0  ■0.10
           CRF                   ■       ■
```

8 Move the cursor to the required tool, peripheral speed or feedrate with page and cursor keys.

9 Enter a new value and press **[EOB/ENT]** key.
Be sure to enter also a decimal point when entering a value.
A figure with or without decimal point has a totally different meaning.

10 Press **[F0]** key. Follow the instruction given by the function key, to end the operation.

11 Set the PROTECT switch on ON position.

(2) CUT COND. 2 (MILLING TOOL)

Enter tool name and its cutting conditions for milling. Perform the following operations in succession to the procedure above *1* to *6*.

7 Enter **[2]** and press **[EOB/ENT]** key.
The cursor on "E.MIL R (ROUGH)".

```
                                        CUTTING COND2
 MATERIAL   ALUMINUM
                                       m/min  mm/Teeth
●EMIL R   TRV□EMIL R                  ■ 50.0 ■0.050
 (ROUGH)  CRF                         ■ 50.0 ■0.100
 (HOL. CBR)

●EMIL R   TRV*                        ■ 75.0 ■ 0.050
 (FINISH) CRF                         ■ 75.0 ■ 0.050

●EMIL F   TRV■                        ■ 55.0 ■ 0.050
 (ROUGH)  CRF                         ■ 55.0 ■ 0.010

●EMIL F   TRV*                        ■ 75.0 ■ 0.050
 (FINISH) CRF                         ■ 75.0 ■ 0.050
 (HOL. CBR)


TOOL →

15. EMIL R
16. EMIL F
17. CBEMILR
18. CBEMILF
19. CHFCTR
```

8 Move the cursor to the required tool, peripheral speed or feedrate with page and cursor keys.

9 Enter a new value and press **[EOB/ENT]** key.

Be sure to enter also a decimal point when entering a value.
A figure with or without decimal point has a totally different meaning:
Example)
With decimal point
[53.]→53.0
Without decimal point
[53]→5.3

10 Press **[F0]** key. Follow the instruction given by the function key , to end the operation.

11 Set the PROTECT switch on ON position.

(3) CUT COND. 3 (EXCEPT TOOL)

Enter the conditions other than tool conditions.Perform the following operations in succession to the procedure above *1* to *6*.

7 Enter **[3]** and press **[EOB/ENT]** key.
The cursor on "STOP POS FORWARD WORK (HOLE)".

```
                                    CUTTING COND3
 MATERIAL   ALUMINUM
●STOP POS FORWORD WORK(HOLE) ·· 2.000
●STOP POS FORWORD WORK(FACNG)·· 2.000
●STOP POS FORWORD WORK(POCKT)·· 2.000
●LENGTH AFTER THROUGH CUT····· 2.000
●CHAMFERING CUTTER POSITION···· 2.000
●TAP PRIMARY HOLE DEPTH····· 6.000
●REAMER PRIMARY HOLE DEPTH····· 1.000

STOP POS (HOLE) →

 F0    F1    F2    F3    F4
```

8 Move the cursor to the required cutting conditions with page and cursor keys.

9 Enter a new value and press **[EOB/ENT]** key.

10 Press **[F0]** key. Follow the instruction given by the function key, to end the operation. Pressing **[FUNC]** key provides the display of the function assigned to the function keys.

11 Set the PROTECT switch on ON position.

Description of the function keys
(Functions assigned to the function keys when editing cutting conditions)

```
                                        CUTTING COND1
 MATERIAL   ALUMINUM
                                        m/min    mm/rev
●C. DRILL  TRV□C. DRILL                ■ 30. 0  ■0. 10
           CRF                         ■        ■

●DRILL     S.  ■DRILL                  ■ 50. 0  ■
        L.                             ■ 50. 0  ■

●CBDRILL   S.  ■CBDRILL                ■100. 0  ■
        L.                             ■100. 0  ■

●TAP       S.  ■S. TAP                 ■ 35. 0  ＊
  (BLD)    L.                          ■ 40. 0  ＊

●TAP       S.  ■P. TAP                 ■ 30. 0  ＊
  (THR)    L.                          ■ 40. 0  ＊

 TOOL →

   EDIT    PREV.   NEXT
   END     TOOL    TOOL
   MODE
   F0      F1      F2      F3      F4
```

[F0]: EDIT END MODE
This key validates the edit termination mode.

[F1]: PREV. TOOL
The cursor moves to the preceding tool (for only the cutting conditions 1 and 2).

[F2]: NEXT TOOL
The cursor moves to the next tool (for only the cutting conditions 1 and 2).

[F0]

[F4]

(Functions assigned to the function keys in cutting condition edit end mode)

```
                                        CUTTING COND1
 MATERIAL   ALUMINUM
                                        m/min    mm/rev
●C. DRILL  TRV□C. DRILL                ■ 30. 0  ■0. 10
           CRF                         ■        ■

●DRILL     S.  ■DRILL                  ■ 50. 0  ■
        L.                             ■ 50. 0  ■

●CBDRILL   S.  ■CBDRILL                ■100. 0  ■
        L.                             ■100. 0  ■

●TAP       S.  ■S. TAP                 ■ 35. 0  ＊
  (BLD)    L.                          ■ 40. 0  ＊

●TAP       S.  ■P. TAP                 ■ 30. 0  ＊
  (THR)    L.                          ■ 40. 0  ＊

   EDIT            CANCL           EDIT
   END             EDIT            MODE
   F0      F1      F2      F3      F4
```

[F0]: EDIT END
Edited data is stored in memory.

[F2]: CANCEL EDIT
Edited data becomes ineffective and is not stored in memory.

[F4]: EDIT MODE
Edit mode is resumed.

[F0] **[F2]**

CUTTINGCONDITIONMENUSCREEN

[F0]

MATERIALMENUSCREEN

[F0]

DATABANKMENUSCREEN

7.7 Setting User Parameters

This section describes the user parameter modifying procedure.

1 Set the PROTECT switch on OFF position.

2 Press **[DATA BANK]** key to make the data bank menu screen appear on the display.

3 Enter **[5]** and press **[EOB/ENT]** key.
On the menu screen, it is also possible to select an option of the menu by setting the cursor on the required menu nurnber and pressing **[EOB/ENT]** key.

```
USER PARAMETER                          DATA BANK
        USER PARAMETER MENU
        1. SWITCH 1
        2. SWITCH 2
        3. COMMUNICATION
        4. EXTRL IN SIGNAL
        5. EXTRL OUT SIGNAL
        6. Z MEASUREMENT
        7. ZERO MEASUREMENT
        8 AUTO THRM DISP CMP
        9. QUICK TABLE
MENU →_
   DATA
   BANK
   MENU
   F0    F1    F2    F3    F4
```

4 Enter the required menu number and press **[EOB/ENT]** key.
Suppose that the data on “1: SWITCH 1” is to be modified.

5 Move the cursor to the item to be modified, with Page and cursor keys, enter the required data and press **[EOB/ENT]** key.

6 When the data setting is completed, press **[F0]** key and end the operation by following the instuction given by the function key.

7 Setthe PROTECT switch on ON position.

Description of the function keys
(Functions assigned to the function keys when editting parameters)

```
SWITCH1                          USER PARsAMETER
●MACHINE ORDER ····· *
 (1:INDV JOB-1pc 2:INDV TOOL-1pc)
 (3:INDV JOB     4:INDV TOOL     )
 (5:INDV TOOL-COORD              )
●MODE SELECT (0:MANUAL 1:MEMORY) ····· *
●MANUAL FEED(0:RAPID 1:JOG 2:STEP) ··· *
●RESTART (0:STOP 1:RESTART) ····· *
●WORK COUNTER WHEN RESTART ····· *
 (0:INVALID 1:VALID)
●TOOL LIFE MANAGE WHEN RESTART ····· *
 (0:NO 1:YES)
●TOOL LENGTH OFFSET VALUE ····· ***.***
RESTART →_

EDIT
END
MODE
F0  F1  F2  F3  F4
```

[F0]: EDIT END MODE
This key validates the edit termination mode.

[F0]

[F4]

```
SWITCH1                          USER PARAMETER
●MACHINE ORDER ····· *
 (1:INDV JOB-1pc 2:INDV TOOL-1pc)
 (3:INDV JOB     4:INDV TOOL     )
 (5:INDV TOOL-COORD              )
●MODE SELECT (0:MANUAL 1:MEMORY) ····· *
●MANUAL FEED(0:RAPID 1:JOG 2:STEP) ··· *
●RESTART (0:STOP 1:RESTART) ····· *
●WORK COUNTER WHEN RESTART ····· *
 (0:INVALID 1:VALID)
●TOOL LIFE MANAGE WHEN RESTART ····· *
 (0:NO 1:YES)
●TOOL LENGTH OFFSET VALUE ····· ***.***

EDIT        CANSEL      EDIT
END         EDIT        MODE
F0  F1  F2  F3  F4
```

[F0]: EDIT END
Edited data is stored in memory.

[F2]: CANCEL EDIT
Edited data becomes ineffective and is not stored in memory.

[F4]: EDIT MODE
Edit mode is resumed.

[F0] **[F2]**

USER PARAMETER MENU SCREEN

[F0]

DATA BANK MENU SCREEN

7

7.8 Setting Machine Parameters

This section describes the machine parameter modifying procedure.

1 Set the PROTECT switch on OFF position.
2 Press **[I/O]** key to make the input/output menu screen appear on the display.
3 Enter **[1]** and press **[EOB/ENT]** key: the input/output menu screen apeears on the display.
On the menu screen, it is also possible to select an option of the menu by setting the cursor on the required menu nurnber and pressing **[EOB/ENT]** key.
4 Press page key to make the ROM Version screen appear on the display.
5 Move the cursor to **[PARAMETER CHANGE]** using the cursor keys.
6 Press the **[1]** and **[EOB/ENT]** keys to enable a machine parameter change.
7 Press **[DATA BANK]** key to make the data bank menu screen appear on the display.
8 Enter **[6]** and press **[EOB/ENT]** key: the machine parameter menu screen apoears on the display.

```
MACHINE PARAMETER                    DATA BANK
        MACHINE PARAMETER MENU
        1. SYSTEM 1
        2. SYSTEM 2
        3. SYSTEM 3
        4. PITCH ERROR OFFSET
        5. SERVO
        6. AUTO THRM DIS CMP

MENU →_
   DATA
   BANK
   F0   F1   F2   F3   F4
```

9 Enter the required menu number and press **[EOB/ENT]** key.
Suppose that the data on “1: SYSTEM 1” is to be modified.
10 Move the cursor to the item to be modified, with Page and cursor keys, enter the required data and press **[ENT]** key.
11 When the data setting is completed, press **[F0]** key and end the operation by following the instuction given by the function key.
12 Set the PROTECT switch on ON position.

Description of the function keys
(Functions assigned to the function keys when editting parameters)

```
SYSTEM1                    MACHINE PARAMETER
●BACKLASH VALUE X ..................... ***
●BACKLASH VALUE Y ..................... ***
●BACKLASH VALUE Z ..................... ***
●STROKE1 X(−) ..................... −****. ***
●STROKE1 Y(−) ..................... −****. ***
●STROKE1 Z(−) ..................... ****. ***
●STROKE1 X(+) ..................... −****. ***
●STROKE1 Y(+) ..................... −****. ***
BACKLASH VALUE X →_

DATA
BANK
MENU
F0   F1   F2   F3   F4
```

[F0]: EDIT END MODE
This key validates the edit termination mode.

[F0]

[F4]

```
SYSTEM1                    MACHINE PARAMETER
●BACKLASH VALUE X ..................... ***
●BACKLASH VALUE Y ..................... ***
●BACKLASH VALUE Z ..................... ***
●STROKE1 X(−) ..................... −****. ***
●STROKE1 Y(−) ..................... −****. ***
●STROKE1 Z(−) ..................... ****. ***
●STROKE1 X(+) ..................... −****. ***
●STROKE1 Y(+) ..................... −****. ***

EDIT      CANCEL      EDIT
END       EDIT        MODE
F0   F1   F2   F3   F4
```

[F0]: EDIT END
Edited data is stored in memory.

[F2]: CANCEL EDIT
Edited data becomes ineffective and is not stored in memory.

[F4]: EDIT MODE
Edit mode is resumed.

[F0] [F2]

MACHINE PARAMETER MENU SCREEN

[F0]

DATA BANK MENU SCREEN

7

7.9 Data Bank

7.9.1 Tool pattern

The tool pattern as shown below is initially set for each machining process before shipment. Modify the tool pattern as required according to the tools, workpiece materials to be used.

Process	With chamfer	Without chamfer
Center hole drilling		1 Center drill
Drilling	1 Center drill 2 Drill 3 Chamfering tool	1 Center drill 2 Drill
Tapping	1 Center drill 2 Drill 3 Chamfering tool 4 Tap 5	1 Center drill 2 Drill 3 Tap 4
Tappingby rolled tap	1 Center drill 2 Drill 3 Chamfering tool 4 Rolled tap 5	1 Center drill 2 Drill 3 Rolled tap 4
Reaming	1 Center drill 2 Drill 3 Chamfering tool 4 End mill R 5 Reamer	1 Center drill 2 Drill 3 End mill R 4 Reamer
Counterboring	1 Center drill 2 Drill 3 Counterboring tool 4 Chamfering tool	1 Center drill 2 Drill 3 Counterboring tool

Process	With chamfer	Without chamfer
Counterbore tapping	1 Center drill 2 Drill 3 Counterboring tool 4 Chamfering tool 5 Tap 6	1 Center drill 2 Drill 3 Counterboring tool 4 Tap 5
Counterbore tapping by rolled tap	1 Center drill 2 Drill 3 Counterboring tool 4 Chamfering tool 5 Rolled tap 6	1 Center drill 2 Drill 3 Counterboring tool 4 Rolled tap 5
Counterborereamer	1 Center drill 2 Drill 3 Counterboring tool 4 Chamfering tool 5 End mill R 6 Reamer	1 Center drill 2 Drill 3 Counterboring tool 4 End mill R 5 Reamer
Face milling	———	1 End mill R
Facing	———	1 End mill R 2 End mill F
Pocketing	1 End mill R 2 End mill F 3 Chamferingmill	1 End mill R 2 End mill F
Counterboring	———	1 End mill R 2 End mill F
Chamfering	1 Chamferingmill	———

7.9.2 Drill diameters for tapping primary hole

The values as shown below are intially set before shipment.
Modify the values as required according to the tools and workpiece materials to be used.

1. Metric coarse screw

Nominal pitch			Drill hole dia.
M	1.0	× 0.25	0.750(0.0295)
M	1.1	× 0.25	0.850(0.0335)
M	1.2	× 0.25	0.950(0.0374)
M	1.4	× 0.3	1.100(0.0433)
M	1.6	× 0.35	1.300(0.0512)
M	1.7	× 0.35	1.400(0.0551)
M	1.8	× 0.35	1.500(0.0591)
M	2.0	× 0.4	1.650(0.0650)
M	2.2	× 0.45	1.800(0.0709)
M	2.3	× 0.4	2.000(0.0787)
M	2.5	× 0.45	2.100(0.0827)
M	2.6	× 0.45	2.200(0.0866)
M	3.0	× 0.5	2.500(0.0984)
M	3.5	× 0.6	3.000(0.1181)
M	4.0	× 0.7	3.300(0.1289)
M	4.5	× 0.75	3.800(0.1496)
M	5.0	× 0.8	4.300(0.1693)
M	6.0	× 1.0	5.100(0.2008)
M	7.0	× 1.0	6.100(0.2402)
M	8.0	× 1.25	6.800(0.2677)
M	9.0	× 1.25	7.800(0.3386)
M	10.0	× 1.5	8.600(0.3386)
M	12.0	× 1.75	10.400(0.4130)
M	14.0	× 2.0	12.200(0.4844)
M	16.0	× 2.0	14.200(0.5625)
M	18.0	× 2.5	15.700(0.6181)
M	20.0	× 2.5	17.700(0.6969)
M	22.0	× 2.5	19.700(0.7756)
M	24.0	× 3.0	21.200(0.8346)
M	27.0	× 3.0	24.200(0.9528)
M	30.0	× 3.5	26.700(1.0512)

2. Metric fine screw

Nominal pitch			Drill hole dia.
m	1.0	× 0.2	0.800(0.0315)
m	1.1	× 0.2	0.900(0.0354)
m	1.2	× 0.2	1.000(0.0394)
m	1.4	× 0.2	1.200(0.0472)
m	1.6	× 0.2	1.400(0.0551)
m	1.8	× 0.2	1.600(0.0630)
m	2.0	× 0.25	1.800(0.0709)
m	2.2	× 0.25	2.000(0.0787)
m	2.5	× 0.35	2.200(0.0866)
m	3.0	× 0.35	2.700(0.1063)
m	3.5	× 0.35	3.200(0.1260)
m	4.0	× 0.5	3.500(0.1378)
m	4.5	× 0.5	4.000(0.1575)
m	5.0	× 0.5	4.500(0.1772)
m	5.5	× 0.5	5.000(0.1969)
m	6.0	× 0.75	5.300(0.2087)
m	7.0	× 0.75	6.300(0.2480)
m	8.0	× 1.0	7.100(0.2795)
m	8.0	× 0.75	7.300(0.2874)
m	9.0	× 1.0	8.100(0.3189)
m	9.0	× 0.75	8.300(0.3268)
m	10.0	× 1.25	8.800(0.3465)
m	10.0	× 1.0	9.100(0.3583)
m	10.0	× 0.75	9.300(0.3661)
m	12.0	× 1.5	10.600(0.4219)
m	12.0	× 1.25	10.800(0.4331)
m	12.0	× 1.0	11.100(0.4375)
m	14.0	× 1.5	12.600(0.5000)
m	14.0	× 1.0	13.100(0.5156)
m	15.0	× 1.5	13.600(0.5469)
m	15.0	× 1.0	14.100(0.5625)
m	16.0	× 1.5	14.600(0.5781)
m	16.0	× 1.0	15.100(0.5938)
m	17.0	× 1.5	15.600(0.6250)
m	17.0	× 1.0	16.100(0.6406)
m	18.0	× 2.0	16.200(0.6406)
m	18.0	× 1.5	16.600(0.6562)
m	18.0	× 1.0	17.100(0.6719)

2. Metric fine screw (cont.)

Nominal pitch			Drill hole dia.
m	20.0	×2.0	18.200(0.7165)
m	20.0	×1.5	18.600(0.7331)
m	20.0	×1.0	19.100(0.7531)
m	22.0	×2.0	20.200(0.7953)
m	22.0	×1.5	20.600(0.8118)
m	22.0	×1.0	21.100(0.8319)
m	24.0	×2.0	22.200(0.8740)
m	24.0	×1.5	22.600(0.8906)
m	24.0	×1.0	23.100(0.9106)
m	25.0	×2.0	23.200(0.9134)
m	25.0	×1.5	23.600(0.9299)
m	25.0	×1.0	24.100(0.9500)
m	26.0	×1.5	24.600(0.9693)
m	27.0	×2.0	25.200(0.9921)
m	27.0	×1.5	25.600(1.0087)
m	27.0	×1.0	26.100(1.0287)
m	28.0	×2.0	26.200(1.0315)
m	28.0	×1.5	26.600(1.0480)
m	28.0	×1.0	27.100(1.0681)
m	30.0	×3.0	27.200(1.0709)
m	30.0	×2.0	28.200(1.1102)
m	30.0	×1.5	28.600(1.1268)
m	30.0	×1.0	29.100(1.1469)

3. Unified coarse screw

Number of threads	Drill hole dia.
UNC 1-64	1.550(0.0610)
UNC 2-56	1.850(0.0728)
UNC 3-48	2.100(0.0827)
UNC 4-40	2.300(0.0906)
UNC 5-40	2.600(0.1024)
UNC 6-32	2.800(0.1102)
UNC 8-32	3.500(0.1378)
UNC 10-24	3.900(0.1535)
UNC 12-24	4.500(0.1772)
UNC 1/4-20	5.200(0.2047)
UNC 5/16-18	6.700(0.2638)
UNC 3/8-16	8.100(0.3189)
UNC 7/16-14	9.500(0.3740)
UNC 1/2-13	11.000(0.4331)
UNC 9/16-12	12.300(0.4844)
UNC 5/8-11	13.800(0.5469)
UNC 3/4-10	16.800(0.6614)
UNC 7/8-9	19.600(0.7717)

4. Unified fine screw

Number of threads	Drill hole dia.
UNF 0-80	1.300(0.0512)
UNF 1-72	1.600(0.0630)
UNF 2-64	1.900(0.0748)
UNF 3-56	2.100(0.0827)
UNF 4-48	2.400(0.0945)
UNF 5-44	2.700(0.1063)
UNF 6-40	3.000(0.1181)
UNF 8-36	3.500(0.1378)
UNF 10-32	4.100(0.1614)
UNF 12-28	4.700(0.1850)
UNF 1/4-28	5.500(0.2165)
UNF 5/16-24	7.000(0.2756)
UNF 3/8-24	8.600(0.3386)
UNF 7/16-20	10.100(0.3970)
UNF 1/2-20	11.600(0.4688)
UNF 9/16-18	13.000(0.5118)
UNF 5/8-18	14.600(0.5781)
UNF 3/4-16	17.600(0.6929)
UNF 7/8-14	20.600(0.8110)

5. NPS screw

Number of threads	Drill hole dia.
NPS 1/16-27	6.630(0.2610)
NPS 1/8-27	8.840(0.3480)
NPS 1/4-18	11.510(0.4531)
NPS 3/8-18	15.080(0.5937)

6. BSP screw

Number of threads	Drill hole dia.
BSP 1/16-28	6.700(0.2638)
BSP 1/8-28	8.800(0.3465)
BSP 1/4-19	11.900(0.4688)
BSP 3/8-19	15.400(0.6094)

7. BSW screw

Number of threads	Drill hole dia.
BSW 1/8-40	2.600(0.1024)
BSW 3/16-24	3.700(0.1457)
BSW 1/4-20	5.100(0.2008)
BSW 5/16-18	6.600(0.2598)
BSW 3/8-16	8.000(0.3150)
BSW 7/16-14	9.400(0.3701)
BSW 1/2-12	10.600(0.4219)
BSW 9/16-12	12.200(0.4844)
BSW 5/8-11	13.600(0.5469)
BSW 11/16-11	15.100(0.5945)

8. BSF screw

Number of threads	Drill hole dia.
BSF 3/16-32	4.000(0.1575)
BSF 7/32-28	4.700(0.1850)
BSF 1/4-26	5.400(0.2126)
BSF 9/32-26	6.200(0.2441)
BSF 5/16-22	6.800(0.2677)
BSF 3/8-20	8.300(0.3268)
BSF 7/16-18	9.800(0.3858)
BSF 1/2-16	11.200(0.4375)
BSF 9/16-16	12.800(0.5118)
BSF 5/8-14	14.100(0.5625)
BSF 11/16-14	15.700(0.6250)

9. BA screw

Number of threads	Drill hole dia.
BA 0 × 1.00	5.100(0.2008)
BA 1 × 0.90	4.500(0.1772)
BA 2 × 0.81	4.000(0.1575)
BA 3 × 0.73	3.500(0.1378)
BA 4 × 0.66	3.100(0.1220)
BA 5 × 0.59	2.700(0.1063)
BA 6 × 0.53	2.400(0.0945)
BA 7 × 0.48	2.100(0.0827)
BA 8 × 0.43	1.800(0.0709)
BA 9 × 0.39	1.600(0.0630)
BA10 × 0.35	1.400(0.0551)
BA11 × 0.31	1.200(0.0472)
BA12 × 0.28	1.100(0.0433)
BA13 × 0.25	1.000(0.0394)
BA14 × 0.23	0.800(0.0315)

10. NPT screw

Number of threads	Drill hole dia.
NPT1 1/16-27	6.400(0.2500)
NPT1 1/8-27	8.600(0.3390)
NPT1 1/4-18	11.400(0.4531)
NPT1 3/8-18	14.700(0.5781)

11. Sewing machine screw

Number of threads	Drill hole dia.
SM 1/16-80	1.250(0.0492)
SM 5/64-64	1.500(0.0591)
SM 3/32-100	2.100(0.0827)
SM 3/32-56	1.900(0.0748)
SM 1/8-48	2.600(0.1024)
SM 1/8-44	2.500(0.0984)
SM 1/8-40	2.500(0.0984)
SM 9/64-40	2.900(0.1142)
SM 11/64-40	3.700(0.1457)
SM 11/64-32	3.500(0.1378)
SM 3/16-40	4.100(0.1614)
SM 3/16-32	3.900(0.1535)
SM 3/16-28	3.800(0.1496)
SM 3/16-24	3.600(0.1417)
SM 13/64-32	4.300(0.1693)
SM 7/32-32	4.700(0.1850)
SM 15/64-28	5.000(0.1969)
SM 1/4-40	5.600(0.2205)
SM 1/4-28	5.400(0.2126)
SM 1/4-24	5.200(0.2047)
SM 9/32-28	6.200(0.2441)
SM 9/32-20	5.800(0.2283)
SM 5/16-28	7.000(0.2756)
SM 5/16-24	6.800(0.2677)
SM 5/16-18	6.300(0.2480)
SM 11/32-28	7.800(0.3071)
SM 3/8-28	8.500(0.3346)
SM 3/8-18	7.900(0.3110)
SM 7/16-28	10.100(0.3976)
SM 7/16-16	9.300(0.3661)
SM 1/2-28	11.700(0.4606)
SM 1/2-20	11.300(0.4449)
SM 1/2-12	10.300(0.4055)
SM 9/16-20	13.000(0.5118)

12. Miniature screw threads

Number of threads	Drill hole dia.
S0.4x0.1	0.310
S0.5x0.125	0.390
S0.6x0.1	0.470
S0.7x0.1	0.550
S0.8x0.1	0.630
S0.9x0.1	0.710

7.9.3 Drill diameters for tapping primary hole by rolled tap

The values as shown below are intially set before shipment.
Modify the values as required according to the tools and workpiece materials to be used.

1. Metric coarse screw

Nominal pitch			Drill hole dia.
M	1.0	× 0.25	0.880
M	1.1	× 0.25	0.980
M	1.2	× 0.25	1.080
M	1.4	× 0.3	1.260
M	1.6	× 0.35	1.440
M	1.7	× 0.35	1.540
M	1.8	× 0.35	1.640
M	2.0	× 0.4	1.820
M	2.2	× 0.45	1.990
M	2.3	× 0.4	2.120
M	2.5	× 0.45	2.300
M	2.6	× 0.45	2.400
M	3.0	× 0.5	2.770
M	3.5	× 0.6	3.210
M	4.0	× 0.7	3.640
M	4.5	× 0.75	4.140
M	5.0	× 0.8	4.620
M	6.0	× 1.0	5.520
M	7.0	× 1.0	6.510
M	8.0	× 1.25	7.380
M	9.0	× 1.25	8.380
M	10.0	× 1.5	9.220
M	12.0	× 1.75	11.080
M	14.0	× 2.0	12.950
M	16.0	× 2.0	14.950
M	18.0	× 2.5	16.670
M	20.0	× 2.5	18.670
M	22.0	× 2.5	20.670
M	24.0	× 3.0	22.410

2. Metric fine screw

Nominal pitch			Drill hole dia.
m	1.0	× 0.2	0.900
m	1.1	× 0.2	1.000
m	1.2	× 0.2	1.100
m	1.4	× 0.2	1.300
m	1.6	× 0.2	1.500
m	1.8	× 0.2	1.700
m	2.0	× 0.25	1.890
m	2.2	× 0.25	2.090
m	2.5	× 0.35	2.340
m	3.0	× 0.35	2.840
m	3.5	× 0.35	3.340
m	4.0	× 0.5	3.770
m	4.5	× 0.5	4.270
m	5.0	× 0.5	4.770
m	5.5	× 0.5	5.270
m	6.0	× 0.75	5.640
m	7.0	× 0.75	6.640
m	8.0	× 1.0	7.510
m	8.0	× 0.75	7.640
m	9.0	× 1.0	8.510
m	9.0	× 0.75	8.640
m	10.0	× 1.25	9.380
m	10.0	× 1.0	9.520
m	10.0	× 0.75	9.660
m	12.0	× 1.5	11.220
m	12.0	× 1.25	11.380
m	12.0	× 1.0	11.520
m	14.0	× 1.5	13.220
m	14.0	× 1.0	13.520
m	15.0	× 1.5	14.220
m	15.0	× 1.0	14.520
m	16.0	× 1.5	15.220
m	16.0	× 1.0	15.520
m	17.0	× 1.5	16.270
m	17.0	× 1.0	16.520
m	18.0	× 2.0	16.950
m	18.0	× 1.5	17.230
m	18.0	× 1.0	17.520

2. Metric fine screw (cont.)

Nominal pitch	Drill hole dia.
m 20.0 × 2.0	18.950
m 20.0 × 1.5	19.230
m 20.0 × 1.0	19.520
m 22.0 × 2.0	20.950
m 22.0 × 1.5	21.230
m 22.0 × 1.0	21.520
m 24.0 × 2.0	22.950
m 24.0 × 1.5	23.230
m 24.0 × 1.0	23.520
m 25.0 × 2.0	23.950
m 25.0 × 1.5	24.230
m 25.0 × 1.0	24.520
m 26.0 × 1.5	25.230
m 27.0 × 2.0	25.950
m 27.0 × 1.5	26.770
m 27.0 × 1.0	26.520
m 28.0 × 2.0	26.950
m 28.0 × 1.5	27.230
m 28.0 × 1.0	27.520
m 30.0 × 3.0	28.390
m 30.0 × 2.0	28.950
m 30.0 × 1.5	29.230
m 30.0 × 1.0	29.520

3. Unified coarse screw

Number of threads	Drill hole dia.
UNC 1-64	1.710
UNC 2-56	2.020
UNC 3-48	2.320
UNC 4-40	2.590
UNC 5-40	2.920
UNC 6-32	3.170
UNC 8-32	3.830
UNC 10-24	4.350
UNC 12-24	4.980
UNC 1/4-20	5.770
UNC 5/16-18	7.240
UNC 3/8-16	8.730
UNC 7/16-14	10.190
UNC 1/2-13	11.680
UNC 9/16-12	13.240
UNC 5/8-11	14.670
UNC 3/4-10	17.740
UNC 7/8-9	20.750

4. Unified fine screw

Number of threads	Drill hole dia.
UNF 0-80	1.410
UNF 1-72	1.720
UNF 2-64	2.040
UNF 3-56	2.330
UNF 4-48	2.630
UNF 5-44	2.950
UNF 6-40	3.230
UNF 8-36	3.870
UNF 10-32	4.470
UNF 12-28	5.070
UNF 1/4-28	5.940
UNF 5/16-24	7.430
UNF 3/8-24	9.020
UNF 7/16-20	10.490
UNF 1/2-20	12.050
UNF 9/16-18	13.580
UNF 5/8-18	15.170
UNF 3/4-16	18.250
UNF 7/8-14	21.270

12. Miniature screw threads

Number of threads	Drill hole dia.
S0.4 × 0.1	0.350
S0.5 × 0.125	0.440
S0.6 × 0.1	0.530
S0.7 × 0.1	0.620
S0.8 × 0.1	0.710
S0.9 × 0.1	0.800

7.9.4 Cutting conditions 1 (hole producing tools)

1. SOFT STEEL

Cutting method		Registered tool	Periph. Speed (m/min)	Feed (mm/rev)	Cutting conditions
Center drill	TRV	C.DRILL	12 (39)	0.05 (0.002)	TRV: For center hole cutting CRF: For chamfer milling by forced assignment of center drill
	CRF	C.DRILL1-9			
Drill	~2.999 (~0.1180)	DRILL	10 (33)	0.05 (0.002)	~2.999 : Drill OD less than 2.999mm 3~ : Drill OD 3mm or over
	3~ (0.1181~)	DRILL1-9	18 (59)	0.10 (0.004)	
Carbide drill	~2.999 (~0.1180)	CBDRILL	20 (66)	0.05 (0.002)	~2.999 : Drill OD less than 2.999mm 3~ : Drill OD 3mm or over
	3~ (0.1181~)	CBDRILL1-9	30 (98)	0.10 (0.004)	
Tap (blind)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP 1-9 H TAP, H TAP 1-9	12 (39)	*	~2.999 : Tap dia. less than 2.999mm 3~ : Tap dia. 3mm or over
	3~ (0.1181~)		12 (39)	*	
Tap (through)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	15 (49)	*	~2.999 : Tap dia. less than 2.999mm 3~ : Tap dia. 3mm or over
	3~ (0.1181~)		15 (49)	*	
Rolled tap	~2.999 (~0.1180)	R. TAP	10 (33)	*	~2.999 : Tap dia. less than 2.999mm 3~ : Tap dia. 3mm or over
	3~ (0.1181~)	R. TAP 1-9	10 (33)	*	
Chamfering tool		CHF TOOL, CHF TOOL 1-9	15 (49)	*	

7

Cutting conditions 1 (hole producing tools)

Cutting method		Registered tool	Periph. Speed (m/min)	Feed (mm/rev)	Cutting conditions
Couterboring tool		CBRTOOL, CBRTOOL1-9	15 (49)	0.07 (0.002)	
Chamfered drill	HOL	CHFDRL	18 (59)	0.10 (0.004)	HOL : Drilling by chamfer-red drill CHF : Chamfering
	CHF	CHFDRL1-9	15 (49)	0.10 (0.004)	
Stepped drill	HOL	STEPDDRL	18 (59)	0.10 (0.004)	HOL : Drilling by stepped drill CBR : Counterboring
	CBR	STEPDDRL1-9	15 (49)	0.07 (0.002)	
Drill tap	HOL	DRLTAP	18 (59)	0.10 (0.004)	HOL : Drilling by drill tap TAP : Tapping
	TAP	DRLTAP1-9	15 (49)	*	
Reamer	~2.999 (~0.1180)	RMR	6 (20)	0.10 (0.004)	-2.999 : Reamer OD less than 2.999mm 3- : Reamer OD 3mm or over
	3~ (0.1181~)	RMR1-9	12 (39)	0.20 (0.008)	
Drill reamer	HOL	DRLRMR	18 (59)	0.10 (0.004)	HOL : Drilling by reamer drill RMR : Reaming
	RMR	DRLRMR1-9	12 (39)	0.20 (0.008)	

Feed of a hole cutting tool is per revolution.

Cutting conditions 1 (hole producing tools)

2. HARD STEEL

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Center drill	TRV	C.DRILL	10 (33)	0.05 (0.002)	TRV :For center hole cutting CRF : For chamfer milling by forced assignment of center drill
	CRF	C.DRILL1-9			
Drill	~2.999 (~0.1180)	DRILL	7 (23)	0.03 (0.001)	-2.999 :Drill OD less than 2.999mm 3- :Drill OD 3mm or over
	3~ (0.1181~)	DRILL1-9	14 (46)	0.08 (0.003)	
Carbide drill	~2.999 (~0.1180)	CBDRILL	15 (49)	0.03 (0.001)	-2.999 :Drill OD less than 2.999mm 3- :Drill OD 3mm or over
	3~ (0.1181~)	CBDRILL1-9	25 (82)	0.08 (0.003)	
Tap (blind)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	12 (39)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)		12 (39)	*	
Tap (through)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	12 (39)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)		12 (39)	*	
Rolled tap	~2.999 (~0.1180)	R. TAP	10 (33)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)	R. TAP 1-9	10 (33)	*	
Chamfering tool		CHFTOOL, CHF TOOL 1-9	12 (39)	0.08 (0.003)	

7

Cutting conditions 1 (hole producing tools)

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Couterboring tool		CBRTOOL, CBRTOOL1-9	12 (39)	0.05 (0.002)	
Chamfered drill	HOL	CHFDRL	14 (46)	0.08 (0.003)	HOL : Drilling by chamferred drill CHF :Chamfering
	CHF	CHFDRL1-9	12 (39)	0.08 (0.003)	
Stepped drill	HOL	STEPDDRL	14 (46)	0.08 (0.003)	HOL :Drilling by stepped drill CBR :Counterboring
	CBR	STEPDDRL1-9	12 (39)	0.05 (0.002)	
Drill tap	HOL	DRLTAP	14 (46)	0.08 (0.003)	HOL :Drilling by drill tap TAP :Tapping
	TAP	DRLTAP1-9	12 (39)	*	
Reamer	~2.999 (~0.1180)	RMR	5 (16)	0.10 (0.004)	-2.999 :Reamer OD less than 2.999mm 3- :Reamer OD 3mm or over
	3~ (0.1181~)	RMR1-9	10 (33)	0.20 (0.008)	
Drill reamer	HOL	DRLRMR	14 (46)	0.08 (0.003)	HOL : Drilling by reamer drill RMR : Reaming
	RMR	DRLRMR1-9	10 (33)	0.20 (0.008)	

Feed of a hole cutting tool is per revolution.

Cutting conditions 1 (hole producing tools)

3. LEAD BRASS

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Center drill	TRV	C.DRILL	15 (49)	0.08 (0.003)	TRV :For center hole cutting CRF : For chamfer milling by forced assignment of center drill
	CRF	C.DRILL1-9			
Drill	~2.999 (~0.1180)	DRILL	13 (43)	0.06 (0.002)	-2.999 :Drill OD less than 2.999mm 3- :Drill OD 3mm or over
	3~ (0.1181~)	DRILL1-9	25 (82)	0.15 (0.006)	
Carbide drill	~2.999 (~0.1180)	CBDRILL	30 (98)	0.06 (0.002)	-2.999 :Drill OD less than 2.999mm 3- :Drill OD 3mm or over
	3~ (0.1181~)	CBDRILL1-9	50 (164)	0.15 (0.006)	
Tap (blind)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	15 (49)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)		15 (49)	*	
Tap (through)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	15 (49)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)		15 (49)	*	
Rolled tap	~2.999 (~0.1180)	R. TAP		*	-2.999 :Tap dia. less than 2.999mm 3- : Tap dia. 3mm or over
	3~ (0.1181~)	R. TAP 1-9		*	
Chamfering tool		CHFTOOL , CHF TOOL 1-9	15 (49)	0.15 (0.006)	

7

Cutting conditions 1 (hole producing tools)

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Couterboring tool		CBRTOOL, CBRTOOL1-9	15 (49)	0.10 (0.004)	
Chamfered drill	HOL	CHFDRL	25 (82)	0.15 (0.006)	HOL : Drilling by chamferred drill CHF :Chamfering
	CHF	CHFDRL1-9	15 (49)	0.15 (0.006)	
Stepped drill	HOL	STEPDDRL	25 (82)	0.15 (0.006)	HOL :Drilling by stepped drill CBR :Counterboring
	CBR	STEPDDRL1-9	15 (49)	0.10 (0.004)	
Drill tap	HOL	DRLTAP	25 (82)	0.15 (0.006)	HOL :Drilling by drill tap TAP :Tapping
	TAP	DRLTAP1-9	15 (49)	*	
Reamer	~2.999 (~0.1180)	RMR	8 (26)	0.10 (0.004)	-2.999 :Reamer OD 3 - : Reamer OD 3mm or over
	3~ (0.1181~)	RMR1-9	15 (49)	0.20 (0.008)	
Drill reamer	HOL	DRLRMR	25 (82)	0.15 (0.006)	HOL :Drilling by reamer drill RMR : Reaming
	RMR	DRLRMR1-9	15 (49)	0.20 (0.008)	

Feed of a hole cutting tool is per revolution.

Cutting conditions 1 (hole producing tools)

4. ALUMINUM

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Centerdrill	TRV	C.DRILL	30 (98)	0.10 (0.004)	TRV :For center hole cutting CRF : For chamfer milling by forced assignment of center drill
	CRF	C.DRILL1-9			
Drill	~2.999 (~0.1180)	DRILL	50 (164)	0.10 (0.004)	-2.999 : Drill OD less than 2.999mm 3- : Drill OD 3mm or over
	3~ (0.1181~)	DRILL1-9	50 (164)	0.20 (0.008)	
Carbidedrill	~2.999 (~0.1180)	CBDRILL	100 (328)	0.10 (0.004)	-2.999 : Drill OD less than 2.999mm 3- : Drill OD 3mm or over
	3~ (0.1181~)	CBDRILL1-9	100 (328)	0.20 (0.008)	
Tap (blind)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	30 (98)	*	-2.999 : Tap dia. less than 2.999mm 3- : Tap dia. 3mm or over
	3~ (0.1181~)		40 (131)	*	
Tap (through)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	30 (98)	*	-2.999 : Tap dia. less than 2.999mm 3- : Tap dia. 3mm or over
	3~ (0.1181~)		40 (131)	*	
Rolledtap	~2.999 (~0.1180)	R. TAP	40 (131)	*	-2.999 : Tap dia. less than 2.999mm 3- : Tap dia. 3mm or over
	3~ (0.1181~)	R. TAP 1-9	50 (164)	*	
Chamfering tool		CHFTOOL, CHFTOOL 1-9	35 (115)	0.30 (0.012)	

7

Cutting conditions 1 (hole producing tools)

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Couterboring tool		CBRTOOL, CBRTOOL1-9	35 (115)	0.15 (0.006)	
Chamfered drill	HOL	CHFDRL	50 (164)	0.20 (0.008)	HOL : Drilling by chamfer red drill CHF :Chamfering
	CHF	CHFDRL1-9	35 (115)	0.30 (0.012)	
Stepped drill	HOL	STEPDDRL	50 (164)	0.20 (0.008)	HOL :Drilling by stepped drill CBR :Counterboring
	CBR	STEPDDRL1-9	35 (115)	0.15 (0.006)	
Drill tap	HOL	DRLTAP	50 (164)	0.20 (0.008)	HOL :Drilling by drill tap
	TAP	DRLTAP1-9	30 (98)	*	
Reamer	~2.999 (~0.1180)	RMR	15 (49)	0.10 (0.004)	TAP :Tapping -2.999 :Reamer OD less than 2.999mm
	3~ (0.1181~)	RMR1-9	30 (98)	0.20 (0.008)	
Drill reamer	HOL	DRLRMR	50 (164)	0.20 (0.008)	3- : Reamer OD 3mm or over HOL : Drilling by reamer drill RMR : Reaming
	RMR	DRLRMR1-9	30 (98)	0.20 (0.008)	

Feed of a hole cutting tool is per revolution.

Cutting conditions 1 (hole producing tools)
5. STAINLESS S.

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Center drill	TRV	C.DRILL	8 (26)	0.05 (0.002)	TRV :For center hole cutting CRF : For chamfer milling by forced assignment of center drill
	CRF	C.DRILL1-9			
Drill	~2.999 (~0.1180)	DRILL	6 (20)	0.03 (0.001)	-2.999 :Drill OD less than 2.999mm 3- :Drill OD 3mm or over
	3~ (0.1181~)	DRILL1-9	10 (33)	0.07 (0.002)	
Carbide drill	~2.999 (~0.1180)	CBDRILL	10 (33)	0.03 (0.001)	-2.999 :Drill OD less than 2.999mm 3- :Drill OD 3mm or over
	3~ (0.1181~)	CBDRILL1-9	15 (49)	0.07 (0.002)	
Tap (blind)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	6 (20)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)		6 (20)	*	
Tap (through)	~2.999 (~0.1180)	S TAP, S TAP 1-9 P TAP, P TAP 1-9 H TAP, H TAP 1-9	6 (20)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)		6 (20)	*	
Rolled tap	~2.999 (~0.1180)	R. TAP	6 (20)	*	-2.999 :Tap dia. less than 2.999mm 3- :Tap dia. 3mm or over
	3~ (0.1181~)	R. TAP 1-9	6 (20)	*	
Chamfering tool		CHF TOOL, CHF TOOL 1-9	10 (33)	0.07 (0.002)	

7

Cutting conditions 1 (hole producing tools)

Cutting method		Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
Couterboring tool	\	CBRTOOL, CBRTOOL1-9	10 (33)	0.05 (0.002)	
Chamfered drill	HOL	CHFDRL	10 (33)	0.07 (0.002)	HOL : Drilling by chamferred drill CHF : Chamfering
	CHF	CHFDRL1-9	10 (33)	0.07 (0.002)	
Stepped drill	HOL	STEPDDRL	10 (33)	0.07 (0.002)	HOL : Drilling by stepped drill CBR : Counterboring
	CBR	STEPDDRL1-9	10 (33)	0.05 (0.002)	
Drill tap	HOL	DRLTAP	10 (33)	0.07 (0.002)	HOL : Drilling by drill tap
	TAP	DRLTAP1-9	6 (20)	*	
Reamer	~2.999 (~0.1180)	RMR	4 (13)	0.10 (0.004)	TAP : Tapping -2.999 : Reamer OD less than2.999mm
	3~ (0.1181~)	RMR 1-9	8 (26)	0.20 (0.008)	
Drill reamer	HOL	DRLRMR	10 (33)	0.07 (0.002)	3- : Reamer OD 3mm or over HOL : Drilling by reamer drill RMR : Reaming
	RMR	DRLRMR1-9	8 (26)	0.20 (0.008)	

Feed of a hole cutting tool is per revolution.

7.9.5 Cutting conditions 2 (milling tools)

1. SOFT STEEL

Cutting method			Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
End mill R (for rough finishing)	■ R	TRV	EMIL R EMIL R 1-9	15 (49)	0.03(0.001)	R and F: R: For rough finishing F: For finishing Cutting conditions are set for rough finishing when performing a facing, pocketing or contouring and are set for finishing when performing a finishing. TRV/CRF: TRV : Traverse feed cutting by end mill CRF : Cross feed cutting by end mill FACEMILL Effective on the cutting condition marked with ■
		CRF		15 (49)	0.05(0.002)	
	F	TRV		20 (66)	0.03(0.001)	
		CRF		20 (66)	0.03(0.001)	
End mill F (for finishing)	R	TRV	EMIL F EMIL F 1-9	15 (49)	0.03(0.001)	
		CRF		15 (49)	0.05(0.002)	
	■ F	TRV		20 (66)	0.03(0.001)	
		CRF		20 (66)	0.03(0.001)	
Carbideend mill R (for rough finishing)	■ R	TRV	CBEMILR CBEMIL R 1-9	30 (98)	0.03(0.001)	
		CRF		30 (98)	0.05(0.002)	
	F	TRV		40 (131)	0.03(0.001)	
		CRF		40 (131)	0.03(0.001)	
Carbideend mill F (for rough finishing)	R	TRV	CBEMILF CBEMIL F 1-9	30 (98)	0.03(0.001)	
		CRF		30 (98)	0.05(0.002)	
	■ F	TRV		40 (131)	0.03(0.001)	
		CRF		40 (131)	0.03(0.001)	
Chamfering		TRV	CHFCTR CHFCTR1-9	15 (49)	0.03(0.001)	TRV : Traverse feed cutting by chamfering mill CRF : Cross feed cutting by chamfering mill
		CRF		15 (49)	0.05(0.002)	

In hole-machining, hole-facing or spot-facing by end mill, cutting condition marked with ■ is effective as in milling. Feed of a mill is per blade.

Cutting conditions 2 (milling tools)
2. HARD STEEL

Cutting method			Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
End mill R (for rough finishing)	■ R	TRV	EMIL R EMIL R 1-9	12 (39)	0.03(0.001)	R and F: R: For rough finishing F: For finishing
		CRF		12 (39)	0.05(0.002)	
	F	TRV		15 (49)	0.03(0.001)	
		CRF		15 (49)	0.03(0.001)	
End mill F (for finishing)	R	TRV	EMIL F EMIL F 1-9	12 (39)	0.03(0.001)	Cutting conditions are set for rough finishing when performing a facing, pocketing or contouring and are set for finishing when performing a finishing.
		CRF		12 (39)	0.05(0.002)	
	■ F	TRV		15 (49)	0.03(0.001)	
		CRF		15 (49)	0.03(0.001)	
Carbideend mill R (for rough finishing)	■ R	TRV	CBEMILR CBEMIL R 1-9	20 (66)	0.03(0.001)	■ TRV/CRF: TRV :Traverse feed cutting by endmill CRF :Cross feed cutting by endmill FACEMILL Effective on the cutting condition marked with ■
		CRF		20 (66)	0.05(0.002)	
	F	TRV		25 (82)	0.03(0.001)	
		CRF		25 (82)	0.03(0.001)	
Carbideend mill F (for rough finishing)	R	TRV	CBEMILF CBEMIL F 1-9	20 (66)	0.03(0.001)	
		CRF		20 (66)	0.05(0.002)	
	■ F	TRV		25 (82)	0.03(0.001)	
		CRF		25 (82)	0.03(0.001)	
Chamfering		TRV	CHFCTR CHFCTR1-9	12 (39)	0.03(0.001)	TRV :Traverse feed cutting by chamferingmill CRF :Cross feed cutting by chamferingmill
		CRF		12 (39)	0.05(0.002)	

In hole-machining, hole-facing or spot-facing by end mill, cutting condition marked with ■ is effective as in milling.
Feed of a mill is per blade.

Cutting conditions 2 (milling tools)
3. LEAD BRASS

Cutting methodvv			Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
End mill R (for rough finishing)	■ R	TRV	EMIL R			R and F: R: For rough finishing F: For finishing
		CRF				
	F	TRV	EMIL R 1-9			
		CRF				Cutting conditions are set for rough finishing when performing a facing, pocketing or contouring and are set for finishing when performing a finishing.
End mill F (for finishing)	R	TRV	EMIL F			
		CRF				
	■ F	TRV	EMIL F 1-9			
		CRF				TRV/CRF: TRV :Traverse feed cutting by end mill CRF :Cross feed cutting by end mill
Carbideend mill R (for rough finishing)	■ R	TRV	CBEMILR	25 (82)	0.03(0.001)	
		CRF		25 (82)	0.05(0.002)	
	F	TRV	CBEMIL R 1-9	30 (98)	0.03(0.001)	
		CRF		30 (98)	0.03(0.001)	FACEMILL Effective on the cutting condition marked with ■
Carbideend mill F (for rough finishing)	R	TRV	CBEMILF	25 (82)	0.03(0.001)	
		CRF		25 (82)	0.05(0.002)	
	■ F	TRV	CBEMIL F 1-9	30 (98)	0.03(0.001)	
		CRF		30 (98)	0.03(0.001)	
Chamfering		TRV	CHFCTR	15 (49)	0.03(0.001)	TRV :Traverse feed cutting by chamfering mill CRF :Cross feed cutting by chamfering mill
		CRF	CHFCTR1-9	15 (49)	0.03(0.002)	

In hole-machining, hole-facing or spot-facing by end mill, cutting condition marked with ■ is effective as in milling.
Feed of a mill is per blade.

Cutting conditions 2 (milling tools)
4. ALUMINUM

Cutting method			Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
End mill R (for rough finishing)	■ R	TRV	EMIL R EMIL R 1-9	50 (164)	0.05(0.002)	R and F: R: For rough finishing F: For finishing Cutting conditions are set for rough finishing when performing a facing, pocketing or contouring and are set for finishing when performing a finishing. TRV/CRF: TRV :Traverse feed cutting by end mill CRF :Cross feed cutting by end mill FACE MILL Effective on the cutting condition marked with • ¡
		CRF		50 (164)	0.10(0.004)	
	F	TRV		75 (246)	0.05(0.002)	
		CRF		75 (246)	0.05(0.002)	
End mill F (for finishing)	R	TRV	EMIL F EMIL F 1-9	50 (164)	0.05(0.002)	
		CRF		50(164)	0.10(0.004)	
	■ F	TRV		75 (246)	0.05(0.002)	
		CRF		75 (246)	0.05(0.002)	
Carbideend mill R (for rough finishing)	■ R	TRV	CBEMILR CBEMIL R 1-9	100 (328)	0.05(0.002)	
		CRF		100 (328)	0.10(0.004)	
	F	TRV		150 (492)	0.03(0.001)	
		CRF		150 (492)	0.03(0.001)	
Carbideend mill F (for rough finishing)	R	TRV	CBEMILF CBEMIL F 1-9	100 (328)	0.05(0.002)	
		CRF		100 (328)	0.10(0.004)	
	■ F	TRV		150 (492)	0.03(0.001)	
		CRF		150 (492)	0.03(0.001)	
Chamfering		TRV	CHFCTR CHFCTR1-9	50 (164)	0.05(0.002)	TRV :Traverse feed cutting by chamfering mill CRF :Cross feed cutting by chamfering mill
		CRF		50 (164)	0.10 (0.004)	

In hole-machining, hole-facing or spot-facing by end mill, cutting condition marked with ■ is effective as in milling. Feed of a mill is per blade.

Cutting conditions 2 (milling tools)
5. STAINLESS.

Cutting method			Registered tool	Speed Periph. (m/min)	Feed (mm/rev)	Cutting conditions
End mill R (for rough finishing)	■ R	TRV	EMIL R EMIL R 1-9	10 (33)	0.03(0.001)	R and F: R: For rough finishing F: For finishing Cutting conditions are set for rough finishing when performing a facing, pocketing or contouring and are set for finishing when performing a finishing. TRV/CRF: TRV :Traverse feed cutting by end mill CRF :Cross feed cutting by end mill FACEMILL Effective on the cutting condition marked with ■
		CRF		10 (33)	0.05(0.002)	
	F	TRV		12 (39)	0.03(0.001)	
		CRF		12 (39)	0.03(0.001)	
End mill F (for finishing)	R	TRV	EMIL F EMIL F 1-9	10 (33)	0.03(0.001)	
		CRF		10 (33)	0.05(0.002)	
	■ F	TRV		12 (39)	0.03(0.001)	
		CRF		12 (39)	0.03(0.001)	
Carbideend mill R (for rough finishing)	■ R	TRV	CBEMILR CBEMIL R 1-9	15 (49)	0.03(0.001)	
		CRF		15 (49)	0.05(0.002)	
	F	TRV		20 (66)	0.03(0.001)	
		CRF		20 (66)	0.03(0.001)	
Carbideend mill F (for rough finishing)	R	TRV	CBEMILF CBEMIL F 1-9	15 (49)	0.03(0.001)	
		CRF		15 (49)	0.05(0.002)	
	■ F	TRV		20 (66)	0.03(0.001)	
		CRF		20 (66)	0.03(0.001)	
Chamfering		TRV	CHFCTR CHFCTR1-9	10 (33)	0.03(0.001)	TRV :Traverse feed cutting by chamfering mill CRF :Cross feed cutting by chamfering mill
		CRF		10 (33)	0.05(0.002)	

In hole-machining, hole-facing or spot-facing by end mill, cutting condition marked with ■ is effective as in milling. Feed of a mill is per blade.

7.9.6 Cutting conditions 3 (except tool)

Item	Setting range	Description
STOPPOS FORWARD WORK(HOLE)	0-99.999mm (0-9.9999in.)	* Hole machining Distance (air cut stroke) between the switchover point (from rapid traverse to cutting feedrate) and a machining surface is set. If workpiece thickness is excessively uneven due to forged surface, set value requires some allowance. Take top surface cutting into account.
STOPPOS FORWARD WORK(FACING)	0-99.999mm (0-9.9999in.)	* Facing Distance (air cut stroke) between a workpiece and a cutting start position is set.

Cutting conditions 3 (except tool)

Item	Setting range	Description
STOP POS FORWARD WORK(POCKT)	0-99.999mm (0-9.9999in.)	* Hole machining Distance (air cut stroke) between the switch over point (from rapid traverse tocutting feedrate) and a machining surface is set.
LENGTHAFTER THROUGHCUT	0-99.999mm (0-9.9999in.)	Projection after through-hole drilling is set.

7

Cutting conditions 3 (except tool)

Item	Setting range	Description
CHAMFERING CUTTER POSITION	0-99.999mm (0-9.9999in.)	Relative positions of chamfering tool and workpiece in pocketing or chamfering are set.

Cutting conditions 3 (except tool)

Item	Setting range	Description
TAPPRIMARRY HOLEDEPTH	0-99.999 threads	Difference in depth between primary hole and tapped hole is set in terms of number of threads If drilled hole is less deep than tapped hole in blind hole cutting, use the parameter. (Primary hole depth allowance) $= \frac{\text{(Primary hole depth) - (Tap depth)}}{\text{(Pitch)}} = \frac{A}{\text{(Pitch)}}$ If primary hole is less deep than tapped hole, follow the formula below: (Primary hole depth) = (Tapped hole depth) + (Primary hole depth allowance) × (Pitch)

Cutting conditions 3 (except tool)

Item	Setting range	Description
REAMERPRIMARY HOLEDEPTH	0-99.999times	Difference in depth between primary hole and reamed hole is set by its ratio to reamer diameter If primary hole is less deep than reamed hole in blind hole cutting, use the parameter. (Primary hole depth allowance) $= \frac{\text{(primary hole depth) - (reamer depth)}}{\text{(Reamer dia.)}} = \frac{B}{\text{(Reamer dia.)}}$ If primary hole is less deep than reamed hole, follow the formula below: (Primary hole depth) = (Reamed hole depth) + (Primary hole depth allowance) x (Reamer diameter)

Cutting conditions 3 (except tool)

Item	Setting range	Description
REAMERFINISH ALLOW1 0~2.999 (0~0.1180) 3.000~ (0.1181~)	0-99.999mm (0-9.9999in.)	Finishing allowance for 1-step finish or for the 1st step finish in 2-step finish reaming. Set A+A. * 0~2.999(0~0.1180):For reamer diameter less than 2.999mm(0.1180in.) * 3~(0.1181~) :For reamer diameter 3mm(0.1181in.) or over
REAMERFINISH ALLOW2 0~2.999 (0~0.1180) 3.000~ (0.1181~)	0-99.999mm (0~9.9999in.)	Finishing allowance for the 2nd step finish in 2- step finish reaming. Set B+B, referring to the figure above.

7

Cutting conditions 3 (except tool)

Item	Setting range	Description
DRILLSTEPMODE	0-2	Select the stepping mode in drilling from among the following 3: 0: NONE No stepping 1: FIXED Depth of cut is constant in all steps. Depth of cut can be calculated in the following way: $L(\text{mm or inch}) = \dfrac{\text{DrillOD (mm or inch)} \times \text{Step ratio (\%)}}{100}$ 2:REDUCING Cut of depth becomes smaller as drilled depth becomes larger. Depth of cut can be calculated in the following way: $\text{L(N) depth of cut for Nth time (mm or inch)} = \dfrac{\text{[Cutting coefficient]} \times \text{Drill OD (mm or inch)} \times \text{Step ratio (\%)}}{100}$ No of steps: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 Coefficient: 4.0, 3.3, 2.7, 2.1, 1.7, 1.4, 1.2, 0.9, 0.7, 0.6, 0.4, 0.4, 0.3, 0.3 *For the 15th and after, use the step coefficient of the 14th. *If the calculated depth of cut is less than 0.1mm (0.0039in.)in the method 1 or 2, set 0.1mm (0.0039in.) nevertheless.
DRILLSTEPRATIO	0-999%	

Cutting conditions 3 (except tool)

Item	Setting range	Description
DRILLSTEP RETURN	0 ~ 1	Select a required drill POINT step return position from the following 2 types: 0: START POS The tool returns to the start position of the first drill step. 1: RETURN POS The tools returns to a position obtained by combining the start position of the last drill step and the drill step return amount. DRILL STEP RETURN AMOUNT is effective only when the drill step return position is set in 1: RETURN POS [Designation of start point] [Designation of return point] Drill step start position L :Depth of cut for 1 step *This stroke is determined by the selected drill step and ratio. Bfr :Stop position before preceding to the next step (fixed at 0.5mm(0.0200in.)) Back :Drill step return amount
DRILLSTEP RETURN AMOUNT	0 ~ 99.999mm (0 ~ 9.9999in.)	

Cutting conditions 3 (except tool)

<table>
<tr><th>Item</th><th>Setting range</th><th>Description</th></tr>
<tr><td>TAP STEP MODE</td><td>0-2</td><td rowspan="2">Select the stepping mode in tapping from among the following 3:
0: NONE
No stepping
1: FIXED
Depth of cut is constant in all steps.
Depth of cut can be calculated in the following way:

$L \text{ (mm or inch)} = \frac{\text{Nominal dia. (mm or inch)} \times \text{Step ratio (\%)}}{100}$

2 :REDUCING
Cut of depth becomes smaller as tapped depth comes larger.
Depth of cut can be calculated in the following way:

$\text{L(N) depth of cut for Nth time (mm or inch)} = \frac{\text{[Cutting coefficient]} \times \text{Nominal dia. (mm or inch)} \times \text{Step ratio (\%)}}{100}$

<table>
<tr><td>No of steps</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td></tr>
<tr><td>Coefficient</td><td>2.0</td><td>1.7</td><td>1.3</td><td>1.1</td><td>0.8</td><td>0.7</td><td>0.6</td><td>0.4</td><td>0.4</td><td>0.3</td><td>0.2</td><td>0.2</td><td>0.1</td><td>0.1</td></tr>
</table>

*For the 15th and after, use the step coefficient of the 14th.
*If the calculated depth of cut is less than the pitch/10 in the method 1 or 2, set the pitch/10 nevertheless.</td></tr>
<tr><td>TAP STEP RATIO</td><td>1-999%</td></tr>
<tr><td>TAPRETURN SPEED(RATIO)</td><td>100-999%</td><td>With respect to the one in downward motion.
* The feedrate never exceeds the max. tapping revolving speed.</td></tr>
<tr><td>DWELL(CHF)</td><td>0-99 × 0.1sec</td><td>Specify Z-axis dwell time for a post-chamfering stop for better accuracy.

This setting is effective also for the drill, drill tap, drill reamer and stepped drill forcibly assigned for chamfering and for machining with end mill R and F and carbide end mill R and F.</td></tr>
<tr><td>DWELL(CBR)</td><td>0-99 × 0.1sec</td><td>Specify Z-axis feedrate in tapping in upward motion.
This setting is effective also for end mill R and F and carbide end mill R and F.</td></tr>
</table>

Cutting conditions 3 (except tool)

Item	Setting range	Description
OVERRIDEIN POCKET	1-100%	During a pocketing, a tool under-goes cutting load. Therefore, apply the override to a feedrate when the tool undergoes the load. Feedrate can be calculated by the following formula. F' Actual feedrate m(ft)/min = F Feedrate by cutting conditions m(ft)/min × Pocket Override (%) / 100 The thick arrows in the left figure indicate the stroke in which the override is effective.
FACING OVERRIDE	1-100%	This setting is effective when a facing is performed in X or Y axis (WALL ON BOT SIDES). When the 1st line is cut, the feedrate calculated from the cutting conditions is overriden, because it is a heavy duty cutting.

Cutting conditions 3 (except tool)

Item	Setting range	Description
OVERRIDELMT IN INSIDE ARC	1-100%	When a circular cutting is executed inside a workpiece during tool diameter offset, the tool center moves at a feedrate calculated from the cutting conditions. That is, the feedrate on the cutting surface inside the workpiece is faster than specified. In such a case, apply an override to the feedrate according to the ratio of programmed radius R to the tool radius r.

Cutting conditions 3 (except tool)

Item	Setting range	Description
OVERRIDE LIMIT IN INSIDE ARC		When the tool radius R and the designated radius R are almost the same, the feedrate will be extremely reduced. To avoid this phenomenon, the lower limit of the override for an internal arc should be set as follows: If $\frac{100 \times (R-r)}{R} \geqq$ Internal arc override limit Actual feedrate = $\frac{\text{Designated feedrate} \times (R-r)}{R}$ If $\frac{100 \times (R-r)}{R} <$ Internal arc override limit Actual feedrate = $\frac{\text{Designated feedrate} \times \text{Internal arc override}}{100}$

7

Cutting conditions 3 (except tool)

Item	Setting range	Description
AUTOCORNER OVERRIDE [LEN1] [LEN2] [RATIO]	LEN1 LEN2 0-99.999mm (0-9.9999in.) RATIO 1-100%	For inside corner cutting in tool diameter offset mode, override can be applied to the feedrate to avoid increase of cutting load or to reduce the impact caused by a sudden change of cutting direction. In case of a circular arc, the length of chord is effective. * Automatic corner override angle is set by parameter 1.

7

Cutting conditions 3 (except tool)

Item	Setting range	Description
TL RPLC SIMUL OPE START POS	0-999.999mm 0-99.9999in.	Indicates the start position of the Z axis in the machine coordinates when the X, Y, and Z axes have moved upon tool replacement. Caution : Considering that the X and Y axes move upon tool replacement, set the start position so that these axes do not make contact with the workpiece.

7.9.7 User parameter 1 (switch 1)

Item	Setting range	Description
MACHINI ORDER 1:INDV JOB(1PC) 2:INDV TOOL(1PC) 3:INDV JOB 4:INDV TOOL (TOOL) 5:INDV TOOL (COORDINATE/B AXIS INDEX)	1-5	Select a machining order for an edited program from the following 5 types. *For details, refer to MACHINING ORDER in the Programming Manual.*
MODE SELECT 0: MANUAL 1: MEMORY	0-1	Specify the mode to be established after power ON: manual operation or MDI operation
MANUAL FEED 0: RAPID 1: JOG 2: STEP	0-2	Specify the feed mode in manual operation mode after power ON.
RESTART 0:STOP 1:RESTART 1	0-1	Specify whether to stop or restart the operation after a program is completed in the memory operation mode.
WORK COUNTER WHEN RESTART 0:INVALID 1:VALID	0-1	Specify whether to continue recounting or not when restarting operation.
TOOL LIFE MANAGE WHEN RESTART 0: NO 1: YES	0-1	Specify whether to calculate down the tool life when restarting operation.
TOOL LENGTH OFFSET VALUE	0-999.999mm (0-99.9999in.)	Measure the tool length by moving Z axis as shown below, and store the data in the tool menu. Set the height (A) of the height presetter or block as offset amount.

User parameter 1 (switch 1)

Item	Setting range	Description
MAXIMUM TIME OF EXT SIGNAL	0-9999sec.	Allowable lapse of time from an external signal ouput to reception of an motion completion signal from an external equipment is set in second.
DRY RUN OFFSET	0-999.999mm (0-99.9999in.)	Offset amount for the Z-axis absolute command during dry run in the memory operation is set. * This does not apply to the incremental command.
BOTTOM HOLE DEPTH TOLERANCE	0.000-0.999mm (0.000-0.999in.)	Compound tools for drilling blind holes can be assigned in the setting range according to the depth of drill hole bottom and drilling length.
REMRRETN SPEED 0: RAPID 1: JOG	0-1	Reamer return feedrate is set: rapid feedrate or jog feedrate
START UP/CANCEL 0: TYPE1 1: TYPE2	0-1	Set TYPE 1 or TYPE 2 for tool movement method at start-up and cancellation in tool diameter offset mode in a motion program. ・*For details, refer to Motion Programs.*
MINIMUM CORNER MOVEMENT	0.000-99.999mm (0.0000-9.9999in.)	When a cutting outside a corner of acute angle which is almost 90° in tool diameter offset mode, the feed, if it is shorter than the preset distance, is cancelled. Cancelled if ΔVX ≦ setting value and ΔVY ≦ setting value.

7

User parameter 1 (switch 1)

Item	Setting range	Description
AUTO. CORNER OVERRIDE ANGLE	0.000-179.999°	When a tool moves long a corner smaller than specified in tool diameter offset mode, feedrate override can be applied before and after the corner. Length 1 :Deceleration stroke at corner end point Length 2 :Deceleration stroke at corner start point Rate :Deceleration rate *Lengths 1 and 2 and rate are set according to the tools used and cutting conditions (except tool conditions).

7

User parameter 1 (switch 1)

Item	Setting range	Description
CENTER ALIGN FEEDRATE 1	1-5000mm/min (0.1-196.8in./min)	Rapid traverse during automatic alignment is set.
CENTER ALIGN FEEDRATE2	1-5000mm/min (0.1-196.8in./min)	Measuring feedrate during automatic alignment is set.
CENTER ALIGN RETRACT VALUE	0.000-99.999mm (0.0000-9.9999in.)	Return stroke after each detection during automatic aligning cycle is set. Correction of automatic aligning position is set.
CENTER ALIGN CORRECT VALUE	0.000-9.999mm (0.0000-0.9999in.)	Time constant for measurement feed is specified with this parameter.
CENTER ALIGN TIME CONSTANT	0-999msec	Applicable functions are automatic centering, tool breakage detection, Z-axis thermal displacement offset and auto tool length measurement.
Z.M. ZERO RTN AT MEMORY RUN START 0: NO 1: YES	0 or 1	When starting a memory operation, whether to return Z axis to zero point or not is set.
LAMP AT COUNT UP 0: NO 1: YELLOW 2: RED	0, 1 or 2	Light or not to do so the pilot lamp when the production counter ends is specified (lamp lit: yellow or red)
TOOL BREAKAGE DETECT OPTION 0: NO 2:TYPE2 1: TYPE1 3:TYPE3	0 - 3	Set 1, if tool breakage detect option is installed.
TOOL BRK DETECT RETURN POS	0.000-999.999mm	Set tool end return position in machine coordinate before tool breakage detect motion. Tool Tool breakage detect position TOOL BRK DETECT RETURN POS Table surface

7

User parameter 1 (switch 1)

Item	Setting range	Description
TOOLBRKDETECTION POS X Y	-9999.999-0.000	Set the tool breakage detection position on the machine coordinate.
TOOLBRKDETECTION (number of operation)	1-999	This parameter sets the frequency to perform tool breakage detection, according to the number of times the program is performed. For example, when [5] is set, tool breakage detection is performed once after the program has been performed five times. When [1] is set, tool breakage detection is performed after each time the program has been performed.
EXTERNAL ERROR 10 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 10) occurs when EXER10 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 11 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 11) occurs when EXER11 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.

User parameter 1 (switch 1)

Item	Setting range	Description
EXTERNAL ERROR 12 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 12) occurs when EXER12 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 13 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 13) occurs when EXER13 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 14 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 14) occurs when EXER14 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.

User parameter 1 (switch 1)

Item	Setting range	Description
EXTERNAL ERROR 15 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 15) occurs when EXER15 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 16 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 16) occurs when EXER16 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 17 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 17) occurs when EXER17 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.

User parameter 1 (switch 1)

Item	Setting range	Description
EXTERNAL ERROR 18 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 18) occurs when EXER18 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 19 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 19) occurs when EXER19 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 20 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 20) occurs when EXER20 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.

User parameter 1 (switch 1)

Item	Setting range	Description
EXTERNAL ERROR 21 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 21) occurs when EXER21 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 22 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 22) occurs when EXER22 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 23 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 23) occurs when EXER23 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
EXTERNAL ERROR 24 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 24) occurs when EXER24 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.

User parameter 1 (switch 1)

Item	Setting range	Description
EXTERNAL ERROR 25 ALARM LEVEL 0: LEVL0 1: LEVL1 2: LEVL2 3: LEVL3 4: LEVL4	0-4	Select the desired poeration status from the following selections when an alarm (External Error 25) occurs when EXER25 signal is is input: 0. Operation continues. 1. Operation stops upon completion of the current program. 2. Operation stops upon completion of the current block. 3. Operation stops immediately. 4. Servomotor turns off.
UNREGISTERED M-CODE 0: ERROR 1: OFF0-1	0-1	This is the setting to determinate whether or not to continue operation when three digit M code which is not defined for the machine is instruction memory operation.
ONE SHOT SIGNAL M450 OUTPUT TIME ONE SHOT SIGNAL M451 OUTPUT TIME	0-99 sec	This turns on for the specified time when signal output 450 or 451 is commanded. The next motion is executed after the specified time has passed.
ONE SHOT SIGNAL M455 OUTPUT TIME ONE SHOT SIGNAL M456 OUTPUT TIME	0-99 sec	This turns on for the specified time when signal output 450 or 451 is commanded. The next motion is executed without waiting for the specified time.

User parameter 1 (switch 1)

Item	Setting range	Description
AUTO DISPLAY CLEAR TIME	0 - 1	Automatically clears the screen when entry operations using switches are not performed within the time preset here.
MACHINE NUMBER	0-999999	Sets a number to a machine when multiple machines are installed, to differentiate them.
AUTOMATIC DOOR 0: NO 1: YES	0-1	Sets whether an optional automatic door is provided or not.
AREA SENSOR PATTERN 0: PATTERN1 1: PATTERN2	0-1	Sets the area sensor pattern to stop the automatic door immediately when the beam of area sensor is obstructed during automatic door operation. Pattern1: The area sensor becomes active when the door is closing. Pattern2: The area sensor becomes active when the door is opening or closing.
RESET AUTOMATIC DOOR ERROR 0: EMERGENCY STOP 1: NORMAL STOP	0-1	Sets whether emergency stop or normal stop should be applied when the following automatic door error is detected. When the time taken for opening and closing of automatic door exceeds the preset time (parameter value). When both open end and close end limit seitches of automatic door have turned ON.

User parameter 1 (switch 1)

Item	Setting range	Description
AUTOMATIC DOOR OPERATION TIME	0-99 sec	Sets the opening and closing time of automatic door.
DISPLAY COMMENT 0: NO 1: YES	0-1	Sets whether or not to display the contents of the comments set for machining data.
OVERRIDE SWITCH 0: INVALID 1: VALID	0-1	Sets whether override is valid or invalid.
DISP ALARM WHEN OVERRIDE IS VALID 0: NO 1: YES	0-1	Sets whether or not to display the alarm when the override is not set to 100%.
DISPLAY ALARM WHEN DOOR IS OPEN 0: NO 1: YES	0-1	Sets whether or not to display the alarm when the door is open.

User parameter 1 (switch 1)

Item	Setting range	Description
START POS AFTER SCHEDL PROGRAM RESET 0: PROGRAM TOP 1: SCHEDULE PROGRAM TOP	0-1	Sets the position where operation is resumed when the **[RESET]** key is pressed during schedule program operation.
STOP WHEN CURRENT PROGRAM IS ENDED 0: NO 1: YES	0-1	Sets whether the machine should stop each time one machining program has ended or proceed to the next machining data during schedule program operation.
M490 COOLANT BLOWING TIME	0-99.9 sec	High Pressure Coolant Type This parameter sets the coolant blowing time when high pressure coolant is turned on by M490 signal output. CTS (Coolant Through Spindle) Type Sets the time the back washing cycle pump is activated.
M491 COOLANT BLOWING TIME	0-99.9 sec	Not TC-S2B This parameter sets the coolant blowing time when high pressure coolant is turned on by M491 signal output. TC-S2B Sets the time until the tool washing filter check starts. Setting “0” disables the filter check..
M492 COOLANT BLOWING TIME	0-99.9 sec	High Pressure Coolant Type This parameter sets the coolant blowing time when high pressure coolant is turned on by M492 signal output. CTS (Coolant Through Spindle) Type Sets the time until the CTS pump pressure check starts when CTS is off. Setting “0” disables the pressure check.
M493 COOLANT BLOWING TIME	0-99.9 sec	High Pressure Coolant Type This parameter sets the coolant blowing time when high pressure coolant is turned on by M493 signal output. CTS (Coolant Through Spindle) Type Sets the time for releasing pressure (valve “C” is on) when CTS is stopped..

User parameter 1 (switch 1)

Item	Setting range	Description
M494 COOLANT BLOWING TIME	0-99.9 sec	High Pressure Coolant Type This parameter sets the coolant blowing time when high pressure coolant is turned on by M494 signal output. CTS (Coolant Through Spindle) Type Sets the time after CTS pump is turned on by the M494 signal until the CTS pump pressure check starts. Do not change the setting since this value is unique to the pump.
CHIP SHOWER DRAIN TIME	0-99s sec	Set the time that the chip shower remains ON after M401 is executed. The chip shower turns off when the time preset here has elapsed.
AUTOMATIC COOLANT OFF TIME (0: NO AUTOMATIC OFF)	0-999min	Set the time until the coolant pump turns off when the coolant pump is activated but the machine is not operated (both the start and stop LEDs are off). The coolant pump automatically turns on again when the machine is started by pressing the [START] button on the machine or the [START] button on the external unit. Since there is a time lag after the pump turns on until coolant is actually dispensed, the start of coolant dispensing is delayed for the time set for [COOLANT DELAY TIME]. When the coolant pump is automatically turned off, the coolant pump LED flashes.
COOLANT DELAY TIME	0-99×0.1S	Set the time that the start of coolant dispensing is delayed when the coolant pump automatically turns on again (**[START]** on machine / **[START]** on external unit). The start LED stays lit while waiting during the preset time.
AUTOMATIC MACHINE LIGHT OFF TIME (0: NO AUTOMATIC OFF)	0 - 999 min	Set the time after the machine light turns on until it turns off. When 1 or more (minute) is set, the machine light turns off when the preset time has elapsed after the machine light turned on.

User parameter 1 (switch 1)

Item	Setting range	Description
TIME UNTIL STAND BY MODE IS ENTERED (0:NO AUTOMATIC OFF)	0 - 999 min	Set the time after the servo motor is turned off until standby mode is entered when the machine is not operated. When no machine operation is performed even after the preset time has elapsed, the servo motors for all axes turn off and standby mode is entered, and the alarm message "*STANDBY MODE" is displayed. (Note that this alarm is not registered in the alarm log. In addition, an external signal alarm is not output.) Servo motors turn on again when any of the following operations are performed: · Any key operation from the operation panel · Machine operation is started ([START] button on machine, [START] button on external unit, communication remote command, etc.)
AUTOMATIC POWER OFF (0:INVALID 1:VALID)	0 - 1	Set whether [AUTOMATIC POWER OFF] is valid or invalid. When [1: VALID] is set, power automatically turns off when the time set for [AUTOMATIC POWER OFF TIME] is reached. In addition, power turns off during operation when any of the following conditions are met: ·Program ends (It is regarded as "Program end" when the machine is restarted or external start is reserved). · Pause or block stop is applied.
AUTO POWER OFF TIME	00:00:00-23:59:59	Set the time until power automatically turns off when [1:VALID] is set for [AUTOMATIC POWER OFF]. When [1:VALID] is set, [AUTO OFF IS ON] is displayed on the screen.
POT LOWERING STARTPOSITION	-999.999-999.999mm (-99.9999-99.9999in.)	Set the position where tilting the pot is to be started relative to the distance from the ATC return height.
CORNER DECELERATION ANGLE	0 - 179.999 deg.	(Descriptions are provided in the Machine Parameter List.) When the angle between two blocks is less than this setting, the speed decelerates in the corner zone.
CORNER DECELERATION MINIMUM RATE	1 - 100%	(Descriptions are provided in the Machine Parameter List.) This setting is used as the deceleration ratio when the ratio of the angle between two blocks against the above corner deceleration angle is less than this setting.

User parameter 1 (switch 1)

Item	Setting range	Description
ALARM WHILE SCREEN IS DIMMED (0:ALARM SCRN 1:STAY DIMMED)	0 - 1	Set whether to display the alarm screen when an alarm occurs while the screen is dimmed. 0: ALARM SCREEN The alarm screen appears when an alarm occurs. 1: STAYS DIMMED The screen stays dimmed even when an alarm occurs.
TABLE LOADED MASS	0 - 999kg	Used to switch the rapid traverse time constant according to the value set here. The axes affected by the rapid traverse time constant are listed below. Models with moving tables: X- and Y-axes Models with quick tables: 4th-axis
BACK WASHING AT PROGRAM END 0:NO 1:YES	0,1	Sets whether the back washing cycle is performed when the program is completed. When [1:Yes] is selected with a CTS command included in the program, the back washing cycle is performed at the end of the program.
OPERATION TIME	0000:00:00 - 9999:59:59	Default value of automatic operation time (accumulated memory operation run time) displayed by **[POS]** key is set.
CURRENT DATE	1996/01/04 - 2038/12/31	Sets the current date. Once set, the data is automatically updated.
CURRENT TIME	00:00:00 - 23:59:59	Set the current time. Once set, the time is automatically updated.
MACHINE UNIT SYSTEM 0: METRIC 1: INCH	0-1 [0]	Sets metric or imperial (inch) as the unit of length used for machining data.

7

7.9.8 User parameter 2 (switch 2)

Item	Setting range	Description
STROKE4 0: NO 1: YES	0,1	When the 4-axis stroke is set,input “1.” When it is not set, input “0.” When “1: YES” is specified, the 4-axais (-) or (+) value of stroke described in the next row is valid.
STROKE5 0: NO 1: YES	0,1	When the 5-axis stroke is set, input “1.” When it is not set, input “0.” When “1: YES” is specified, the 5-axais (-) or (+) value of stroke described in the next row is valid.
STROKE6 0: NO 1: YES	0,1	When the 6-axis stroke is set, input “1.” When it is not set, input “0.” When “1: YES” is specified, the 6-axis (-) or (+) value of stroke described in the next row is valid.
STROKE 4(-) 4(+)	-9999.999-0.000 0.000-9999.999	When the 4-axis stroke is “1: YES,” the stroke value is input as an angle in the machine coordinates.
STROKE 5(-) 5(+)	-9999.999-0.000 0.000-9999.999	When the 5-axis stroke is “1: YES,” the stroke value is input as an angle in the machine coordinates.
STROKE 6(-) 6(+)	-9999.999-0.000 0.000-9999.999	When the 6-axis stroke is “1: YES,” the stroke value is input as an angle in the machine coordinates.

User parameter 2 (switch 2)

Item	Setting range	Description
SOFTWARE STROKE LIMIT1 X(-) Y(-) Z(-) X(+) Y(+) Z(+)	X and Y axes: -9999.999-9999.999mm (-999.9999-999.9999in.) Z axis: 0.000-9999.9999mm (0.0000-999.9999in.)	Stroke limits of the X and Y axes are defined in terms of machine coordinates. As for Z-axis, set the lower limit of the tool end in terms of distance from the table top surface. (-) and (+) are the setting values in the plus and minus directions, respectively.
SOFTWARE STROKE LIMIT 4(-) 4(+)	-9999.999-0.000 0.000-9999.999	When the 4-axis stroke limit is “1: YES” the stroke limit value is input as an angle in the machine coordinates.
SOFTWARE STROKE LIMIT 5(-) 5(+)	-9999.999-0.000 0.000-9999.999	When the 5-axis stroke limit is “1: YES” the stroke limit value is input as an angle in the machine coordinates.
SOFTWARE STROKE LIMIT 6(-) 6(+)	-9999.999-0.000 0.000-9999.999	When the 6-axis stroke limit is “1: YES” the stroke limit value is input as an angle in the machine coordinates.
SOFTWARE STROKE LIMIT2 X(-) X(+)	-9999.999-9999.999 -9999.999-9999.999	Sets a prohibited area within the X-axis stroke. When the negative setting is larger that the positive setting, check within the X-axis prohibited area is not performed.
SOFTWARE STROKE LIMIT2 Y(-) Y(+)	-9999.999-9999.999 -9999.999-9999.999	Sets a prohibited area within the Y-axis stroke. When the negative setting is larger that the positive setting, check within the Y-axis prohibited area is not performed.

User parameter 2 (switch 2)

Item	Setting range	Description
SOFT STROKE LIMIT2 Z(-) Z(+)	0-9999.999 0-9999.999	Sets a prohibited area within the Z-axis stroke of the tool tip position. When the negative setting is larger that the positive setting, check within the Z-axis prohibited area is not performed.
X zero return position (No.2)	-999.999-0.000 mm (-99.999-0.0000 in.) (X2 in the right figure)	The 2nd and 3rd zero points are set with respect to the machine zero point.
Y zero return position (No.2)	-999.999-0.000 mm (-99.999-0.0000 in.) (Y2 in the right figure)	
X zero return position (No.3)	-999.999-0.000 mm (-99.999-0.0000 in.) (X3 in the right figure)	
Y zero return position (No.3)	-999.999-0.000 mm (-99.999-0.0000 in.) (Y3 in the right figure)	
4 ZERO RETURN POSITION (No.2)	-999.999-999.999 ?: NOT RETURN	Sets the second origin return position for the 4th, 5th, and 6th axes on the rotation coordinate.
5 ZERO RETURN POSITION (No.2)	-999.999-999.999 ?: NOT RETURN	
6 ZERO RETURN POSITION (No.2)	-999.999-999.999 ?: NOT RETURN	

User parameter 2 (switch 2)

Item	Setting range	Description
4 ZERO RETURN POSITION (No.3)	-999.999-999.999 ?: NOT RETURN	Sets the third origin return position for the 4th, 5th, and 6th axes on the rotation coordinate.
5 ZERO RETURN POSITION (No.3)	-999.999-999.999 ?: NOT RETURN	
6 ZERO RETURN POSITION (No.3)	-999.999-0.000 -999.999 ?: NOT RETURN	
RAPID TRAVERSE OVERRIDE SPD.1	0-99999mm/min (0-9999.99in./min)	Specifies the feedrate of the RAPID TRAVERSE OVERRIDE switch on the operation panel. This becomes effective only when RAPID TRAVERSE is selected.
RAPID TRAVERSE OVERRIDE SPD2	0-99999mm/min (0-9999.99in./min)	
RAPID TRAVERSE OVERRIDE SPD3	0-99999mm/min (0-9999.99in./min)	
4-AXIS OVERRIDE ROTATE SPD.1	0-99.9rpm	Sets the rotation speed when SPEED 1 of OVERDRIVE switch is selected.
4-AXIS OVERRIDE ROTATE SPD.2	0-99.9rpm	Sets the rotation speed when SPEED 2 of OVERDRIVE switch is selected.
4-AXIS OVERRIDE ROTATE SPD.3	0-99.9rpm	Sets the rotation speed when SPEED 3 of OVERDRIVE switch is selected.

User parameter 2 (switch 2)

Item	Setting range	Description
5-AXIS OVERRIDE ROTATE SPD.1	0-99.9rpm	Sets the rotation speed when SPEED 1 of OVERDRIVE switch is selected.
5-AXIS OVERRIDE ROTATE SPD.2	0-99.9rpm	Sets the rotation speed when SPEED 2 of OVERDRIVE switch is selected.
5-AXIS OVERRIDE ROTATE SPD.3	0-99.9rpm	Sets the rotation speed when SPEED 3 of OVERDRIVE switch is selected.
6-AXIS OVERRIDE ROTATE SPD.1	0-99.9rpm	Sets the rotation speed when SPEED 1 of OVERDRIVE switch is selected.
6-AXIS OVERRIDE ROTATE SPD.2	0-99.9rpm	Sets the rotation speed when SPEED 2 of OVERDRIVE switch is selected.
6-AXIS OVERRIDE ROTATE SPD.3	0-99.9rpm	Sets the rotation speed when SPEED 3 of OVERDRIVE switch is selected.
X POSI SIGNAL OUTPUT (-) (+)	-9999.999~ 9999.999	External output signal XPOSSW turns on when the machine coordinate of the X-axis is within the range set for this parameter (including the boundary value) and turns off when it is not within the range. This signal does not turn on unless dog zero return is completed.
Y POSI SIGNAL OUTPUT (-) (+)	-9999.999~ 9999.999	External output signal YPOSSW turns on when the machine coordinate of the Y-axis is within the range set for this parameter (including the boundary value) and turns off when it is not within the range. This signal does not turn on unless dog zero return is completed.

User parameter 2 (switch 2)

Item	Setting range	Description
Z POSI SIGNAL OUTPUT (-) (+)	-9999.999~ 9999.999	External output signal ZPOSSW turns on when the machine coordinate of the Z-axis is within the range set for this parameter (including the boundary value) and turns off when it is not within the range. This signal does not turn on unless dog zero return is completed.
4 POSI SIGNAL OUTPUT (-) (+)	-9999.999~ 9999.999	External output signal 4POSSW turns on when the machine coordinate of the 4-axis is within the range set for this parameter (including the boundary value) and turns off when it is not within the range. This signal does not turn on unless dog zero return is completed.
5 POSI SIGNAL OUTPUT (-) (+)	-9999.999~ 9999.999	External output signal 5POSSW turns on when the machine coordinate of the 5-axis is within the range set for this parameter (including the boundary value) and turns off when it is not within the range. This signal does not turn on unless dog zero return is completed.
6 POSI SIGNAL OUTPUT (-) (+)	-9999.999~ 9999.999	External output signal 6POSSW turns on when the machine coordinate of the 6-axis is within the range set for this parameter (including the boundary value) and turns off when it is not within the range. This signal does not turn on unless dog zero return is completed.

7.9.9 User parameter 3 (Communication)

Item	Setting range	Description
SELECT PORT 0: PORT A 1: PORT B	0-1	Selects the serial port used for communication.
CONNECTED TO 0: PTP/PTR 1: COMPUTER	0-1	Set the equipment to be bommunicated with.
COMP COMMUNICATN PROTOCOL (MASTER) 0: TYPE1 1: TYPE2	0-1	Select the protocol used for communication; the protocol conventionally used (compatible) or the protocol extended for remote operation.
BAUD RATE 0: 300 1: 600 2: 1200 3: 2400 4: 4800 5: 9600 6: 19200	0-6	Set the baud rate for data transmission.
PARITY 0: NONE 1: ODD 2: EVEN	0-2	Set the type of parity bit to be added to one-character data.
STOP BIT 0: 1 BIT 1:1.5 BIT 2: 2 BIT	0-2	Set the distance which discriminates the end of one-character data.
CHARACTER LENGTH 0: 7 BIT 1: 8 BIT	0-2	Set the length of one-character data.
RESPONSE START TIME	0-999 sec	Allowable time interval between the receipt of the 1st character and that of the 2nd. If 0 is set. this time is infinte.

User parameter 3 (Communication)

Item	Setting range	Description
COMMUNICATION 0:LINE 1:CODE1 2:CODE2	0-2	Select a communication method from the following 3 types: 0: LINE (Control line system) Communication is controlled by RS/CS. 1: CODE 2 (Control code system 1) Communication is performed by control code system on the master station and by control line system on the slave station. 2: CODE 2 (Control code system 2) Communication is performed by control code system on both master and slave stations. Communication is controlled by DC1 and DC3 code. The head and end of the data are suffixed with DC2 and DC4, respectively.
DC1CODE DC2CODE DC3CODE DC4CODE	0-255	Set the control code in the code 1 and code 2 system. The code is set in decimal number. DC1:17=11H(hexadecimal) DC2:18=12H DC3:147=93H DC4:20=14H <Meaning of the DC code> DC1 : Start of communication or restart of the communication interrupted by DC3 DC2 : Indication of the head of the data DC3 : Temporary interruption of the communication in case of buffer overflow for example DC4 : Indication of the end of the data.

User parameter 3 (Communication)

Item	Setting range	Description
DR SIGNAL CHECK 0: NO 1: YES	0-1	DR signal is checked during communication when "1" is set. Communication cannot be established if DR signal is off. DR signal is not checked when 0 is set.
COMMUNICATION END DC3 CODE 0: NO 1: YES	0-1	Transmission of DC3 code at the end of a communication or waiting in receiving mode in code 1 and 2 systems <When receiving data> On receiving all the external data, DC3 code is transmitted to external equipments. <When transmitting data> On transmitting all the data to external equipments, the system is ready to receive DC3 code. The communication terminates upon receiving DC3 code. When 0 is set, this communication end DC3 code is not available.
OUTPUT TAPE FEED	0 - 1	Set 1 to overwrite when same program input while slave communication. Overwrite is denied, if 0 is set.
RESET (SLAVE) 0: NO 1: YES	0-1	Alternative of stopping a communication or not with the **[RESET]** key when the machine is in computer mode (slave) is set. If 0 is set, the communication is not stopped even if the **[RESET]** key is pressed.

User parameter 3 (Communication)

Item	Setting range	Description
RESET RECOVERY TIME	0-99sec	If one of the following events takes place while the machine is in computer mode, DR and RS signals of the machine are off during the reset recovery time: 1. **[RESET]** key is pressed, when RESET (SLAVE) setting is effective, during communication of the machine as slave station. 2. An error occurs because of communication abend. When 0 is set, DR and RS signals are not deactivated.
DATA OVER WRITE (SLAVE) 0: NO 1: YES	0-1	Set 1 to overwrite when same program input while slave communication. Overwrite is denied, if 0 is set.
REMOTE OPERATION 0: INVALID 1: VALID	0-1	Sets ON or OFF for origin return via communication, memory operation start and stop by remote operation.
REMOTE PROTOCOL CHECK SUM 0: NO 1: YES	0-1	Sets whether or not to perform error detection by the check sum for communication by remote protocol.

7

7.9.10 User parameter 4 (Extrl In Signal)

Item	Setting range	Description
TERMINAL NUMBER 53 54 55 56 57 58 59 60 203 204 205 206 207 208 209 210 213 214 215 216 217 218 219 220	1-58	Sets the external output signal corresponding to the terminal number. Pressing the **[DEL]** key can cancel the setting. 1:PRO1 34:M468 2:PRO2 35:SPLOOK 3:PRO4 36:ATCLCK 4:PRO8 37:XYLOCK 5:PRO16 38:ZLOCK 6:PRO32 39:4LOCK 7:PRO64 40:5LOCK 8:PR9900 41:6LOCK 9:EXORG 42:MDLOCK 10:CTURN 43:KYLOCK 11:EXORG2 44:PRLOCK 12:EXORG3 45:EDLOCK 13:MFIN 46:DRLOCK 14:EXER10 47:EXZORG 15:EXER11 48:TLEDOK 16:EXER12 49:TPEDOK 17:EXER13 50:THEDOK 18:EXER14 51:CTEDOK 19:EXER15 52:UPEDOK 20:EXER16 53:MPEDOK 21:EXER17 54:WCEDOK 22:EXER18 55:MGEDOK 23:EXER19 56:PRSNSR 24:EXER20 57:OILEMP 25:EXER21 58:BOXDR 26:EXER22 27:EXER23 28:EXER24 29:EXER25 30:M460 31:M462 32:M464 33:M466

7.9.11 User parameter 5 (Extrl Out Signal)

Item	Setting range	Description
TERMINAL NUMBER 103 104 105 106 107 108 109 110 303 304 305 306 307 308 309 310 313 314 315 316 317 318 319 320 323 324 325 326 327 328 329 330 333 334 335 336 337 338 339 340	1-91	Sets the external output as desired in accordance with the terminal number. 1:M11 2:M12 3:M14 4:M18 5:M21 6:M22 7:M24 8:M28 9:M00 10:M30/1 11:M30/2 12:ORGFN2 13:ORGFN3 14:M08 15:M400 16:M402 17:M404 18:M406 19:M408 20:M480 21:M482 22:M484 23:M486 24:MF 25:AUTO 26:STL 27:MEMOK 28:NCOK 29:ALM 30:ALMLV1 31:ALMLV2 32:TOOL 33:TOLPRE 34:ORGFIN 35:SPTURN 36:ZPX 37:ZPY 38:ZPZ 39:ZPSP 40:ZP4 41:ZP5 42:ZP6 43:PFIN1 44:PFIN2 45:RSTOUT 46:MEMMOD 47:TKBRKE 48:RUNSTP 49:M450 50:M451 51:M455 52:M456 53:GRN 54:YEL 55:RED 56:CNTUP 57:CNTPRE 58:STPOUT 59:DROPN 60:DRCLS 61:INDRCL 62:RDYLED 63:STPLED 64:DRYRUN 65:SINGL 66:RESTAT 67:RPD100 68:SPN100 69:FED100 70:RELESE 71:SAFETY 72:COOLSW 73:CHIPSW 74:SDDRCL 75:OG4FN2 76:OG5FN2 77:OG6FN2 78:OG4FN3 79:OG5FN3 80:OG6FN3 81:PULOFF 82:QTSEL1 83:QTSEL2 84:OILPMP 81:PULOFF 82:QTSEL1 83:QTSEL2 84:OILPMP 85:BATALM 86:XPOSSW 87:YPOSSW 88:ZPOSSW 89:4POSSW 90:5POSSW 91:6POSSW

7

7.9.12 User parameter 6 (Z measurement)

Item	Setting range	Description
TOOL BREAKEGE DETECT FUNCTION 0: INVALID 1: VALID	0,1	This specifies whether or not tool breakage should be detected.
THERMAL MEASUREMENT FUNCTION 0: INVALID 1: VALID	0,1	This specifies whether or not Z-axis thermal displacement should be offset.
THERMAL DISPLCMNT COMPEN PALLET	0,1	Specifies the pallet subject to thermal displacement compensation measurement.
PALLET1 SIDE MEASUREMENT DEVICE 0: NO 1: YES	0,1	Set to 1: PROVIDED or 0: NOT PROVIDED when thermal measurement device is provided or not provided for pallet 1 respectively.
PALLET2 SIDE MEASUREMENT DEVICE 0: NO 1: YES	0,1	Set to 1: PROVIDED or 0: NOT PROVIDED when thermal measurement device is provided or not provided for pallet 2 respectively.
XY POSITION RADIUS SHIFT DIRCTN 0: +X 1: -X 2: +Y 3: -Y	0,1,2,3	This specifies the direction of dislocation when XY position is determined, displaced from the measurement device center by the amount of the tool radius.
DWELL (AIR BLOW)	0 to 99 X 0.1sec	This sets air blow time. The purpose is to remove chips and cutting oil before starting measurement.

User parameter 6 (Z measurement)

Item	Setting range	Description
MEASUREMENT START POSITION	0 to 99.999mm 0 to 9.9999inch	This sets position from the measurement device installation position on Z-axis.
MEASUREMENT STOP RANGE	0 to 99.999mm 0 to 9.9999inch	This sets the stop range of Z-axis measurement movement.
COOLANT AUTO OPE 0: NO 1: YES	0,1	This specifies whether or not the coolant should be placed into automatic operation. With [1] specified, coolant is stopped at the beginning of measurement motion. When measurement is completed, coolant is returned to the original condition before measurement.
SPINDLE ROTATION WNMSRING DISP 0: NO 1: YES	0,1	With [1] specified, the spindle revolves during measurement so as to remove debris and chips.
THERMAL MEASUREMENT TOOL NO.1-5	0 to 99	This sets the number in the tool list of the tool to be measured. [0] indicates that this number is not set.
THERMAL MEASUREMENT MOTION COND. 0: EVERY COMMAND 1: WATCHING *	0,1	This specifies whether the thermal displacement measurement motion command should be set so that the measurement motion is performed each time the command is issued or that watching motion is performed so that the measurement motion can be canceled via watching of displacement.

7

User parameter 6 (Z measurement)

Item	Setting range	Description
Z-AXIS MACHINING ACCURACY *	0 to 0.999mm 0 to 0.0999inch	This sets the required working precision in Z-axis direction. When measurement (displacement) exceeds the set value, *TRM DISPMT AMT OVR occurs.
THERMAL WATCH DISPLACMT AMNT	0 to 0.999mm 0 to 0.0999inch	This sets the criterion value for displacement. The frequency of watching is updated depending on judgment result.
NUMBER OF THERMAL WATCHING *	1 to 99 frequency	This sets the frequency of checking past measurement data. Watching frequency is updated to that which is set herein.
NO. OF THERMAL WATCHING CANCEL *	1 to 99 frequency	This sets the maximum of watching frequency.
INTIAL SET NO. OF THERMAL MSMT *	1 to 99 frequency	This sets the frequency of thermal displacement measurement after power is turned on. In this measurement canceling motion does not work even when the watching motion is set.
THERMAL WATCHING STOP TIME *	1 to 99 min	This sets time in minute elapsing ahter operation is stopped after which time the thermal displacement watching conditions should be initialize.
THRM OFFSET AMT LIMIT VALUE	0.001 to 0.999 min 0.0001 to 0.0999inch	This sets the limit value of thermal displacement offset amount.

7

User parameter 6 (Z measurement)

Item	Setting range	Description
RETRACT AMNT AFT MEASUREMENT	0 to 99.999mm 0 to 9.9999inch	This sets the retract amount after rough measurement.
MSMT FEEDRATE B TOOL DIAMTR	0 to 99.999mm 0 to 9.9999inch	This sets the diameter of the tool to which measurement feedrate B applies. To tools whose diameter is greater than the set diameter, measurement feedrate B applies.
MEASUREMENT FEEDRATE 1A	1 to 5000mm/min 0.1 to 196.8inch/min	This sets the measurement feedrate in rough measurement when the tool diameter is smaller than that of those to which measurement feedrate B applies.
MEASUREMENT FEEDRATE 1B	1 to 5000mm/min 0.1 to 196.8inch/min	This sets the measurement feedrate in rough measurement when the tool diameter is equal to or greater than that of those to which measurement feedrate B applies.

User parameter 6 (Z measurement)

Item	Setting range	Description
MEASUREMENT FEEDRATE 2A	1 to 5000mm/min 0.1 to 196.8inch/min	This sets the measurement feedrate in final measurement when the tool diameter is smaller than that of those to which measurement feedrate B applies.
MEASUREMENT FEEDRATE 2B	1 to 5000mm/min 0.1 to 196.8inch/min	This sets the measurement feedrate in final measurement when the tool diameter is equal to or greater than that of those to which measurement feedrate B applies.
THERMAL MEASUREMENT FEEDRATE	1 to 5000mm/min 0.1 to 196.8inch/min	This sets the measurement feedrate in final measurement.
PAL1 SIDE MSMT DEV POS X Y Z	0-9999.999mm (0-999.9999in.)	Sets the X,Y,and Z axes machine coordinate positions for the tool length measurement device mounted on pallet 1. Detection signals turn ON when axes are at these positions.
PAL2 SIDE MSMT DEV POS X Y Z	0-9999.999mm (0-999.9999in.)	Sets the X,Y,and Z axes machine coordinate positions for the tool length measurement device mounted on pallet 2. Detection signals turn ON when axes are at these positions.

Monitoring operation and frequency

Monitoring operation
The displacement due to ball screw elongation in the Z-axis direction is monitored for the Z-axis thermal displacement compensation.
When the displacement is within the specified range, measurement is canceled as it is not necessary to perform measurement each time.

Monitoring frequency
This word has two meanings; one is measurement pitch and the other is the number of monitoring operations.
The later is set so that measurement is performed upon completion of this number.

7.9.13 User parameter 7 (Zero measurement)

Item	Setting range	Description
PROBE OFFSET VALUE 1 PROBE OFFSET VALUE 2	-9.999-9.999mm (-0.9999 - 0.9999in.)	Sets the difference between the stylus tip ball center and the spindle when the detection signal is turned on while the touch probe is attached to the spindle. X component and Y component of the difference are probe offset 1 and 2 respectively. To set the difference, carry out 6.PROBE OFFSET of automatic centering.
PROBE OFFSET VALUE 3 PROBE OFFSET VALUE 4	-9.999-9.999mm (-0.9999 - 0.9999in.)	Sets the difference of the center of the circle obtained by the three-point measurement and the actual circle center. X component and Y component of the difference are probe offset 3 and 4 respectively. To set the difference, carry out 7.PROBE OFFSET of automatic centering.
MEASURING MOTION	0-1	0: TYPE1 Measures at measuring speed 1 and 2. 1: TYPE2 Measures at measuring speed 2 only.

7

User parameter 7 (Zero measurement)

Item	Setting range	Description
MEASURING SPEED 1	1-5000mm/min 0.1-196.8in./min	Sets the first measuring for speed for MEASURING MOTION (TYPE1).
MEASURING SPEED 2	1-5000mm/min 0.1-196.8in./min	Sets the second measuring for speed for MEASURING MOTION (TYPE1) and the measuring speed for MEASURING MOTION (TYPE2).
STOP DISTANCE BEFORE MSRNG	0.0-99.999mm 0.0-9.9999in.	Sets the distance between the probe end face at the measurement start point and the estimated workpiece surface. When measuring has been skipped for the values preset to STOP DISTANCE BEFORE MSRING and MEASURING TRAVEL LMT DISTANCE, SENSOR SIGNAL OFF alarm will occur.
MEASURINGTRAVEL LMT DISTANCE	0.0-99.999mm 0.0-9.9999in.	Sets the amount of overtravel when the measuring skip has exceeded the estimated value (program command value).
MEASUREMENT TOLERANCE1	0.0-99.999mm 0.0-9.9999in.	When the difference between the measured value and the estimated value (program command value) has exceeded the preset value, MEASD VAL ERR LRG (1): will occur. When 0 is set, the value error check is not carried out.
MEASUREMENT TOLERANCE2	0.0-99.999mm 0.0-9.9999in.	When the difference between the measured value and the previous measured value has exceeded the preset value, MEASD VAL ERR LRG (2) : will occur. When 0 is set, the value error check is not carried out.
RETURN DISTANCE AFT MEASURNG	0.0-99.999mm 0.0-9.9999in.	Sets the amount that the measuring probe retracts where it has contacted the non measuring object during automatic measurement.

7.9.14 User parameter 8 (Auto THRM DISP CMP)

Item	Setting range	Description
Z-AXIS COMPENSATION ADJUSTMENT	0-200%	This parameter sets the Z-axis compensation value to between 0% and 200%.
SPINDLE COMPENSATION ADJUSTMENT (Z)	0-200%	This parameter sets the spindle for Z axis value to between 0% and 200%.
X-AXIS COMPENSATION ADJUSTMENT	0-200%	This parameter sets the X-axis compensation value to between 0% and 200%.
SPINDLE COMPENSATION ADJUSTMENT (X)	0-200%	This parameter sets the X-axis compensation value to between 0% and 200%.
Y-AXIS COMPENSATION ADJUSTMENT	0-200%	This parameter sets the Y-axis compensation value to between 0% and 200%.
SPINDLE COMPENSATION ADJUSTMENT (Y)	0-200%	This parameter sets the Y-axis compensation value to between 0% and 200%.

7.9.15 User Parameter 9 (Quick Table)

When machine is equipped with quick table

Item	Setting range	Description
PALLET 1 PROGRAM NUMBER PALLET 2 PROGRAM NUMBER	1~8999, 9900~9999	Set the program number processed with each pallet. When the external program selection input signal is turned on, external selection is effective.
PALLET 2 SHIFT VALUE X Y Z		When you process the same program with the pallet 1 and the pallet 2, set this parameter. Correct the deviation of the work fixed position of the pallet 2 from the pallet 1 by this parameter. The coordinates set here move the working zero position when the pallet 2 is machined. Program as follows: -Put a work on the pallet 1 and make a program. -Put the other work on the pallet 2 and align the working zero position. - Set the pallet 1 program number and the pallet 2 program number. These are sure to become the same program number. - Calculate and set the pallet 2 shift values. pallet 1 work zero: X: -100.000 Y: -60.000 Z: 70.000 pallet 2 work zero: X:-110.000 Y: -55.000 Z: 71.000 In the example above, calculate as follows.

Item	Setting range	Description
		pallet 2 work zero - pallet 1 work zero = pallet 2 shift value X: -110.000 - (-100.000) = -10.000 Y: -55.000 - (-60.000) = 5.000 Z: 71.000 - (70.000) = 1.000 *CAUTION* Set 0.000 when the different programs are processed between pallet 1 and pallet 2. If a non-zero value is set, the pallet 2 working zero will shift. NOTE This parameter is effedtive only when the pallet select switch is set to 1<->2 or 2.
PALLET 1 CARRY IN MOTION PALLET 2 CARRY IN MOTION 0: WHEN START 1: 1ST TOOL CHNG	0~1	Set the time to carry in the pallet after the memory operation starts. The pallet 1 and the pallet 2 can be separately set. 0: After a memory operation starts, carry a palletimmediately. After the pallet carrying in, the program starts from the first process. 1: Carry in a pallet at the same time with the first tool change command. Therefore, non-working time can be shortened. And it executes the instructions before the first tool change without carrying in the pallet.

7

7.9.16 List of external input signals and functions

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
External program selection	PRO1 PRO2 PRO4 PRO8 PRO16 PRO32 PRO64 PR9900	○				○		If used to specify the prepared program by a peripheral. For the details on the usage, refer to "Details of external input signals".
M function end	MFIN	○			○	○		The signal MFIN is set from a peripheral as an operation (in response to M-function output M00 - M99) end signal. For the details on the timing, refer to "Details of external input signals".

7

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
External 2nd zero point return External 3rd zero point return	EXORG2 EXORG3	○				○		The machine can be returned to its 2nd or 3rd zero point set with the parameter by opening and then closing the contact of the signal EXORG2orEXORG3. If no zero point return is performed after turning on the power: EXORG2, EXORG3 input ↓ Zero point (machine zero point) return ↓ Return to 2nd/3rd origine End of the return can be confirmed with by ORGFIN3. (Refer to the description of the 2nd/3rd zero point return completion signals for details.) Note 1 The signals EXORG2 and EXORG3 are effective when the signal STL is off. 2 The signal STL is not activated during a return. 3 The signal must remain active for 500msec or longer in the edit mode during an operation.

7

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
External error 10 error 11 error 12 error 13 error 14 error 15 error 16 error 17 error 18 error 19 error 20 error 21 error 22 error 23 error 24 error 25	EXER10 EXER11 EXER12 EXE13 EXER14 EXER15 EXER16 EXER17 EXER18 EXER19 EXER20 EXER21 EXER22 EXER23 EXER24 EXER25	○		○	○	○	○	When the contact of signal EXER10 or EXER 11 is closed, 'External error 10' or 'External error 11' is displayed on the screen. The alarm level can be selected from 1 to 4 below. Set this in parameter 1. 1. Servo OFF 2. Operation stop 3. One block stop 4. One cycle stop 5. Display only To recover from the alarm state, open the contact and press the **[RESET]** key or enter EXRESET for alarm levels 1 to 3, and press the **[CANCEL]** key for alarm level 4.
Wait single 1 Wait single 2	M460 M462 M464 M466 M468	○		○	○	○	○	These are input signals used for signal output functions 460 and 462 and are used to halt the next motion during operation. When the contacts of signal M460 and M462 are closed, signal output functions 460 and 462 proceed to the next motion. When the contacts of signal M460 and M462 are open, signal output functions 461 and 463 proceed to the next motion. Note Maximum waiting time is set to MAXIMUM TIME OF EXT SIGNAL in parameter 1. When '0' is set, operation is halted indefinitely.

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Spindle operation prohibited	SPLOCK	○		○	○	○		Prohibit spindle rotation. Spindle stop and orientation are possible. When this signal is turned ON during spindle rotation, the spindle does not stop.
ATC operation prohibited	ATLOCK	○		○	○	○		Prohibits ATC operations; magazine swivel, use of **[SINGL MAGAZ]** key, tool replacement in MDI or memory mode, and next tool preparation.
XY axes opration prohibited	XYLOCK	○		○	○	○		Prohibits XY axes operation. When the program is created so that other aces operate simultaneously, these axes do not operate either.
Z axis operation prohibited	ZLOCK	○		○	○	○		Prohibits Z-axis operation.
4th axis operation prohibited	4LOCK	○		○	○	○		Prohibits 4th axis operation. Also prohibits clamping and unclamping operations.
5th axis operation prohibited	5LOCK	○		○	○	○		Prohibits 5th axis operation. Also prohibits clamping and unclamping operations.
6th axis operation prohibited	6LOCK	○		○	○	○		Prohibits 6th axis operation. Also prohibits clamping and unclamping operations.

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Mode changeover prohibited	MDLOCK	○		○	○	○	○	Prohibits mode changeover.
Key operation prohibited	KYLOCK	○		○	○	○	○	Prohibits operation of keys other than the override (spindle, cutting, positioning), emergency stop, stop, external start, and reset keys.
Program edit prohibited	PRLOCK	○					○	Prohibits data change operation (insertion, deletion, setting) in edit mode (program screen). Also prohibits deletion and copy of files in the DIRECTORY OF MEMORY function.
Edit prohibited	EDLOCK	○		○	○	○	○	Prohibits program editing, data bank editing, and production counter and magazine tool editing.

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
External zero return	EXORG	○				○		The axis moves to the zero point when the contact of signal EXORG has closed and then opened again. [Notes] 1) Axes move at the positioning speed. 2) The movement order of axes is Z and then X and Y (simultaneous). 3) Axes do not move to the middle point. 4) Dog type zero return is performed if not yet already performed. 5) When axes have returned to their origins correctly, the zero point return completion signal (ORGFIN) is output. 6) Input signal for 100 msec. or longer. 7) The state of Automatic Operation Ongoing signal (STL) cannot be switched to on during external zero return. [Effective conditions] 1) Automatic operation ongoing signal (STL) is off. 2) The **[STOP]** key is not pressed. 3) The external stop signal (EXSTOP) is off. 4) An alarm higher than stop level 2 has not occurred.

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
External Indexing pallet	CTURN	○				○		Indexing pallet is performed when the contact of signal CTRUN is closed and then opened again. Operation is the same as when the **[P. IDX]** key is pressed. [Effective conditions] 1) Automatic operation ongoing signal (STL) is off. 2) The **[STOP]** key is not pressed. 3) The external stop signal (EXSTOP) is off. 4) An alarm higher than stop level 2 has not occurred.
Door lock	DRLOCK	○		○	○	○	○	When the contact of signal DRLOCK is closed, the door is locked in a state where the door is closed.
External Z axis zero return	EXZORG	○				○		The axis moves to the zero point when the contact of signal EXZORG has closed and then opened again. [Notes] 1) Axes move at the positioning speed. 2) Axes do not move to the middle point. 3) Dog type zero return is performed if not yet already performed. 4) Input signal for 100 msec. or longer. 5) The state of Automatic Operation Ongoing signal (STL) cannot be switched to on during external zero return. [Effective conditions] 1) Automatic operation ongoing signal (STL) is off. 2) The **[STOP]** key is not pressed. 3) The external stop signal (EXSTOP) is off. 4) An alarm higher than stop level 2 has not occurred.

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Editing tool menu permitted	TLEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the tool menu can be edited.
Editing tool paturn permitted	TPEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the tool pattern can be edited.
Editing drill diameter for tapping primary hole permitted	THEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the drill diameter for tapping primary hole can be edited.
Editing cutting condition permitted	CTEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the cutting condition can be edited.
Editing user parameter permitted	UPEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the user parameter can be edited.
Editing machine parameter permitted	MPEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the machine parameter can be edited.
Editing work counter permitted	WCEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the work counter can be edited.
Editing magazine tool permitted	MGEDOK	○		○	○	○	○	As long as this signal is on and even when **[EDLOCK]** is on, the magazine tool can be edited.

*1 stands for a program edit.

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Automatic oiling pressure sensor	PRSNSR	○		○	○	○	○	Input signal to inform the operator that the pressure sensor of the automatic oiling unit is turned on.
Insufficent oil for automatic oiling	OILEMP		○	○	○	○	○	Input signal to inform the operator that the amount of oil for automatic oiling is insufficient
CNTRL BOX DOOR OPEN	BOXDR		○	○	○	○	○	This signal indicates that the door of the control box is open. “CNTRL BOX DOOR OPEN” is displayed on the screen. When the door is closed, the message automatically disappears.

7.9.17 Details of external input signals

External program selection

Usage of external program selection signals and precautions are described below.

(1) Usage

Activate the signal for PRO1,PRO2,PRO4,PRO8,PRO16,PRO32,PRO64 and PR9900 in memory operation mode. In response to the start signal, the NC unit read the signal and execute the relevant program.

Program No.	PR 9900	PRO64	PRO32	PRO16	PRO08	PRO04	PRO02	PRO01
Last input program No.	×	×	×	×	×	×	×	×
0001	×	×	×	×	×	×	×	○
0002	×	×	×	×	×	×	○	×
0003	×	×	×	×	×	×	○	○
0004	×	×	×	×	×	○	×	×
0005	×	×	×	×	×	○	×	○
0006	×	×	×	×	×	○	○	×
0007	×	×	×	×	×	○	○	○
0008	×	×	×	×	○	×	×	×
0009	×	×	×	×	○	×	×	○
0010	×	×	×	×	○	×	○	×
0011	×	×	×	×	○	×	○	○
0012	×	×	×	×	○	○	×	×
0013	×	×	×	×	○	○	×	○
0014	×	×	×	×	○	○	○	×
0015	×	×	×	×	○	○	○	○
0016	×	×	×	○	×	×	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0032	×	×	○	×	×	×	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0064	×	○	×	×	×	×	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0099	×	○	○	×	×	×	○	○
0100	×	○	○	×	×	○	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0127	×	○	○	○	○	○	○	○

○ : Contact losef
× : Contact open

Schedule Program No.	PR 9900	PRO64	PRO32	PRO16	PRO08	PRO04	PRO02	PRO01
Last input program No.	○	×	×	×	×	×	×	×
9901	○	×	×	×	×	×	×	○
9902	○	×	×	×	×	×	○	×
9903	○	×	×	×	×	×	○	○
9904	○	×	×	×	×	○	×	×
9905	○	×	×	×	×	○	×	○
9906	○	×	×	×	×	○	○	×
9907	○	×	×	×	×	○	○	○
9908	○	×	×	×	○	×	×	×
9909	○	×	×	×	○	×	×	○
9910	○	×	×	×	○	×	○	×
9911	○	×	×	×	○	×	○	○
9912	○	×	×	×	○	○	×	×
9913	○	×	×	×	○	○	×	○
9914	○	×	×	×	○	○	○	×
9915	○	×	×	×	○	○	○	○
9916	○	×	×	○	×	×	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
9932	○	×	○	×	×	×	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
9964	○	○	×	×	×	×	×	×
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
9999	○	○	○	×	×	×	○	○
Error condition	○	○	○	×	×	○	×	×
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	○	○	○	○	○	○	○	○

(2)

1 The signal is read in response to the start signal when the program is in the initial condition (the START switch is not pressed after turning on the power or resetting) or when its execution is completed.

2 When the contacts of all signals PRO1, PRO2, PRO4, PRO8, PRO16, PRO32 and PRO64 are open, the last program number entered is executed.

3 To execute the same program as before turning off the power, enter its number or open the contacts of all signals PRO1, PRO2, PRO4, PRO8, PRO16, PRO32 and PRO64.

7.9.18 List of external output signals and functions

*1 stands for a program edit.

Signal	Symbol	Output in motion		Effective mode				Function
		Transistor						
		On	Off	Manual	MDI	Memory	Edit*1	
M function output	M11 M12 M14 M18 M21 M22 M24 M28 MF	○			○	○		Sends the 2-digit decimal number BCD code to a peripehral by specifying any of signal outputs M01 to m ((during MDI or memory operation. Refer to "Details of external output signals".

7

***1 stands for a program edit.**

Signal	Symbol	Output in motion		Effective mode				Function
		Transistor						
		On	Off	Manual	MDI	Memory	Edit*1	
External signal output	M400 M402 M404 M406 M408 M480 M482 M484 M486	○			○	○		Can be turned on and off according to the program during MDI or memory operation. Example) Activation when M402 is commanded in the program and disactivation in response to M403. Unlike the case with M11 to M28,M function end signal MFIN is not activated.

Signal	On	Off
M400	M400 commanded in the program	M401 commanded in the program
M402	M402 commanded in the program	M403 commanded in the program
M404	M404 commanded in the program	M405 commanded in the program
M406	M406 commanded in the program	M407 commanded in the program
M408	M408 commanded in the program	M409 commanded in the program
M480	M480 commanded in the program	M481 commanded in the program
M482	M482 commanded in the program	M483 commanded in the program
M484	M484 commanded in the program	M485 commanded in the program
M486	M486 commanded in the program	M487 commanded in the program

Note:
1 The signal is disactivated in response to a reset signal.
2 The signal is not disactivated if an alarm occurs.
3 M406 is exclusively used for air blowing when the machine is equipped with an optional Z axis measurement system.
4 M408 is exclusively used for supplying oil to oil hole. M408 cannot be used for other than this purpose.

*1 stands for a program edit.

Signal	Symbol	Output in motion		Effective mode				Function
		Transistor		Manual	MDI	Memory	Edit*1	
		On	Off					
Automatic operation ongoing	AUTO	○			○	○		During MDI or memory operation: On conditions 1st start input Off conditions 1 Reset 2 Alarm causing the servo to turn off The signal is not activated in response to external origin return signal.
Automatic operation ongoing	STL	○			○	○		During MDI or memory operation: On conditions 1 During an operation 2 The SC unit (option) is in operation Off conditions 1 End of a motion 2 Single block stop 3 Stop 4 Reset 5 Alarm The signal is not activated in response to an external zero point return.
Memory operation enabled	MEMOK	○				○		This signal is activated when the machine is ready for memory operation with the mode selected. It is not activated in the following cases: ・SIGNAL or DRY key is active ・During a resetting ・Alarm
Tool error output	TOOL	○				○		This signal is activated when "program end" is executed due to expiration of the tool life thememory operation of the tool life the memory operation according to the program is completed. To restart this signal and then restart the operation, follow the procedure below : (1)When the spare tool is registered: Restart is possible. The program can be executed with this spare tool. This signal remains active when the spare tool is in use. (2)When the spare tool is not registered: Restart is impossible. Set again tool life and press RESET key. The signal is disactivated for an instant if RESET KEY is pressed without setting the tool life.

7

***1 stands for a program edit.**

Signal	Symbol	Output in motion		Effective mode				Function
		Transistor		Manual	MDI	Memory	Edit*1	
		On	Off					
Spindle rotation	SPTURN	○		○	○	○	○	This signal is active while the spindle rotates and is inactive while it is in stop. The signal, however, is not active during an oriented spindle stop and a tapping.
Zero point output	ZPX ZPY ZPZ ZPSP ZP4 ZP5 ZP6	○		○	○	○	○	ZPX, ZPY, ZPZ, ZP4, ZP5 and ZP6, for the respective axes, are activated when a zero point return is completed. Each signal is disactivated when its relevant axis is fed from the machine zero point and is activated again when the zero point is reached again. PPSP is activated when an oriented spindle stop is completed and is disactivated when the spindle starts rotating, or in response to a reset signal or to SPINDLE STOP key operation. Note: The signal is disactivated in the event, for example, of emergency stop, which causes the servo to be turned off.
Zero point return completion	ORGFIN	○		○	○	○	○	This signal is activated when the first zero point return after the power is turned on is completed and remains active until the power is turned off.
Program stop	M00	○				○		This signal is activated when a “program stop” is executed during memory operation and is disactivated in response to a start or reset signal. Note: The signal undergoes no change in case an alarm occurs.
Program end	M30/1 M30/2	○				○		This signal is activated when a “program end” is executed during memory operation. * M30/1 : This signal is activated when the “program end” of pallet 1 is executed. * M30/2 : This signal is disactivated when the “program end” of pallet 2 is executed. This signal is disactivated in response to the a start or reset signal. [Reference] For further details on the program end, refer to “Details of external output signals”. [Note] When the PALLET SELECT switch is set to OFF, M30/1 is output regardless of the pallet.

***1 stands for a program edit.**

Signal	Symbol	Output in motion		Effective mode				Function
		Transistor		Manual	MDI	Memory	Edit*1	
		On	Off					
Alarm output	ALM	○		○	○	○	○	These signals are output when an alarm lowering the servo motor level or an alarm marked "**" on the alarm list occurs. For recovery, remove the alarm cause, and reset. Reference: For details about alarms, see the error code list.
2nd home position return finish 3rd home position return finish	ORGFIN2 ORGFIN3	○				○		These signals are output when the 2nd or 3rd home position return has been completed. The signals go off under either of the following conditions: 1. When a joint is not at the 2nd or 3rd origin. 2. When the servo motor is emergency stopped. Note: These signals will not be out put, when you position a joint to the 2nd or 3rd origin manually, or when you position-ing command.
NC prepara-tion ok	NCOK	○		○	○	○	○	This signal is turned ON when the NC unit is ready for any operation such as axis movement. If alarm of stop level 5 is generated it is turned OFF.
Pallet index finish	PFIN1 PFIN2	○		○	○	○	○	After the pallet home position return has been completed, these signals work as follows: PFIN1 goes on when pallet 1 is indexed outside. PFIN2 goes on when pallet 2 is indexed outside. If you move the pallet from the origin, the corresponding signal will go off. Returning the pallet to the origin will turn the signal on. [Note] The signal will be turned off, if the servo control will be off such as an emergency stop.
Reset output	RSTOUT	○		○	○	○	○	This signal is on during NC reset operation.
Meemory operation mode	MEMMOD	○				○		Goes off when you switch to memory operation mode or edit mode during operation.

7

*1 stands for a program edit.

Signal	Symbol	Output in motion		Effective mode				Function
		Transistor						
		On	Off	Manual	MDI	Memory	Edit*1	
TOOL BROKEN ERROR	TLBRKE	○			○	○		This signal turns on when a TOOL BROKEN ERROR has occurred. When the error is reset, the signal turns off.
OPERATION STOP ERROR	RUNSTP	○		○	○	○	○	This signal turns on when any error that stops operation has occurred (error with asterisk*). Eliminate the error cause, reset the error, and the signal turns off.
ONESHOT SIGNAL OUTPUT M450 M451	M450 M451	○			○	○		A signal is output by oneshot. Output time is set in parameter 1. Signal output is completed and the program proceeds to the next motion. M450 | Next motion ONESHOT SIGNAL M450 OUTPUT TIME ⟷ (parameter 1) Note 1: Turns off when the reset signal is input. Note 2: Does not turn off unless the alarm is reset.
ONESHOT SIGNAL OUTPUT M455 M456	M455 M456	○			○	○		A signal is output by oneshot. Output time is set in parameter 1. When the signal is output, the program simultaneously proceeds to the next motion. M450 Next motion ⟷ Note 1: Turns off when the reset signal is input. Note 2: Does not turn off unless the alarm is reset.
GREEN LAMP	GRN	○			○	○		Outputs the signal with the same condition as the green lamp. • ON conditions STL = ON or during SC motion • OFF conditions Other than ON conditions

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Yellow lamp	YEL	○			○	○		Outputs the signal with the same condition as yellow lamp. ・ON conditions 1) M30=ON 2) INDICATION SELECT AT COUNT-UP (Parameter 1) = YEL-LOW and COUNTER END ・OFF conditions Other than ON condition
Red lamp	RED	○			○	○		Outputs the signal with the same condition as red lamp. ・ON conditions 1) ALM=ON 2) INDICATION SELECT AT COUNT-UP(Parameter 1)=RED and COUNTER END ・OFF conditions Other than ON condition
COUNTER END	CNTUP	○			○	○		・ON conditions Production counter has finished counting ・OFF conditions Other than ON condition
COUNTER END NOTICE	CNTPRE	○			○	○		・ON conditions Production counter notices end ・OFF conditions Other than ON condition

7

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Stop	STPOUT	○		○	○	○	○	The same as for stop key input.
Door (external) open end	DROPEN	○		○	○	○	○	Indicates that the external door is open.
Door (external) close end	DRCLS	○		○	○	○	○	Indicates that the external door is closed.
Inner door close end	INDRCL	○		○	○	○	○	Indicates that the inner door is closed.
External start LED	RDYLED	○				○		Indicates that the machine is ready for operation.
Stop	STPLED	○		○	○	○	○	Indicates that the machine is stopped (same as stop LED).
Dry run	DRYRUN	○		○	○	○	○	Indicates that the machine is in dry run mode.
Single operation	SINGLE	○		○	○	○	○	Indicaes that the machine is in single operation.
Restart	RE-START	○		○	○	○	○	Indicates that the mathine is restarted.
Alarm Level	ALMLV1 ALMLV2	○		○	○	○	○	ALMLV1 ALMLV2 0 0 NO error 0 1 1 cyycle stop 1 0 Block stop 1 1 Temporary stop or higher

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Rapid feed override	PROR100	○		○	○	○	○	Indicates rapid feed override. 1:100% 0: Below 100%
Spindle override	SPOR100	○		○	○	○	○	Indicater spindle override. 1:100% 0: Below 100%
Cyttubg overrude	FDOR100	○		○	○	○	○	Indicates cutting overrride. 1:100% 0: Below 100%
Estinmate tool service life	TOOLPRE	○				○		Turns on if the srvice life of the tool used for operation is shorter than the estimated service life. ON timing is the same as for TOOL signal.

7

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
Coolant	M08	○			○	○		Indicates that the coolant is being circulated.
Relese key	RELESE	○		○	○	○	○	Indicates that the **[RELSE]** key has been held down.
Door interlock	SAFETY	○		○	○	○	○	Indicates that the door interlock is possible.
Coolant switch	COOLSW	○		○	○	○	○	Indicates that the coolant switch is ON.
Chip shower switch	CHIPSW	○		○	○	○	○	Indicates that the chip shower switch is ON.
Side door close end	SDDRCL	○		○	○	○	○	Indicates that the side door is closed.
4th axis 1st ref. Point return finish 5th axis 1st ref. Point return finish 6th axis 1st ref. Point return finish	RE4FN RE5FN RE6FN	○			○	○		This signal turns on when X, Y, Z, 4th, 5th, and 6th axes have all completely returned to the 1st reference point when G30 is executed in MDI or MEMORY RUN mode. [OFF conditions] 1. 4th, 5th, or 6th axis has deviated from the 1st reference point. 2. An alarm of stop level 5 has occurred. [Notes] This signal does not turn on even if 4th, 5th, or 6th axis is intentionally moved to the 1st reference point in manual mode.

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
4th axis 2nd ref. Point return finish 5th axis 2nd ref. Point return finish 6th axis 2nd ref. Point return finish	RE4FN2 RE5FN2 RE6FN2	○			○	○		This signal turns on when X, Y, Z, 4th, 5th, and 6th axes have all completely returned to the 2nd reference point when G30 is executed in MDI or MEMORY RUN mode. [OFF conditions] 1. 4th, 5th, or 6th axis has deviated from the 2nd reference point. 2. An alarm of stop level 5 has occurred. [Notes] This signal does not turn on even if 4th, 5th, or 6th axis is intentionally moved to the 2nd reference point in manual mode.
Manual pulse generator OFF	PULOFF	○		○	○	○	○	When the manual pulse generator is not mounted or the axis selection switch is set to the OFF position, this signal is turned ON. When the manual pulse generator is mounted and the axis selection switch is to X, Y, Z, or 4, this signal is turned OFF.
PALLET SELECT switch	QTSEL1 QTSEL2	○		○	○	○	○	Indicates PALLET SELECT switch. Pallet select switch / QTSEL1 / QTSEL2 OFF / OFF / OFF 1 / ON / OFF 2 / OFF / ON 1⇔2 / ON / ON
Automatic oiling pump	OILPMP	○		○	○	○	○	Output signal to turn on the pump of the automatic oiling unit.

7

***1 stands for a program edit.**

Signal	Symbol	Logic		Effective mode				Function
		a-contact	b-contact	Manual	MDI	Memory	Edit*1	
BATTERY ALARM	BATALM	○		○	○	○	○	Output of battery alarm
X POSI SIGNAL OUTPUT	XPOSSW	○		○	○	○	○	The signal turns on, regardless of whether the servo amplifier is on or off, when the machine coordinate of each axis is within the range set for the parameter (including the boundary value) and turns off when it is out of the range. The signal does not turn on unless dog zero return is completed.
Y POSI SIGNAL OUTPUT	YPOSSW							
Z POSI SIGNAL OUTPUT	ZPOSSW							
4 POSI SIGNAL OUTPUT	4POSSW							
5 POSI SIGNAL OUTPUT	5POSSW							
6 POSI SIGNAL OUTPUT	6POSSW							

7.9.19 Details of external output signals

M function output
Usage of the M function output signals and precautions are described below.

(1) Usage

A 2-digit number in BCD code is sent to a peripheral by specifying any of signal output 01 to 99 in MDI or memory operation mode.
The signal MF is activated 50msec after the activation of this signal.Make the external unit read an M function output signal in response to this signal MF.
After the peripheral completes the operation according to the M function output signal,close the contact of the M function end signal MFIN for 100msec or longer.

Signal output in a program	Upper digits				Lower digits			
	Signals				Signals			
	M28	M24	M22	M21	M18	M14	M12	M11
Signal output07	×	×	×	×	×	×	×	×
Signal output10	×	×	×	○	×	×	×	×
Signal output16	×	×	×	○	×	○	○	×
Signal output25	×	×	○	×	×	○	×	○
Signal output40	×	○	×	×	×	×	×	×
Signal output53	×	○	×	○	×	×	○	○
Signal output67	×	○	○	×	×	○	○	○
Signal output74	×	○	○	○	×	○	×	×
Signal output89	○	×	×	×	○	×	×	○
Signal output95	○	×	×	○	×	○	×	○

○ : ON
× : OFF

M00 to M99 can be created by combination of upper and lower digits. However, note that M00, M01, M02, M03, M04, M05, M06, M08, M09, M19, M30, M98, and M99 are codes for intimal use and are not output to external devices.

(2) Signal timing chart

When a reset signal is activated or if the signal output time over error occurs;

The external signal read-in limit time is set with the parameter 1 in the data bank.
(Refer to the description of the parameter 1.)
If MFIN is not activated within the time set with the parameter 1 after MF is activated,the signal output time over error occurs.
If the set time is 0,the NC unit waits for the signal infinitely and the error does not occur.

***Program end, M30/1, M30/2**

1. When the restart of parameter 1 is 0.

PALLET SELCT switch	OFF	1 or 2	1 ⇔ 2
ON conditions	M30/1 goes on irrespective of the used pallet when you execute the program end.	M30/1 or M30/2 goes on when you execute the program end and take out the pallet.	M30/1 or M30/2 goes on when you execute the program end.
OFF conditions	1. When the reset signal is input. 2. When a start input is accepted.	1. When the reset signal is input. 2. When an outside start input is accepted.	

7

(1) When PALLET SELECT switch is set to "OFF".

[without SC unit]

(Note 1) When EXST signal is input from an external unit, check that M30 signal is ON and STL signal OFF.

7

[with SC unit]

(Note 1) SC operation indicates that the optional automatic door or external sequencer controller is activated.

(2) When PALLET SELECT switch is set to "1 or 2".

[without SC unit]

[with SC unit]

(Note 1) SC operation indicates that the optional automatic door or external sequencer controller is activated.

(3) When PALLET SELECT switch is set to "1 ⇔ 2".

[without SC unit]

[with SC unit]

(NOTE 1) SC operation indicates that the optional automatic door or external sequencer controller is activated.

2. When starting via start signal with the restart of parameter 1 set to 1.

If the pallet selection switch is set to other than off, the program for pallets located inside at start will be executed again.
The signals go on when you execute the program end during memory operation.
The signals go off under either of the following conditions:

1. When you restart after the program end has been completed.
2. When you input the reset signal.

*2 M30/2 will go on if you perform the following:
Starting when pallet 2 is located inside with the pallet selection switch set to 1 ⇔ 2 or 2.

(Note 1) These signals will remain unchanged if an alarm occurs.
(Note 2) The automatic door (optional) works only one time at start.
Thereafter it will not work.
(Note 3) STL does not go off even during M30/1 or M30/2 output.

3. When starting via outside start with the restart of parameter 1 set to 1.

(1) When the pallet selection switch is set to off
Out side is disabled.
(2) When the pallet selection switch is set to 1 or 2.

The signals go on when you execute the program end during memory operation and take out the pallet.
The signals go off when you restart after the program execution has been completed or when you input the reset signal.

*2 M30/2 will go on if you perform the following:
Starting when pallet 2 is located inside with the pallet selection switch set to 1⇔ 2 or 2.

(Note 1) These signals will remain unchanged if an alarm occurs.
(Note 2) The automatic door (optional) works only one time at start.
Thereafter it will not work.
(Note 3) STL does not go off even during M30/1 or M30/2 output.

(3) When the pallet selection switch is set to 1⇔ 2.

Go on when you execute the program end during memory operation.
Go off under either of the following conditions:
1) When carrying in a pallet on the opposite side starts the execution of a program.
2) When you input the reset signal.

*2 M30/2 will go on if you perform the following:
Starting when pallet 2 is located inside with the pallet selection switch set to 1 ⇔ 2 or 2.

(Note 1) These signals will remain unchanged if an alarm occurs.
(Note 2) The automatic door (optional) works only one time at start.
Thereafter it will not work.
(Note 3) STL does not go off even during M30/1 or M30/2 output.

7.9.20 Machime parameter

The customer is requested not to modify the machine parameter.
If this parameter must be modified, contact in advance our after-service department.

Refer to installation for details.

7.10 Data bank (default value list)

Cutting conditions 3 (except tool)

No.	Item	metric	inch
1	STOP POS FORWARD WORK (HOLE)	2.000	0.1000
2	STOP POS FORWARD WORK (FACNG)	2.000	0.1000
3	STOP POS FORWARD WORK (POCKT)	2.000	0.1000
4	LENGTH AFTER THROUGH CUT	2.000	0.1000
5	CHAMFERING CUTTER POSITION	2.000	0.1000
6	TAP PRIMARY HOLE DEPTH	6.000	6.0000
7	REAMER PRIMARY HOLE DEPTH	1.000	1.0000
8	REAMER FINISH ALLOW1(S.)	0.000	0.000
9	REAMER FINISH ALLOW2(S.)	0.000	0.000
10	REAMER FINISH ALLOW1(L.)	0.000	0.000
11	REAMER FINISH ALLOW2(L.)	0.000	0.000
12	DRILL STEP MODE	2	2
13	DRILL STEP RATIO		
	[SOFTSTEEL]	100	100
	[HARDSTEEL]	80	80
	[LEADBRASS]	200	200
	[ALUMINUM]	300	300
	[STAINLESS]	70	70
14	DRILL STEP RETURN POSITION	0	0
15	DRILL STEP RETURN AMOUNT	0.500	0.0200
16	TAP STEP MODE	2	2
17	TAP STEP RATIO		
	[SOFTSTEEL]	100	100
	[HARDSTEEL]	80	80
	[LEADBRASS]	200	200
	[ALUMINUM]	300	300
	[STAINLESS]	70	70
18	TAP RETURN SPEED(RATIO)	100	100
19	DWELL(SHAMFERING)	0	0
20	DWELL(COUNT BORE)	0	0
21	OVERRIDE IN POCKET	70	70
22	OVERRIDE FOR FACING	70	70
23	OVERRIDE LMT IN INSIDE ARC	100	100
24	AUTO. CORNER OVERRIDE LEN1	0.000	0.000
25	AUTO. CORNER OVERRIDE LEN2	0.000	0.000
26	AUTO. CORNER OVERRIDE RATIO	100	100
27	TL RPLC SIMUL OPE START POS		
	TC-31A	300.000	11.8110
	TC-22A		
	[Standard type]	330.000	12.9921
	[Long stroke type]	310.000	12.2047
	TC-S2A		
	[Standard type]	330.000	12.9921
	[Long stroke type]	330.000	12.9921
	TC-32A	350.000	13.7795
	TC-R2A	350.000	13.7795
	TC-20A	330.000	12.9921
	TC-S2B		
	[Standard type]	330.000	12.9921
	[Long stroke type]	330.000	12.9921

User Parameter1 (switch 1) (metric)

Item	31A	22A	S2A	32A	R2A	20A	S2B
MACHINING ORDER	2	2	2	2	2	2	2
MODE SELECT	0	0	0	0	0	0	0
MANUAL FEED	0	0	0	0	0	0	0
RESTART	0	0	0	0	0	0	0
WORK COUNTER WHEN RESTART	0	0	0	0	0	0	0
TOOL LIFE MANAGE WHEN RESTART	0	0	0	0	0	0	0
TOOL LENGTH OFFSET VALUE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAXIMUM TIME OF EXT SIGNAL	0	0	0	0	0	0	0
DRY RUN OFFSET VALUE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BOTTOM HOLE DEPTH TOLERANCE	0.100	0.100	0.100	0.100	0.100	0.100	0.100
REMR RETN SPD	0	0	0	0	0	0	0
START UP/CANCEL	0	0	0	0	0	0	0
MINIMUM CORNER MOVEMENT	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AUTO.CORNER OVERRIDE ANGLE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CENTER ALIGN FEEDRATE 1	500	500	500	500	500	500	500
CENTER ALIGN FEEDRATE 2	10	10	10	10	10	10	10
CENTER ALIGN RETRACT VALUE	0.500	0.500	0.500	0.500	0.500	0.500	0.500
CENTER ALIGN CORRECT VALUE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Z.M.ZERO RTN AT MEMORY RUN START	1	1	1	1	1	1	1
INDICATION SELECT AT COUNT-UP	0	0	0	0	0	0	0
TOOL BREAKAGE DETECT OPTION	0	0	0	0	0	0	0
TOOL BRK DETECT RETURN POS							
[Standard type]	550.000	610.000	430.000	610.000	450.000	370.000	430.000
[Long stroke type]		590.000	410.000				410.000
TOOL BRK DETECTION POS X	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOOL BRK DETECTION POS Y	0.000	0.000	0.000	-140.000	0.000	0.000	0.000
TL BRK DET EXE CYCLE	1	1	1	1	1	1	1
EXTERNAL ERROR 10 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 11 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 12 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 13 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 14 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 15 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 16 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 17 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 18 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 19 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 20 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 21 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 22 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 23 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 24 ALARM LEVEL	1	1	1	1	1	1	1

User Parameter1 (switch 1) (metric)

Item	31A	22A	S2A	32A	R2A	20A	S2B
EXTERNAL ERROR 25 ALARM LEVEL	1	1	1	1	1	1	1
UNREGISTERED M-CODE	0	0	0	0	0	0	0
ONESHOT SIGNAL M450 OUTPUT TIME	5	5	5	5	5	5	5
ONESHOT SIGNAL M451 OUTPUT TIME	5	5	5	5	5	5	5
ONESHOT SIGNAL M455 OUTPUT TIME	5	5	5	5	5	5	5
ONESHOT SIGNAL M456 OUTPUT TIME	5	5	5	5	5	5	5
AUTO DISPLAY CLEAR TIME	0	0	0	0	0	0	0
MACHINE NUMBER	0	0	0	0	0	0	0
AUTOMATIC DOOR	0	0	0	0	0	0	0
AREA SENSOR PATTERN	1	1	1	1	1	1	1
RESET AUTOMATIC DOOR ERROR	1	1	1	1	1	1	1
AUTOMATIC DOOR OPERATION TIME	5	5	5	5	5	5	10
DISPLAY PROGRAM LIST	1	1	1	1	1	1	1
OVERRIDE SWITCH	1	1	1	1	1	1	1
DISP ALARM WHEN OVERRIDE IS VALID	1	1	1	1	1	1	1
DISPLAY ALARM WHEN DOOR IS OPEN	0	0	0	0	0	0	0
START POS AFTER SCHEDL PROGM RESET	0	0	0	0	0	0	0
STOP WHEN CURRENT PROGRAM IS ENDED	0	0	0	0	0	0	0
M490 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M491 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M492 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M493 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M494 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHIP SHOWER DRAIN TIME	0	0	0	0	0	0	0
AUTOMATIC COOLANT OFF TIME	0	0	0	0	0	0	0
COOLANT DELAY TIME	20	20	20	20	20	20	20
AUTOMATIC MACHINE LIGHT OFF TIME	0	0	0	0	0	0	0
TIME TILL STANDBY MODE ENTERED	0	0	0	0	0	0	0
AUTOMATIC POWER OFF	0	0	0	0	0	0	0
AUTO POWER OFF TIME	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
POT LOWERING START POSITION	0.000	0.000	0.000	0.000	0.000	50.000	0.000
CORNER DECELERATION ANGLE	179.999	179.999	179.999	179.999	179.999	179.999	179.999
CORNER DECELERATION MINIMUM RATE	20	20	20	20	20	20	20
ALARM WHILE SCREEN IS DIMMED	0	0	0	0	0	0	0
TABLE LOADED MASS	160	200	150	160	160	70	150
BACK WASHING AT PROGRAM END	0	0	0	0	0	0	1
OPERATION TIME	-	-	-	-	-	-	-
CURRENT DATE	-	-	-	-	-	-	-
CURRENT TIME	-	-	-	-	-	-	-
MACHINE UNIT SYSTEM	-	-	-	-	-	-	-

User Parameter 2 (switch 2)

Item	31A	22A	S2A	32A	R2A	20A	S2B
STROKE 4	1	0	0	1	1	0	0
STROKE 5	0	0	0	0	0	0	0
STROKE 6	0	0	0	0	0	0	0
STROKE 4(-)	-180.000	0.000	0.000	-180.000	-180.000	0.000	0.000
STROKE 5(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 6(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 4(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 5(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 6(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 X(-)							
[Standard type]	-350.000	-500.000	-480.000	-450.000	-420.000	-200.000	-480.000
[Long stroke type]		-700.000	-700.000				-700.000
SOFTWARE STROKE LIMIT1 Y(-)	-250.000	-400.000	-360.000	-320.000	-320.000	-255.000	-360.000
SOFTWARE STROKE LIMIT1 Z(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 4(-)	-180.000	0.000	0.000	-180.000	-180.000	0.000	0.000
SOFTWARE STROKE LIMIT1 5(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 6(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 X(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 Y(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 Z(+)							
[Standard type]	550.000	610.000	430.000	610.000	450.000	370.000	430.000
[Long stroke type]		590.000	410.000				410.000
SOFTWARE STROKE LIMIT1 4(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 5(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 6(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 X(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 Y(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 Z(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 X(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 Y(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 Z(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RAPID TRAVERSE OVERRIDE SPD1	0	0	0	0	0	0	0
RAPID TRAVERSE OVERRIDE SPD2	500	500	500	500	500	500	500
RAPID TRAVERSE OVERRIDE SPD3	5000	5000	5000	5000	5000	5000	5000
4-AXIS OVERRIDE ROTATE SPD.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-AXIS OVERRIDE ROTATE SPD.2	0.3	0.5	0.3	0.3	0.3	0.5	0.3
4-AXIS OVERRIDE ROTATE SPD.3	2.5	5	2.5	2.5	2.5	5.0	2.5
5-AXIS OVERRIDE ROTATE SPD.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-AXIS OVERRIDE ROTATE SPD.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5-AXIS OVERRIDE ROTATE SPD.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
6-AXIS OVERRIDE ROTATE SPD.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-AXIS OVERRIDE ROTATE SPD.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6-AXIS OVERRIDE ROTATE SPD.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
X POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

User Parameter 2 (switch 2)

Item	31A	22A	S2A	32A	R2A	20A	S2B
Z POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Z POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

User Parameter 3 (Communication)

Item	31A	22A	S2A	32A	R2A	20A	S2B
SELECT PORT	0	0	0	0	0	0	0
CONNECTION OBJECT	1	1	1	1	1	1	1
COMP COMMUNICATN PROTOCOL(MASTER)	0	0	0	0	0	0	0
BAUD RATE	5	5	5	5	5	5	5
PARITY	0	0	0	0	0	0	0
STOP BIT	0	0	0	0	0	0	0
CHARACTER	0	0	0	0	0	0	0
RESPONSE MONITORING TIME	60	60	60	60	60	60	60
COMMUNICATION TYPE	0	0	0	0	0	0	0
DC1 CODE	17	17	17	17	17	17	17
DC2 CODE	18	18	18	18	18	18	18
DC3 CODE	147	147	147	147	147	147	147
DC4 CODE	20	20	20	20	20	20	20
DR SIGNAL CHECK	1	1	1	1	1	1	1
ENDING DC3 CODE	0	0	0	0	0	0	0
OUTPUT TAPE FEED	1	1	1	1	1	1	1
RESET IN SLAVE COMMUNICATION	1	1	1	1	1	1	1
RECOVERY TIME OF RESET	1	1	1	1	1	1	1
DATA OVERWRITE(SLAVE)	0	0	0	0	0	0	0
REMOTE OPERATION	0	0	0	0	0	0	0
CHECKSUM	0	0	0	0	0	0	0

User Parameter 4 (Extrl in Signal)

Item	31A	22A	S2A	32A	R2A	20A	S2B
No.53	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR
No.54	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP
No.55	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR
No.56	1 PRO1	1 PRO1	1 PRO1	1 PRO1	1 PRO1	1 PRO1	1 PRO1
No.57	2 PRO2	2 PRO2	2 PRO2	2 PRO2	2 PRO2	2 PRO2	2 PRO2
No.58	27 EXER23	27 EXER23	27 EXER23	27 EXER23	27 EXER23	27 EXER23	27 EXER23
No.59	28 EXER24	28 EXER24	28 EXER24	28 EXER24	28 EXER24	28 EXER24	28 EXER24
No.60	29 EXER25	29 EXER25	29 EXER25	29 EXER25	29 EXER25	29 EXER25	29 EXER25
No.203							
No.204							
No.205	3 PRO4	3 PRO4	3 PRO4	3 PRO4	3 PRO4	3 PRO4	3 PRO4
No.206	4 PRO8	4 PRO8	4 PRO8	4 PRO8	4 PRO8	4 PRO8	4 PRO8
No.207	8 PR9900	8 PR9900	8 PR9900	8 PR9900	8 PR9900	8 PR9900	8 PR9900
No.208	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2
No.209	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3
No.210							
No.213							
No.214							
No.215	25 EXER21	25 EXER21	25 EXER21	25 EXER21	25 EXER21	25 EXER21	25 EXER21
No.216	26 EXER22	26 EXER22	26 EXER22	26 EXER22	26 EXER22	26 EXER22	26 EXER22
No.217	10 CTURN			10 CTURN	10 CTURN		
No.218	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK
No.219	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK
No.220	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK

User Parameter 5 (Extrl out Signal)

Item	31A	22A	S2A	32A	R2A	20A	S2B
No.103	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP
No.104	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM
No.105	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1
No.106	18 M406	18 M406	18 M406	18 M406	18 M406	18 M406	18 M406
No.107	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF
No.108	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22
No.109	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24
No.110	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28
No.303	1 M11	1 M11	1 M11	1 M11	1 M11	1 M11	1 M11
No.304	2 M12	2 M12	2 M12	2 M12	2 M12	2 M12	2 M12
No.305	3 M14	3 M14	3 M14	3 M14	3 M14	3 M14	3 M14
No.306	4 M18	4 M18	4 M18	4 M18	4 M18	4 M18	4 M18
No.307	5 M21	5 M21	5 M21	5 M21	5 M21	5 M21	5 M21
No.308	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22
No.309	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24
No.310	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28
No.313	9 M00	9 M00	9 M00	9 M00	9 M00	9 M00	9 M00
No.314	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1
No.315	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2
No.316	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3
No.317	16 M402	16 M402	16 M402	16 M402	16 M402	16 M402	16 M402
No.318	17 M404	17 M404	17 M404	17 M404	17 M404	17 M404	17 M404
No.319							
No.320	11 M30/2			11 M30/2	11 M30/2		
No.323	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF
No.324	25 AUTO	25 AUTO	25 AUTO	25 AUTO	25 AUTO	25 AUTO	25 AUTO
No.325	26 STL	26 STL	26 STL	26 STL	26 STL	26 STL	26 STL
No.326	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK
No.327	28 NCOK	28 NCOK	28 NCOK	28 NCOK	28 NCOK	28 NCOK	28 NCOK
No.328	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM
No.329	32 TOOL	32 TOOL	32 TOOL	32 TOOL	32 TOOL	32 TOOL	32 TOOL
No.330	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN
No.333	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN
No.334	36 ZPX	36 ZPX	36 ZPX	36 ZPX	36 ZPX	36 ZPX	36 ZPX
No.335	37 ZPY	37 ZPY	37 ZPY	37 ZPY	37 ZPY	37 ZPY	37 ZPY
No.336	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ
No.337	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP
No.338	43 PFIN1			43 PFIN1	43 PFIN1		
No.339	44 PFIN2			44 PFIN2	44 PFIN2		
No.340							

User Parameter 6 (Z measurement)

Item	31A	22A	S2A	32A	R2A	20A	S2B
TOOL BREAKAGE DETECT FUNCTION	0	0	0	0	0	0	0
THERMAL MEASUREMENT FUNCTION	0	0	0	0	0	0	0
THERMAL DISPLCMNT COMPEN PALLET	0	-	-	0	0	-	-
PALLET1 SIDE MEASUREMENT DEVICE	0	-	-	0	0	-	-
PALLET2 SIDE MEASUREMENT DEVICE	0	-	-	0	0	-	-
XY POSITION RADIUS SHIFT DIRCTN	0	0	0	0	0	0	0
DWELL (AIR BLOW)	0	0	0	0	0	0	0
MEASUREMENT START POSITION	2.000	2.000	2.000	2.000	2.000	2.000	2.000
MEASUREMENT STOP RANGE	1.000	1.000	1.000	1.000	1.000	1.000	1.000
COOLANT AUTO OPE	1	1	1	1	1	1	1
SPINDLE ROTATION WN MSRING DISP	1	1	1	1	1	1	1
THERMAL MEASUREMENT TOOL NO.1	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.2	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.3	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.4	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.5	0	0	0	0	0	0	0
THERMAL MEASUREMENT MOTION COND.	0	0	0	0	0	0	0
Z-AXIS MACHINING ACCURACY	0.020	0.020	0.020	0.020	0.020	0.020	0.020
THERMAL WATCH DISPLACMT AMNT	0.010	0.010	0.010	0.010	0.010	0.010	0.010
NUMBER OF THERMAL WATCHING	2	2	2	2	2	2	2
NO.OF THERMAL WATCHING CANCEL	10	10	10	10	10	10	10
INITIAL SET NO. OF THERMAL MSMT	10	10	10	10	10	10	10
THERMAL WATCHING STOP TIME	2	2	2	2	2	2	2
THRM OFFSET AMT LIMIT VALUE	0.200	0.200	0.200	0.200	0.200	0.200	0.200
RETRACT AMNT AFT MEASUREMNT	0.500	0.500	0.500	0.500	0.500	0.500	0.500
MSMT FEEDRATE B TOOL DIAMTR	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MEASUREMENT FEEDRATE 1A	500	500	500	500	500	500	500
MEASUREMENT FEEDRATE 1B	2000	2000	2000	2000	2000	2000	2000
MEASUREMENT FEEDRATE 2A	50	50	50	50	50	50	50
MEASUREMENT FEEDRATE 2B	50	50	50	50	50	50	50
THERMAL MEASUREMENT FEEDRATE	50	50	50	50	50	50	50
PAL1 SIDE MSMT DEV POS X	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PAL1 SIDE MSMT DEV POS Y	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PAL1 SIDE MSMT DEV POS Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PAL2 SIDE MSMT DEV POS X	0.000	-	-	0.000	0.000	-	-
PAL2 SIDE MSMT DEV POS Y	0.000	-	-	0.000	0.000	-	-
PAL2 SIDE MSMT DEV POS Z	0.000	-	-	0.000	0.000	-	-

User Parameter 7 (Zero measurement)

Item	31A	22A	S2A	32A	R2A	20A	S2B
PROBE OFFSET VALUE 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PROBE OFFSET VALUE 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PROBE OFFSET VALUE 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PROBE OFFSET VALUE 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MEASURING MOTION	0	0	0	0	0	0	0
MEASURING SPEED 1	500	500	500	500	500	500	500
MEASURING SPEED 2	100	100	100	100	100	100	100
STOP DISTANCE BEFORE MSRNG	5.000	5.000	5.000	5.000	5.000	5.000	5.000
MEASURNG TRAVEL LMT DISTANCE	2.000	2.000	2.000	2.000	2.000	2.000	2.000
MEASUREMENT TOLERANCE 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MEASUREMENT TOLERANCE 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RETURN DISTANCE AFT MEASURNG	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RETURN DISTANCE AFT MEASURNG	1.000	1.000	1.000	1.000	1.000	1.000	1.000

User Parameter 8 (Auto THRM DISP CMP)

Item	31A	22A	S2A	32A	R2A	20A	S2B
Z-AXIS COMPENSATION ADJUSTMENT	100	100	100	100	100	100	100
SPINDLE COMP ADJUSTMENT(Z)	100	100	100	100	100	100	100
X-AXIS COMPENSATION ADJUSTMENT	100	100	100	100	100	100	100
SPINDLE COMP ADJUSTMENT(X)	100	100	100	100	100	100	100
Y-AXIS COMPENSATION ADJUSTMENT	100	100	100	100	100	100	100
SPINDLE COMP ADJUSTMENT(Y)	100	100	100	100	100	100	100

User Parameter 9 (Quick Table)

Item	31A	32A	R2A
PALLET 1 PROGRAM NUMBER	-	-	-
PALLET 2 PROGRAM NUMBER	-	-	-
PALLET 2 SHIFT VALUE X	0.000	0.000	0.000
PALLET 2 SHIFT VALUE Y	0.000	0.000	0.000
PALLET 2 SHIFT VALUE Z	0.000	0.000	0.000
PALLET 1 CARRY IN MOTION	0	0	0
PALLET 2 CARRY IN MOTION	0	0	0

User Parameter1 (switch 1) (INCH)

Item	31A	22A	S2A	32A	R2A	20A	S2B
MACHINING ORDER	2	2	2	2	2	2	2
MODE SELECT	0	0	0	0	0	0	0
MANUAL FEED	0	0	0	0	0	0	0
RESTART	0	0	0	0	0	0	0
WORK COUNTER WHEN RESTART	0	0	0	0	0	0	0
TOOL LIFE MANAGE WHEN RESTART	0	0	0	0	0	0	0
TOOL LENGTH OFFSET VALUE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MAXIMUM TIME OF EXT SIGNAL	0	0	0	0	0	0	0
DRY RUN OFFSET VALUE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
BOTTOM HOLE DEPTH TOLERANCE	0.100	0.100	0.100	0.100	0.100	0.100	0.100
REMR RETN SPD	0	0	0	0	0	0	0
START UP/CANCEL	0	0	0	0	0	0	0
MINIMUM CORNER MOVEMENT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AUTO.CORNER OVERRIDE ANGLE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CENTER ALIGN FEEDRATE 1	19.6	19.6	19.6	19.6	19.6	19.6	19.6
CENTER ALIGN FEEDRATE 2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
CENTER ALIGN RETRACT VALUE	0.0196	0.0196	0.0196	0.0196	0.0196	0.0196	0.0196
CENTER ALIGN CORRECT VALUE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Z.M.ZERO RTN AT MEMORY RUN START	1	1	1	1	1	1	1
INDICATION SELECT AT COUNT-UP	0	0	0	0	0	0	0
TOOL BREAKAGE DETECT OPTION	0	0	0	0	0	0	0
TOOL BRK DETECT RETURN POS							
[Standard type]	21.6535	24.0157	16.9291	24.0157	17.7165	14.5669	16.9291
[Short stroke type]							16.9291
[Long stroke type]		23.2283	16.1417				16.1417
TOOL BRK DETECTION POS X	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOOL BRK DETECTION POS Y	0.0000	0.0000	0.0000	-5.5118	0.0000	0.0000	0.0000
TL BRK DET EXE CYCLE	1	1	1	1	1	1	1
EXTERNAL ERROR 10 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 11 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 12 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 13 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 14 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 15 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 16 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 17 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 18 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 19 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 20 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 21 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 22 ALARM LEVEL	1	1	1	1	1	1	1

Item	31A	22A	S2A	32A	R2A	20A	S2B
EXTERNAL ERROR 23 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 24 ALARM LEVEL	1	1	1	1	1	1	1
EXTERNAL ERROR 25 ALARM LEVEL	1	1	1	1	1	1	1
UNREGISTERED M-CODE	0	0	0	0	0	0	0
ONESHOT SIGNAL M450 OUTPUT TIME	5	5	5	5	5	5	5
ONESHOT SIGNAL M451 OUTPUT TIME	5	5	5	5	5	5	5
ONESHOT SIGNAL M455 OUTPUT TIME	5	5	5	5	5	5	5
ONESHOT SIGNAL M456 OUTPUT TIME	5	5	5	5	5	5	5
AUTO DISPLAY CLEAR TIME	0	0	0	0	0	0	0
MACHINE NUMBER	0	0	0	0	0	0	0
AUTOMATIC DOOR	0	0	0	0	0	0	0
AREA SENSOR PATTERN	1	1	1	1	1	1	1
RESET AUTOMATIC DOOR ERROR	1	1	1	1	1	1	1
AUTOMATIC DOOR OPERATION TIME	5	5	5	5	5	5	10
DISPLAY PROGRAM LIST	1	1	1	1	1	1	1
OVERRIDE SWITCH	1	1	1	1	1	1	1
DISP ALARM WHEN OVERRIDE IS VALID	1	1	1	1	1	1	1
DISPLAY ALARM WHEN DOOR IS OPEN	0	0	0	0	0	0	0
START POS AFTER SCHEDL PROGM RESET	0	0	0	0	0	0	0
STOP WHEN CURRENT PROGRAM IS ENDED	0	0	0	0	0	0	0
M490 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	1.0
M491 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M492 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	1.0
M493 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M494 COOLANT BLOWING TIME	0.0	0.0	0.0	0.0	0.0	0.0	1.0
CHIP SHOWER DRAIN TIME	0	0	0	0	0	0	0
AUTOMATIC COOLANT OFF TIME	0	0	0	0	0	0	0
COOLANT DELAY TIME	20	20	20	20	20	20	20
AUTOMATIC MACHINE LIGHT OFF TIME	0	0	0	0	0	0	0
TIME TILL STANDBY MODE ENTERED	0	0	0	0	0	0	0
AUTOMATIC POWER OFF	0	0	0	0	0	0	0
AUTO POWER OFF TIME	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
POT LOWERING START POSITION	0.000	0.000	0.000	0.000	0.000	1.9685	0.000
CORNER DECELERATION ANGLE	179.999	179.999	179.999	179.999	179.999	179.999	179.999
CORNER DECELERATION MINIMUM RATE	20	20	20	20	20	20	20
ALARM WHILE SCREEN IS DIMMED	0	0	0	0	0	0	0
TABLE LOADED MASS	160	200	150	160	160	70	150
BACK WASHING AT PROGRAM END	0	0	0	0	0	0	1.
OPERATION TIME	-	-	-	-	-	-	-
CURRENT DATE	-	-	-	-	-	-	-
CURRENT TIME	-	-	-	-	-	-	-
MACHINE UNIT SYSTEM	1	1	1	1	1	1	1

User Parameter 2 (switch 2)

Item	31A	22A	S2A	32A	R2A	20A	S2B
STROKE 4	1	0	0	1	1	0	0
STROKE 5	0	0	0	0	0	0	0
STROKE 6	0	0	0	0	0	0	0
STROKE 4(-)	-180.000	0.000	0.000	-180.000	-180.000	0.000	0.000
STROKE 5(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 6(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 4(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 5(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
STROKE 6(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 X(-)							
[Standard type]	-13.7795	-19.6850	-18.8976	-17.7165	-16.5354	-7.8740	-18.8976
[Short stroke type]							-11.8110
[Long stroke type]		-27.5591	-27.5591				-27.5591
SOFTWARE STROKE LIMIT1 Y(-)	-9.8425	-15.7480	-14.1732	-12.5984	-12.5984	-10.0394	-14.1732
SOFTWARE STROKE LIMIT1 Z(-)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT1 4(-)	-180.000	0.000	0.000	-180.000	-180.000	0.000	0.000
SOFTWARE STROKE LIMIT1 5(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 6(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 X(+)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT1 Y(+)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT1 Z(+)							
[Standard type]	21.6535	24.0157	16.9291	24.0157	17.7165	14.5669	16.9291
[Short stroke type]							16.9291
[Long stroke type]		23.2283	16.1417				16.1417
SOFTWARE STROKE LIMIT1 4(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 5(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT1 6(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOFTWARE STROKE LIMIT2 X(-)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT2 Y(-)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT2 Z(-)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT2 X(+)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT2 Y(+)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SOFTWARE STROKE LIMIT2 Z(+)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
X ZERO RETURN PSTN(NO.2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y ZERO RETURN PSTN(NO.2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4 ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 ZERO RETURN PSTN(NO.2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X ZERO RETURN PSTN(NO.3)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y ZERO RETURN PSTN(NO.3)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4 ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 ZERO RETURN PSTN(NO.3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RAPID TRAVERSE OVERRIDE SPD1	0	0.0	0.0	0.0	0	0.0	0.0
RAPID TRAVERSE OVERRIDE SPD2	19.6	19.6	19.6	19.6	19.6	19.6	19.6
RAPID TRAVERSE OVERRIDE SPD3	196.8	196.8	196.8	196.8	196.8	196.8	196.8
4-AXIS OVERRIDE ROTATE SPD.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-AXIS OVERRIDE ROTATE SPD.2	0.3	0.5	0.5	0.3	0.3	0.5	0.5
4-AXIS OVERRIDE ROTATE SPD.3	2.5	5.0	5.0	2.5	2.5	5.0	5.0
5-AXIS OVERRIDE ROTATE SPD.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-AXIS OVERRIDE ROTATE SPD.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5-AXIS OVERRIDE ROTATE SPD.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
6-AXIS OVERRIDE ROTATE SPD.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-AXIS OVERRIDE ROTATE SPD.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6-AXIS OVERRIDE ROTATE SPD.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
X POSI SIGNAL OUTPUT(+)	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000

Item	31A	22A	S2A	32A	R2A	20A	S2B
X POSI SIGNAL OUTPUT(-)	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000
Y POSI SIGNAL OUTPUT(+)	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000
Y POSI SIGNAL OUTPUT(-)	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000
Z POSI SIGNAL OUTPUT(+)	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000
Z POSI SIGNAL OUTPUT(-)	0.000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000
4 POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 POSI SIGNAL OUTPUT(+)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 POSI SIGNAL OUTPUT(-)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

User Parameter 3 (Communication)

Item	31A	22A	S2A	32A	R2A	20A	S2B
SELECT PORT	0	0	0	0	0	0	0
CONNECTION OBJECT	1	1	1	1	1	1	1
COMP COMMUNICATN PROTOCOL(MASTER)	0	0	0	0	0	0	0
BAUD RATE	5	5	5	5	5	5	5
PARITY	0	0	0	0	0	0	0
STOP BIT	0	0	0	0	0	0	0
CHARACTER	0	0	0	0	0	0	0
RESPONSE MONITORING TIME	60	60	60	60	60	60	60
COMMUNICATION TYPE	0	0	0	0	0	0	0
DC1 CODE	17	17	17	17	17	17	17
DC2 CODE	18	18	18	18	18	18	18
DC3 CODE	147	147	147	147	147	147	147
DC4 CODE	20	20	20	20	20	20	20
DR SIGNAL CHECK	1	1	1	1	1	1	1
ENDING DC3 CODE	0	0	0	0	0	0	0
OUTPUT TAPE FEED	1	1	1	1	1	1	1
RESET IN SLAVE COMMUNICATION	1	1	1	1	1	1	1
RECOVERY TIME OF RESET	1	1	1	1	1	1	1
DATA OVERWRITE(SLAVE)	0	0	0	0	0	0	0
REMOTE OPERATION	0	0	0	0	0	0	0
CHECKSUM	0	0	0	0	0	0	0

User Parameter 4 (Extrl in Signal)

Item	31A	22A	S2A	32A	R2A	20A	S2B
No.53	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR	56 PRSNSR
No.54	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP	57 OILEMP
No.55	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR	58 BOXDR
No.56	1 PRO1	1 PRO1	1 PRO1	1 PRO1	1 PRO1	1 PRO1	1 PRO1
No.57	2 PRO2	2 PRO2	2 PRO2	2 PRO2	2 PRO2	2 PRO2	2 PRO2
No.58	27 EXER23	27 EXER23	27 EXER23	27 EXER23	27 EXER23	27 EXER23	27 EXER23
No.59	28 EXER24	28 EXER24	28 EXER24	28 EXER24	28 EXER24	28 EXER24	28 EXER24
No.60	29 EXER25	29 EXER25	29 EXER25	29 EXER25	29 EXER25	29 EXER25	29 EXER25
No.203							
No.204							
No.205	3 PRO4	3 PRO4	3 PRO4	3 PRO4	3 PRO4	3 PRO4	3 PRO4
No.206	4 PRO8	4 PRO8	4 PRO8	4 PRO8	4 PRO8	4 PRO8	4 PRO8
No.207	8 PR9900	8 PR9900	8 PR9900	8 PR9900	8 PR9900	8 PR9900	8 PR9900
No.208	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2	11 EXORG2
No.209	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3	12 EXORG3
No.210							
No.213							
No.214							
No.215	25 EXER21	25 EXER21	25 EXER21	25 EXER21	25 EXER21	25 EXER21	25 EXER21
No.216	26 EXER22	26 EXER22	26 EXER22	26 EXER22	26 EXER22	26 EXER22	26 EXER22
No.217	10 CTURN			10 CTURN	10 CTURN		
No.218	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK	39 4LOCK
No.219	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK	40 5LOCK
No.220	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK	41 6LOCK

User Parameter 5 (Extrl out Signal)

Item	31A	22A	S2A	32A	R2A	20A	S2B
No.103	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP	84 OILPMP
No.104	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM
No.105	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1
No.106	18 M406	18 M406	18 M406	18 M406	18 M406	18 M406	18 M406
No.107	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF
No.108	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22
No.109	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24
No.110	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28
No.303	1 M11	1 M11	1 M11	1 M11	1 M11	1 M11	1 M11
No.304	2 M12	2 M12	2 M12	2 M12	2 M12	2 M12	2 M12
No.305	3 M14	3 M14	3 M14	3 M14	3 M14	3 M14	3 M14
No.306	4 M18	4 M18	4 M18	4 M18	4 M18	4 M18	4 M18
No.307	5 M21	5 M21	5 M21	5 M21	5 M21	5 M21	5 M21
No.308	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22	6 M22
No.309	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24	7 M24
No.310	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28	8 M28
No.313	9 M00	9 M00	9 M00	9 M00	9 M00	9 M00	9 M00
No.314	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1	10 M30/1
No.315	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2	12 ORGFN2
No.316	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3	13 ORGFN3
No.317	16 M402	16 M402	16 M402	16 M402	16 M402	16 M402	16 M402
No.318	17 M404	17 M404	17 M404	17 M404	17 M404	17 M404	17 M404
No.319							
No.320	11 M30/2			11 M30/2	11 M30/2		
No.323	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF	24 MF
No.324	25 AUTO	25 AUTO	25 AUTO	25 AUTO	25 AUTO	25 AUTO	25 AUTO
No.325	26 STL	26 STL	26 STL	26 STL	26 STL	26 STL	26 STL
No.326	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK	27 MEMOK
No.327	28 NCOK	28 NCOK	28 NCOK	28 NCOK	28 NCOK	28 NCOK	28 NCOK
No.328	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM	29 ALM
No.329	32 TOOL	32 TOOL	32 TOOL	32 TOOL	32 TOOL	32 TOOL	32 TOOL
No.330	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN	34 ORGFIN
No.333	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN	35 SPTURN
No.334	36 ZPX	36 ZPX	36 ZPX	36 ZPX	36 ZPX	36 ZPX	36 ZPX
No.335	37 ZPY	37 ZPY	37 ZPY	37 ZPY	37 ZPY	37 ZPY	37 ZPY
No.336	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ	38 ZPZ
No.337	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP	39 ZPSP
No.338	43 PFIN1			43 PFIN1	43 PFIN1		
No.339	44 PFIN2			44 PFIN2	44 PFIN2		
No.340							

User Parameter 6 (Z measurement)

Item	31A	22A	S2A	32A	R2A	20A	S2B
TOOL BREAKAGE DETECT FUNCTION	0	0	0	0	0	0	0
THERMAL MEASUREMENT FUNCTION	0	0	0	0	0	0	0
THERMAL DISPLCMNT COMPEN PALLET	0	-	-	0	0	-	-
PALLET1 SIDE MEASUREMENT DEVICE	0	-	-	0	0	-	-
PALLET2 SIDE MEASUREMENT DEVICE	0	-	-	0	0	-	-
XY POSITION RADIUS SHIFT DIRCTN	0	0	0	0	0	0	0
DWELL (AIR BLOW)	0	0	0	0	0	0	0
MEASUREMENT START POSITION	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
MEASUREMENT STOP RANGE	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500
COOLANT AUTO OPE	1	1	1	1	1	1	1
SPINDLE ROTATION WN MSRING DISP	1	1	1	1	1	1	1
THERMAL MEASUREMENT TOOL NO.1	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.2	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.3	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.4	0	0	0	0	0	0	0
THERMAL MEASUREMENT TOOL NO.5	0	0	0	0	0	0	0
THERMAL MEASUREMENT MOTION COND.	0	0	0	0	0	0	0
Z-AXIS MACHINING ACCURACY	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
THERMAL WATCH DISPLACMT AMNT	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
NUMBER OF THERMAL WATCHING	2	2	2	2	2	2	2
NO.OF THERMAL WATCHING CANCEL	10	10	10	10	10	10	10
INITIAL SET NO. OF THERMAL MSMT	10	10	10	10	10	10	10
THERMAL WATCHING STOP TIME	2	2	2	2	2	2	2
THRM OFFSET AMT LIMIT VALUE	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
RETRACT AMNT AFT MEASUREMNT	0.0196	0.0196	0.0196	0.0196	0.0196	0.0196	0.0196
MSMT FEEDRATE B TOOL DIAMTR	0.0393	0.0393	0.0393	0.0393	0.0393	0.0393	0.0393
MEASUREMENT FEEDRATE 1A	19.6	19.6	19.6	19.6	19.6	19.6	19.6
MEASUREMENT FEEDRATE 1B	78.7	78.7	78.7	78.7	78.7	78.7	78.7
MEASUREMENT FEEDRATE 2A	1.9	1.9	1.9	1.9	1.9	1.9	1.9
MEASUREMENT FEEDRATE 2B	1.9	1.9	1.9	1.9	1.9	1.9	1.9
THERMAL MEASUREMENT FEEDRATE	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PAL1 SIDE MSMT DEV POS X	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PAL1 SIDE MSMT DEV POS Y	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PAL1 SIDE MSMT DEV POS Z	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PAL2 SIDE MSMT DEV POS X	0.0000	-	-	0.0000	0.0000	-	-
PAL2 SIDE MSMT DEV POS Y	0.0000	-	-	0.0000	0.0000	-	-
PAL2 SIDE MSMT DEV POS Z	0.0000	-	-	0.0000	0.0000	-	-

User Parameter 7 (Zero measurement)

Item	31A	22A	S2A	32A	R2A	20A	S2B
PROBE OFFSET VALUE 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PROBE OFFSET VALUE 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PROBE OFFSET VALUE 3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PROBE OFFSET VALUE 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MEASURING MOTION	0	0	0	0	0	0	0
MEASURING SPEED 1	19.6	19.6	19.6	19.6	19.6	19.6	19.6
MEASURING SPEED 2	3.9	3.9	3.9	3.9	3.9	3.9	3.9
STOP DISTANCE BEFORE MSRNG	0.1968	0.1968	0.1968	0.1968	0.1968	0.1968	0.1968
MEASURNG TRAVEL LMT DISTANCE	0.0787	0.0787	0.0787	0.0787	0.0787	0.0787	0.0787
MEASUREMENT TOLERANCE 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MEASUREMENT TOLERANCE 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
RETURN DISTANCE AFT MEASURNG	0.0393	0.0393	0.0393	0.0393	0.0393	0.0393	0.0393

User Parameter 8 (Auto THRM DISP CMP)

Item	31A	22A	S2A	32A	R2A	20A	S2B
Z-AXIS COMPENSATION ADJUSTMENT	100	100	100	100	100	100	100
SPINDLE COMP ADJUSTMENT(Z)	100	100	100	100	100	100	100
X-AXIS COMPENSATION ADJUSTMENT	100	100	100	100	100	100	100
SPINDLE COMP ADJUSTMENT(X)	100	100	100	100	100	100	100
Y-AXIS COMPENSATION ADJUSTMENT	100	100	100	100	100	100	100
SPINDLE COMP ADJUSTMENT(Y)	100	100	100	100	100	100	100

7

User Parameter 9(Quick Table

Item	31A	32A	R2A
PALLET 1 PROGRAM NUMBER	-	-	-
PALLET 2 PROGRAM NUMBER	-	-	-
PALLET 2 SHIFT VALUE X	0.000	0.000	0.000
PALLET 2 SHIFT VALUE Y	0.000	0.000	0.000
PALLET 2 SHIFT VALUE Z	0.000	0.000	0.000
PALLET 1 CARRY IN MOTION	0	0	0
PALLET 2 CARRY IN MOTION	0	0	0

(This page is blank.)

CHAPTER 8

ALARM MESSAGE

8.1 Display of alarm messages
8.2 Battery Fault Alarm
8.3 Alarm stop level and reset level
8.4 *Axis display
8.5 Alarm Message
8.6 Servo error message
8.7 Resettig ATC
8.8 Resettig procedure for tool clamp error

8.1 Display of alarm messages

Each message is displayed with * mark at the beginning according to the reset level.

(Ex.)

Reset level 3 = **

1000 **TURN OFF POWER

Reset level 2 = *

1040 *EMMERGENCY SW ON

Reset level 1 = No * mark

1280 MEMORY RUNNING

8.2 Battery Fault alarm

In tapping center, the data in the memory is retained by batteries.
If the batteries are dead , the battery alarm mark as shown below appears on the right bottom of the screen. If this mark appears, replace the batteries.

Fig.11-1 Battery alarm

8.3 Alarm stop level and reset level

8.3.1 Alarm stop level

According to the stop level, the NC functions to stop as shown below.

(1) Stop level 5
The servo system stops.

(2) Stop level 4
The motion currently in execution stop instantaneously and no more motions are available afterwards.

(3) Stop level 3 (block stop)
The operation continues until the currently executed block is completed.
The blocks afterwards are not available. The START swich becoms ineffective and the NC program cannot be executed any longer.

(4) Stop level 2 (stop by M02 or M30)
The operation continues until the currently executed program is completed.
The START switch becomes ineffective and the NC program cannot be executed any longer.

When single block is ON, the stop level 3 and 2 become the same.

(5) Stop level 1
Only a warning is given but machine motions are not affected.

If a stop level 3 alarm occurs, the spindle stops when the block currently being executed is completed.
If a stop level 4 alarm occurs, the spindle stops immediately.
Note that the spindle does not stop even when the [STOP] key is pressed.

8.3.2 Alarm reset level

According to the reset level, reset each alarm as shown below:

(1) Reset level 3 (**)
Turn OFF the power. (An alarm cannot be reset otherwise.)

(2) Reset level 2 (*)
Press the **[RST]** key.

(3) Reset level 1 (No * mark)
Press any key.

The stop level and the reset level are independent from each other.
Therefore, they can be combined in different ways as shown below.

(Ex.) Stop level 5 and Reset level 2
Stop level 1 and Reset level 2

8.4 *Axis display

All about “ * axis “ description will be fixed, according to the machine parameter (system 2) setting in the manual , shown as below:

5-axis instslleation position (0: independent 1: table 1 2: table 2)
6-axis instslleation position (0: independent 1: table 1 2: table 2)
4-axisaddress (0: A 1: B 2: C)
5-axis address (0: A 1: B 2: C)
6-axis address (0: A 1: B 2: C)

		Installeation position		
		0: Independent	1: Table 1	2: Table 2
Address	0: A	A	A 1	A 2
	1: B	B	B 1	B 2
	2: C	C	C 1	C 2

8.5 Alarm message

The list includes alarms that may occur only in the specified models or in models with optional specifications.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0000	5	3	WATCH DOG (MAIN)	An error has occurred in main CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0001	5	3	WATCH DOG (SLAVE)	An error has occurred in slave CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0002	5	3	WATCH DOG (LOCAL)	An error has occurred in local CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0003	5	3	RAM ERROR (MAIN)	Reading and writing using main RAM is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0004	5	3	ROM ERROR (MAIN)	The check sum of main ROM does not match.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0005	5	3	RAM ERROR (SLAVE)	Reading and writing using slave RAM is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0006	5	3	ROM ERROR (SLAVE)	The check sum of slave ROM does not match.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0007	5	3	RAM ERROR (LOCAL)	Reading and writing using local RAM is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0008	5	3	ROM ERROR (LOCAL)	The check sum of local ROM does not match.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0009	5	3	RAM ERROR (MAIN-LOC1)	Reading and writing using RAMcommon for main-loc1 is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0010	5	3	RAM ERROR (MAIN-LOC2)	Reading and writing using RAM common for main-loc2 is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0011	5	3	RAM ERROR (MAIN-SLV)	Reading and writing using RAM common for main-slv is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0012	5	3	TIMER ERROR (SLAVE)	An error has occurred in slave CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0014	5	3	CALC ERROR (MAIN)	Improper calculation is executed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0015	5	3	CALC ERROR (SLAVE)	Improper calculation is executed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0016	5	3	CALC ERROR (LOCAL)	Improper calculation is executed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0017	5	3	MAIN INITIAL IMPSBLE	Main CPU has not started.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer
0018	5	3	SLV INITIAL IMPSBLE	Slave CPU has not started.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0019	5	3	AC POWER SUPPLY DROP	AC power supply voltage dropped by more than 30%.	Check the power supply voltage, change the tap of the transformer or check power supply capacity.
0020	5	3	DC POWER ERROR(24V)	24 vdc supply for control has dropped.	Check if a short circuit has occurred or the power supply is overload.
0021	5	3	SPECIAL INTIAL(*)	Power is turned on by special operations.	Perform required operations and turn power off and then on again.
0022	5	3	THERMAL (TRANS)	The thermal relay of transformer 1 has tripped. 1) Transformer is over loaded. 2) Machining condition has exceeded capacity.	1) Check if a load more than acceptable is connected. 2) Check machining conditions and operation patterns. Eliminate the causes and turn off power for at lease 30 minutes before turning it on again.

8

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0023	5	3	THERMAL (CNTL BX)	The thermal relay at the center of the control panel has tripped. 1) Temperature is too high. 2) Machining condition has exceeded capacity.	1) Check that temperature is 40 degrees or more. 2) Review the machining conditions and operation patterns.
0024	5	3	AIR PRESSURE LOW	Air pressure has dropped.	1) Check air piping and pressure. 2) Check that the pressure switch is set correctly.
0025	5	3	DATA ERR (M/C PARAM)	Data structure of machine parameter is destroyed.	Press [RST] key, and delete the destroyed data by memory display in edit mode and create new data again.
0026	5	3	NO M/C PARAM DATA	There is no machine parameter data.	Create the machine parameter and turn power off and then on again.
0027	5	3	100V POWER SUPPLY ER	The circuit protector of the 100v power supply circuit has tripped. 1) overloaded 2) short-circuited	Eliminate the cause and turn on the circuit protector of transformer 2.
0028	5	3	POWER TURNED OFF	Power OFF activated or external power OFF signal activated.	The message, through displayed on turning off the power, is not an error. If this error occurs in a case other than the above, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0029	5	3	POS DETECT ERR	The difference between the absolute position data inside the magazine amplifier and relative position data inside the NC unit has exceeded the allowable range.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0030	5	3	I/O CRC ERROR 1	CRC error has occurred during communication between the keyboard and NC unit. 1) External noise. 2) The faulty keyboard or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0031	5	3	I/O TIMEOVER 1	Framing error has occurred during communication between the keyboard and NC unit. 1) External noise. 2) The faulty keyboard or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0032	5	3	I/O CRC ERROR 2	CRC error has occurred during communication between the keyboard and NC unit. 1) External noise. 2) The faulty keyboard or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0033	5	3	I/O TIMEOVER 2	Framing error has occurred during communication between the keyboard and NC unit. 1) External noise. 2) The faulty keyboard or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.
0034	5	3	I/O CRC ERROR 3	A CRC error has occurred during communication between I/O board and NC unit. 1) External noise 2) Faulty I/O board or cable.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0035	5	3	I/O TIMEOVER 3	Framing error has occurred during communication between the I/O board and NC unit. 1) External noise. 2) The faulty I/O board or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.
0036	5	3	I/O CRC ERROR 4	A CRC error has occurred during communication between I/O board and NC unit. 1) External noise 2) Faulty I/O board or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.
0037	5	3	I/O TIMEOVER 4	A CRC error has occurred during communication between I/O board and NC unit. 1) External noise 2) Faulty I/O board or cable.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.
0038	5	3	I/O CRC ERROR 5	A CRC error has occurred during communication between EXIO board and NC unit. 1) External noise. 2) Faulty EXIO board or cable.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.
0039	5	3	I/O TIMEOVER 5	A CRC error has occurred during communication between the EXIO board and NC unit. 1) External noise. 2) The faulty EXIO board or cable connection.	Turn power off and then on again. If the error still occurs. 1) Eliminate the cause of external noise Caused by the likes of welders. 2) The faulty keyboard or cable needs replacement. This error may occur due to machine failure and the like. Contact the nearest BROTHER Approved service dealer.
0046	5	3	THERMAL (CHIP SHOWER)	The thermal relay for the chip shower protection circuit has tripped. 1) Motor is overloaded. 2) Motor capacity is exceeded 3) Thermal relay setting value is incorrect. 4) There is an open motor phase	For 1), turn off power for 15 to 20 minutes and eliminate the cause. For causes other than simply eliminate the cause and turn power off and then on again
0047	5	3	THERMAL (OIL HOLE)	The thermal relay for the oil hole protection circuit has tripped. 1) Motor is overloaded. 2) Motor capacity is exceeded 3) Thermal relay setting value is incorrect. 4) There is an open motor phase	For 1), turn off power for 15 to 20 minutes and eliminate the cause. For causes other than simply eliminate the cause and turn power off and then on again.
0048	5	3	THERMAL (SP MOTOR)	The thermal relay inside the spindle motor has tripped. 1) Motor is overloaded or locked. 2) Machining condition has exceeded motor's capacity.	1) Manually turn the spindle to check if the spindle load is great. 2) Review the machining conditions and operation patterns. Eliminate the causes and leave the motor with power on for 30 minutes before resuming operation

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0049	5	3	THERMAL (COOLANT)	The thermal relay for coolant protection circuit has tripped. 1) Motor is overloaded. 2) Motor capacity is exceeded. 3) Thermal relay setting value is incorrect. 4) There is an open motor phase.	For 1), turn off power for 15 to 20 minutes and eliminate the cause. For causes other than simply eliminate the cause and turn power off and then on again.
0050	5	3	THERMAL (SP THROUGH)	An alarm has occurred in the high pressure pump. 1) Pump is overloaded. 2) Filter is clogged.	1) Eliminate the cause and turn on power again. 2) Replace the filter.
0051	5	3	ABSOLUTE CLEAR ERR	Clearing start point data was attempted but the data was not cleared within the specified time.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0052	5	3	COMMAND ERROR	Main CPU is not synchronized with slave CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0053	5	3	THERMAL (ATC MOTOR)	The thermal switch inside the ATC motor has tripped 1) Motor is overloaded and locked. 2) ATC operation condition has exceeded motor's capacity.	Turn off power for thirty minutes and eliminate the cause before resuming operation.
0054	5	3	TOOL CLAMP ERROR	Tool clamp sensor turned on.	See Resetting procedure for tool clamp error.
0055	5	3	RAM ERROR (MAIN-LOC3)	Reading and writing using RAM common for main-loc3 is not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0056	5	3	SERVO RELAY1 ERROR	The state of servo power supply relay 1 is as below. 1) The relay is already on. 2) The relay turned off midway.	Turn power off and then on again. If the error still occurs, this error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0057	5	3	SERVO RELAY2 ERROR	The state of servo power supply relay2 is as below. 1) The relay is already on. 2) The relay turned off midway.	Turn power off and then on again. If the error still occurs, this error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0058	5	3	SP SERVO (***)	A servo error has occurred for the spindle the cause differs depending on (***). Refer to the servo error list.	
0059	5	3	X SERVO (***)	A servo error has occurred for the X-axis. the cause differs depending on (***). Refer to the servo error list.	
0060	5	3	Y SERVO (***)	A servo error has occurred for the Y-axis. the cause differs depending on (***). Refer to the servo error list.	
0061	5	3	Z SERVO (***)	A servo error has occurred for the Z-axis. the cause differs depending on (***). Refer to the servo error list.	
0062	5	3	* SERVO (***)	A servo error has occurred for the 4 axis. the cause differs depending on (***). Refer to the servo error list.	
0063	5	3	* SERVO (***)	A servo error has occurred for the 5 axis. the cause differs depending on (***). Refer to the servo error list.	
0064	5	3	* SERVO (***)	A servo error has occurred for the 6 axis. The cause differs depending on (***). Refer to the servo error list.	
0066	5	3	M SERVO (***)	A servo error has occurred for the M axis. The cause differs depending on (***). Refer to the servo error list.	

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0068	5	3	ROM ERROR (SEQ)	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0069	5	3	RAM ERROR (SEQ)	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0070	5	3	SOFT TRAP(SEQ)	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0071	5	3	WATCH DOG (SEQ)	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0072	5	3	ADRS ERROR (SEQ)	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0073	5	3	CALC ERROR (SEQ)	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0074	5	3	SEQ INTIAL IMPSBLE	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0075	5	3	SEQ RAM OPE ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0076	5	3	COMPILE ERROR 1	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0077	5	3	COMPILE ERROR 2	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0078	5	3	CONVERT ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0079	5	3	VERIFY ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0080	5	3	STEP OVER ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0081	5	3	MEMORY PROTECT ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0082	5	3	DOUBLE COIL ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0083	5	3	USER WDT-UP	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0084	5	3	USERRAM ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0085	5	3	USER PROGRAM ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0086	5	3	MEMORY CASSETTE ERR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0087	5	3	CALCULATION EXE ERR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0088	5	3	NO EXTENSION UNIT	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0089	5	3	STATION NO SET ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0090	5	3	RETAINING DATA ERROR	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0091	5	3	M EXCPT INTRPT(*)	Main CPU has detected incorrect interruption. The figure in brackets () indicates interruption no.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0093	5	3	L EXCPT INTRPT(*)	Local CPU has detected incorrect interruption. The figure in brackets () indicates interruption no.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0094	5	3	PULSE ERROR (SPINDLE)	Pulse signal sent from the spindle motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0095	5	3	PULSE ERROR (X-AXIS)	Pulse signal sent from the X-axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0096	5	3	PULSE ERROR (Y-AXIS)	Pulse signal sent from the Y-axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0097	5	3	PULSE ERROR (Z-AXIS)	Pulse signal sent from the Z-axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0098	5	3	PULSE ERROR (* AXIS)	Pulse signal sent from the 4 axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0099	5	3	PULSE ERROR (* AXIS)	Pulse signal sent from the 5 axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0100	5	3	PULSE ERROR (* AXIS)	Pulse signal sent from the 6 axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0102	5	3	PULSE ERROR (M AXIS)	Pulse signal sent from the M axis motor could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0103	5	3	ATC BOARD ERR (power)	AC power supply voltage increased more than 15%.	Check the power supply voltage and Change the tap of the transformer.
0104	5	3	FORMAT TYPE IS WRONG	Memory has been formatted incorrectly for the conversation language.	Retry the formatting the memory correctly.
0105	5	3	FORMAT CAPA IS WRONG	The capacity of the formatted memory does not match the current machine state.	Retry the formatting the memory correctly.
0106	5	3	RAM ERROR (MAIN-LOC4)	Reading and writing of the RAM commonly used for main/local 4 was not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0107	5	3	RAM ERROR (MAIN-LOC5)	Reading and writing of the RAM commonly used for main/local 5 was not possible.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0108	5	3	NO MEMORY FORMAT	The memory was not cleared at all, the data is damaged, or the memory has exceeded its capacity.	Output all data to the external device and format the memory.
0109	5	3	3-PHASE POWER ERROR	The three-phase power supply's phases are reversed.	Turn the primary power supply off, and then reverse the positions of the U-phase cord and the V-phase cord.
0110	5	3	MACHINE SETTING ERR	The model identification signal could not be read correctly.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0500	5	2	EMERGENCY SW ON	EMERGENCY switch on signal was sent by the communication command. 1 Emergency switch is pushed. 2 External emergency stop contact is open.	Send emergency switch off signal by the communication command. 1 Remove the cause of trouble and press [RST] key. 2 Contact point of EXIO board terminal is to be closed again.
0501	5	2	SYSTEM ERROR (MAIN)	Error signal is detected but no relative error is found.	Press [RST] key and clear the alarm. If the same trouble occurs repeatedly, this error may be due to machine and the like. Contact the nearest BROTHER approved service dealer.
0502	5	2	NOT CLOSING DOOR	The door was opened while door interlock was valid.	Invalidate door interlock or close the door.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0503	5	2	SERVO MOTOR STOPPED	The door was opened during operation while door interlock was valid.	Invalidate door interlock or close the door and press the [RST] key.
0504	5	2	POSITION ERROR SP	(For model with a double-arm ATC) The ATC arm was not at zero point during spindle rotation. (For model with an armless ATC) Z axis was attempted to be lift above the Z-axis zero point, while main axis servo had been truned on. (exsept the main axis oirent 0°)	(For model with a double-arm ATC) Press the [RST] key Press the [ATC] key with the [relse] key held down in manual mode to move the ATC arm to zero position. (For model with an armless ATC) Press the [RST] key to reset the error.
0505	5	2	OVERRUN (+X)	The axis has overrun in the direction indicated by the alarm.	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0506	5	2	OVERRUN (-X)	The axis has overrun in the direction indicated by the alarm.	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0507	5	2	OVERRUN (+Y)	The axis has overrun in the direction indicated by the alarm.	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0508	5	2	OVERRUN (-Y)	The axis has overrun in the direction indicated by the alarm.	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0509	5	2	OVERRUN (+Z)	The axis has overrun in the direction indicated by the alarm.	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0510	5	2	OVERRUN (-Z)	The axis has overrun in the direction indicated by the alarm.	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0511	5	2	DEVIATION ERROR1 SP	The amount of spindle motor deviation has exceeded the value set to [maximum deviation spindle].	1) Check the value set to [maximum deviation spindle] of machine parameters system. 2) Check that machining condition is within motor's capacity press the [rls] key to reset the error.
0512	5	2	DEVIATION ERROR1 X	The amount of the X-axis motor deviation has exceeded the value set to [maximum deviation x].	1) Check the value set to [maximum deviation x] of machine parameters system. 2) Check that machining condition is within motor's capacity 3) Press the [rls] key to reset the error.
0513	5	2	DEVIATION ERROR1 Y	The amount of the Y-axis motor deviation has exceeded the value set to [maximum deviation y].	1) Check the value set to [maximum deviation y] of machine parameters system. 2) Check that machining condition is within motor's capacity. 3) Press the [rls] key to reset the error.
0514	5	2	DEVIATION ERROR1 Z	The amount of the Z-axis motor deviation has exceeded the value set to [maximum deviation z].	1) Check the value set to [maximum deviation z] of machine parameters system. 2) Check that machining condition is within motor's capacity 3) Press the [rls] key to reset the error.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0515	5	2	DEVIATION ERROR1 *	The amount of the 4 axis motor deviation has exceeded the value set to [maximum deviation 4].	1) Check the value set to [maximum deviation 4] of machine parameters system. 2) Check that machining condition is within motor's capacity. 3) Press the [rls] key to reset the error.
0516	5	2	DEVIATION ERROR1 *	The amount of the 5 axis motor deviation has exceeded the value set to [maximum deviation 5].	1) Check the value set to [maximum deviation 5] of machine parameters system. 2) Check that machining condition is within motor's capacity. 3) Press the [rls] key to reset the error.
0517	5	2	DEVIATION ERROR1 *	The amount of the 6 axis motor deviation has exceeded the value set to [maximum deviation 6].	1) Check the value set to [maximum deviation 6] of machine parameters system. 2) Check that machining condition is within motor's capacity press the [rls] key to reset the error.
0519	5	2	DEVIATION ERROR1 M	The amount of the M axis motor deviation has exceeded the value set to [maximum deviation magazine].	1) Check the value set to [maximum deviation m] of machine parameters system. 2) Check that machining condition is within motor's capacity press the [rls] key to reset the error.
0520	5	2	INVERTER ERR(ATC)	1) Overloaded ATC motor 2) Voltage error	1) Check if tool weight is within the specified range. 2) Check if the power supply voltage is within the specified range.
0521	5	2	DEVIATION ERROR2 SP	The amount of spindle motor deviation has exceeded the value set to [spindle posi deviation magnif] or the on set to [minimum sp position deviation] (motor is overloaded.)	1) Check the value set to [spindle posi deviation magnif] of machine parameters (system 1). 2) Check the value set to minimum sp position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0522	5	2	DEVIATION ERROR2 X	The amount of the X motor deviation has exceeded the value set to [X posi deviation magnif] or the on set to [minimum X position deviation] (motor is overloaded.)	1) Check the value set to [X posi deviationmagnif] of machine parameters(system 1). 2) Check the value set to minimum X position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0523	5	2	DEVIATION ERROR2 Y	The amount of the Y motor deviation has exceeded the value set to [Y posi deviation magnif] or the on set to [minimum Y position deviation] (motor is overloaded.)	1) Check the value set to [Y posi deviation magnif] of machine parameters (system 1). 2) Check the value set to minimum Y position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0524	5	2	DEVIATION ERROR2 Z	The amount of the Z motor deviation has exceeded the value set to [Z posi deviation magnif] or the on set to [minimum Z position deviation] (motor is overloaded.)	1) Check the value set to [Z posi deviation magnif] of machine parameters (system 1). 2) Check the value set to minimum Z position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0525	5	2	DEVIATION ERROR2 *	The amount of the 4 motor deviation has exceeded the value set to [4 posi deviation magnif] or the on set to [minimum 4 position deviation] (motor is overloaded.)	1) Check the value set to [4 posi deviation magnif] of machine parameters (system 2). 2) Check the value set to minimum 4 position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0526	5	2	DEVIATION ERROR2 *	The amount of the 5 motor deviation has exceeded the value set to [5 posi deviation magnif] or the on set to [minimum 5 position deviation] (motor is overloaded.)	1) Check the value set to [5 posi deviation magnif] of machine parameters (system 2). 2) Check the value set to minimum 5 position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0527	5	2	DEVIATION ERROR2 *	The amount of the 6 motor deviation has exceeded the value set to [6 posi deviation magnif] or the on set to [minimum 6 position deviation] (motor is overloaded.)	1) Check the value set to [6 posi deviation magnif] of machine parameters (system 2). 2) Check the value set to minimum 6 position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0529	5	2	DEVIATION ERROR2 M	The amount of the M motor deviation has exceeded the value set to [magazine posi deviation magnif] or the on set to [min magazine position deviation] (motor is overloaded.)	1) Check the value set to [magazine posi deviation magnif] of machine parameters (system 3). 2) Check the value set to minimum magazine position deviation of machine parameters system. 3) Check that machining condition is within motor's capacity. Press the [rls] key to reset the error.
0530	5	2	MASTER OFF	1 Emergency switch is pushed. 2 External emergency stop contact is open. 3 EMERGENCY switch on signal was sent by the communication command.	1 Remove the cause of trouble and press [RST] key. 2 Contact point of EXIO board terminal is to be closed again. 3 Send emergency switch off signal by the communication command.
0531	5	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT pulse for position alrm]. If the value set to [in-position width 4] is larger than the value set to [LMT pulse for position alrm], however this error occurs when the axis has shifted more than the value set to [in-position width 4]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT pulse for 4 position alrm] is not too small. When this error occurs during memory operation reduce the cutting depth.
0532	5	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT pulse for position alrm]. If the value set to [in-position width 5] is larger than the value set to [LMT pulse for position alrm], however this error occurs when the axis has shifted more than the value set to [in-position width 5]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT pulse for 5 position alrm] is not too small. When this error occurs during memory operation reduce the cutting depth.
0533	5	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT pulse for position alrm]. If the value set to [in-position width 6] is larger than the value set to [LMT pulse for position alrm], however this error occurs when the axis has shifted more than the value set to [in-position width 6]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT pulse for 6 position alrm] is not too small. When this error occurs during memory operation reduce the cutting depth.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0534	5	2	SP IN-POS CHCK TMOUT	The amount of deviation did not become smaller than the value set to in-position width spindle even after the time set to [spindle inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width spindle] and [spindle inposi check timeout] of machine parameters (system 1). Press the [RST] key to reset the error.
0535	5	2	X IN-POS CHECK TMOUT	The amount of deviation did not become smaller than the value set to in-position width x even after the time set to [X inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width x] and [X inposi check timeout] of machine parameters (system 1). Press the [RST] key to reset the error.
0536	5	2	Y IN-POS CHECK TMOUT	The amount of deviation did not become smaller than the value set to in-position width y even after the time set to [Y inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width y] and [Y inposi check timeout] of machine parameters (system 1). Press the [RST] key to reset the error.
0537	5	2	Z IN-POS CHECK TMOUT	The amount of deviation did not become smaller than the value set to in-position width z even after the time set to [Z inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width z] and [Z inposi check timeout] of machine parameters (system 1). Press the [RST] key to reset the error.
0538	5	2	* IN-POS CHCK TMOUT	The amount of deviation did not become smaller than the value set to in-position width 4 even after the time set to [4 inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width 4] and [4 inposi check timeout] of machine parameters (system 2). Press the [RST] key to reset the error.
0539	5	2	* IN-POS CHCK TMOUT	The amount of deviation did not become smaller than the value set to in-position width 5 even after the time set to [5 inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width 5] and [5 inposi check timeout] of machine parameters (system 2). Press the [RST] key to reset the error.
0540	5	2	* IN-POS CHCK TMOUT	The amount of deviation did not become smaller than the value set to in-position width 6 even after the time set to [6 inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width 6] and [6 inposi check timeout] of machine parameters (system 2). Press the [RST] key to reset the error.
0542	5	2	M IN-POS CHCK TMOUT	The amount of deviation did not become smaller than the value set to in-position width magazine even after the time set to [magazine inposi check timeout] had elapsed after completion of operation.	Check the values set to [in-position width magazine] and [magazine inposi check timeout] of machine parameters (system 3). Press the [RST] key to reset the error.
0543	5	2	MAGAZINE SERVO OFF	The servo was turned off while the magazine was swiveling or swiveling of the magazine was attempted while the servo was off.	Press the [RST] key and clear the alarm. If the same trouble occurs repeatedly, this may be due to the machine failure and the like. Contact the nearest BROTHER approved service dealer.
0544	5	2	EXTERNAL ERROR 1	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.
0545	5	2	EXTERNAL ERROR 2	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
0546	5	2	EXTERNAL ERROR 3	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.
0547	5	2	EXTERNAL ERROR 4	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.
0548	5	2	EXTERNAL ERROR 5	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.
0549	5	2	EXTERNAL ERROR 6	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.
0550	5	2	EXTERNAL ERROR 7	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0551	5	2	EXTERNAL ERROR 10	EXER10 signal comes on.	Turn off the EXER10 and push [RST] key.
0552	5	2	EXTERNAL ERROR 11	EXER11 signal comes on.	Turn off the EXER11 and push [RST] key.
0553	5	2	EXTERNAL ERROR 12	EXER12 signal comes on.	Turn off the EXER12 and push [RST] key.
0554	5	2	EXTERNAL ERROR 13	EXER13 signal comes on.	Turn off the EXER13 and push [RST] key.
0555	5	2	EXTERNAL ERROR 14	EXER14 signal comes on.	Turn off the EXER14 and push [RST] key.
0556	5	2	EXTERNAL ERROR 15	EXER15 signal comes on.	Turn off the EXER15 and push [RST] key.
0557	5	2	EXTERNAL ERROR 16	EXER16 signal comes on.	Turn off the EXER16 and push [RST] key.
0558	5	2	EXTERNAL ERROR 17	EXER17 signal comes on.	Turn off the EXER17 and push [RST] key.
0559	5	2	EXTERNAL ERROR 18	EXER18 signal comes on.	Turn off the EXER18 and push [RST] key.
0560	5	2	EXTERNAL ERROR 19	EXER19 signal comes on.	Turn off the EXER19 and push [RST] key.
0561	5	2	EXTERNAL ERROR 20	EXER20 signal comes on.	Turn off the EXER20 and push [RST] key.
0562	5	2	EXTERNAL ERROR 21	EXER21 signal comes on.	Turn off the EXER21 and push [RST] key.
0563	5	2	EXTERNAL ERROR 22	EXER22 signal comes on.	Turn off the EXER22 and push [RST] key.
0564	5	2	EXTERNAL ERROR 23	1) EXER23 signal comes on. 2) (For 22A,31A,S2A, and S2B) Shortage of lubricant when optional Automatic intermittent lubricating unit is equipped.	1) Turn off the EXER23 and push [RST] key. 2) Replenish lubricant and push [RST] key.
0565	5	2	EXTERNAL ERROR 24	EXER24 signal comes on.	Turn off the EXER24 and push [RST] key.
0566	5	2	EXTERNAL ERROR 25	EXER25 signal comes on.	Turn off the EXER25 and push [RST] key.
0567	5	2	DOOR ERROR	1) The automatic door limit switch has turned on both at door closing and opening ends. 2) It took x seconds (parameter value) for automatic door closing. 3) It took x seconds (parameter value) for automatic door opening.	Eliminate the error cause and press the [RST] key to reset the error.
0577	5	2	MJR FAILURE RLY ON	An error has occurred in the SEQ unit connected to NC board connector SEQ.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
0578	5	2	OVERRUN	Overrun error signal was received, but the error of the corresponding axis cannot be identified.	Eliminate the error cause and press the [RST] key to reset the error.
0579	5	2	OVERRUN (+*)	The axis has overrun in the direction indicated by the alarm. (An asterisk (*) indicates axis 5)	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0580	5	2	OVERRUN (-*)	The axis has overrun in the direction indicated by the alarm. (An asterisk (*) indicates axis 5)	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0581	5	2	OVERRUN (+*)	The axis has overrun in the direction indicated by the alarm. (An asterisk (*) indicates axis 6)	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0582	5	2	OVERRUN (-*)	The axis has overrun in the direction indicated by the alarm. (An asterisk (*) indicates axis 6)	Switch to manual operation mode and press the [RST] key while holding down the [relse] key. Then move the axis in the opposite direction while holding down the [relse] key until the axis moves out of the overrun area.
0586	5	2	*SERVO MOTOR OFF	When door interlock is valid, the door was opened while the axis "*" (axis 4) was in motion. Conformance to CE specifications is standard for the TC-32A, R2A, and 20A.	Press the [RST] key.
0587	5	2	*SERVO MOTOR OFF	When door interlock is valid, the door was opened while the axis "*" (axis 5) was in motion. Conformance to CE specifications is standard for the TC-32A, R2A, and 20A.	Press the [RST] key.
0588	5	2	*SERVO MOTOR OFF	When door interlock is valid, the door was opened while the axis "*" (axis 6) was in motion. Conformance to CE specifications is standard for the TC-32A, R2A, and 20A.	Press the [RST] key.
0589	5	2	C INDEX TIMEOVER	The C-axis did not contact the stopper when traveling toward the stopper at low speed, although the time set for the parameter has elapsed.	Check the setting for MACHINE PARAMETER (SYSTEM 2).
0590	5	2	C-AXIS CURRENT ERROR	The current command value when the C-axis contacts the stopper is not within the range set for the parameter.	Check the setting for MACHINE PARAMETER (SYSTEM 2).
0591	5	2	IN-POS CHCK TMOUT	In-position check time has exceeded five seconds.	Press the [RST]key and clear the alarm.
0592	5	2	MAGAZINE POS SHIFTED	The magazine position was shifted more than the value set for [LMT PULSE FOR MZ POSITION ALRM] in machine parameter3 while the magazine was stopped (when the pot was fully lowered.)	Check the machine parameter. When the error occurs repeatedly, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0593	5	2	ORG POS ERROR SP	When the first orientation is performed after power is turned on, PHASE C signal cannot be received even after spindle motor has rotated one turn.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0594	5	2	COMMAND ERROR(SP)	Main CPU is not synchronized with slave CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
0595	5	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT PULSE FOR 4 POSITION ALRM]. If the value set to [IN-POSITION WIDTH 4] is larger than the value set to [LMT PULSE FOR POSITION ALRM], however this error occurs when the axis has shifted more than the value set to [IN-POSITION WIDTH 4]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT PULSE FOR 4 POSITION ALRM] is not too small. When this error occurs during memory operation reduce the cutting depth.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
0596	5	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT PULSE FOR 5 POSITION ALRM]. If the value set to [IN-POSITION WIDTH 5] is larger than the value set to [LMT PULSE FOR 5 POSITION ALRM], however this error occurs when the axis has shifted more than the value set to [IN-POSITION WIDTH 5]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT PULSE FOR 5 POSITION ALRM] is not too small. When this error occurs during memory operation reduce the cutting depth.
0597	5	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT PULSE FOR 6 POSITION ALRM]. If the value set to [IN-POSITION WIDTH 6] is larger than the value set to [LMT PULSE FOR 6 POSITION ALRM], however this error occurs when the axis has shifted more than the value set to [IN-POSITION WIDTH 6]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT PULSE FOR 6 POSITION ALRM] is not too small. When this error occurs during memory operation reduce the cutting depth.
0598	4	2	END MILL TAPPING	The spindle command was ordered by intervention operate during the spindle rotation of the end mill tap is command.	Press the [RST] key to reset the alarm.
0599	5	2	SPINDLE ROTATING	The end mill tap command was ordered during the spindle rotation.	Press the [RST] key to reset the alarm.
0600	5	2	DR OPEN MACHINE STOP	The door was opened during operation while door interlock was valid.	Invalidate door interlock or close the door and press the [RST] key.
0601	5	2	SYSTEM ERROR(SLV)	Slave CPU error signal was received, but the corresponding error cannot be identified.	Press the [RST] key to reset the error. If the error still occurs, this error may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1050	4	3	TURN OFF POWER	Important parameter is modified.	Turn power OFF once and ON again.
1051	4	3	START POINT DATA1 ER	When power was turned on, start point data 1 was smaller than zero or larger than machine coordinate value for one round of magazine.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1053	4	3	M/C PARAM ERR (SYS2)	Setting of machine parameters 2 (system 2) is faulty.	Check the setting of machine parameters 2 (system 2).
1055	4	3	ATC ARM POS ERR 2	ATC arm is not at home.	Turn off power and see 13.6 Resetting ATC.
1056	4	3	ATC OFF POSITION ERR	The ATC arm is stopped midway, and cannot be reset by key operation.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1057	4	3	DATA ERR (USER PARAM)	Data structure of user parameter is destroyed.	Press [RST] key, and delete the destroyed data by memory screen in edit mode and create new data again.
1058	4	3	USER PARAM ERR (SW2)	Setting of user parameters 2 (switch 2) is faulty.	Check the setting of user parameters 2 (switch 2).
1059	4	3	USER PARAM ERR (SW1)	Setting of user parameters 1 (switch 1) is faulty.	Check the setting of user parameters 1 (switch 1).
1150	4	2	SYSTEM ERROR(SLV)	Slave CPU error signal was received, but the corresponding error cannot be identified.	Press the [RST] key to reset the error. If the error still occurs, this error may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1151	4	2	NO MEMORY FORMAT	Memory never cleared or data destroyed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1152	4	2	EDITING	The same data are to be edited at the same time.	Check that communication mark has disappeared. Then press [RST] key and clear the alarm.
1153	4	2	EDIT ERROR 1	During editing, data is destroyed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1154	4	2	EDIT ERROR 2	During editing, data is destroyed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1155	4	2	EDIT ERROR 3	During editing, data is destroyed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1156	4	2	LONG RTRN DISTANCE	Recovery distance when turning on the servo is too long. (Door interlock is effective.)	Press the [RST] key.
1157	4	2	NO USER PARAM DATA	There is no user parameter data.	Create the user parameter and turn power off and then on again.
1158	4	2	PARITY ER (USER PARA)	Data structure of user parameter is destroyed.	Press [RST] key, and delete the destroyed data by memory screen in edit mode and create new data again.
1159	4	2	PARITY ER (M/C PARAM)	Data structure of machine parameter is destroyed.	Press [RST] key, and delete the destroyed data by memory screen in edit mode and create new data again.
1160	4	2	PARITY ERR (PRGRM)	Program is structure is destroyed.	Press [RST] key, and delete the destroyed data by memory screen in edit mode and create new data again.
1161	4	2	Check the magzine pos	When the power is on, the servo motor is on, or while the magazine is swiveling, the difference between START POINT DATA 2 and the absolute position data in the magazine amplifier has exceeded the value for one revolution of the magazine.	Check the pot number displayed on the present position screen and the pot number actually indexed. If these differ, switch to ATC maintenance mode and adjust the magazine position.
1162	4	2	MAGAZINE POS SHIFTED	The magazine position was shifted more than the value set for [LMT PULSE FOR MZ POSITION ALRM] in machine parameter3 while the magazine was stopped (when the pot was fully lowered.)	Check the machine parameter. When the error occurs repeatedly, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1163	4	2	ORG POS ERROR X	Zero dog signal was not confirmed while dog zero return was being performed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1164	4	2	ORG POS ERROR Y	Zero dog signal was not confirmed while dog zero return was being performed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1165	4	2	ORG POS ERROR Z	Zero dog signal was not confirmed while dog zero return was being performed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1166	4	2	ORG POS ERROR SP	When the first orientation is performed after power is turned on, PHASE C signal cannot be received even after spindle motor has rotated one turn.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1167	4	2	ORG POS ERROR *	Zero dog signal was not confirmed while dog zero return was being performed.(the asterisk (*) indicates axis 4.)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1168	4	2	ORG POS ERROR *	Zero dog signal was not confirmed while dog zero return was being performed.(the asterisk (*) indicates axis 5.)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1169	4	2	ORG POS ERROR *	Zero dog signal was not confirmed while dog zero return was being performed.(the asterisk (*) indicates axis 6.)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1170	4	2	ORG POS ERROR *	Zero dog signal was not confirmed while dog zero return was being performed.(the asterisk (*) indicates axis 7.)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1171	4	2	ORG POS ERROR *	Zero dog signal was not confirmed while dog zero return was being performed.(the asterisk (*) indicates axis 8.)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1172	4	2	COMMAND ERROR(SP)	Main CPU is not synchronized with slave CPU.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1173	4	2	CAN NOT CLAMP *	Clamping axis was attempted but failed. (the asterisk (*) indicates axis 4.)	Press the [RST] key. Check if air pressure is appropriate. Check the machine parameter.
1174	4	2	CAN NOT UNCLAMP *	Unclamping axis was attempted but failed. (The asterisk (*) indicates axis 4.)	Press the [RST] key. Check if air pressure is appropriate. Check the machine parameter.
1175	4	2	* CLAMP	While * axis (4 axis) is rotating,* axis is clamped.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1176	4	2	* UNCLAMP	While * axis (4 axis) is holding,* axis is unclamped.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1177	4	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT PULSE FOR 4 POSITION ALRM]. If the value set to [IN-POSITION WIDTH 4] is larger than the value set to [LMT PULSE FOR POSITION ALRM], however this error occurs when the axis has shifted more than the value set to [IN-POSITION WIDTH 4]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT PULSE FOR 4 POSITION ALRM] is not too small. When this error occurs during memory operation reduce the cutting depth.
1178	4	2	CAN NOT CLAMP *	Clamping axis was attempted but failed. (the asterisk (*) indicates axis 5.)	Press the [RST] key. Check if air pressure is appropriate. Check the machine parameter.
1179	4	2	CAN NOT UNCLAMP *	Unclamping axis was attempted but failed. (The asterisk (*) indicates axis 5.)	Press the [RST] key. Check if air pressure is appropriate. Check the machine parameter.
1180	4	2	* CLAMP	While * axis (5 axis) is rotating,* axis is clamped.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1181	4	2	* UNCLAMP	While * axis (5 axis) is holding,* axis is unclamped.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1182	4	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT PULSE FOR 5 POSITION ALRM]. If the value set to [IN-POSITION WIDTH 5] is larger than the value set to [LMT PULSE FOR 5 POSITION ALRM], however this error occurs when the axis has shifted more than the value set to [IN-POSITION WIDTH 5]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT PULSE FOR 5 POSITION ALRM] is not too small. When this error occurs during memory operation reduce the cutting depth.
1183	4	2	CAN NOT CLAMP *	Clamping axis was attempted but failed. (the asterisk (*) indicates axis 6.)	Press the [RST] key. Check if air pressure is appropriate. Check the machine parameter.
1184	4	2	CAN NOT UNCLAMP *	Unclamping axis was attempted but failed. (The asterisk (*) indicates axis 6.)	Press the [RST] key. Check if air pressure is appropriate. Check the machine parameter.
1185	4	2	* CLAMP	While * axis (6 axis) is rotating. * axis is clamped.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1186	4	2	* UNCLAMP	While * axis (6 axis) is holding. * axis is unclamped.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1187	4	2	*-AXISPOS SHIFTED	The axis has shifted during clamping more than the value set to [LMT PULSE FOR 6 POSITION ALRM]. If the value set to [IN-POSITION WIDTH 6] is larger than the value set to [LMT PULSE FOR 6 POSITION ALRM], however this error occurs when the axis has shifted more than the value set to [IN-POSITION WIDTH 6]. (these parameters are set on the <machine parameter (system 2) >screen.)	Press the [RST] key. Check the axis position on the current position screen and move the axis to the correct position. Check that the value set to [LMT PULSE FOR 6 POSITION ALRM] is not too small. When this error occurs during memory operation reduce the cutting depth.
1188	4	2	POSITION ERROR Z	(For model with a double-arm ATC) Z-axis was commanded when the Z-axis was above the ATC zero point. (For model with an armless ATC) Z-axis was commanded above the Z axis zero point. (While ATC area servo has been turned on)	Press the [RST] key. Move the Z-axis until it is below the Z-axis zero point while holding down the [RELSE] key.
1189	4	2	POSITION ERROR SP	(For model with a double-arm ATC) Spindle was commanded while the ATC arm was not at zero position. (For model with an armless ATC) Spindle was commanded above the Z axis zero point. (While ATC area servo has been turned on)	(For model with a double-arm ATC) Press the [RST] key. Press the [ATC] key with the [RELSE] key held down in manual mode to move the ATC arm to zero position. (For model with an armless ATC) Press the [RST] key. Move the Z-axis until it is below the Z-axis zero point while holding down the [RELSE] key.
1191	4	2	COMMAND ERROR(SPEED)	The commanded speed is zero or larger than the maximum speed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1192	4	2	ARC SPEED ERROR	For arc cutting when the last point is not on the arc, the speed of the single axis is larger than the maximum speed.	Check start point and end point of program as well as circular are center point.
1193	4	2	ATC TIMEOVER ERROR	The ATC arm swivels is not completed with the time set for [ATC ARM SWIVEL TIMEOUT 1-4].	Press the [RST] key to reset the error.
1194	4	2	MAGAZINE NO. ERROR	(For model with a double-arm ATC) The [emergency stop] key was pressed while the magazine was swiveling and the magazine stopped midway. (For model with an armless ATC) After the Magazine rotation, a tool was not indexed. Encorder signal is 0. Or, the number of tool were exceeded than those of magazine.	Press the [RST] key with the [RELSE] key held down in manual mode. After the alarm indication has disappeared, press the [MAGZ] key with the [RELSE] key held down.
1195	4	2	MAGAZINE INDEX ERROR	A tool was not indexed correctly, but magazine was attempted to be rotated. Or Z axis was commanded.	Press the [RST] key with the [RELSE] key held down in manual mode. After the alarm indication has disappeared, press the [MAGZ] key with the [RELSE] key held down.
1196	4	2	MAGAZINE POS ERROR	Magazine was attempted to be rotated when the Z axis was not on the ATC zero point.	Press the [RST] key to cancel the alarm.
1197	4	2	COMMAND ERROR(ATC)	A number exceeding the number of tools set in the magazine was required by ATC command.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1198	4	2	POT POSITION ERROR	Pot position is incorrect.	Switch to manual operation mode press the [RST] key with the [RELSE] key held down. Then, press the [MAGZ] key with the [RELSE] key held down to move the magazine pot to the correct position.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1199	4	2	MAGAZINE TIME OVER	Magazine was not indexed in 5 seconds per a pitch or the thermal in the magazine motor functioned.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1200	4	2	POT TIME OVER	Raising and lowering of the pot was not completed within the specified time.	Turn off power and eliminate the cause.
1201	4	2	POT SENSOR ERROR	Pot sensor is faulty.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1202	4	2	ATC ARM POS ERR 1	ATC arm is not at home.	Press the [RST] key with the [RELSE] key held down in manual mode. See 13.6 Resetting ATC.
1203	4	2	STROKE OVER (+X)	The X-axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1204	4	2	STROKE OVER (-X)	The X-axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1205	4	2	STROKE OVER (+Y)	The Y-axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1206	4	2	STROKE OVER (-Y)	The Y-axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1207	4	2	STROKE OVER (+Z)	The Z-axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1208	4	2	STROKE OVER (-Z)	The Z-axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1209	4	2	STROKE OVER (+*)	The 4 axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1210	4	2	STROKE OVER (-*)	The 4 axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1211	4	2	STROKE OVER (+*)	The 5 axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1212	4	2	STROKE OVER (-*)	The 5 axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1213	4	2	STROKE OVER (+*)	The 6 axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1214	4	2	STROKE OVER (-*)	The 6 axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1215	4	2	LIMIT OVER (+X)	The X-axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1216	4	2	LIMIT OVER (-X)	The X-axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1217	4	2	LIMIT OVER (+Y)	The Y-axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1218	4	2	LIMIT OVER (-Y)	The Y-axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1219	4	2	LIMIT OVER (+Z)	The Z-axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1220	4	2	LIMIT OVER (-Z)	The Z-axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1221	4	2	LIMIT OVER (+*)	The 4 axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1222	4	2	LIMIT OVER (-*)	The 4 axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1223	4	2	LIMIT OVER (+*)	The 5 axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1224	4	2	LIMIT OVER (-*)	The 5 axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1225	4	2	LIMIT OVER (+*)	The 6 axis was attempted to be moved past its stroke limit in the positive direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1226	4	2	LIMIT OVER (-*)	The 6 axis was attempted to be moved past its stroke limit in the negative direction.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1227	4	2	STROKE OVER 2	The axis was attempted to be moved into the prohibited stroke zone.	Press the [RST] key and correct the program. (check the machine parameters (system 1).)
1228	4	2	LIMIT OVER 2	The axis was attempted to be moved into the prohibited stroke limit zone.	Press the [RST] key and correct the program. (check the machine parameters (switch 2).)
1232	4	2	COUNTER1 END	Each workpiece counter has attained the preset value.	
1233	4	2	COUNTER2 END	Each workpiece counter has attained the preset value.	
1234	4	2	COUNTER3 END	Each workpiece counter has attained the preset value.	
1235	4	2	COUNTER4 END	Each workpiece counter has attained the preset value.	
1236	4	2	SENSOR SIGNAL OFF	Detection signal was not turned on during measurement.	Press the [RST] key and check the measurement position.
1237	4	2	SENSOR SIGNAL ON	Detection signal was not turned off during measurement.	Press the [RST] key and check the measurement position.
1238	4	2	THRED CUT FEED ERR	The Z axis feedrate is not obtained from the X/Y axis feedrate during the thread cutting.	Press the [RST] key and check the end point, center point and feedrate in the thread cutting.
1239	4	2	NO THREAD CUTTING	There is no optinal thread cutting function.	Purchase a thread cutting option.
1240	4	2	SIGNAL TIME OVER	After external signal is given, completion signal can not be detected even when external signal reading limit time is over. M46* signals are not detected even after the time preset to MAXIMUM TIME OF EXIT SIGNAL has passed after motions of signal output functions 46* have been completed.	Press [RST] key and set external reading completion signal within the limit time, or charge parameter value.
1241	4	2	CALCULATION ERROR	1 Feed rate of the additional axis could not be calculated. 2 Working path could not be calculated. 3 Tool data for tool assignment could not be calculated.	Press the [RST] key , and For 1 and 2,check the program and enter the correct value. For 3, check the tool list and enter the correct value.
1242	4	2	TOOL BROKEN ERROR	A signal was output from the tool detection sensor.	Check the service life of the broken tool on the <magazine tool> screen, and then press the [RST] key. If a suitable spare tool is registered, operation can be resumed. If no suitable spare tool is registered, replace the tool, set the tool length and tool life, and then resume operation. Note: when the [RST] key is pressed, the tool life indication value is automatically cleared. Note: if the tool is not broken, the tool breakage detection device needs adjustment. Refer to option - tool breakage detection device -> 4.adjustment.
1243	4	2	TOOL LIFE END (*)	The tool life of the tool in use or the one to be used has reached zero. The figure in brackets ( ) indicates the tool number.	Replace tools and set tool life according after pressing [RST] key.
1244	4	2	MEASD VAL ERR LRG(1)	The result of zero point measurement has exceeded the tolerance set by the user parameter (zero point measurement).	Press the [RST] key and check the measurement position in the program.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1245	4	2	NO MEASURING DATA	Positioning to the measuring point was attempted (G120) although measuring data does not exist	Press the [RST] key and check the program.
1246	4	2	TRM DISPMT AMT OVR	Displacement measured in Z-axis thermal displacement offset mode exceeded parameter Z-AXIS MACHINING ACCURACY.	See “parameter setting and change Z-axis thermal displacement offset witching motion to appropriate conditions.
1247	4	2	THRM COMP POS ERR	Thermal displacement compensation was attempted for areas other than Z-axis machine zero position.	Do not move the axis in manual mode.
1248	4	2	THRM COMP AMT OVER	Offset at stroke end exceeded THRM OFFSET AMT LIMIT VALUE in Z-axis thermal displacement offset mode.	Check if parameter measuring device installation position Z and tool length menu are correct. Check the measuring section of the tool length measuring device for chip adhesion.
1249	4	2	COVER DOES’T OPEN	When COVER OPEN CHCKING is executed, cover opening cannot be comfirmed within 10 seconds.	Check tool length measuring device cover.
1250	4	2	NO Z-AX MEASUREMENT	Tool breakage detection command or thermal measurement command was attempted to be executed for machines without optional Z-axis measurement system.	Change program.
1252	4	2	PROGRAM PROTECT	An attempt is made to modify the data while the PROTECT SW is ON.	Set the PROTECT switch to OFF, and modify the data.
1253	4	2	NO SEQ CONTROLLER	A signal output 8XX is executed without sequence controller (option).	Change the signal output into a signal output XX.
1254	4	2	NO EXT ERROR CODE	An error signal was received from the external PLC. At this time, no bit of internal auxiliary contact 20 signal (8-bit data) is on.	Check the conditions when the external PLC alarm occurs, eliminate the cause, and press the [RST] key.
1255	4	2	EXTERNAL ERROR 1	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause and press the [RST] key.
1256	4	2	EXTERNAL ERROR 2	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
1257	4	2	EXTERNAL ERROR 3	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
1258	4	2	EXTERNAL ERROR 4	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
1259	4	2	EXTERNAL ERROR 5	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
1260	4	2	EXTERNAL ERROR 6	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
1261	4	2	EXTERNAL ERROR 7	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occurs eliminate the cause and press the [RST] key.
1262	4	2	EXTERNAL ERROR 10	EXER10 signal comes on.	Turn off the EXER10 and push [RST] key.
1263	4	2	EXTERNAL ERROR 11	EXER11 signal comes on.	Turn off the EXER11 and push [RST] key.
1264	4	2	EXTERNAL ERROR 12	EXER12 signal comes on.	Turn off the EXER12 and push [RST] key.
1265	4	2	EXTERNAL ERROR 13	EXER13 signal comes on.	Turn off the EXER13 and push [RST] key.
1266	4	2	EXTERNAL ERROR 14	EXER14 signal comes on.	Turn off the EXER14 and push [RST] key.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1267	4	2	EXTERNAL ERROR 15	EXER15 signal comes on.	Turn off the EXER15 and push [RST] key.
1268	4	2	EXTERNAL ERROR 16	EXER16 signal comes on.	Turn off the EXER16 and push [RST] key.
1269	4	2	EXTERNAL ERROR 17	EXER17 signal comes on.	Turn off the EXER17 and push [RST] key.
1270	4	2	EXTERNAL ERROR 18	EXER18 signal comes on.	Turn off the EXER18 and push [RST] key.
1271	4	2	EXTERNAL ERROR 19	EXER19 signal comes on.	Turn off the EXER19 and push [RST] key.
1272	4	2	EXTERNAL ERROR 20	EXER20 signal comes on.	Turn off the EXER20 and push [RST] key.
1273	4	2	EXTERNAL ERROR 21	EXER21 signal comes on.	Turn off the EXER21 and push [RST] key.
1274	4	2	EXTERNAL ERROR 22	EXER22 signal comes on.	Turn off the EXER22 and push [RST] key.
1275	4	2	EXTERNAL ERROR 23	1) EXER23 signal comes on. 2) (For 22A,31A,S2A, and S2B) Shortage of lubricant when optional Automatic intermittent lubricating unit is equipped.	1) Turn off the EXER23 and push [RST] key. 2) Replenish lubricant and push [RST] key.
1276	4	2	EXTERNAL ERROR 24	EXER24 signal comes on.	Turn off the EXER24 and push [RST] key.
1277	4	2	EXTERNAL ERROR 25	EXER25 signal comes on.	Turn off the EXER25 and push [RST] key.
1278	4	2	DOOR ERROR	1) The automatic door limit switch has turned on both at door closing and opening ends. 2) It took x seconds (parameter value) for automatic door closing. 3) It took x seconds (parameter value) for automatic door opening.	Eliminate the error cause and press the [RST] key to reset the error.
1279	4	2	NO TOOL IN MAGAZINE	Tool required for operation is not set in the magazine.	Press the [RST] key, and set the tool on the <magazine tool> screen correctly.
1280	4	2	SYSTEM ERROR (MC)	An error was received but the corresponding error cannot be identified.	Press the [RST] key and clear the alarm. If the same troble occurs repeatedly, this error may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1281	4	2	SYSTEM ERROR (ATC)	An error was received but the corresponding error cannot be identified.	Press the [RST] key and clear the alarm. If the same troble occurs repeatedly, this error may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1282	4	2	PROHIBITED POT	The tool was attempted to be replaced with a prohibited pot.	
1283	4	2	CAPPED	The tool was attempted to be replaced with a pot with the cap specified.	
1284	4	2	NO OPTION (A)	An “a” axis program was attempted to be executed although an optional “a” axis is not provided.	Purchase an optional “a” axis. When already provided, set [a option] to [1. Yes].
1285	4	2	NO OPTION (B)	A “b” axis program was attempted to be executed although an optional “b” axis is not provided.	Purchase an optional “b” axis. When already provided, set [b option] to [1. Yes].
1286	4	2	NO OPTION (C)	A “c” axis program was attempted to be executed although an optional “c” axis is not provided.	Purchase an optional “c” axis. When already provided, set [c option] to [1. Yes].
1287	4	2	SHORT POTMOTION TIM	Raising or lowering of the pot has been completed earlier than the specified time.	Turn off power and eliminate the cause.
1288	4	2	NO EMPTY POT	No pot was available when changing from standard to large tool or vice versa.	Prepare an empty pot.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1289	4	2	CAN'T SET TOOL LEN	The [protect] switch was turned on as soon as [tool length set] was executed in automatic tool length measurement mode or [tool length set] could not be executed for some reason.	Multiple errors have occurred concurrently. Check the causes on the <alarm> screen and eliminate them.
1291	4	2	NO MEASURING DEVICE	The Z-axis measurement system was attempted to be operated using the pallet without a measurement device.	Operate the system using the pallet with a measurement device.
1292	4	2	PALLET POS ERROR	The Z-axis measurement system was attempted to be operated although the pallet was not indexed.	Index the pallet and operate the system.
1293	4	2	MAGAZN TOOL SET ERR	Tools are not set in the magazine correctly.	Set the tools in the magazine correctly.
1294	4	2	ADDRESS SETTING ERR	The address of the additional axis is not set correctly.	Set the address correctly.
1295	4	2	OUT PLT NOT COMMDED	The additional axis of the pallet opposite the pallet in operation was attempted to be moved.	Press the [RST] key and check the program.
1296	4	2	NO ZERO MEASUREMENT	Zero position measurement was attempted although zero position measurement option is not provided.	Purchase this option or change the program.
1297	4	2	TOOL BRK SNSOR ERR	Tool breakage detecting sensor input is illegal.	When a tool breakage detection option is not provided, set [tool breakage detect option] to [0: no]. When provided, check to see if chips are stuck to the detection arm. if so, remove them. If the same error occurs, this error may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1298	4	2	TOOL BRK TIME OVER	Tool breakage detecting motion (extend or fold the detevting arm) time exceeds 5 sec.	Push [RST] key and check the air pressure (3-5kg/cm2). If the air is OK, inform us.
1299	4	2	PARITY (SOFT SWITCH)	Software switch data was damaged.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1300	4	2	S OVRRD NO CONNECTED	The spindle override connector is not connected.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1304	4	2	NO AUTO THRM COMP(Z)	Although Z axis automatic thermal displacement compensation is not provided, Z axis automatic thermal displacement compensation was attempted.	Purchase this option.
1305	4	2	* SERVO MOTOR OFF	When door interlock is valid for machines conforming to ce specifications, the door was opened while the axis "*" (axis 4) was in motion. Conformance to CE specifications is standard for the TC-32A, R2A, 20A and S2B.	Press the [RST] key.
1306	4	2	* SERVO MOTOR OFF	When door interlock is valid for machines conforming to ce specifications, the door was opened while the axis "*" (axis 5) was in motion. Conformance to CE specifications is standard for the TC-32A, R2A, 20A and S2B.	Press the [RST] key.
1307	4	2	* SERVO MOTOR OFF	When door interlock is valid for machines conforming to ce specifications, the door was opened while the axis "*" (axis 6) was in motion. Conformance to CE specifications is standard for the TC-32A, R2A, 20A and S2B.	Press the [RST] key.
1308	4	2	COOLANT BLOWING ON	The spindle was attempted to be rotated while the coolant blowing function was ON.	Turn the coolant blowing function OFF and then rotate the spindle.
1309	4	2	SPINDLE ROTATING	The coolant blowing function was attempted to be turned ON while the spindle was rotating.	Stop the spindle and then turn the coolant blowing function ON.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1310	4	2	NOT CLOSING DOOR	The door was open when swiveling the ATC arm was attempted.	Close the door and press the [RST] key.
1311	4	2	H PRE COOLANT ERR 1	Either the high pressure or filter pump is overloaded.	Eliminate the cause of the overload.
1312	4	2	H PRE COOLANT ERR 3	The line filter is clogged.	Check that the element in the line filter and pipe are not damaged, and clean the element.
1317	4	2	MGZN COVER TIMEOVER	The cover did not complete opening and closing within five seconds after opneing and closing operation was commaenced.	Press [RST] key. When this error happens repeatedly, this may be due to the machine failure and the like. Contact the nearest BROTHER approved service dealer.
1318	4	2	MGZN COVER NOT OPEN	The magazine cover was not fully open when the arm started swiveling.	Press [RST] key. When this error happens repeatedly, this may be due to the machine failure and the like. Contact the nearest BROTHER approved service dealer.
1319	4	2	MGZN CVR SENSOR ERR	The sensors to detect the magazine cover opening and closing ends were on when the power was turned on and the [RST] key pressed.	Press [RST] key. When this error happens repeatedly, this may be due to the machine failure and the like. Contact the nearest BROTHER approved service dealer.
1320	4	2	POSITION ERROR XY	The X and Y axes were beyond their stroke limits when the [ATC] key was pressed.	Press [RST] key to reset the alarm and return the X axis to within their stroke limits.
1321	4	2	POSITION ERROR X	The machine was attempted to be operated when the X axis was within the ATC operation range or the ATC operation limit switch was on, or the ATC operation limit switch was turned off before the ATC arm was attempted to be swiveled.	Press [RST] key to reset the alarm and return the X axis to within their stroke limits. When the error occurs even after this operation, this error may be due to the machine failure and the like. Contact the nearest BROTHER service dealer.
1323	4	2	C ZERO RTRN POS ERR	Zero positon return was attmpted when the C-axis (pallet) had not been indexed.	Press the [RST] key to reset the alarm. Index the C axis to 0 degrees or -180 degrees and then conduct zero position return.
1324	4	2	ORGIN LS OFF (*)	The zero point limit switch for axis No. 4 was not on when zero position return was attempted by pressing the [RELSE] and [Z.RTN] keys.	Press the [RST] key to reset the alarm. Move the axis No. 4 to the position where the zero position limit switch for the axis No. 4 turns on, and press the [RELSE] and [Z.RTN] keys. -> See the attached sheet.
1325	4	2	ORGIN LS OFF (*)	The zero point limit switch for axis No. 5 was not on when zero position return was attempted by pressing the [RELSE] and [Z.RTN] keys.	Press the [RST] key to reset the alarm. Move the axis No. 5 to the position where the zero position limit switch for the axis No. 5 turns on, and press the [RELSE] and [Z.RTN] keys. -> See the attached sheet.
1326	4	2	ORGIN LS OFF (*)	The zero point limit switch for axis No. 6 was not on when zero position return was attempted by pressing the [RELSE] and [Z.RTN] keys.	Press the [RST] key to reset the alarm. Move the axis No. 6 to the position where the zero position limit switch for the axis No. 6 turns on, and press the [RELSE] and [Z.RTN] keys. -> See the attached sheet.
1327	4	2	NO MEM (XY THRM COMP)	There is no memory area for automatic X and Y axes thermal diplacement compensation deta.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1328	4	2	NO AUTO THERM COMP (X)	Although X axis automatic thermal displacement compensation is not provided, X axis automatic thermal displacement compensation was attempted.	Edit the program.
1329	4	2	NO AUTO THERM COMP (Y)	Although Y axis automatic thermal displacement compensation is not provided, Yaxis automatic thermal displacement compensation was attempted.	Edit the program.
1330	4	2	DIAMETER CORRECTING	1. The diameter is being corrected during XZ or YZ circular interpolation. 2. The tool diameter is being offset during XZ, YZ, XYZ, XA, XB, YA, or YB linear interpolation.	Edit the program.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1331	4	2	COORDINATE ROTATION	The coordinates are being rotated during XZ and YZ circular interpolation.	Edit the program.
1332	4	2	MEASD VAL ERR LRG(2)	The difference between the current zero measurement result and the previous zero measurement result has exceeded measurement tolerance 2 of USER PARM (ZERO MEASUREMENT).	Press the [RST] key and check the measurement position in the program.
1334	4	2	TOOL LENGTH ERROR	Tool length setting for [TOOL BREAKAGE DETECT OPTION (TYPE 3)] is incorrect. This error occurs when the length of the tool subject to breakage detection corresponds to any of the following: 1.(Tool length - Tool breakage detector return position) < 60 mm 2.(Tool length - Tool breakage detector return position) > (Tool breakage detection motor stroke + 60 mm)	Check the settings for [TOOL BREAKAGE DETECT OPTION] and [TOOL BRK DETECT RETURN POS] (user parameters), and [TOOL LENGTH] on the tool list screen.
1335	4	2	TOOL BREAKAGE POS.ER1	IO board, TB board, or tool breakage detector is faulty.	Press the [RST] key to reset the error. If the error still occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1336	4	2	TOOL BREAKAGE POS.ER2	Tool breakage detection motor did not move to the specified position.	Press the [RST] key to reset the error. If the error still occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1337	4	2	T.BRK POS.DRIVER ER	The tool breakage detector is faulty.	Press the [RST] key to reset the error. If the error still occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1338	4	2	CTS ON	M496 command is used while CTS is on.	Press the [RST] key and clear the alarm. This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1339	4	2	THERM ERR (CTS PUMP)	The CTS pump thermal signal was input.	Press the [RST] key and clear the alarm. This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
1340	4	2	CTS ERROR	There is a problem in the CTS pump. 1) Coolant level low 2) Coolant leakage 3) Valve damage 4) Pump damage 5) Sensor failure	This error occurs if the CTS command is used during back washing. Change the program. For other cases, 1) Check that there is no problem in the pipe. 2) When the error occurs while coolant is being discharged, check the level of coolant in the tank and replenish if necessary. If the level is correct, check the user parameter (switch 1) [M494 COOLANT BLOWING TIME]. 3) When the error occurs while coolant is not being discharged, check the valve for any damage. 4) If the error still occurs, causes 4) and 5) may be the reason. Contact your nearest BROTHER approved service dealer.
1341	4	2	TOOL CLAMP ERROR	Spindle operation was attempted without turning the arm.	Press the [ATC] key to turn the arm.

When alarm No. 1324 ~ 1326 “ORIGIN LS OFF (*)” occurs

This alarm occurs when the **[RELSE]** and **[Z.RTN]** keys are pressed when the zero position limit switch is not on. Thus, follow the steps below to move the axis using jog operation to the position where the zero position limit switch turns on.

1. Press the **[RST]** key to reset the alarm.
2. Select the desired additional axis on the <MANU COND> screen or the <POS> screen.
   axis No. 4: **[F0]** key
   axis No. 5: **[F1]** key
   axis No. 6: **[F2]** key
3. Press the **[I/O]** key and the <I/O> screen appears.
   Select **[1]** and press the **[ENT]** key.
4. Press the **[PAGE UP]** key to display the screen below.

5. While observing the screen, move the additional axis by pressing the **[+4]** or **[-4]** key to move in the direction that the cables connected to the additional axis are not entangled. When the manual pulse generator is provided, use it.
6. Release your finger from the key when the zero position limit switch of the additional axis being operated turns on.
   When the axis has stopped at its stroke end, you can move the axis to a position out beyond the stroke limit by pressing the **[+4]** or **[-4]** key while holding down the **[RELSE]** key.
7. Press the **[RELSE]** and **[Z.RTN]** keys.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1850	3	2	MARK NOT FOUND	Delimiter of data in program is lost.	Delete the program and reedit it after pressing [RST] key.
1851	3	2	PRESS RESET KEY	Important parameter is modified.	Press [RST] key.
1852	3	2	EXTERNAL ERROR 10	Exer 10 signal comes on.	Turn off the exer 10 and push [RST] key.
1853	3	2	EXTERNAL ERROR 11	Exer 11 signal comes on.	Turn off the exer 11 and push [RST] key.
1854	3	2	EXTERNAL ERROR 12	Exer 12 signal comes on.	Turn off the exer 12 and push [RST] key.
1855	3	2	EXTERNAL ERROR 13	Exer 13 signal comes on.	Turn off the exer 13 and push [RST] key.
1856	3	2	EXTERNAL ERROR 14	Exer 14 signal comes on.	Turn off the exer 14 and push [RST] key.
1857	3	2	EXTERNAL ERROR 15	Exer 15 signal comes on.	Turn off the exer 15 and push [RST] key.
1858	3	2	EXTERNAL ERROR 16	Exer 16 signal comes on.	Turn off the exer 16 and push [RST] key.
1859	3	2	EXTERNAL ERROR 17	Exer 17 signal comes on.	Turn off the exer 17 and push [RST] key.
1860	3	2	EXTERNAL ERROR 18	Exer 18 signal comes on.	Turn off the exer 18 and push [RST] key.
1861	3	2	EXTERNAL ERROR 19	Exer 19 signal comes on.	Turn off the exer 19 and push [RST] key.
1862	3	2	EXTERNAL ERROR 20	Exer 20 signal comes on.	Turn off the exer 20 and push [RST] key.
1863	3	2	EXTERNAL ERROR 21	Exer 21 signal comes on.	Turn off the exer 21 and push [RST] key.
1864	3	2	EXTERNAL ERROR 22	Exer 22 signal comes on.	Turn off the exer 22 and push [RST] key.
1865	3	2	EXTERNAL ERROR 23	1) EXER23 signal comes on. 2) (For 22A,31A,S2A, and S2B) Shortage of lubricant when optional Automatic intermittent lubricating unit is equipped.	1) Turn off the EXER23 and push [RST] key. 2) Replenish lubricant and push [RST] key.
1866	3	2	EXTERNAL ERROR 24	Exer 24 signal comes on.	Turn off the exer 24 and push [RST] key.
1867	3	2	EXTERNAL ERROR 25	Exer 25 signal comes on.	Turn off the exer 25 and push [RST] key.
1868	3	2	CHG TOOL DG WK	Data on used tools are modified during operation.	Press [RST] key and restart operation.
1869	3	2	CHECK MAGAZINE TOOL	Resetting ATC arm was attempted by pressing the [relse] and [ATC] keys.	Check the magazine tool and press the [RST] key.
1870	3	2	SPINDLE RPM ERROR	The S command is not given during the spindle rotation, or the commanded value exceeds the allowable range.	Press the [RST] key and check the program.
1871	3	2	USER PARA ER (Z MESR)	Setting of user parameters 6 (Z measurement) is faulty.	Check the setting of user parameters 6(Z measurement).
1872	3	2	H PRE COOLANT ERR 2	Cause 1) The filter is clogged. The coolant in the clean tank has fallen below the minimum required level.	Replace the filter. Check the coolant level of the 200 L tank and replenish coolant if necessary.
1873	3	2	LOADED MASS SET ERR	For table movement type, the mass loaded on the table exceeds [TABLE LOADED MASS] + mass error tolerance. For column movement type, the current value of the C-axis (quick table) command exceeds the tolerance.	Check that the mass loaded on the table is the same as the setting for [TABLE LOADED MASS] (user parameter).
1874	3	2	FILTER ERR	Tool washing filter is clogged.	Press the [RST] key to reset the error. When the machine is the armless ATC type and the Z-axis position is above the machine zero point, press the [RST] key with the [RELSE] key held down. Then lower the axis below the machine zero point in manual mode. If the error occurs repeatedly, contact your nearest BROTHER approved service dealer.

8

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
1875	4	2	LINE FILTER ERROR	1) The line filter's coolant through spindle differential pressure switch turned on while CTS is on. 2) The back washing filter is clogged while CTS is on.	Press the [RST] key to reset the error. Use M496 to perform back washing. If the error occurs repeatedly, contact your nearest BROTHER approved service dealer.
2104	2	2	EXTERNAL ERROR 10	Exer 10 signal comes on.	Turn off the exer 10 and push [RST] key.
2105	2	2	EXTERNAL ERROR 11	Exer 11 signal comes on.	Turn off the exer 11 and push [RST] key.
2106	2	2	EXTERNAL ERROR 12	Exer 12 signal comes on.	Turn off the exer 12 and push [RST] key.
2107	2	2	EXTERNAL ERROR 13	Exer 13 signal comes on.	Turn off the exer 13 and push [RST] key.
2108	2	2	EXTERNAL ERROR 14	Exer 14 signal comes on.	Turn off the exer 14 and push [RST] key.
2109	2	2	EXTERNAL ERROR 15	Exer 15 signal comes on.	Turn off the exer 15 and push [RST] key.
2110	2	2	EXTERNAL ERROR 16	Exer 16 signal comes on.	Turn off the exer 16 and push [RST] key.
2111	2	2	EXTERNAL ERROR 17	Exer 17 signal comes on.	Turn off the exer 17 and push [RST] key.
2112	2	2	EXTERNAL ERROR 18	Exer 18 signal comes on.	Turn off the exer 18 and push [RST] key.
2113	2	2	EXTERNAL ERROR 19	Exer 19 signal comes on.	Turn off the exer 19 and push [RST] key.
2114	2	2	EXTERNAL ERROR 20	Exer 20 signal comes on.	Turn off the exer 20 and push [RST] key.
2115	2	2	EXTERNAL ERROR 21	Exer 21 signal comes on.	Turn off the exer 21 and push [RST] key.
2116	2	2	EXTERNAL ERROR 22	Exer 22 signal comes on.	Turn off the exer 22 and push [RST] key.
2117	2	2	EXTERNAL ERROR 23	3) EXER23 signal comes on. 4) (For 22A,31A,S2A, and S2B) Shortage of lubricant when optional Automatic intermittent lubricating unit is equipped.	3) Turn off the EXER23 and push [RST] key. 4) Replenish lubricant and push [RST] key.
2118	2	2	EXTERNAL ERROR 24	Exer 24 signal comes on.	Turn off the exer 24 and push [RST] key.
2119	2	2	EXTERNAL ERROR 25	Exer 25 signal comes on.	Turn off the exer 25 and push [RST] key.
2120	2	2	MNR FAILURE RLY ON	An error has occurred in the SEQ unit connected to NC board connector seq.	Refer to the instruction manual of the connected SEQ unit eliminate the cause and turn on power again.
2121	2	2	PRESS .HIGH (AUTO OIL)	The pressure sensor was not off when oil supply was attmepted.	Press the [RST]key. When the error still occurs after pressing the [RST] key, the error may be due to the machine failure or the like. Contact the nearest BROTHER approved service dealer.
2122	2	2	PRESS .LOW (AUTO OIL)	The pressure sensor did not turn on witin the time set for [AUTOMATIC OILING MONITORING TIME] in the machine parameter (system1) after the oiling pump was turned on.	Press the [RST]key. When the error still occurs after pressing the [RST] key, the error may be due to the machine failure or the like. Contact the nearest BROTHER approved service dealer.
2123	2	2	LEVEL DROP (AUTO OIL)	Insufficient oil input signal was turned on.	Supply oil.
2400	1	2	MEMORY OVERFLOW	Areas for directories and data are insufficient.	If you are editing, reduce the current program capacity before storing it or delete other programs to create greater free memory area and edit the program again.
2401	1	2	M/C PARA NOT DELETED	When formatting or deleting all data banks, [PARAMETER CHANGE] was set to [NO].	When deleting machine parameters, set [PARAMETER CHANGE] to [YES] on the [I/O] screen.
2402	1	2	* SERVO MOTOR OFF	The outer door was opened while the door interlock was valid for the CE specification machine. (*-axis (4 axis) servomotor power was turned off.) Conformance to CE specifications is standard for the TC-32A, R2A, 20A and S2B.	Turn off power and see 13.6 Resetting ATC.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
2403	1	2	* SERVO MOTOR OFF	The outer door was opened while the door interlock was valid for the CE specification machine. (*-axis (5 axis) servomotor power was turned off.) Conformance to CE specifications is standard for the TC-32A, R2A, 20A and S2B	Turn off power and see 13.6 Resetting ATC.
2404	1	2	* SERVO MOTOR OFF	The outer door was opened while the door interlock was valid for the CE specification machine. (*-axis (6 axis) servomotor power was turned off.) Conformance to CE specifications is standard for the TC-32A, R2A, 20A and S2B	Turn off power and see 13.6 Resetting ATC.
2500	1	1	MEMORY RUNNING	An attempet is made to start the MDI operation during the halt of memory operation. The magazine tool data was attempted to be set during memory operation. Copying, detection, formatting, or changing data number was attemped on the <MEMORY> screen during memory operation. Editing data bank was attemped during memory operation.	Execute the MDI operation after the memory operation is finished. Complete memory operation and then set the data. Complete memory operation and then perform the desired operation.
2501	1	1	IN MDI OPERATION	Mode is changed during MDI operation. The magazine tool data was attempted to be set during MDI operation. Editing data bank was attempted during MDI operation.	Execute mode change after the MDI operation is finished. Complete MDI operation and then set the data. Complete MDI operation and then edit the data bank.
2502	1	1	HANDLE MODE	Manual mode operation is performed during manual pulse generator mode.	Set to OFF axis selector switch of manual pulse generator.
2503	1	1	COUNTER1 END NOTICE	The workpiece counter has attained the end notice number.	
2504	1	1	COUNTER2 END NOTICE	The workpiece counter has attained the end notice number.	
2505	1	1	COUNTER3 END NOTICE	The workpiece counter has attained the end notice number.	
2506	1	1	COUNTER4 END NOTICE	The workpiece counter has attained the end notice number.	
2507	1	1	NOT CLOSING DOOR	Attempt of runnung the machine while the door is open and the interlock unit is ON.	Close the door or set the interlock unit to OFF.
2508	1	1	IN AUTO ALIGNMENT	The mode is changed during center aliginment.	Finish the center alignment operation.
2509	1	1	RELEASE MACHINE LOCK	An attempt is made to execute the center alignment in the machine lock.	Turn OFF the respective lock status before executing the center alignment.
2510	1	1	ZERO RTN COMMAND ERR	An attempt is made to return to M.Z. point during the machine lock.	Release the machine lock before executing the zero point return.
2511	1	1	DR OPEN SPNDL STOP	The door was opened during spindle rotation (the door interlock is effective).	Close the door and restart the operation. The spindle starts rotating from the position when the operation was stopped.
2512	1	1	TOO SMALL TM CONST	Tap time constant set by M code was smaller than the minimum tap time constant operable for tap rotation.	Set the time constant by M code appropriately for tap rotation.
2513	1	1	PALLET POS ERROR	A memory operation is commanded while the pallet is not indexed.	Change to the manual mode and index pallet with [C INDEX] key.
2514	1	1	INNER DOOR OPEN	The inner door is opened in the operation.	Close the inner door and push [CAN] key.
2515	1	1	OUTER DOOR OPEN	The C axis is going to rotate while the safety switch is ON and the outer door is open. Or machine is going to be operated while the pallet is not indexed.	Close the outer door, or turn off the safety switch.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
2516	1	1	PRESSPALLET START	The inner pallet is going to carry out before take off the outer pallet work.	Take off the outer pallet work and press [PALLET START] key.
2517	1	1	DIFFER FROM PLT PRG	The program different from the one set to user parameter (quick table) was selected in memory operation mode.	Check the pallet program number set to user parameter (quick table).
2518	1	1	STROKE OVER (C)	When the pallet beyond its stroke, the [z. rtn] or [p. idx] key was pressed.	Press the [+c] or [-c] key to move the C-axis between -180.000 degrees and 0.000 degrees, and retry operation.
2519	1	1	SPARE TOOL USING	Life of tool used in machining is over.	
2520	1	1	MEASUREMEN T ON	Switching the mode was attempted during zero position measurement.	Complete zero position measurement.
2521	1	1	M406 IS ON	M406 signal was on when memory operation was executed.	Output m407 signal in MDI operation mode (block operation) to turn m406 signal off.
2522	1	1	TL LF EXPIRING(*)	Tool life has reached the preset value. The figure in brackets ( ) indicates the tool number.	
2523	1	1	INPUT DATA ERROR	Data beyond the specified range is set.	Set the data within the specified range.
2524	1	1	ZERO RTN NOT DONE	An attempt is made to start operation or automatic setting without executing M.Z. return.	Execute the zero point return.
2525	1	1	PROGRAM NO ERROR	An attempt is made to set the program No. which is not allowed.	Set the program No. correctly.
2526	1	1	NO COPY SOURCE DATA	The program or data bank to be copied does not exist.	Check the program no. or data bank no.
2527	1	1	DST DATA ALRDY EXST	A program or data bank with an identical no. to those to be copied already exists.	Copy to a different no. or delete the existing program or the data bank.
2528	1	1	PROGRAM PROTECT	An attempt is made to modify the data while the PROTECT SW is ON.	Set the PROTECT switch to OFF, and modify the data.
2529	1	1	CHARACTER NO. sOVER	Number of characters exceeds 128.	Reduce a number of characters.
2530	1	1	PRGRM IN EXECUTION	An attempt is made to edit or delete the file concerning the program in operation.	Execute it after finishing the operation.
2531	1	1	SELECT AXIS	The additional axis select switch was not set after power was turned on.	Set the switch correctly.
2532	1	1	COMMUNICATI NG	When the program or data is to be modified, the same data is in communication.	Execute it after finishing the communication.
2533	1	1	REQD DATA NOT FOUND	There is no specified program or data.	Check the program No. or data No.
2534	1	1	OPERATING COMMU DATA	The data desired for communication is currently being used.	Stop operation and start communication.
2535	1	1	EDITING COMMUNI DATA	The data desired for communication is currently being edited.	Complete editing and start communication.
2536	1	1	COMMUNI PARAM ERROR	[7 bit] is set to [character] and era is set to [trans data code] for communication parameter.	Check the parameter.
2537	1	1	DR SIGNAL OFF	DR signal was turned off during communication. (Only when DR SIGNAL CHECK in parameter 4 is effecive.)	Check the parameter.
2538	1	1	CS SIGNAL OFF	CS signal was off during output of DC1 and DC3 codes.	Check the parameter.
2539	1	1	RC BUFFER OVERFLOW	Receiving buffer has over flown (256 bytes).	Check the parameter.
2540	1	1	PARITY ERROR(COM)	PARITY error has occurred during data entry.	Check the parameter.
2541	1	1	OVERRUN ERROR(COM)	Overrun error (data skip) has occurred during data entry.	Check the parameter.
2542	1	1	FRAMING ERROR(COM)	Framing error (stop bit was not detected) occurred during data entry.	Check the parameter.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
2543	1	1	TIMEOVER (COM)	Data could not be received or transmitted during the time preset to RESPONSE MONITORING TIME of the parameter.	
2544	1	1	FORMAT ERROR(COM)	The header, data portion, or footer cannot be recognized.	Check the communication parameter or data.
2545	1	1	LOAD HEADER ERROR	The format of the received header is not correct.	Check the format.
2546	1	1	LOAD DATA NAME ERROR	The data name of the received header is not correct.	Check the data name.
2547	1	1	RCV RSPONCE HEAD ERR	The received response header is not correct for the command requested through communication.	Check the response header.
2548	1	1	LOAD RESPNCE ERR END	The response of error end was received for the command that has been sent.	Check any cause originating in the connected communication equipment.
2549	1	1	CHECK ERROR	The contents of the machine data differ from those of input data.	
2550	1	1	IGNORE LOAD (SYMBOL)	Invalid symbol was detected in the received data, thus the corresponding record was ignored.	Check the symbol in the data.
2551	1	1	IGNORE LOAD (ASCEND)	The symbol in the received data is not in chronological order, thus the corresponding record was ignored.	Check the order of symbols in the data.
2552	1	1	CONV. LOAD (ITEM QTY)	The number of items in one record of the received data is not correct. Excessive items are ignored. Nothing is set for missing items.	Check the record format.
2553	1	1	CONV. LOAD (ITM RANGE)	The range of the item of the received data is not correct, thus changed. Nothing is set for the changed portion.	Check the value of each item.
2554	1	1	COMMUNI DATA EDIT ER	Edit error has occurred during processing of communication data.	
2555	1	1	SAVE DATA ERROR	The saved data format is not correct.	Edit the corresponding data again.
2556	1	1	EXCESSIVE LOAD DIR.	The number of loaded directories has exceeded 256.	The number of directories to be loaded should be up to a maximum of 256.
2557	1	1	COMMUNI TV CHECK ERR	The number of data in one block is incorrect.	Check the communication protocol.
2558	1	1	RECEIVD DATA INVALID	The data that cannot be converted was received.	Check the communication protocol.
2560	1	1	OVERWRITE PROTECT	Overwriting is prohibited for communication with slave station.	Check the communication parameter.
2561	1	1	SEND(*)	The program indicated in brackets ( ) was sent to an external device.	
2562	1	1	SEND(*)	The data indicated in brackets ( ) was sent to an external device.	
2564	1	1	RECV(*)	The program indicated in brackets ( ) was received from an external device.	
2565	1	1	RECV(*)	The data indicated in brackets ( ) was received from an external device.	
2566	1	1	COMMUNI CHECKSUM ERR	The checksum of receiving response is not correct.	Set the checksum value correctly or set the checksum of user parameter (Communication) to [0:INVALID].
2567	1	1	EXTERNAL ERROR 8	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause.
2568	1	1	EXTERNAL ERROR 9	Error signal was input from the external PLC.	Check the conditions that external PLC alarm occur eliminate the cause.
2569	1	1	EXTERNAL ERROR 10	EXER10 signal comes on.	Turn off the exer 10 and push [RST] key.
2570	1	1	EXTERNAL ERROR 11	EXER11 signal comes on.	Turn off the EXER11 and push [RST] key.
2571	1	1	EXTERNAL ERROR 12	EXER12 signal comes on.	Turn off the EXER12 and push [RST] key.
2572	1	1	EXTERNAL ERROR 13	EXER13 signal comes on.	Turn off the EXER13 and push [RST] key.
2573	1	1	EXTERNAL ERROR 14	EXER14 signal comes on.	Turn off the EXER14 and push [RST] key.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
2574	1	1	EXTERNAL ERROR 15	EXER15 signal comes on.	Turn off the EXER15 and push [RST] key.
2575	1	1	EXTERNAL ERROR 16	EXER16 signal comes on.	Turn off the EXER16 and push [RST] key.
2576	1	1	EXTERNAL ERROR 17	EXER17 signal comes on.	Turn off the EXER17 and push [RST] key.
2577	1	1	EXTERNAL ERROR 18	EXER18 signal comes on.	Turn off the EXER18 and push [RST] key.
2578	1	1	EXTERNAL ERROR 19	EXER19 signal comes on.	Turn off the EXER19 and push [RST] key.
2579	1	1	EXTERNAL ERROR 20	EXER20 signal comes on.	Turn off the EXER20 and push [RST] key.
2580	1	1	EXTERNAL ERROR 21	EXER21 signal comes on.	Turn off the EXER21 and push [RST] key.
2581	1	1	EXTERNAL ERROR 22	EXER22 signal comes on.	Turn off the EXER22 and push [RST] key.
2582	1	1	EXTERNAL ERROR 23	1) EXER23 signal comes on. 2) (For 22A,31A,S2A, and S2B) Shortage of lubricant when optional Automatic intermittent lubricating unit is equipped.	1) Turn off the EXER23 and push [RST] key. 2) Replenish lubricant.
2583	1	1	EXTERNAL ERROR 24	EXER24 signal comes on.	Turn off the EXER24 and push [RST] key.
2584	1	1	EXTERNAL ERROR 25	EXER25 signal comes on.	Turn off the EXER25 and push [RST] key.
2586	1	1	EDITING AREA OVER	Editing contents have exceeded the editing capacity (64 Kbytes).	The memory area cannot be increased during editing, thus divide the program. When this error occurs when starting editing, this means the program is too large to edit.
2587	1	1	SP LOCK SIGNAL ON	The spindle lock signal is on.	Turn it off.
2588	1	1	ATC LOCK SIGNAL ON	The ATC lock signal is on.	Turn it off.
2589	1	1	XY LOCK SIGNAL ON	The XY-axis lock signal is on.	Turn it off.
2590	1	1	Z LOCK SIGNAL ON	The Z-axis lock signal is on.	Turn it off.
2591	1	1	* LOCK SIGNAL ON	The axis 4 lock signal is on.	Turn it off.
2592	1	1	* LOCK SIGNAL ON	The axis 5 lock signal is on.	Turn it off.
2593	1	1	* LOCK SIGNAL ON	The axis 6 lock signal is on.	Turn it off.
2594	1	1	SPINDLE OVERRIDE ON	The spindle override is set to the value other than 100%.	Set the spindle override to 100%.
2595	1	1	CUT FEED OVERRIDE ON	Cutting feed override is set to a value other than 100%.	Set the cutting feed override to 100%.
2596	1	1	RPD TRVS OVERRIDE ON	Rapid feed override is set to a value other than 100%.	Set the rapid feed override to 100%.
2597	1	1	MODE CHANGE PROHIBIT	Mode changeover prohibition signal is on.	Turn the signal off.
2598	1	1	DOOR LOCKED	The door OPEN/CLOSE switch was pressed while the door was locked.	
2599	1	1	AREA SNSR OBSTRUCTED	The beam of the area sensor was obstructed while the door was opening or closing.	
2600	1	1	TOOL ALRDY REGISTRD	The tool attempted to be set to [magazine tool] is already set for another pot.	Delete the current tool and set a new one.
2601	1	1	NO TOOL IN MAGAZINE	The tool necessary for operation is not set in the magazine.	Set the correct tool on the <magazine tool> screen.
2602	1	1	EDITING	Deleting and copying the data bank or changing the data bank number was attempted on the <directory of memory> screen during data bank editing.	Complete the data bank currently being edited.
2603	1	1	INCORRECT TOOL TYPE	Replacement with a tool of incorrect type was attempted in manual operation mode.	

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
2604	1	1	PROHIBITED POT	1) Setting other than “attachment of cap” was attempted for a prohibited pot on the <magazine tool> screen. The tool was attempted to be changed with a prohibited pot.	1) Only “attachment of cap” can be set for a prohibited pot.
2605	1	1	CAPPED	The tool was attempted to be replaced with a pot with the cap specified.	
2606	1	1	EXCESSIVE TOOLS	Setting more than 30 tools per tool group was attempted.	Up to 30 tools can be set for one group.
2607	1	1	TOOL SET TONEXT POT	Although a tool is set in the adjacent pot, a large tool was attempted to be set.	Delete the tool set to the adjacent pot or set the large tool in another location.
2608	1	1	DELETE POS ERROR	Deletion was attempted at an incorrect position.	Move the cursor to the correct position.
2609	1	1	NO MEASURING DATA	Automatic setting (parameter) was attempted although the measurement data does not exist.	Perform measurement using automatic centering function.
2611	1	1	TOOL LEN SETTING ON	1) Changing mode was attempted during automatic tool length measurement. 2) The [m. lck] key was pressed.	Complete automatic tool length measurement.
2612	1	1	OPERATING MANUALLY	Start data was attempted to be set during jog movement in ATC maintenance mode.	Stop jog movement and set the data.
2615	1	1	NO OPTION (4)	Although an optional axis 4 is not provided, axis 4 operation was attempted to be performed.	Purchase an optional axis 4. When already provided, set [4 option] to [1: yes].
2616	1	1	NO OPTION (5)	Although an optional axis 5 is not provided, axis 5 operation was attempted to be performed.	Purchase an optional axis 5. When already provided, set [5 option] to [1: yes].
2617	1	1	NO OPTION (6)	Although an optional axis 6 is not provided, axis 6 operation was attempted to be performed.	Purchase an optional axis 6. When already provided, set [6 option] to [1: yes].
2618	1	1	KEY OPE PROHIBITED	Key entry cannot be accepted because key operation prohibition signal is on.	Turn the signal off and then perform key entry.
2619	1	1	PRGM EDIT PROHIBITED	Changing data was attempted while the program edit signal was on.	Turn the signal off and then change the data.
2620	1	1	EDIT PROHIBITED	Changing data was attempted while the edit prohibition signal was on.	Turn the signal off and then change the data.
2621	1	1	USER PARAM ERR (COM)	Setting of user parameter 3 (communication) is incorrect.	Check the setting.
2622	1	1	SIDE DOOR OPEN	The machine was attempted to be operated while the side door was open.	Close the door and then operate the machine.
2623	1	1	DATA ERR (DATA BANK)	Data structure of the non-selected data banks is damaged.	Delete the damaged data on the <directory of memory> screen in edit mode, and create new data.
2624	1	1	SET POS ERROR	Setting data was attempted for a location where data cannot be set.	Set the data in other locations.
2625	1	1	RCV COM ER END(***)	The command received communication with the TC slave resulted in an error.	Check the cause and send the command again.
2626	1	1	COMMUNICATI ON I/F ER	An errror occured in the interface with communication device.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
2627	1	1	COMMUNI VER. CHECK ER	The version of the data attempted to be transmitted differs from that of system data version.	Edit the data again.
2628	1	1	COMMU COMD END(***)	Coomunication command indicated in brackets()was ended.	
2629	1	1	DELETE(***)	The data indicated in brackets ()was deleted during communication.	
2630	1	1	DELETE(***)	The data indicated in brackets ()was deleted during communication.	
2634	1	1	M PARAM CHNG DISABLE	Although input of machine parameter was attempted through communication, [parameter change] was set to [no].	When inputting the machining parameter, select [1. input/output] on the <I/O> screen, and set [parameter change] to [yes].
2635	1	1	POT NOT FULLY RAISED	The pot is not at the upper end.	Press the [ATC] key to move the pot to the upper end.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
2636	1	1	DURING ATC	Changing to another mode was attempted during tool change.	The mode can not be changed during tool change.
2637	1.	1	NO A/T THRM DISP COM	The compensation data screen was attempted to be opened although the automatic thermal displacement compensation function is not provided.	
2638	1	1	MACHINE OPERATING	The C-axis is operating when the C-axis start point data is cleared.	Clear the data after the C-axis has stopped.
2639	1	1	CNTRL BOX DOOR OPEN	The door of the control box is open.	Close the door of the control box.
2996	5	3	KERNEL ERROR (MAIN)	An error has occurred in the main CPU operating system.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
2997	5	3	KERNEL ERROR(SLAVE)	An error has occurred in the slave CPU operating system.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
2998	5	3	KERNEL ERROR(LOCAL)	An error has occurred in the local CPU operating system.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
2999	5	2	NO ERROR NO		This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
3200	4	2	PARITY ERR (TOOL)	Each data is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3201	4	2	PARITY ERR (PTRN)	Each data is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3202	4	2	PARITY ERR (HOLE)	Each data is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3203	4	2	PARITY ERR (CUTC)	Each data is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3204	4	2	DATA E (TOOL)	Each data structure is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3205	4	2	DATA ERR (PTRN)	Each data structure is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3206	4	2	DATA ERR (HOLE)	Each data structure is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3207	4	2	DATA ERR (CUTC)	Each data structure is destroyed.	Press [RST] key, an delete the destroyed data by memory display in edit mode and create new data again.
3208	4	2	IMPROPER DATA TYPE	Program of different type is to be started.	Check program.
3209	4	2	POS CALCUL IMPSBL	Improper command code is generated.	Check program.
3210	4	2	NO TOOL IN SPINDLE	Tool break checking (signal output m120) was executed with no tool set on spindle.	Check program.
3211	4	2	NO TOOL IN MENU	The tool to be used for machining is not included in the tool list.	Press the [RST] key and include the tool in the list.
3212	4	2	IMPROPER TOOL	The tool is not appropriate for machining or the tool list has been changed after the tool was assigned.	Press the [RST] key and assign the tool again.
3213	4	2	TOOL LNGTH NOT SET	Tool length is set to 0, or not set.	Set tool length after pressing [RST] key.
3214	4	2	N. D. NOT SPECIFIED	Number of pattern divisions is specified as 0.	Set no. of divisions after pressing [RST] key.
3215	4	2	N. M. NOT SPECIFIED	Machining number of patterns is specified as 0.	Set machining number after pressing [RST] key.
3216	4	2	TOO MANY N. M.	Machining number of patterns is specified beyond the range (999).	Set machining number again after pressing [RST] key.
3217	4	2	RPM NOT SPECIFIED	There is no peripheral speed set in cutting condition in memory operation, or it is set too small.	Set cutting conditions correctly after pressing [RST] key.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
3218	4	2	FDRATE NOT SPECFD	There is no feed rate set in cutting condition in memory operation, or it is set too small.	Set cutting conditions correctly after pressing [RST] key.
3219	4	2	NO PECK DATA	Step data is set to 0 or no data in cutting condition in memory operation.	Set cutting conditions correctly after pressing [RST] key.
3220	4	2	DRILL DIA NOT SET	Od of drill or small dia. of drill to be used is not set or set to 0.	After pressing [RST] key, set od of drill in tool menu.
3221	4	2	NO PITCH DATA	Pitch data in tool menu is set to 0 or not set at all for tapping.	After pressing [RST] key, set pitch data.
3222	4	2	TAP SIZE ERROR	Denominator of inch screw thread size is 0.	After pressing [RST] key, set the nominal size of tap correctly.
3223	4	2	R OR L HAND ?	Data on torsion direction is not set in tool menu for tapping.	After pressing [RST] key, set torsion direction.
3224	4	2	R. COMP ERROR	Motion of tool dia. offset start-up cancel is in circular arc command.	Set linear command for motion of start-up /cancel after pressing [RST] key.
3225	4	2	TOO MANY LINES	Number of lines is set beyond the range (99). (cutting width is 0 or too small. or tool dia. is too small)	Press [RST] key, and set cutting width and tool dia. correctly
3226	4	2	TOO MANY INFEEDS	Depth of cut is too small	Press [RST] key and set depth of cut correctly.
3227	4	2	CORNER CALC IMPSBL	Calculation of corner r and c is not available in contouring or chamfering.	Modify corner r or c where error occurred after pressing [RST] key.
3228	4	2	POCKET IMPOSSIBLE	Too dia. is larger in pocket machining as shown below: circle : dia. Square : shorter one of X or Y track : width or tool radius is larger than corner r of square pattern. (excl. corner r or 0)	Press [RST] key and select a tool with dia. Smaller than pocket.
3229	4	2	CHAMFERING IMPSBL	Chamfer milling function comes first in pocketing.	Press [RST] key and assign tools again so that chamfer milling function comes after milling function.
3230	4	2	ATC IMPOSSIBLE	Before/after cutting, there is a tool change code in auxiliary function or tool or auxiliary function of motion call process.	Press [RST] key, and deleted tool change code.
3231	4	2	RPM OVER	Rotation commanded by MDI results in higher spindle speed than specified by machine parameter 1.	Press [RST] key and set the correct data.
3232	4	2	FEEDRATE OVER	Cutting commanded by MDI results in higher feedrate than max. cutting speed or max. rapid feedrate specified by machine parameter 1.	Press [RST] key and set the correct data.
3233	4	2	TOO LARGE R. COMP	During inner arc cutting in tool dia. Offset, programmed radius is smaller than dia. offset amount.	Press [RST] key, and set programmed radius larger than tool dia. offset amount.
3234	4	2	NO ENTRY M. CODE	Unregistered m code is to be executed.	Press [RST] key, and changed m code afterwards.
3235	4	2	ILLEGAL APPROACH	Cutter radius compensation is done on the center of line in rectangular or circular approach.	Press [RST] key, and modify approaching method afterwards.
3236	4	2	ILLEGAL RELIEF	Cutter radius compensation is done on the center of line in rectangular or circular release.	Press [RST] key, and modify release method afterwards.
3237	4	2	NO CUTTING LENGTH	Cutting length of the line of approach or release is not sufficient.	Press [RST] key, and modify the program afterwards.
3238	4	2	AXIS NOT DESIGNTD	No axis is designated in the program	Check the program.
3239	4	2	ILLEGAL AXIS	Axis is improperly designated in the program.	Check the program.
3240	4	2	R NOT DESIGNATED A	The A-axis radius is not specified in the program.	Check the program.
3241	4	2	R NOT DESIGNATED B	The B-axis radius is not specified in the program.	Check the program.
3242	4	2	A OUT OF COMMAND	During operation, A-axis operation has exceeded the range of 0 ~ 359.999.	Check the program.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
3243	4	2	B OUT OF COMMAND	During operation, B-axis operation has exceeded the range of 0~ 359.999.	Check the program.
3244	4	2	NO NXT TOOL IN MGZ	Next tool is not set in the magazine.	Set next tool.
3245	4	2	NO ATC RTN HEIGHT	Return height for tool change is not set.	Set a return height.
3247	4	2	COORD. ROT. IMPOSS	X and Y positions cannot be calculated after coordinate rotation because the machining coordinate position of the X or Y-axis is not selected.	Correct the program and retry operation again. (set both the X and Y positions for XY movement within the first operation calling process.)
3248	4	2	NO REQUIRED DATA	Data disappeared for some reason during processing.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
3253	4	2	CAN ’ T SET TOOL LEN	Protect switch was turned on as soon as tool length set was executed in automatic tool length measurement mode, or tool length set could not be executed for some reason.	More than one causative errors occur at the same time. Identify causes on alarm screen and remove.
3257	4	2	NO PROGRAM (A)	A-axis motion command is executed in a program without A-axis.	Change the program.
3258	4	2	NO PROGRAM (B)	B-axis motion command is executed in a program without B-axis.	Change the program.
3259	4	2	NOT MEASURED IN INC	Zero measurement was attempted in incremental mode.	Switch to absolute mode and perform zero measurement.
3260	4	2	NOT MEASURED IN COOD	Zero measurement was attempted in coordinate rotation mode.	Cancel coordinate rotation and perform zero measurement.
3261	4	2	NOT MEASURED IN COMP	Zero measurement was attempted in diameter offset mode.	Cancel diameter offset and perform zero measurement.
3262	4	2	EXTRNL PROGRM NO. ERR	The selected external program no. of the scheduled program is 5 digits or more.	Numbers that can be used for scheduled program are up to 4 digits.
3263	4	2	TL BRK DET POS ERR	The detecting motion is going to execute in the position lower than the return position.	Push [RST] key and check the user parameter1 'return position of tool breakage detection' or make lower the 'inprocess return ' or 'intercoordinate return ' value in the program.
3264	4	2	RELEASE MACHINE LOCK	Tool replacement with the pot number (M701 ~ 749)specified was attempted in memory operation with the machine locked.	Release machine lock. (The tool cannot be replaced with pot specified while machine is locked.)
3700	3	2	PROGRAM ERROR	Program directory is destroyed.	Delete the program and reedit it after pressing [RST] key.
4450	1	1	RPM NOT SPECIFED	RPM is not specified even after speed command is given in MDI operation.	Specify speed and give speed command.
4451	1	1	AXIS NOT DSGNTD	Axis data is not specified even after motion command is given in MDI operation.	specify-axis data and give motion command.
4452	1	1	ILLEGAL AXIS	Simultaneous cutting using 3 axes other than x, y, and z was attempted in MDI mode or simultaneous cutting using 4 axes or more was attempted.	Simultaneous cutting using 3 axes is impossible if any optional axis is included.
4453	1	1	XYAB DSGNTD IN TAP	Tapping command is given with X, Y,A or B axes data set in MDI operation.	X, Y,A or B axes data can not be specified in tapping command.
4454	1	1	Z NOT DSGN IN TAP	Tapping command is given with no z-axis data set in MDI operation.	Specify z-axis data.
4455	1	1	FDRATE NOT SPECFD	Cutting command is given with no feed rate set in MDI operation	Specify speed rate and give cutting command.
4456	1	1	FEED NOT SPECIFIED	Kind of feed is not specified in MDI operation.	Specify kind of feed.
4457	1	1	NO SCHEDULE PROGRAM	There is no schedule program available for operation.	Check schedule program number.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
4458	1	1	NO SUBPROGRAM	Subprogram is not set in the program required for operation.	Set subprogram or deleted subprogram call process.
4459	1	1	NO. OF WKPCS ERROR	Workpiece number is not set.	Set workpiece number.
4460	1	1	TOOL ASGN NOT DONE	Tool assignment is not finished.	Assign tools.
4461	1	1	? CALC NOT DONE	Calculation of the unknown is not finished.	Check if line data is correctly set. assign tools afterwards.
4462	1	1	MACHINING ORD ERROR	Machining order other than 1-5 is set, or not set at all.	Set the machining order correctly.
4463	1	1	NO DIRECTION DATA	Operation is to be started without measuring direction set in automatic alignment.	Set measuring direction.
4464	1	1	DATA IMCOMPLETE	Data other than numerical values are set for the coordinate such as measuring start point, etc. when automatic aligning is started.	Set the data correctly again.
4465	1	1	ILLEGAL START SET	Operation is to be started by setting a start point in the coordinate setting process.	Check start point.
4466	1	1	NO TOOL IN SPINDLE	Spindle has no tool.	Set a proper tool in the spindle.
4467	1	1	R NOT DESIGNATED A	Radius is not designed in A-axis cutting.	Set radius.
4468	1	1	R NOT DESIGNATED B	Radius is not designed in B-axis cutting.	Set radius.
4469	1	1	A OUT OF COMMAND	A-axis angle is improperly specified.	Check the program.
4470	1	1	B OUT OF COMMAND	B-axis angle is improperly specified.	Check the program.
4472	1	1	NO PROGRAM	There is no program available for operation.	Check program number.
4473	1	1	TOO MANY DIGITS	Data of more than allow able digits are set.	Set the data within the range.
4474	1	1	MINUS SIGN ASSIGNED	Minus data is set while minus input is not allowed.	Set plus data.
4475	1	1	JOB IN POS ERROR	Copy is to be taken where it is not allowed.	Shift the cursor to the position where copy can be taken in. (position of process)
4476	1	1	PROG NO. NOT SPECFD	Program number is not specified.	Specify program number.
4477	1	1	NO SEARCH DATA	There is no data to be searched.	Check if there is the data to be searched.
4478	1	1	TOO MANY NO. OF JOBS	The one hundredth process is to be created.	Number of processes should not exceed 99.
4479	1	1	SUBPRG ALRDY DSGNTD	Attempt of preparing a subprogram already prepared.	Use another number or deleted the existing subprogram number.
4480	1	1	ALTER POSITION ERR	Data in unchangeable position is to be modified.	Shift the cursor to changeable position and modify the data.
4481	1	1	DELETE IMPOSSIBLE	Deletion is to be done during insertion.	Press [insert] key again and stop insertion, or deleted after insertion.
4482	1	1	INSRT POSITION ERR	Insertion is to be done where it is not possible.	Shift the cursor to the proper position for insertion.
4484	1	1	CURSOR MOVE IMPSBL	Cursor is to be shifted to order data than on insertion during insertion.	Shift the cursor to the proper position after insertion of all the data.
4485	1	1	JOB OUT POS ERROR	Copy is to be inserted where it is not possible.	Shift the cursor to the proper position for inserting copy.
4486	1	1	TOO MANY MOTIONS	The one hundredth motion is to be made in motion program editing.	Number of motions should be within 99.
4487	1	1	TOO MANY LINES	The one hundredth line is to be made in editing of contouring or chamfering process.	Number of lines should be within 99.
4488	1	1	WK ZERO SET POS ERR	Working zero position is to be set where it is not possible.	Move the cursor to x of working zero position and set zero position.
4490	1	1	SEARCH IMPOSSIBLE	Search is to be performed during insertion.	Press [insert] key again and stop insertion, or perform search after insertion.
4492	1	1	TOO MANY SCHDL PRG	Number of schedule programs is to be set beyond 99.	Number of programs should be within 99.
4493	1	1	JOB IN NOT DONE	Copy is to be taken in but it is not possible.	Take in the data to be copied.
4494	1	1	TOO MANY NO. OF WKPC	Number of workpieces to be inserted is over 99.	Number of workpieces should be within 99.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
4495	1	1	NO TOOL IN MENU	Tool not registered in tool menu is set in the magazine.	Register the required tool in the magazine.
4496	1	1	TOO MANY NO. POINTS	Number of machining holes (point random system) to be inserted is over 12.	Number of machining holes should be within 12.
4497	1	1	ASSIGN TOOL	Data on assignment is modified upon completion of tool assignment.	Assign tools again.
4498	1	1	CALCULATION ?	Data on calculation is modified upon completion of items with? mark.	Assign tools again.
4499	1	1	ATC RT. DATA DELETED	Machining order or assigned tool is modified.	
4500	1	1	SET MACHINING ORDER	Data on return height for tool change is to be edited without setting machining order.	
4501	1	1	NO ATC RTN DATA	Unavailable data on return height for tool change is to be used.	
4502	1	1	DATA ERR (PRGRM)	Unmatched unit program is set in edit.	Set matching unit program.
4503	1	1	WRONG TOOL LENGTH	The tool length set by the [tool offset] key becomes 0 or less.	Check user parameter (switch1) 'tool length compensation amount'.
4504	1	1	NO TOOL MENU DATA	There is no data on tool menu.	Set tool menu.
4505	1	1	NO PATTERN DATA	There is no data on tool pattern.	Set tool pattern.
4506	1	1	NO HOLE DATA	There is no data on drill hole dia. for tapping.	Set drill hole dia. for tapping.
4507	1	1	NO CUT COND DATA	There is no data on cutting conditions.	Set cutting conditions.
4508	1	1	MATERIAL NOT DESIGN	Workpiece material is cutting conditions.	Set workpiece material.
4509	1	1	REQD TOOL NOT FOUND	There is no tool for required machining function in tool assignment.	Check contents, etc. of machining data, tool pattern, drill hole dia. for tapping, cutting tools, cutting conditions and tool menu, and modify as required.
4510	1	1	TOO MANY TOOLS ASGD	The number of assigned tools has exceeded the maximum storage capacity.	Assign the tools appropriatery with the program.
4511	1	1	NO JOB	There is no process in program.	Check machining data.
4512	1	1	NO DATA IN MENU	There is no data on specified tool in tool menu.	Set the data to the specified number in tool menu.
4513	1	1	INADEQUATE TOOL	Specified tools is not proper for machining.	Set proper tool for machining.
4514	1	1	TAP SIZE ERROR	Denominator of inch thread size is 0.	Set the correct tapping designation.
4515	1	1	JOB WITHOUT TOOL	Tools are not set in tool pattern in some process during assignment.	Set the tools in tool pattern before assignment.
4516	1	1	ILLEGAL TOOL PTRN	No tools is set in tool pattern for the required machining function in the process during assignment.	Check the tool pattern and modify as required.
4517	1	1	CALC OF ? IMPSBL	Calculation of the unknown is not available.	Modify machining data.
4518	1	1	DEPTH SHALLOW	When the tool stops at the hole bottom during center hole drilling or chamfering, the tip touches the bottom.	Check the contents of machining data and tool menu, and modify as required. Check the contents of machining data and tool menu, and modify as required.
4519	1	1	SHALLOW COUNTERBORE	Tool touches counterbore surface in chamfering.	
4520	1	1	WORK HEIGHT IMPRPR	Max. depth of cut calculated from workpiece height comes below table surface.	
4521	1	1	S. DIA TOO SMALL	Smaller dia. of tool is too small for machining data.	
4522	1	1	TL LNGT NOT SPECFD	Tool length is set to 0 or not set at all.	
4523	1	1	TL LIFE NOT SPECFD	Tool life is set to 0 or not set at all.	Check the contents of machining data and tool menu, and modify as required.
4524	1	1	TOOL TOO LONG	Tool is too long.	Check the contents of machining data and tool menu, and modify as required.
4525	1	1	S. DIA TOO LARGE	Smaller dia. is too large.	Check the contents of machining data and tool menu, and modify as required.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
4526	1	1	IMPROPER S. DIA L	Smaller dia. is not proper.	Check the contents of machining data and tool menu, and modify as required.
4527	1	1	S. DIA L TOO LONG	Smaller dia portion is too long.	Check the contents of machining data and tool menu, and modify as required.
4528	1	1	IMPROPER S. DIA L	Smaller dia portion is not proper.	Check the contents of machining data and tool menu, and modify as required.
4529	1	1	S. DIA L TOO SHORT	Smaller dia portion is too small.	Check the contents of machining data and tool menu, and modify as required.
4530	1	1	TOOL TOO SHORT	Tool does not reach the bottom of cut.	Check the contents of machining data and tool menu, and modify as required.
4531	1	1	TOOL DIA TOO SMALL	Tool od is too small.	Check the contents of machining data and tool menu, and modify as required.
4532	1	1	IMPROPER TOOL DIA	Tool od is not proper.	Check the contents of machining data and tool menu, and modify as required.
4533	1	1	IMPROPER CENTER ANG	Center angle is not proper.	Check the contents of machining data and tool menu, and modify as required.
4534	1	1	IMPROPER CHAMF ANG	Chamfer angle is not proper.	Check the contents of machining data and tool menu, and modify as required.
4535	1	1	FLUTE TOO SHORT	Flute is too short.	Check the contents of machining data and tool menu, and modify as required.
4536	1	1	TORSION IMPROPER	Torsion direction of tap is not proper.	Check the contents of machining data and tool menu, and modify as required.
4537	1	1	THREAD IMPROPER	Kind of tap is not proper.	Check the contents of machining data and tool menu, and modify as required.
4538	1	1	THREAD DIA IMPROPER	Dia. of thread is not proper.	Check the contents of machining data and tool menu, and modify as required.
4539	1	1	PITCH IMPROPER	Pitch or number of threads of tap is not proper.	Check the contents of machining data and tool menu, and modify as required.
4540	1	1	PRIMARY DEPTH INSUF	Primary depth is not sufficient.	Check the contents of machining data and tool menu, and modify as required.
4541	1	1	NO TOOL NUMBER	Tool check is to be performed where tool number is not set.	Set tool number, or perform tool check where tool number is set.
4542	1	1	TOOL DIA TOO LARGE	Tool od is too large.	Check contents of machining data, tool menu, tool pattern, cutting conditions, etc. and modify as required.
4543	1	1	POCKET NOT DONE	Chamfering is to be done before pocketing. (chamfer milling function comes first.)	Check program.
4544	1	1	MIN. DISTANCE (SIDE)	There is interference at the side in chamfering.	Check program.
4545	1	1	MIN. DISTANCE (BTM)	There is interference at the bottom in chamfering.	Check program.
4546	1	1	B. H. NOT THROUGH	Tool which can not be used for blind hole is set.	Check program.
4547	1	1	DIFRNT TL FROM CUTC	Tool not set in cutting conditions is to be used.	Check program.
4548	1	1	TOO LARGE CONER R	Corner r is longer than the half of X or Y whichever is shorter in a square pocket in the pocketing operation.	Check program.
4549	1	1	APPROACH RAD SMALL	Approach radius (in program) in chamfering process is smaller than tool radius.	Check program.
4564	1	1	TOOL MENU EDITING	[start] key was pressed in automatic tool length measurement mode during tool menu editing.	Complete editing tool menu.
4565	1	1	LARGE OPE PROGRAM	Machining data size is larger than buffer capacity.	Divide the machining data. using the scheduled program function, divided machining data can be used for continuous operation.
4566	1	1	OPEN ERROR (PROGRAM)	The operation program cannot be analyzed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
4567	1	1	OPEN ERROR (CUT COND)	Cutting conditions cannot be referred to.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
4568	1	1	WRONG M/C UNIT SYS	When selected memory operation mode, the dimention unit of set program is not same with the dimention unit of machine.	Reset the program to which having the same dimension unit with the machine.

NO.	STOP LEVEL	RESET LEVEL	ERROR MESSAGE	CAUSE	SOLUTION
4569	1	1	NO ZERO MEASUREMEN T	Zero measurement was attempted although zero measurement option is not provided.	Please purchase the option.
4570	1	1	NO THREAD CUTTING	Helical screw cutting was attempted although screw cutting option is not provided.	Please purchase the option.

8.6 Servo error message

DISPLAY	No	CAUSE	SOLUTION
OC	1	Overcurrent.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
AOH	2	Register DB in the amplifier is overheating.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
EOH	3	The external regenerative register is overheating.	Turn off the power supply. After 15 to 20 minutes, check the condition. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer
OV	5	Overvoltage.	Check power supply voltage, capacity, momentary service interruption, and correct them as necessary. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer
CPE	6	Controller power supply has decreased.	Check power supply voltage, capacity, momentary service interruption, and correct them as necessary. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer
DE1	7	Encoder signal line is broken.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
DE2	8	Serial broken wire.	Main power supply voltage drop.
OL	9	Overloaded.	Turn off the power supply. After 15 to 20 minutes, check the condition. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer
OS	10	Overspeed.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
MPE	11	Main power error.	Check power supply voltage, capacity, momentary service interruption, and correct them as necessary. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
FP	12	Main circuit open phase.	Check power supply voltage, capacity, momentary service interruption, and correct them as necessary. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
RGE	13	Regenerative register is overloaded.	Turn off the power supply. After 15 to 20 minutes, check the condition. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
DSPE	14	DSP error	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
ROME	15	Memory error	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
PARE	16	Servo parameter error.	Check the following servo parameter settings. ・Motor type (*13) ・Limit of current while preventing drop due to dead load (*18)
BATT DROP	17	Battery voltage drop.	Replace alkaline battery for absolute encoder backup.
CSE	18	Encoder error in initial state.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
MOC	19	Motor overcurrent.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
DTO	20	Command monitor timer has expired. (No command has been recived from the amplifier within 4 msec)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
STO	21	Response monitor timer has expired. (No command has been recived from the amplifier within 4 msec)	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
SYS1	22	Servo error signal was input but alarm number was not notified.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
SYS2	23	Servo error signal was input but undefined alarm number was issued.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
INI	24	Communication between the NC and amplifier was impossible when the power was turned on.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
SS	25	Already transmitting when the data was attempted to be transferred to the amplifier.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
SR	26	Already receiving when the data was attempted to be transferred to the amplifier.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
CRCE	27	CRC error.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
FRME	28	Framming error.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.

DISPLAY	No	CAUSE	SOLUTION
VERE1	29	Output deta to the amplifier was incorrect. (Data bank of servo amplifier 3, 4, 5)	This error occurs when power is turned on for the first time after replacing the servo amplifier. Turn the power off and then on again. If the error still occurs, check the following servo parameter settings: If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
ATO	30	Amplifier tmeout error.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
RSTM	31	Amplifier RST input has decreased during servo on.	Check power supply voltage, capacity, momentary service interruption, and correct them as necessary. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
SCE	32	CRC error for synchronized frame.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
RECD	33	Encorder signal reading impossible error.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
VERI	34	The motor type, encoder pulse, and encoder type previously set do not coincide with those set this time. This error will occur only to the PV amplifier and PY2C amplifier.	Set the following servo parameters correctly, and turn the power off and then on again. Upon this operation, the [SERVO (VERI)] message will appear again. Just turn the power off and then on again. Motor type (*13) Encoder pulse (*14) Encoder type (*15)
SRE	35	Serial receiving error	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
PSE	36	Encoder initial receiving error	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
VERE2	37	Output deta to the amplifier was incorrect. (Data bank of servo amplifier 6, 7)	Check the servo parameter settings. If the error still occurs, it may be due to machine failure and the like. Contact the nearest BROTHER approved service dealer.
DE11	38	The encoder signal was recovered while the DE1 alarm is current.	This error may occur due to machine failure and the like. Contact the nearest BROTHER approved service dealer.

8.7 Resetting ATC

(Case TC-31A)

When an error has occurred in the ATC during its operation or the ATC arm has stopped midway due to shutdown of power, the ATC arm must be reset.
When power is shutdown, turn on power and the system is booted with the screen below appearing.
When an error has occurred in the ATC, turn the power off and then on again.
When the ATC or ATC arm has stopped due to an emergency stop, reset the emergency stop switch and turn on the power.

```
                                   MANUAL  CONDITIONS

●RAPID FEEDRATE (XYZ)                10 %
    ●HIGH SPEED (4)                  10 %
●JOG FEEDRATE (XYZ)                  50 mm/min
    ●JOG SPEED (4)                  0. 1 min⁻¹
●STEP LENGTH (XYZ)             0. 001 mm
    ●STEP AMOUNT (4)           0. 001 °
●SPINDLE SPEED                      100 min⁻¹

RETURN ATC TO CORRECT POSITION
ACCORDING TO PROCEDURES IN
OPERATION MANUAL.
S:ORIENT SPINDLE    T:TURN ATC ARM

4AXIS  5AXIS  6AXIS

F0  F1  F2  F3  F4
```

When the screen above appears, perform the following procedures:

1. Press the **[RST]** key while the **[RELSE]** key is depressed to clear the error.
2. Press the **[E. STA]** key and the **[E. STA]** LED will light.
3. Check the machine state.

3-1 Arm is stopped, during the movement from the waiting point to the clamping point. But the arm is not lowered.
Two arms positioned at the spindle and the magazine is called “clamping point”.

3-1-1 Tool holder is attached to spindle
(1)The finger key is correctly inserted into the key groove in the tool holder.
——— Perform from step 5.
(2)The finger key is not correctly inserted into the key groove in the tool holder.
——— Please inform BROTHER of circumstances when an error occurs.

3-1-2 Tool holder is not attached to spindle
———Perform from step 4.

3-2 Arm is lowered
——— Perform from step 4.

8

4.Press the **[S]** key while the **[RELSE]** key is depressed to execute spindle orientation.
5.Press the **[T]** key while the **[RELSE]** key is depressed, and the ATC arm will swivel to the correct position.
6.Press the **[E. STA]** key and the **[E. STA]** LED will go out.
7.Press the **[RST]** key. Unless [ATC ARM POS ERR 1] occurs, the ATC arm has been reset.
If **[ATC ARM POS ERR 1]** immediately reoccurs, inform BROTHER of circumstances when the error occurred.

(Note 1) Mode selection and other operations to move the spindle are not possible.
(Note 2) Perform normal key entry operation with the [E. STA] LED unlit.

(Case TC-22A)

When an error has occurred in the ATC during its operation or the ATC arm has stopped midway due to shutdown of power, the ATC arm must be reset.
When power is shutdown, turn on power and the system is booted with the screen below appearing.
When an error has occurred in the ATC, turn the power off and then on again.
When the ATC or ATC arm has stopped due to an emergency stop, reset the emergency stop switch and turn on the power.

```
                                   MANUAL  CONDITIONS

●RAPID  FEEDRATE (XYZ)              10  %
     ●HIGH  SPEED (4)               10  %
●JOG  FEEDRATE (XYZ)                50  mm/min
     ●JOG  SPEED (4)               0. 1  min⁻¹
●STEP  LENGTH (XYZ)             0. 001  mm
     ●STEP  AMOUNT (4)          0. 001  °
●SPINDLE  SPEED                    100  min⁻¹

RETURN  ATC  TO  CORRECT  POSITION
ACCORDING  TO  PROCEDURES  IN
OPERATION MANUAL.
S:ORIENT  SPINDLE    T:TURN  ATC  ARM

4AXIS   5AXIS   6AXIS

F0   F1   F2   F3   F4
```

When the screen above appears, perform the following procedures:

1. Press the **[RST]** key while the **[RELSE]** key is depressed to clear the error.
2. Press the **[E. STA]** key and the **[E. STA]** LED will light.
3. Check the machine state.

3-1 Arm is stopped, during the movement from the waiting point to the clamping point. But the arm is not lowered.
Two arms positioned at the spindle and the magazine is called “clamping point”.

3-1-1 Tool holder is attached to spindle
(1)The finger key is correctly inserted into the key groove in the tool holder.
——— Perform from step 5.
(2)The finger key is not correctly inserted into the key groove in the tool holder.
——— Please inform BROTHER of circumstances when an error occurs.

3-1-2 Tool holder is not attached to spindle
———Perform from step 4.

8

3-2 Arm is lowered.

—— Compared with four pin's height on the rotation arm surface.
(regular pin height is around 12mm.)
*Rotate the rotation arms to clock wise from the upper viewing, when the arm lock pin's height is low in the four pins.
Reposition the arm lock pin to the regular height 12mm.
*When rotation arm has a tool, it must remove the tool.
There are two pins that diameter 6mm on the rotation arm surface (four pins of all).
Push the nearest pin (tool lock pin) from the removal tool.
This action, to push the pin needs power, keep careful to do it.
(Wear leather gloves to prevent your hands being cut by the tools.)

4. Press the **[S]** key while the **[RELSE]** key is depressed to execute spindle orientation.
5. Press the **[T]** key while the **[RELSE]** key is depressed, and the ATC arm will swivel to the correct position.
6. Press the **[E. STA]** key and the **[E. STA]** LED will go out.
7. Press the **[RST]** key. Unless [ATC ARM POS ERR 1] occurs, the ATC arm has been reset.
   If **[ATC ARM POS ERR 1]** immediately reoccurs, inform BROTHER of circumstances when the error occurred.

(Note 1) Mode selection and other operations to move the spindle are not possible.

(Note 2) Perform normal key entry operation with the [E. STA] LED unlit.

Fig.1

22AMT2.6.1-1.doc

(Case TC-32A)

When an error has occurred in the ATC during its operation or the ATC arm has stopped midway due to shutdown of the power or an emergency stop, the ATC arm must be restore by the following process.
Tools may fall when resetting. Take the utmost care.
Before the operation, push the power switch to check the power is turned off.

1. Check the machine state.
1.1 When the arm is not completely lowered.
1.1.1 When the tool holder is not unstable from the spindle,
perform from step 2.
1.1.2 When the tool holder is not on the spindle,
perform from step 4.
1.1.3 When the tool holder is a little unstable from the spindle,
perform from step 5.
1.2 When the arm is completely lowered,
perform from step 6.
2.
2.1 When the arm and the tool holder clamped to the spindle are touched,
set the hex wrench in the hole in the upper section of the cam motor and turn the wrench clockwise or counter clock wise until detached it.
Perform from step 5.
2.2 When the arm and the tool holder clamped to the spindle are detached,
turn the arm to the left by hand.
3. Remove the tool holder indexed to the ATC from the magazine.
Perform from step 7.
4. When the arm and the tool holder clamped to the ATC position are touched,
set the hex wrench in the hole in the upper section of the cam motor and turn the wrench clockwise or counter clock wise until detached it.
Perform from step 3.
5. Remove the Y axis apron cover, set the hex wrench in the hole (M10) on the face of the Y axis BS.
Turn the wrench counter clock wise until the arm is lowered.
(column is move to the + Y axis) Perform from step 6.
6. Remove two tool holders from the ATC arm while pressing the tool lock pin.
(Wear leather gloves to prevent your hands being cut by the tools.)
7. Turn the power on.
When the power is shutdown, turn the power on and the system is booted up with the screen below appearing.
When an error has occurred in the ATC, turn the power off and then on again.
When the ATC or ATC arm has stopped due to an emergency stop, reset the emergency stop switch and turn the power on.

```
                                  MANUAL  CONDITIONS
●RAPID  FEEDRATE (XYZ)              10  %
    ●HIGH  SPEED (4)                10  %
●JOG  FEEDRATE (XYZ)                50  mm/min
    ●JOG  SPEED (4)               0.1  min⁻¹
●STEP  LENGTH (XYZ)             0.001  mm
    ●STEP  AMOUNT (4)           0.001  °
●SPINDLE  SPEED                   100  min⁻¹

 RETURN  ATC  TO  CORRECT  POSITION
 ACCORDING  TO  PROCEDURES  IN
 OPERATION MANUAL.
   S:ORIENT  SPINDLE   T:TURN  ATC  ARM
   P:OPEN  MAGAZINE    Q:CLOSE  MAGAZINE

  4AXIS   5AXIS   6AXIS
  F0      F1      F2      F3      F4
```

When the screen above appears, perform the following procedure:

8. Press the [RST] key with the [RELSE] key held down to clear the error.
9. Select MANUAL mode. Press the [-X] key with the [RST] key held down to move the X-axis in the negative direction 150 mm or more.
10. Press the [-Z] key with the [RST] key held down to move the Z-axis in the negative direction 2 mm or more.
11. Press the [E.STA] key and the [E.STA] LED will light.
12. Press the [T] key with the [RELSE] key held down, and the ATC arm will swivel to the correct position.
    Press the [E.STA] key and the [E.STA] LED will go out.
    Press the [RST] key. Unless [ATC ARM POS ERR 1] occurs, the ATC arm has been reset. Turn the power off and then on again.

22AMT2.6.1-1.doc

(Case TC-20A)

A. When the ATC arm has stopped due to an emergency stop, reset the emergency stop switch and press the [RST] key.

1. Press the [RST] key while the [RELSE] key is depressed to clear the error.
2. Press the [ATC] key while the [RELSE] key is depressed.

· Check that the spindle drive key is parallel to the Y-axis.
If it is not parallel, adjust it manually before operation.

B. When an error has occurred in the ATC during its operation or the ATC arm has stopped midway due to shutdown of power, the ATC arm must be reset.
When power is shutdown, turn on power and the system is booted with the screen below appearing.
When an error has occurred in the ATC, turn the power off and then on again.
When the ATC or ATC arm has stopped due to an emergency stop, reset the emergency stop switch and turn on the power.

1. Press the **[RST]** key while the **[RELSE]** key is depressed to clear the error.
2. Press the **[E. STA]** key and the **[E. STA]** LED will light.

```
                                   MANUAL  CONDITIONS

●RAPID  FEEDRATE (XYZ)              10  %
     ●HIGH  SPEED (4)               10  %
●JOG  FEEDRATE (XYZ)                50  mm/min
     ●JOG  SPEED (4)               0. 1  min⁻¹
●STEP  LENGTH (XYZ)             0. 001  mm
     ●STEP  AMOUNT (4)          0. 001  °
●SPINDLE  SPEED                    100  min⁻¹

RETURN  ATC  TO  CORRECT  POSITION
ACCORDING  TO  PROCEDURES  IN
OPERATION MANUAL.
S:ORIENT  SPINDLE    T:TURN  ATC  ARM

4AXIS   5AXIS   6AXIS

F0      F1      F2      F3      F4
```

When the screen above appears, perform the following procedures:

3-1 When finger is closed and arm is not lowered.

3-1-1 Tool holder is attached to spindle

(1)The finger key is correctly inserted into the key groove in the tool holder.

→ Perform from step 4.

(2)The finger key is not correctly inserted into the key groove in the tool holder.

→ Please inform BROTHER of circumstances when an error occurs.

3-1-2 Tool holder is not attached to spindle

(1)When spindle drive key is parallel to Y-axis

→ Perform from step 4.

(2)When spindle drive key is not parallel to Y-axis

→ Please inform BROTHER of circumstances when an error occurs.

3-2 Arm is lowered

· When the tool is attached to the ATC arm, remove the tool by opening the finger manually. (Wear leather gloves to protect your hands.)

4.Press the **[T]** key while the **[RELSE]** key is depressed, and the ATC arm will swivel to the correct position.

5.Press the **[E. STA]** key and the **[E. STA]** LED will go out.

6.Press the **[RST]** key. Unless [ATC ARM POS ERR 1] occurs, the ATC arm has been reset.

If **[ATC ARM POS ERR 1]** immediately reoccurs, inform BROTHER of circumstances when the error occurred.

Note 1: Mode selection and other operations to move the spindle are not possible.

Note 2: Perform normal key entry operation with the [E. STA] LED unlit.

8.8 Resetting procedure for tool clamp error.

(Case TC-32A)

[0054 ** TOOL CLAMP ERROR] occurs when the tool holder (hereafter simply referred to as the holder) is not clamped by the spindle correctly after automatic tool change.

Cause	Solution
The holder is set to the pot incorrectly.	Re-attach the holder to the pot, paying attention to the direction of the holder.
Tool holder is incorrect.	Use a holder that conforms to the standards.
Cutting chips are stuck to the tapered section of the holder.	Check the end face washing filter.
Spindle clamp collet operation is incorrect.	Apply Gleitmetall spray to the collet.
ATC mechanism is faulty.	Repair is necessary. Please contact BROTHER.

8

Resetting procedure

1. Check the holder clamping condition.
   - 1-1 When the distance between the end face of the spindle and the end face of the holder is 1 mm or less, go to step 2.
   - 1-2 When the distance between the end face of the spindle and the end face of the holder is more than 1 mm, jump to step 3.

13c01.doc

2. Resetting procedure for condition 1-1 above
   2-1 Press **[I/O]**. Select [1. I/O] and display the version screen. Move the cursor to [MAINTE. INPUT], and press **[1]** and **[ENT]**.
   2-2 Press the **[POWER]** button (off) and then press it again (on).
   Conduct origin return. Press **[ATC]** to perform automatic tool change and check the following:
   ·No cutting chips are stuck to the end face of the holder, end face of the spindle, and the tapered section.
   ·No flaw or dent is found on the tapered section.

3. Resetting procedure for condition 1-2 above
   3-1 Press **[I/O]**. Select [1. I/O] and display the version screen.
   Move the cursor to [MAINT. INPUT], and press **[1]** and **[ENT]**.
   3-2 Press the **[POWER]** button (off) and press it again (on).
   Press **[-X]** key while **[RST]** key is held down to move the column at least 300 mm in the negative X direction from the origin.
   Press the **[POWER]** button (off).
   3-3 Remove the holder from the indexed pot. Insert a hex wrench to the hole in the upper section of the cam motor and turn the wrench counterclockwise until the ATC arm is fully lowered.
   3-4 Remove the M6 bolts (4 pcs.) from the top face of the ATC arm, and then remove the ATC arm and the rotation arm spacer.

8

08C83.doc

3-5 Press the **[POWER]** button (on). (The screen shown in section "11.9 Resetting ATC" appears.)
Press **[RST]** while **[RELSE]** is held down to reset the error.
Press **[E.STA]** and the LED on the key lights.
Press **[T]** while **[RELSE]** is held down. The ATC arm axis rises.

3-6 Press the **[POWER]** button (off) and then press it again (on).
Conduct origin return. Press **[ATC]** to perform automatic tool change.
The tool is released from the spindle and drops, so place a box or cushion below the spindle to prevent the tool being damaged.

3-7 Move the column at least 300 mm in the negative X direction from the origin. Press the **[POWER]** button (off).

3-8 Insert a hex wrench to the hole in the upper section of the cam motor and turn the wrench counterclockwise until the ATC arm is fully lowered.

3-9 Attach the ATC arm and rotation arm spacer.

3-10 Press the [**POWER]** button (on).
Press **[RST]** while **[RELSE]** is held down to reset the error.
Press **[E.STA]** and the LED on the key lights.
Press **[T]** while **[RELSE]** is held down. The ATC arm rises.

3-11 Check the following:
·No cutting chips are stuck to the end face of the holder, end face of the spindle, and the tapered section.
·No flaw or dent is found on the tapered section.

(Case TC-22A)

[0054 ** TOOL CLAMP ERROR] occurs when the tool holder (hereafter simply referred to as the holder) is not clamped by the spindle correctly after automatic tool change.

Cause	Solution
The holder is set to the pot incorrectly.	Re-attach the holder to the pot, paying attention to the direction of the holder.
Tool holder is incorrect.	Use a holder that conforms to the standards.
Cutting chips are stuck to the tapered section of the holder.	Check the end face washing filter.
Spindle clamp collet operation is incorrect.	Apply Gleitmetall spray to the collet.
ATC mechanism is faulty.	Repair is necessary. Please contact BROTHER.

8

Resetting procedure

1. Check the holder clamping condition.
   A clearance between the end face of the spindle and the end face of the holder is made “L”.

1-1 In case of L ≦ 1 mm. ⇒ Go to section 2.

1-2 In case of L > 1 mm. ⇒ Go to section 3.

Tool clamp T22AE.doc

2. Resetting procedure for condition 1-1 above

2-1 Press **[I/O]**. Select **[1. I/O]** and display the version screen. Move the cursor to **[MAINTE. INPUT],** and press **[1]** and **[ENT]**.

2-2 Press the **[POWER]** button (off) and then press it again (on). Conduct origin return. Press **[ATC]** to perform automatic tool change and check the following:

·No cutting chips are stuck to the end face of the holder, end face of the spindle, and the tapered section.

·No flaw or dent is found on the tapered section.

2-3 Restoration is completed.

3. Resetting procedure for condition 1-2 above

3-1 Press **[I/O]**. Select **[1. I/O]** and display the version screen. Move the cursor to **[MAINT. INPUT]**, and press **[1]** and **[ENT]**.

3-2 Press the **[POWER]** button (off) and then press it again (on). Check that the arm does not contact the spindle head when the Z-axis moves.

3-3 Press **[ATC]** to return the Z-axis to its origin.

3-4 Press **[ATC]**. The spindle up and down, the pot rises.

3-5 Press **[ATC]**. The pot lowers and the spindle rises to the ATC position.

3-6 Press **[POS]**. The present position screen appears.

3-7 Press **[RELSE]** and **[+Z]** to raise the spindle head the distance measured in section 1 above (L: between the end face of the spindle and the end face of the holder), and then check the following:

· If the spindle head rises the distance defined above.

⇒ Go to step 3-8.

· If the [5509 * OVERRUN (+Z)] error occurs and the spindle head stops.

⇒ Go to section 4.

3-8 Insert a hex wrench to the hole in the upper section of the cam motor and turn the wrench counterclockwise until the ATC arm is fully lowered.

3-9 Remove the arm from the tool while pushing the tool lock pin down.

08C83.doc

3-10 Press **[I/O]**. Select **[1. I/O]** and display the versiont screen.
Move the cursor to **[ATC MAINT. MD]**, and press **[1]** and **[ENT].**

3-11 Press the **[POWER]** button (off) and then press it again (on).

3-12 Press **[RST]** while **[RELSE]** is held down to reset the error.

3-13 Press **[E.STA]** and the LED on the key lights.

3-14 Press **[T]** while **[RELSE]** is held down. The ATC arm rises.

3-15 Press **[E.STA]** to reset the edit start mode.

3-16 Press **[I/O]**. Select **[1. I/O]** and display the version screen.
Move the cursor to **[ATC MAINT. MD]**, and press **[0]** and **[ENT]**.

3-17 Press the **[POWER]** button (off) and then press it again (on).
Conduct origin return. Check the following:
· No cutting chips are stuck to the end face of the holder, end face of the spindle, and the tapered section.
· No flaw or dent is found on the tapered section.

3-18 Restoration is completed.

4.

4-1 Check the following:
· In case of "L-(Machine Pos(Z)-610-ATC Zero Distance)≤ 1 mm".
⇒ Return to step 3-8.
· In case of "L-(Machine Pos(Z)-610-ATC Zero Distance)>1 mm".
⇒ Go to step 4-2.

4-2 Hold **[RST]** down and press **[RELSE]** to reset the error.
Hold **[RELSE]** down and press **[-Z]** to lower the spindle head approximately 20 mm.

4-3 The tool is released from the spindle and drops. Place a box below the tool to prevent the tool being damaged.

4-4 Press **[POS]**. The present position screen appears.

4-5 Press **[-Z]** until the Machine Pos(Z) reaches 540 mm.

4-6 Insert a metal bar of 20 mm diameter and at least 400 mm long between the CL2 lever and the rod, and push the bar in the direction of the arrow until the tool is released.

4-7 Check the following:
· No cutting chips are stuck to the end face of the holder, end face of the spindle, and the tapered section.
· No flaw or dent is found on the tapered section.

4-8 Restoration is completed.

08C88.doc

(This page is blank.)

CHAPTER 9 (1)

COOLANT UNIT

Coolant is used to cool the tools and workpiece, and to remove the machining chips. The coolant unit supplies coolant to the machining section, chip flow and oil hole .

1. **Cautions for Handling**
2. **Sketch Drawing**
3. **Operation Procedure**

1 Cautions for Handling

⚠ WARNING

Because the coolant tank is heavy, you may suffer from a herniated vertebral disk or drop the tank on your feet when lifting the tank.
Do not lift the coolant tank even when removing chips.

⚠ WARNING

When machining workpiece using an oil type coolant, the machined part may heat up and catch fire.
Do not use oil type coolant when a fire alarm and automatic fire extinguisher are not installed.
When machining the workpiece, an operator must attend the machine.

a)Coolant

(1) Depending on the type of coolant and its method of use, bubbles may be generated in the coolant within the tank. In this case, use deforming agent or reduce the amount of discharge.

(2) For the chip flow, use water soluble oil only. If non water soluble oil is used, sufficient coolant is not supplied to the machining tools due to large adhesive resistance.
When using such a coolant, turn off the **[CHP. F]** key on the keyboard so that the chip flow is not activated even if the program instruction is given.

(3) Do not drain coolant oil. Cosign disposal of machines to a company specialized for handling such.

(4) Some types of coolant may cause rust in parts within the guide section due to their material. Further, there are types of coolant that tend to cause corrosion. Please check with the coolant manufacturer for coolant characteristics before use.
Move each axis one full stroke at least once a day to lubricate the guide and ball screw ,and prevent rust.
Performing this before and after operation is the most effective.

b) Maintenance

(1) Remove chips accumulated in the chip bucket daily. If the chips are accumulated excessively, coolant may splash around.

(2) When the coolant is not discharged well, the filter may be clogged.
Clean the filter.

(3) To fully utilize the coolant and coolant tank, regularly replace the entire coolant and clean the coolant tank.

Weight of coolant tank

Specifications		Weight(kg)
50L	nozzle	40
100L	nozzle, chip flow	80
150L	nozzle, chip flow	110

2 Sketch Drawing

[50L coolant tank]

[100L coolant tank with chip flow]

TS2AOP12-1-1.doc

9

TS2AOP12-1-2.doc

3 Operation Procedure

(1) Coolant operation

1 Turn the power on.
2 Return the machine to the zero position.
3 When the **[CLT]** key on the keyboard,the key lamp will light and the motor will rotate.
4 Press the **[MDI]** key to enter MDI operation mode
5 Check that all work doors are closed.
(NC)
6 Press the **[CAN]** key to clear the edit field.
7 Enter **[M8]** using the numerical keys.
(Conversation)
6 Set the curser on "COOLANT" with **[DOWN]** curser key.
7 Enter **[1]** and press **[ENT]** key.

8 Press the **[START]** switch and coolant flows.
9 When the **[CLT]** switch is set to OFF, the lamp on the switch goes out and coolant stops.
When the **[CLT]** switch is set to On, coolant flows again.
10 When the **[RST]** key is pressed, the valve closes and coolant stopes although the coolant pump keeps rotating.

(2) Chip flow operation

1 Turn the power on.
2 Return the machine to the zero position.
3 Set the **[CHIP FLOW]** switch on the operation panel to ON. The lamp on the switch lights.
4 Press the **[MDI]** key to enter MDI operation mode.
5 Check that all work doors are closed.
(NC)
6 Press the **[CAN]** key to clear the edit field.
7 Enter **[M400]** using the numerical keys.
(Conversation)
6 Set the curser on "EXE SIGNAL" with **[DOWN]** curser key.
7 Enter **[400]** and press **[ENT]** key.
8 When the **[START]** key ispressed, the chip flow motor rotates and water flows, flows the the chips.
9 When the **[CHIP FLOW]** switch is set to OFF, water stops.
When the **[CHIP FLOW]** switch is set to ON, water flows again.
10 When the **[RST]** key is pressed, stop the chip shower pump and chip shower.

(This page is a blank.)

CHAPTER 9 (2)

MANUAL PULSE GENERATOR

Manual pulse generator is a device switch, when turned with its handle in manual mode, allows fine feed of an axis specified.

1. **Cautions**
2. **Overall View**
3. **Operation Procedure**

1 Cautions

When the axis selection switch is set on X,Y or Z, manual operation through the main operation panel is disactivated.
This status can be checked by pressing the AXIS FEED key on the operation panel: the message MANUAL PULSE MODE ON appears on the screen if the above-mentioned operation is disactivated.

2 Overall view

1103C01-1.doc

3 Operation procedure

Follow the procedure below when utilizing the manual pulse generator.

1 Press the **[MANU]** key to validate the manual operation mode.
2 Select the axis with the axis selection switch on the manual pulse generator.
3 Select the increment of feed with the increment selector.
4 Turn the handle.

Increment	Feed			
	Metric (mm)		Inch (inch)	
	One division	One turn	One division	One turn
X1	0.001	0.1	0.0001	0.01
X10	0.01	1	0.001	0.1
X100	0.1	10	0.01	1

(This page is a blank.)

CHAPTER 9 (3)

INDICATION LAMP

1. External View
2. Function of indicator lamps

1 External View

(Single -lamp type)

(Twin -lamp type)

(Three -lamp type)

Manual:c:TC31ﾏﾆｭｱﾙ:表示灯:1105L02

2 Function of indicator lamps

Indication lamps inforn distant operators of machine status (in operation, cutting completed, error).

(1) Red lamp

1) When the EMERGENCY STOP switch is pressed.
2) When an alarm turning off the servo system occurs.
3) When a positioning switch of automatic door or jig has a failure.
4) When the production counter ends (on condition that this setting is validated with the USER PARAMETER (SWITCH1))

(2) Yellow lamp

1) When a memory operation ends (on M30 output).
2) When the production counter ends (on condition that this setting is validated with the USER PARAMETER(SWITCH1))

(3) Green lamp

1) During a memory operation or MDI operation (on STL output)

(This page is a blank.)

CHAPTER 9 (4)

AUTOMATIC CENTERING UNIT

1. Cautions
2. Shapes Measured
3. Mounting the automatic centering tool
4. Motion check
5. Dismounting an automatic centering tool
6. Setting Data Banks of Automatic Centering
7. Checking before Starting
8. Operating Procedure
9. Motion Switchover and Motion Display

1 Cautions

SONY TS1 is a wire-carried type. Do not perform the following operations:

1. Tool replacement
2. Spindle rotation

A touch sensor probe manufactured by SONY can be used only for an object that conducts electricity.
For safety, be sure to confirm that a signal is actually input, by following the operation check.
A touch sensor probe manufactured by SONY cannot be used in Z-axis direction. Use it only in X- and Y-axis directions.

2 Shapes Measured

The following five shapes can be automatically centered.

1. Corner - X and Y coordinates of a corner

2. Parallel - X and Y coordinates of the axis of parallel groove or boss

3. Center of circle (groove) - X and Y coordinates of the center of a hole

4. Center of circle (boss) - X and Y coordinates of the center of a boss

5. A-axis height - Z ordinate of the top of a workpiece

Only a centering tool releasing in the Z-axis direction can be measured.
The SONY TS1 cannot be used.

3 Mounting the automatic centering tool

1 Press **[MANU]** key to change to the manual operation mode.
2 Mount an empty holder on the magazine.
3 Press **[ATC]** and **[MAGZ]** keys to set the empty holder in the spindle.
4 Press **[MDI]** key to make the block operation screen.
5 Move the cursor to the SIGNAL OUTPUT, enter **[1]** and **[9]**, press **[ENT]** key and press the START switch.
Then an oriented spindle stop (at 0°) is executed.
6 Set a centering tool so that is connector faces the left when viewed from an operator, and fix the tool by tightening the nut.

7 Connect one cable to the connector at the lower part of the operation box and the other to the connector of the centering tool.

1. SONY TS1 is a wire-carried type. Do not perform the following operations:
   1. Tool replacement
   2. Spindle rotation

2 Oriented spindle stops (0°) (180°) are made during au automatic centering. Make sure there is no obstacle within spindle revolving zone.

Make sure before starting an automatic centering, the connector of a centering tool faces to the operator. This is for keeping the cable from being wound around the tool.

* In an oriented spindle stop (0°), the spindle always rotates CW.

* In an oriented spindle stop (180°), the spindle always rotates CCW.

9

4 Motion check

1 Set the touch sensor probe according to the requirements given in the section related to the preparations.

2 Make appear 2 I/O screens with [I/O] [1] [ENTER] and [⇩ PAGE] keys in manual operation mode.

3 Bring the touch sensor probe into contact with a work clamp or workpiece with the JOG key. If work clamp or workpiece is not mounted, connect the top of the touch sensor probe to the screw of the table with a wire .

```
SLAVE                                          INPUT/OUTPUT

 IN                                   OUT
    FEDCBA98 7654 3210                   FEDCBA98 7654 3210
 1  1000 0111 0000 0000   ◜1            0001 1111 0001 0000

 2  0000 0000 1111 1111   ●2            0001 1111 0001 0000

 3  1000 0111 0000 0000

 4  0000 0000 1111 1111

    FEDCBA98 7654 3210                   FEDCBA98 7654 3210
OUT  →0 0011 1100 0010 0000

    I/O
    MENU
    F0      F1      F2      F3      F4
```

Check the function as follows:

IN4 XXXXXXXXXXXXXXX0

0: when the probe is not in contact
1: when the probe is in contact

A touch sensor probe manufactured by SONY can be used only for an object that conducts electricity.
For safety, be sure to confirm that a signal is actually input, by following the operation check.
A touch sensor probe manufactured by SONY cannot be used in Z-axis direction.
Use it only in X- and Y-axis directions.

5 Dismounting an automatic centering tool

1 Remove the cable of the centering tool.
2 Loosen the nut of the holder and dismount the centering tool.
3 Press **[MANU]** key to change to manual operation mode.
4 Return the empty holder back to the magazine by pressing **[ATC]** and **[MAGZ]** keys.
5 Dismount the empty holder from the magazine.

6 Setting Data Banks of Automatic Centering

6.1 Tool menu

Register the centering tool to be used into the tool list.
Refer to Tool Registration on tool menu in the Instruction Manual.

```
                                                TOOL MENU
TOOL NO.  ●19          ●20          ●21
TOOL      ■CHFCTR      ■TOUCH P     ■
POINT ANG■*            ■*           ■
SMALL DIA■   3.000     ■  10.000    ■
SMALL D.L■*            ■*           ■
C.ANGLE  ■  90.000     ■*           ■
INEF L   ■*            ■*           ■
DIAMETER ■  10.000     ■*           ■
PCH THR/I■*            ■*           ■
FLUTE L  ■*            ■*           ■
TORSION  ■*            ■*           ■
TEETH    ■          4  ■*           ■
OVERALL L■100.000      ■100.000     ■
INIT LIFE■   9999M     ■*           ■
EXPIRING ■   9999M     ■*           ■
TOOL LIFE■   9999M     ■*           ■

TOOL NO.  →_

                                SERCH:TOOL NO.



EDIT     TOOL
END      SET
MODE
 F0       F1       F2       F3       F4
```

6.2 Magazine tools

Mount the centering tool registered on the tool menu in the data bank, register this tool on the magazine tool.
Register the centering tool, which has been registered in No. 20 on the tool list, into the No.2 location of the magazine.

```
                                        MAGAZN

●SP                                     ■******
     TL LIFE            ■MAIN TOOL

●01  01 C. DRILL   0. 000×90. 000 ■STD TL
     TL LIFE *******■MAIN TOOL

●02  20 TOUCH P 10. 000×100. 000■STD TL
     TL LIFE **       ■MAIN TOOL **

●03                                     ■STD TL
     TL LIFE            ■MAIN TOOL

●04                                     ■STD TL
     TL LIFE            ■MAIN TOOL

PROGRAM NO. →_


   TOOL
   NO.
   F0    F1    F2    F3    F4
```

Refer to Tool Registration (1) in the Instruction Manual.

6.3 Parameter

Set the following items for user parameters (switch 1).

Item	Setting value	Description
CENTERALIGN FEEDRATE1	1~5000mm/min (0.0394-196.8504 inch/min)	Set the positioning speed in a center aligning and the axis feedrate in a rough measurement.
CENTERALIGN FEEDRATE2	1~5000mm/min (0.0394-196.8504 inch/min)	Set the axis feedrate in a fine measurement for center alignment.
CENTERALIGN RETRACTVALUE	0~99.999mm (0~9.9999inch)	Set the retract value after a rough measurement for center alignment before a fine measurement.

(Note) The setting values of CENTER ALIGN FEEDRATE , CENTER ALIGN RETRACT VALUE and so on differ according to the probe mounted. Consult the probe maker and set the values.

Specifying center alignment parameters

[Center aliment motion]

1. CENTER ALIGN FEEDRATE 1

* Relief amount of probe = L (mm)
* SKIP FEED TIME CONSTANT = t (msec)
* CENTER ALIGN FEEDRATE 1 = F1 (mm/min)
* Delay in control system = td (msec) = 12 (msec)

$$L >= \underline{((F1 \times td)/(60 \times 1000)) + ((F1 \times t/2)/60 \times 1000))}$$

↑ Overtravel amount due to delay in control system

↑ Overtravel amount

$$F1 <= (12000L/(24+t))/1.2$$

↑ Safety rate

2. CENTER ALIGN FEEDRATE 2

* Allowable error in control system = E (mm)
* CENTER ALIGN FEEDRATE 2 = F2 (mm/min)
* Delay in control system = td (msec) = 0.5(msec)

$$E \geqq (F2 \times td)/60$$

$$\boxed{F2 \leqq 120 \times E}$$

3. CENTER ALIGN RETRACT VALUE

* CENTER ALIGN RETRACT VALUE = Lb (mm)
* SKIP FEED TIME CONSTANT = t (msec)
* CENTER ALIGN FEEDRATE 2 = F2 (mm/min)

(a) The Z upward movement from an excessively close point may cause an interference between the probe and a workpiece due to workpiece form dispersion. Moderate value is 1.0mm.

(b) During the measurement, contact the probe and a workpiece at an ordinary speed (not at accelerated speed).

Set either (a) or (b) whichever is larger.

$$\boxed{Lb \geqq MAX(1.0, F2 \times t/6000)}$$

4. Correction of automatic centering

* Lapse of time from the contact of centering tool with a workpiece to the activation of detection signal = tc (msec)
* Automatic centering speed 2 = F2 (mm/min)
* Correction of automatic centering = Lc (mm)

$$\boxed{Lc = tc \times F2/60000}$$

5. SKIP FEED TIME CONSTANT

This is determined by the CENTER ALIGN FEEDRATE 1 and a relief amount of probe.
Set it to 100msec in general.

7 Checking before Starting

Check the following points before performing an automatic centering.

1 Are the data bank and magazine tools, which are necessary for automatic centering, correctly set?
Improper settings may cause breakage of centering tool.

Refer to the Chapter 3. SETTINGS VARIOUS DATA BANKS OF AUTO MATICCENTERING.

2 Is the message "DETECTION SIGNAL ON" displayed on the screen when the centering tool in service comes into contact with the workpiece?

If this message is not displayed, the centering tool may have been damaged.

3 The first measurement made after performing various settings of automatic centering should be made motion by motion in single operation mode by pressing **[SINGLE]**(CENTERING SIGNAL) key (the lamp coming on).

4 When an accurate centering is required, measure several times.

5 The spindle will rotate to 0 or 180 degrees during an automatic centering.
Make sure there is no obstacle within spindle revolving zone.
Make sure also before starting an automatic centering, the connector of a centering tool faces to the operator. This is for keeping the cable from being wound arround the tool.

8 Operating Procedure

8.1 Automatic centering menu

1 Press the **[MDI]** key.

```
                                        MDI  RUN

●COORDINATE      ■   (1:ON)
●EXT SIGNAL     ■■■
●TOOL            ■   (1~18:POT NO.)
●COOLANT         ■   (0:OFF 1:ON)
●SPINDLE         ■   (0:STOP 1:CW 2:CCW)
●S. SPEED     ■■■■■   min⁻¹
●AXIS MOVE       ■   (0:DESIGNATE POS
                      1:W. ZERO 2:M. ZERO
                      3:M. ZERO (NO. 2)
                      4:M. ZERO (NO. 3))
●X  ■■■■■■■■  ●Y  ■■■■■■■■  ●Z  ■■■■■■■■
●A  ■■■■■■■■  ●B  ■■■■■■■■  ●RAD ■■■■■■
●FEED            ■   (0:POSITIONING
                      1:CUTTING 2:TAPPING)
●FEEDRATE     ■■■■■  mm/min
COORDINATE →_

 CENTER   AUTO
 ALIGN    T. LEN
 MENU     MSMT
 F0       F1       F2       F3       F4
```

2 Press **[F0]** key.

```
                                   CENTER ALIGNMENT

    CENTER ALIGNMENT MENU

    1. CORNER
    2. PARALLEL
    3. CIRCLE (HOLE)
    4. CIRCLE (BOSS)
    5. Z LEVEL
    6. PROBE OFFSET (CORNER)
    7. PROBE OFFSET (CRC/3P)

MENU →_

MDI
OPERTN
F0       F1       F2       F3       F4
```

3 Select the workpiece shape to be measured in the centering menu (1. ANGLE - 5. Z-AXIS HEIGHT), enter its number and press **[ENT]** key.
Follow the steps described in 8-2 to 8-6 after selecting a menu option number.

9

8.2 Corner

This menu measures X and Y coordinates of a corner.

```
CORNER                                  CENTER ALIGNMENT
 ●M. POS 1  □X      ■■■■■■■■■■  ■Y     ■■■■■■■■■■
            ■DRCTN
 ●M. POS 2  ■X      ■■■■■■■■■■  ■Y     ■■■■■■■■■■
            ■DRCTN
 ●Z  POS    ■HGT   ■■■■■■■■■■  ■Ht    ■■■■■■■■■■

   ---  RESULT OF MEASURMENT  ---
 ●M. POS    ■X      ■■■■■■■■■■  ■Y     ■■■■■■■■■■

X  →_

 CENTER                                  TEACH
 ALIGN                                   POSI.
 MENU                                    LOAD
 F0        F1        F2        F3        F4
```

1. Set appropriate data.

***MEASURING POSITION 1.**
***MEASURING POSITION 2.**
Enter X and Y coordinates of the automatic centering starting position and specify the sense of measurement with +X, -X, +Y or -Y.

The example in the figure below shows that the sense of measurement for MEASURING POSITION 1 is +X and MEASURING POSITION 2 is +Y.

***Z-axis position**

***HEIGHT**
Specify the height to be measured with Z-axis working coordinate.
***RETURN**
Specify, with Z-axis working coordinate, the height of return when a tool passes from the measuring position 1 to the measuring position 2 and on completion of the measurement.
Refer to 5-7 Automatic Coordinate Setting with **[F4]** key.

2 Press the START switch and the automatic centering is executed.

3 The result of the measurement is displayed.
X and Y axes move to the measuring position.

```
CORNER                          CENTER ALIGNMENT

●M. POS1  ■X     −120.000  ■Y     − 80.000
          ■DRCTN  +X
●M. POS2  ■X      −80.000  ■Y    −120.000
          ■DRCTN  +Y
●Z  POS   ■HGT     20.000  □Ht     35.000


      −−− RESULT OF MEASURMENT −−−

●M. POS   ■X     ■■■■■■■■■■ ■Y  ■■■■■■■■■■


RETURN HGT →_


 CENTR                                  TEACH
 ALIGN                                  POSI.
 MENU                                   LOAD
  F0      F1      F2      F3      F4
```

4 Press **[F0]** key to return to the center alignment menu.

9

8.3 Parallel

This menu measures X and Y coordinates of the centerline of a straight groove or boss.

1. Set appropriate data.

***MEASURING POSITION 1.**

***MEASURING POSITION 2.**

Enter X and Y coordinates of the automatic centering starting position and specify the sens of measurement with +X, -X, +Y or -Y.

The example in the figure below shows that the sens of measurement for MEASURING POSITION 1 is -X and and that for MEASURING POSITION 2 is +X.

***Z-axis position**

***HEIGHT**

Specify the height to be measured with Z-axis coordinate in the work coordinate system.

***RETURN**

Specify, with Z-axis coordinate in the work coordinate system, the height of return when a tool passes from the measuring position 1 to the measuring and on completion of the measurement.

Refer to 5-7 Automatic Coordinate Setting with **[F4]** key.

2 Press the START switch.

3 The result of the measurement is displayed.
X and Y axes move to the measuring position.

Result of the measurement

```
PARALLEL                    CENTER ALIGNMENT

●M. POS1  ★X    −80.000  ■Y    −50.000
          ■DRCTN −X
●M. POS2  ■X   −120.000  ■Y    −50.000
          ■DRCTN +X
●Z. POS   ■HGT   20.000  □Ht    50.000


   −−− RESULT OF MEASURMENT −−−

●M. POS   ■X  ■■■■■■■■■■ ■Y  ■■■■■■■■■■


RETURN HGT →_


  CENTR                                TEACH
  ALIGN                                POSI.
  MENU                                 LOAD
  F0      F1      F2      F3      F4
```

4 Press **[F0]** key return to the center alignment menu.

9

8.4 Center of a circle (groove)

This menu measures X and Y coordinates of a hole center.

The figure below represents the screen which appears when 3. CENTER OF CIRCLE (GROOVE) is selected in 8-1 (3).

```
CIRCLE (HOLE)                    CENTER ALIGNMENT

●M. POS    □X    ■■■■■■■■   ■Y    ■■■■■■■■
●Z. POS    ■HGT  ■■■■■■■■   ■Ht   ■■■■■■■■

      --- RESULT OF MEASURMENT ---

●M. POS    ■X    ■■■■■■■■   ■Y    ■■■■■■■■

X →_

CENTER                                TEACH
ALIGN                                 POSI.
MENU                                  LOAD
F0        F1        F2        F3        F4
```

1 Set appropriate data.

* **MEASURING POSITION**

Make a point near the center of a hole and enter its X and Y coordinates as automatic centering starting position.

***Z-axis position**

***HEIGHT**

Specify the height to be measured with Z-axis coordinate in the work coordinate system.

Refer to 5-7 Automatic Coordinate Setting with [F4] key.

***RETURN**

Specify, with Z-axis coordinate in the work coordinate system, the height of return when a tool passes from the measuring position 1 to the measuring position 2 and on completion of the measurement.

2 Press the START switch .

Motion

Measurement

* Measurement in X-axis + sens and Y-axis + sens

* Measurement in X-axis + sens and Y-axis +sens

3 The result of the measurement is displayed.
X and Y axes move to the measuring position.

Result of the measurement

```
CIRCLE (HOLE)                    CENTER ALIGNMENT

●M. POS   ■X      -105.000  ■Y        49.000
●Z. POS   ■HGT      30.000  □Ht       50.000



   --- RESULT OF MEASURMENT ---

●M. POS   ■X      ■■■■■■■■  ■Y      ■■■■■■■■

RETURN HGT →_

  CENTER                                TEACH
  ALIGN                                 POSI.
  MENU                                  LOAD
  F0        F1        F2        F3        F4
```

4 Press **[F0]** key to return to the center alignment menu..

9

8.5 Center of a circle (boss)

This menu measures X and Y and coordinates of a circular boss center.

CENTER OF CIRCLE (BOSS) is selected in 8-1(3).

1 Set appropriate data.

*MEASURINGPOSITION1
*MEASURINGPOSITION2
Take 2 points in X axis near the center of a cylinder in Y axis to be centered and enter their X and Y coordinates as automatic centering starting positions.

***Z-AXIS POSITION**

***HEIGHT**
Specify the height to be measured with Z-axis coordinate in the work coordinate system.
***RETURN**
Specify, with Z-axis coordinate in the work coordinate system, the height of return when a tool passes from the measuring position 1 to the measuring position 2 and on completion of the measurement.

Manual:c:TC31ﾏﾆｭｱﾙ|1動芯出し-1204L07

Refer to 5-7 Coordinate Setting with **[F4]** key.

2 Press the START switch.

Motion

The figure below represents the screen which appears when 4.

9

Measurement

*Measurement in X-axis + sens and Y-axis + sens

*Measurement in X-axis - sens and Y-axis - sens

9

3 The result of the measurement is displayed.
X and Y axes move to the measuring position.

Result of the measurement

```
CIRCLE (BOSS)                    CENTER ALIGNMENT

●M. POS1  ■X      -20.000  ■Y      -51.000
●M. POS2  ■X      -30.000  ■Y      -51.000
●Z. POS   ■HGT    -30.000  □Ht      50.000

   --- RESULT OF MEASURMENT ---

●M. POS   ■X      ■■■■■■■■  ■Y      ■■■■■■■■

RETURN HGT →_

CENTER                                  TEACH
ALIGN                                   POSI.
MENU                                    LOAD
F0        F1        F2        F3        F4
```

4 Press **[F0]** key to return to the center alignment menu.

9

8.6 Z level

This menu measures the Z height of the work top surface.

The figure below represents the screen which appears when 5. Z-AXIS HEIGHT is selected in 8-1 (3).

1 Set appropriate data.

*MEASURINGPOSITION

Specify the position to be centered with X- and Y-axis coordinates.

***Z-AXIS POSITION**

***HEIGHT**

Specify the height to be measured with Z-axis coordinate in the work coordi nate system.

***RETURN**

Specify, with Z-axis coordinate in the work coordinate system, the height of return on completion of the measurement.

Centering of z-axis height is possible only when a centering tool which is released in Z-axis direction.

Refer to 5-7 Automatic Coordinate Setting with **[F4]** key.

2 Press the START switch.

3 The result of the measurement is displayed.

Result of the measurement

```
Z LEVEL                    CENTER ALIGNMENT

 ●M. POS   □X      -50.000   ■Y       -50.000
 ●Z. POS   ■HGT     80.000   ■Ht       80.000



   --- RESULT OF MEASURMENT ---

 ●M. POS   ■Z (WORKING POS)      ■■■■■■■■■
           ■Z (MACHINE POS)      ■■■■■■■■■

RETURN  HGT →_


CENTER                                TEACH
ALIGN                                 POSI.
MENU                                  LOAD
  F0      F1      F2      F3      F4
```

4 Press **[F0]** key to return to the center alignment menu

8.7 Probe Offset

8.7.1 Probe Offset Value

Some menu items of the center alignment and the automatic measurement require the settings of the probe offset value.
If the offset value is not set, some error may occur to the measurement results.
The items below do not require the probe offset values, thus setting to PROBE OFFSET VALUE is not necessary.
-CenterAlignment"PARALLEL""CIRCLE(HOLE)""CIRCLE(BOSS)""ZLEVEL"
- Automatic measurement "PARALLEL, CIRCLE(4 POINT), Z LEVEL, ROTATION

- The items below require the values set to PROBE OFFSET VALUE 1 and PROBE OFFSET VALUE 2.
- Center Alignment "CORNER"
- Automatic measurement CORNER

- The items below require the values set to PROBE OFFSET VALUE 3 and PROBE OFFSET VALUE 4.
- Automatic measurement CIRCLE(3 POINT)

8.7.2 Probe Offset Value (CORNER)

This command calculates the value to be set to PROBE OFFSET VALUE 1 and PROBE OFFSET VALUE 2 parameters.

The screen below is when 6. PROBE OFFSET (CORNER) is set on the center alignment.

1) Prepare a ring gauge.
2) Set the necessary values
* Measurement position is specified by the X and Y absolute coordinate position, regarding the position near the center of the ring gauge as the start position of center alignment.

*Z axis position (Height)
Specify the measurement height with the Z absolute coordinates.
*Z axis position (Ht)
Specify the return height after measurement is finished with the Z absolute coordinates.

3) Press the START switch and execute the center alignment operation in the following procedures.

(1) Execute the measurement start motion.
(2) Measure the pattern 3 in the X direction at the measurement position.
(3) Measure the pattern 3 in the X direction at the position measured in above (2).
(4) Measure the pattern 3 in the X direction at the position measured in above (3).
(5) Move to the measurements position in above (4).

Measurement start motion
Z movement to return position
(Movement by skip function, CENTER ALIGN FEEDRATE 1)

Movement to measurement positions
X/Y movement to measurement position
(Movement by skip function, CENTER ALIGN FEEDRATE 1)
Detection signal OFF check

Measurement pattern 3

——— : Movement by skip function (CENTER ALIGN FEEDRATE 1)
━━━ : Movement by skip function (CENTER ALIGN FEEDRATE 2)
- - - - - - : Linear interpolation (CENTER ALIGN FEEDRATE 1)

1. X/Y movement to measurement position
   (Movement by skip function, CENTER ALIGN FEEDRATE 1)
2. Detection signal OFF check
3. Z movement to measurement position
   (Movement by skip dunction, CENTER ALIGN FEEDRATE 1)
4. Detection signal OFF check
5. Spindle orientation 0°
6. X/Y movement to target position in the +direction
   (Movement by skip function , CENTER ALIGN FEEDRATE 1)
7. Detection signal ON check
8. X/Y detection position take-in in the +direction
9. X return position calculation
10. Y return position calculation
11. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
12. Detection signal OFF check
13. X/Y movement to target position in the +direction
    (Movement by skip function , CENTER ALIGN FEEDRATE 2)
14. X/Y detection position take-in in the +direction
15. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
16. Detection signal OFF check
17. Spindle orientation 180°
18. X/Y movement to target position in the -direction
    (Movement by skip function , CENTER ALIGN FEEDRATE 1)
19. Detection signal ON check
20. X/Y detection position take-in in the -direction
21. X return position calculation
22. Y return position calculation
23. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
24. Detection signal OFF check
25. X/Y movement to target position in the -direction
    (Movement by skip function , CENTER ALIGN FEEDRATE 2)
26. X/Y detection position take-in in the -direction
27. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
28. Spindle stop
29. Z movement to return position
    (Movement by skip function, CENTER ALIGN FEEDRATE 1)

(Note)"Z movement to return position" in the above (29) is done after all the measurements are done.
During the measurement, the Z moves to the measurement position.

4) After measurement, the measured results are displayed, and X and Y axes move to the ring gauge center.

```
PROBE OFFSET (CORNER)  CENTER ALIGNMENT

●M. POS   ■X    -105.000 ■Y     -49.000
●Z. POS   ■HGT    30.000 ■Ht     50.000
●M. HOLE  □DIA    30.000


   --- RESULT OF MEASURMENT ---

●OFFSET   ■1   ■■■■■■■■ ■2   ■■■■■■■■


HOLE DIAMETER →_

CENTER                          TEACH
ALIGN          AUTO             POSI.
MENU           PARAM            LOAD
 F0      F1      F2      F3      F4
```

9

8.8 Probe Offset Value (CIRCLE-3POINTS)

These command calculate the values to be set to PROBE OFFSET VALUE 3 and PROBE OFFSET VALUE 4 parameters.

```
PROBE OFFSET (CRC/3P)  CENTER ALIGNMENT

 ●M. POS   □X    ■■■■■■■■  ■Y    ■■■■■■■■
 ●Z. POS   ■HGT  ■■■■■■■■  ■Ht   ■■■■■■■■

   --- RESULT OF MEASURMENT ---

 ●OFFSET   ■3    ■■■■■■■■  ■4    ■■■■■■■■

X →_

CENTER                          TEACH
ALIGN          AUTO             POSI.
MENU           PARAM            LOAD
  F0     F1     F2     F3     F4
```

9

1) Set the necessary values

* Measurement position 1 (X,Y)

Specified by the X and Y absolute coordinate position,
regarding the alignment start point around the center of hole with the X/Y abosolu.

*Z axis position (Height)

Specify the measurement height with the Z absolute coordinates.

*Z axis position (Ht)

Specify the return height after measurement is finished with the Z absolute coordinates.

2) Press the START switch and execute the center alignment operation in the following procedures.

(1) Execute the measurement start motion.
(2) Measure the pattern 3 in the X direction at the measurement position.
(3) Measure the pattern 3 in the X direction at the position measured in above (2).
(4) Measure the pattern 3 in the X direction at the position measured in above (3).
(5) Measure the pattern 1 in the 120 ‹direction at the position measured in above (4).
(6) Measure the pattern 1 in the 240 ‹direction at the position measured in above (4).
(7) Move to the measurement position in above (4).

Measurement start motion	Z movement to return position (Movement by skip function, CENTERALIGNFEEDRATE1)
Movement to measurement positions	X/Y movement to measurement position (Movement by skip function, CENTER ALIGNFEEDRATE1) Detection signal OFF check

Measurement pattern 3

——————— : Movement by skip function (CENTER ALIGN FEEDRATE 1)
━━━━━━━━ : Movement by skip function (CENTER ALIGN FEEDRATE 2)
- - - - - - : Linear interpolation (CENTER ALIGN FEEDRATE 1)

9

1. X/Y movement to measurement position
   (Movement by skip function, CENTER ALIGN FEEDRATE 1)
2. Detection signal OFF check
3. Z movement to measurement position
   (Movement by skip dunction, CENTER ALIGN FEEDRATE 1)
4. Detection signal OFF check
5. Spindle orientation 0°
6. X/Y movement to target position in the +direction
   (Movement by skip function , CENTER ALIGN FEEDRATE 1)
7. Detection signal ON check
8. X/Y detection position take-in in the +direction
9. X return position calculation
10. Y return position calculation
11. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
12. Detection signal OFF check
13. X/Y movement to target position in the +direction
    (Movement by skip function , CENTER ALIGN FEEDRATE 2)
14. X/Y detection position take-in in the +direction
15. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
16. Detection signal OFF check
17. Spindle orientation 180°
18. X/Y movement to target position in the -direction
    (Movement by skip function , CENTER ALIGN FEEDRATE 1)
19. Detection signal ON check
20. X/Y detection position take-in in the -direction
21. X return position calculation
22. Y return position calculation
23. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
24. Detection signal OFF check
25. X/Y movement to target position in the -direction
    (Movement by skip function , CENTER ALIGN FEEDRATE 2)
26. X/Y detection position take-in in the -direction
27. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
28. Spindle stop
29. Z movement to return position
    (Movement by skip function, CENTER ALIGN FEEDRATE 1)

(Note)"Z movement to return position" in the above (29) is done after all the measurements are done. During the measurement, the Z moves to the measurement position.

——————— : Movement by skip function (CENTER ALIGN FEEDRATE 1)
━━━━━━━━ : Movement by skip function (CENTER ALIGN FEEDRATE 2)
– – – – – – : Linear interpolation (CENTER ALIGN FEEDRATE 1)

1. X/Y movement to measurement position
   (Movement by skip function, CENTER ALIGN FEEDRATE 1)
2. Detection signal OFF check
3. Z movement to measurement position
   (Movement by skip dunction, CENTER ALIGN FEEDRATE 1)
4. Detection signal OFF check
5. Spindle orientation 0°(180°)*1
6. X/Y movement to target position
   (Movement by skip function , CENTER ALIGN FEEDRATE 1)
7. Detection signal ON check
8. X/Y measurement position take-in in the +direction
9. X return position calculation
10. Y return position calculation
11. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
12. Detection signal OFF check
13. X/Y movement to target position
    (Movement by skip function , CENTER ALIGN FEEDRATE 2)
14. X/Y detection position take-in
15. X/Y return (Linear interpolation, CENTER ALIGN FEEDRATE 1)
16. Spindle stop
17. Z movement to return position
    (Movement by skip function, CENTER ALIGN FEEDRATE 1)

(Note 1) When the target position of movement by skip function is in the +X or +Y direction, the spindle orientation is 0°. When in the -X or -Y direction, the spindle orientation is 180°.

After measurement, the results are displayed and the X/Y axes move to the measurement position

```
PROBE OFFSET (CRC/3P)  CENTER ALIGNMENT

●M. POS   ■X    -105.000 ■Y     -49.000
●Z. POS   ■HGT    50.000 □Ht     50.000


   --- RESULT OF MEASURMENT ---

●OFFSET   ■3   ■■■■■■■■ ■4   ■■■■■■■■


RETURN HGT→_


 CENTER                          TEACH
 ALIGN          AUTO             POSI.
 MENU           PARAM            LOAD
 F0      F1      F2      F3      F4
```

9

8.9 Automatic coordinate setting with [F4] key

The following is the procedure of setting automatically the work coordinates of a measuring position and Z-axis position.

1 In automatic centering mode, press **[MANU]** key with **[MDI]** key kept pressed (the lamp on both keys comes on).
This operation allows the following manual operations to be made in the automatic centering mode.

Effective manual operations:

1.Manual feed at rapid traverse rate
2.Manual feed at low feed
3.Manual step feed
4.Manual feed by pulse generator

2 Move manually a centering tool to the measuring position or Z-axis position.
Example: Automatic setting of a measuring position of center of circle (groove).
Move the centering tool at a positioning speed and at a low feedrate to the measuring position at the center of the circle.

9

3 Press [F4] key (position read).
The current working coordinates are automatically set as coordinates of the item on which the cursor is located.

X and Y coordinates of the measuring position are set at the same time.
For Z-axis position, "height" and "return" are separately set.

9

9 Motion Switchover and Motion Display

9.1 Mode switchover

It is not possible to switchover a mode to another (including temporary stop, stop on single block basis) during an automatic centering.
To switchover forcibly a mode to another, press **[RST]** key and change the mode.

9.2 Motion display

The following motions are displayed during an automatic centering:

[Motion display]	[Motion description]
* MEASURE 1 X -100.000 Y -50.000 500mm/min	X and Y axes are fed by linear Interpolation at 500 mm/min. If detection signal is activated during an axis feed, the feed is stopped on the spot to end this axis feed.
* MEASURE 1 Z 10.000 10mm/min	Z axis is fed at 100mm/min. If detection signal is activated during an axis feed, the feed is stopped on the spot to end this axis feed.
* M320	Detection signal on.
* M321	Detection signal off.
* M302, 310, 311	Internal processing codes. Do not cause axis feed.
* Oriented spindle stop (0°)	The spindle is positioned at 0°, rotating CW.
* Oriented spindle stop (180°)	The spindle is positioned at 180°, rotating CCW.

(This page is a blank.)

CHAPTER 9 (5)

AUTOMATIC DOOR

1. Outline
2. Functions
3. Operation Switches
4. Automatic Operation
5. Door Controller Parameter Settings
6. Alarm messages
7. Automatic Door Safety Device
8. Area Sensor
9. Door Stop Conditions

1 Outline

Once connected, the automatic door can be controlled by parameter settings.
Operation patterns can be set to parameters for selection.

2 Functions

(1) Opening and closing of the automatic door
(2) Area sensor (the automatic door stops immediately when the area sensor beam is obstructed.)

3 Operation Switches

(1) Automatic door [MANU/AUTO] switch
[MANU] Operation with the [OPEN/CLOSE] switch is valid.
The door is not opened and closed automatically.
[AUTO] Operation with the [OPEN/CLOSE] switch is invalid.
The door is opened and closed automatically.

(2) [OPEN/CLOSE] switch
Valid when the [MANU/AUTO] switch is set to MANU.
[OPEN] When [OPEN] is pressed, the door opens. More precisely, opening is initiated when the [OPEN] switch is released.
[CLOSE] When [CLOSE] is pressed, the door closes.
More precisely, closing is initiated when the [CLOSE] switch is released.

Note: Even when the [MANU/AUTO] switch is set to MANU, the [OPEN/CLOSE] switch is invalid when the door is locked.

4 Automatic Operation

(1) When the [MANU/AUTO] switch is set to MANU, the door does not operate automatically.
(2) When the [MANU/AUTO] switch is set to AUTO, the door operates as described below.

1. Press the [START] switch.
2. The automatic door closes.
3. The machine checks the door is closed.
4. The machining begins.
5. The machining is finished.
6. The automatic door opens.

5 Door Controller Parameter Settings

(1) User parameter (switch 1)

Item	Factory set value	Descriptions
AUTOMATIC DOOR (0: NO 1:YES)	0	
AREA SENSOR PATTERN (0: PATTERN 1 1: PATTERN 2)	1	Pattern 1: Valid when door is closing. Pattern 2: Valid when door is opening and closing.
RESET AUTOMATIC DOOR ERROR (0: EMERGENCY STOP 1: STOP)	1	0:Emergency stop level error occurs. 1:Stop level error occurs.
AUTOMATIC DOOR OPERATION TIME	10	Sets the automatic door opening and closing time.

6 Alarm messages

1. [DOOR ERROR]: When any of the followings occurs

(1) When the automatic door limit switch has turned on both at the door close and open end.

(2) When it took ## seconds (time set to parameter) for closing automatic door.

(3) When it took ## seconds (time set to parameter) for opening automatic door.

* When the above error occurs, either emergency stop or stop can be selected.

* To reset the above error, eliminate the error cause and press the **[RST]** key of the machine.

2. [AREA SNSR OBSTRUCTED]: Area sensor error

(1) When the area sensor beam is obstructed when the door is closing.

(2) When the area sensor beam is obstructed while [AREA SENSOR PATTERN] is set to [1: PATTERN 2] (valid when door is opening and closing)
Eliminate the error cause and resume operation to reset the alarm.

3. [DOOR LOCKED]: The [OPEN/CLOSE] switch is invalid because the door is locked.

(1) The [OPEN/CLOSE] switch is pressed while the [MANU/AUTO] switch is set to MANU and the door is locked.

7 Automatic Door Safety Device

Automatic door operation specifications

[MANU/AUTO] switch	DOOR INTERLOCK switch	Mode			
		MANUAL	MDI	MEMORY	PROGRAM EDIT
Manual	Invalid	Can be used	Can be used	Can be used	Can be used
	Valid	Can be used (*1)	Can be used (*1)	Can be used (*1)	Can be used (*1)
Automatic	Invalid	Not operated	Not operated	Operated	Not operated
	Valid	Not operated	Not operated	Operated	Not operated

(Note 1) The [OPEN/CLOSE] switch is invalid when the door is locked.

8 Area Sensor

(TC-20A is not equipped with the area sensor.)

(1) Automatic door control

When the area sensor beam is obstructed while the automatic door is closing. The door stops.

When the area sensor beam is obstructed while the automatic door is opening. Whether or not the door stops can be set by parameter.

(2) When the automatic door is stopped in MEMORY mode because the area sensor beam is obstructed during door opening and closing, press the **[RESTART]** switch to resume operation.

(3) Alarm display

The **[AREA SNSR OBSTRUCTED]** alarm message appears in the following cases:

1. When the automatic door stops because the area sensor beam is obstructed during door opening and closing.
2. Door opening and closing is attempted while the area sensor beam is obstructed.

9 Door Stop Conditions

(1) Automatic door opening and closing is halted when:

1. An error occurs in the machine.
2. **[*DOOR ERROR]** alarm has occurred.
3. The area sensor beam is obstructed.
4. The **[STOP]** key is pressed.
5. The **[RST]** key is pressed.

(2) Door opening and closing when an alarm occurs

Even when an alarm that halts operation occurs, the door can be opened and closed as long as the following conditions are met:

1. The **[MANU/AUTO]** switch is set to MANU.
2. The **[EMERGENCY]** switch is off.
3. The **[OPEN/CLOSE]** switch is pressed while the **[RELSE]** key is pressed.

   However, door opening and closing stops when the **[RELSE]** key is released or the **[EMERGENCY]** switch is turned on.

CHAPTER 9 (6)

AUTOMATIC INTERMITTENT LUBRICATING UNIT

1. Cautions for Handling
2. General View
3. Recommended Lubricant
4. Alarm

1 Cautions for Handling

The ball screws and guides are basically lubricated with grease. This machine does not have a lubricating oil collector, so lubricating oil will be mixed into the coolant.

2 General View

The automatic intermittent lubricating unit serves to supply oil to ball screws of X,Y and Z axes and slide guides at a period automatically.

S2BOP10.doc

3 Recommended Lubricant

For this machine, slideway lubricants or general lubricants for machine tool, equivalent to ISO V68 class are recommended.

Recommended oil : FEBIS K68/Esso
Vactra Oil No.2/Mobil
Tonna Oil T68/Shell

4 Alarm (EXTERNAL ERROR 23)

Insufficient lubricant causes 'EXTERNAL ERROR 23 on the displaay.
Refill the lubricant and press the reset key to cancel the alarm.
The interrupting condition for machine operation depends on the parameter 1 (Ext Error 23 Alarm Level) data.

Lvel 0: Operation is not stopped.
Lvel 1: Operation is stopped after the program is compleated (M02,M30).
(However, if the operation is stopped midway, the situation becomes the same as level 2 because the [START] switch does not work.)
Lvel 2: Operation is stopped after the current block is completed.
Lvel 3: Operation is stopped immediately.
Lvel 4: The servo mechanism is stopped.
The desired level can be set from the above five levels.
For details, refer to the instruction manual → Parameters.

At our shipment, the parameter has been set to the level 1, interruption. after current cycle.

(This page is a blank)

CHAPTER 9 (7)

TOOL BREAKAGE DETECTION UNIT

1. Precautions for Handling
2. Sketch Drawing
3. User Parameter (Switch 1) Setting
4. How to Use the Tool Breakage Detection Unit
5. Trouble shooting

An air cylinder drives the tool detection sensor of the tool breakage detection unit so that the sensor contacts the tool and any tool breakage can be detected. Tool breakage detection is performed for the tool after machining.

1 Precautions for Handling

1. Do not overload the tool detection sensor.

2. When machining chips are entangled in the tool, the chips may contact the tool detection sensor, leading to incorrect detection. When using the tool breakage detection unit, be sure to start machining under conditions that do not allow chips to entangle the tool.

3. The speed controller is factory-adjusted. Do not adjust it unless absolutely necessary.

2 Sketch Drawing

22120702. doc

3 User parameter (Switch 1) Setting

1. Press the **[DATA BANK]** key. The <DATA BANK MENU> screen is displayed.

2. Select **[4]** and press the **[EOB/ENT]** key. The <USER PARAMETER MENU> screen is displayed.

3. Select **[1]** and press the **[EOB/ENT]** key. The <USER PARAMETER (SWITCH1) > screen is displayed.

4. Using the **[PAGE UP] [PAGE DOWN]** and**[CURSOR UP] [CURSOR DOWN]** keys, move the cursor to the desired item and set the required data.

5. Press the **[F0]** key twice and parameter setting is completed. The <USER PARAMETER MENU> screen is displayed.

3.1 Tool breakage detection option

Set the "TOOL BREAKAGE DETECTION OPTION" of parameter 1 (switch) to "1" (TYPE1)..

```
SWITCH1                    USER PARAMETER


★TOOL BREAKAGE DETECT OPTION
 (0:NO 1:TYPE1 2:TYPE2 3:TYPE3)


TOOL BRK DET OP.→

F0   F1   F2   F3   F4
```

9

3.2 Tool breakage detection return position

Setting of "Tool breakage detection return position"
In memory operation mode, set the tool tip return position, after tool breakage detection, in machine coordinates relative to the Z axis direction.

1. Mount a tool whose tool length is correctly set to the main spindle.

2. Switch to manual operation mode.

3. Using the **[Z]** key, move the Z axis vertically.
   Adjust the return position so that the tool tip comes to 1 cm below the detection sensor of the tool breakage detection unit.
   (Pulling out the detection sensor arm by hand is accepted.)

4. Subtract the main spindle tool length from the "Z" of the MACHINE COORDINATE POSITION on the <PRESENT POSITION> screen, and set this value to the TOOL BREAKAGE DETECTION RETURN POSITION of USER PARAMETER(SWITCH1).
   Below is an example when the machine coordinate position is 320.000 and the tool length is 115.000.
   320.000-115.000=205.000(Set205.000.)

Present position

```
●MACHINE POS                    PRESENT POS
 X
 Y
 Z    320.000

 F0    F1    F2    F3    F4
```

User paraemeter

```
SWITCH 1                        USER PARAMETER

●TOOL BREAKAGE DETECT OPTION                1

★TOOL BRK DETECT RETURN POS        450.000

TL BRK DET POS→ 205.000
 F0    F1    F2    F3    F4
```

5. Display the <MDI OPERATION> screen, enter "200" to EXT SIGNAL and press the [SET] key.
   Press the [START] key and check that the tool breakage is detected correctly.

9

3.3 Tool breakage detection position on X(Y) axis

The X and Y positions to perform tool breakage detection are set on the machine coordinate. After the Z-axis has returned to its zero position, the machine positions the X and Y axes to their respective set positions and then performs tool breakage detection.

[This item is invalid for TC-S2A.]

3.4 Tool breakage detection excute cycle (the number of operation)

Sets the frequency to perform tool breakage detection according to the number of times the program is performed.
For example, when **[5]** is set, tool breakage detection is performed once after the program has been performed five times.
One cycle of tool breakage detection performs all detection operations commanded.
When **[1]** is set, tool breakage detection is performed after each time the program has been performed.

```
SWITCH1                                  USER PARAMETER

● TOOL BRK DETECT RETURN POS          400.000
● TOOL BRK DETECT POS        X          0.000
● TOOL BRK DETECT POS        Y          0.000
● TOOL BRK DET EXE CYCLE(NO.OF OPR)

BRK DET CYCLE (OPR)→
F0   F1   F2   F3   F4
```

4 How to use the tool breakage detection.

4.1 MDI operation

Display the <MDI block operation> screen. Move the cursor to the EXTERNAL SIGNAL, enter "200" and press the [SET] key. When the [START] key is pressed, tool breakage is detected.

NOTE: In MDI operation, tool breakage detection is performed at the current position without returning to the tool breakage detection return position. Therefore, the tool must be moved to the return position in advance.
MDI operation is generally used to check the tool breakage detection operation.

```
                                    MDI  OPERATION

★EXT SIGNAL            200
```

9

4.2 Memory operation

In memory operation, tool breakage detection is performed during tool changing after signal output 200 is carried out. Signal output 200 becomes invalid after tool changing. Therefore, to detect tool breakage, signal output 200 must be carried out before the tool to be detected is changed with another.
Signal output 200 is set to AUXILIARY FUNCTION in '1. ASSIGN OF TOOL' on the <preparation for operation> screen. BEFORE CUTTING and AFTER CUTTING are available as AUXILIARY FUNCTION. Setting to either of these is accepted.

```
                                                    ASSIGN OF TOOL
■2  HOLE                02  DRILL
            OFFSET          ■LEN                ■DIA.
            M. FUNC         ★BEFORE CUTTING     ★AFTER
            DWELL                   ■TIME
```

Example
Tool breakage detection is performed when changing to the 03 chamfering tool after using the 02 drill

Process 01 Drilling process

Tools to be used:	1.	01	Center drill
	2.	02	Drill
	3.	03	Chamfering too

Enter '200' to the AUXILIARY FUNCTION of [■2 HOLE] of ASSIGN OF TOOL.
In the example below, signal output 200 is set to BEFORE MACHINING.

```
● JOB    01 HOLE CHAMFERING                         ASSIGN OF TOOL

■1    CENTER HOLE            01  CENTER DRILL
       OFFSET            ■LEH              ■ DIA.
       M. FUNC           ■BEFORE           ■AFTER
       DWELL             ■TIME

■2    HOLE                   02  DRILL
      OFFSET             ■TOOL LENGTH      ■DIA.
      M. FUNC            ★BEFORE  2 0 0    ★AFTER
       DWELL             ■TIME

■3    CHAMFERING             03  CHAMFERING TOOL
      OFSET              ■ LEH             ■DIA.
      M. FUNC            ■BEFORE           ■AFTER
      DWELL              ■TIME
   F0      F1      F2      F3      F4
```

Operation Flow

NOTES

1. **Signal output 200 will become invalid after the current tool is changed. It will also become invalid when the following occur:**
   When the [RESET] key is pressed
   When program end is executed
   When starting point is set
2. **Tool breakage detection cannot be performed in dry run operation mode.**

4.3 Precautions for programming

Tool breakage detection is performed for the tool after machining.
However, to detect breakage of the last tool, add the signal output to the last process of the machining data.
5XX (figures in 'XX' indicate the tool list number of the last tool) is set as the signal output code.
For instance, when the last tool to be used is 18 in the tool list, enter 518 to CODE.

```
                                        MACHINING DATA

■JOB 08   TAP
■    09   SIGNAL OUT            ■CODE   518

●MAIN PROGRAM END
●SUB PROGRAM END
```

4.4 When an alarm has occurred

When [*TOOL BREAKAGE ERROR] has occurred as a result of tool breakage detection, cancel the alarm as below to restart operation.

1.Check the service life of the broken tool on the <magazine tool> screen and replace the workpiece.
2.Press the [RESET] key and the broken tool service life becomes '0'.
3.Restart of operation

When a spare tool is registered
1.Press the [START] key.
(The broken tool is replaced with the spare tool automatically.)

When a spare tool is not registered
1.Replace the broken tool with a new tool. Set the tool service life and press the [START] key.

For spare tool registration, refer to Instruction Manual (2) 'Tool setting for magazine'.

5 Troubleshooting

1. When 3363 [TC RIC DET DOS ERR] has occurred

If this error occurs when the first tool change command is given, the current position is higher than the tool breakage detection return position. Set the axis movement process to PROCESS 1 and lower the detection position by specifying the Z axis position. If this error occurs in other cases, the IN-PROCESS RETURN HEIGHT or COORDINATE RETURN HEIGHT is higher than the tool breakage detection return position. If this cannot be done, tool breakage detection of this tool is impossible.

2. When 1297 [TOOL BRK SENSOR ERR] has occurred

When this error cannot be cleared even by pressing the [RESET] key, the tool breakage detection unit is faulty, so tool breakage detection cannot be performed. In this case, please inform us of the situation. To continue memory operation, set the TOOL BREAKAGE DETECTION OPTION of Parameter 1 to '0' (no use).

(This page is a blank.)

CHAPTER 9 (8)

ZERO MEASUREMENT

1. Before zero measurement
2. Setting of data on zero measurement
3. Operation of zero measurement
4. Handling of measurments
5. Mounting and dismounting of probe

ZERO MEASUREMENT

Zero measuring function

1. Corner boss X/Y coordinate value

2. Corner pocket X/Y coordinate value

3. X/Y coordinates of the axis of parallel groove

4. X/Y coordinates of the axis of parallel boss

5. X/Y coordinates of the center of a hole

6. X/Y coordinates of the center of a boss

7. Z coordinate of the top surface of a workpiece

8. Workpiece rotation angle and coordinate position of workpiece

The corner X/Y coordinate is measured as a coordinate value. In addition, this can be referred to as the offset value from the reference value specified by the program or the measured value.
Two measurement formats are provided: the X-axis 2-point measurement format and the Y-axis 2-point measurement format. The former measures two points on the X axis and one on the Y axis, and the later measures one point on the X axis and two on the Y axis.

1 Before zero measurement

1. Register the touch probe to be used to the tool list.
2. Set the required parameters of user parameter 7.
   Incorrect parameter setting may damage the probe.

2 Setting of data on zero measurement

User parameter7 (Zero measurement)

Item	Description
PROBE OFFSET VALUE1 PROBE OFFSET VALUE2	Sets the difference between the center of the stylus tip and that of the spindle when the detection signal is ON while the touch probe is attached to the spindle. The difference in the X direction is set to **[PROBE OFFSET VALUE 1]** and that in the Y direction is set to **[PROBE OFFSET VALUE 2]**. Execute automatic centering function **[PROBE OFFSET]** to set the data. PROBE OFFSET VALUE Setting range -9.999~9.999mm -0.9999~0.9999inch
PROBE OFFSET VALUE3 PROBE OFFSET VALUE4	Sets the difference between the center of the circle obtained by the 3-point measurement and the center of the actual circuit. The difference in the X direction is set to **[PROBE OFFSET VALUE 3]** and that in the Y direction is set to **[PROBE OFFSET VALUE4]**. Execute **[PROBE OFFSET]** to define the entered value. Setting range -9.999~9.999mm -0.9999~0.9999inch

9

Item	Description
MEASURING MOTION (0: TYPE1 1: TYPE2)	(0: TYPE 1) 1) It is checked that the detection signal is off. 2) The probe moves in the specified axis direction at the speed preset to MEASUREMENT SPEED 1. 3) When the detection signal has turned on, the axis stops traveling. 4) The probe moves in the specified axis direction at the speed preset to MEASURING DISTANCE AFT MEASURING. 5) The probe moves in the specified axis direction at the speed preset to MEASURING SPEED 2. 6) When the detection signal has turned on., the axis stops traveling. 7) The probe returns to the position of 4). 8) It is checked that the detection signal is off. (1: TYPE 2) 1) It is checked that the detection signal is off. 2) The probe moves in the specified axis direction at the speed preset to MEASURING SPEED 2. 3) When the detection signal has turned on, the axis stops traveling. 4) The probe moves forward for the RETURN DISTANCE AFT MEASURNG. 5) It is checked that the detection signal is off.

9

Item	Description
MEASURING SPEED 1	Sets the first measuring speed for MEASURING MOTION (TYPE1). *Relief amount of probe = L (mm) *MEASURING TIME CONSTANT = t (msec) *MEASURING SPEED 1 = F1 (mm/min) *Delay in control system = td (msec) = 0.625 (msec) $L \geqq \underbrace{((F1 \times td) \div (60 \times 1000))}_{\text{Overtravel amount due to delay in control system}} + \underbrace{((F1 \times t/2) \div (60 \times 1000))}_{\text{Overtravel amount}}$ $F1 \leqq (120000L \div (1.25 + t)) \div \underbrace{1.2}_{\text{Safety rate}}$ Setting range : 1~5000 mm/min 0.1~196.8 inch/min
MEASURING SPEED 2	Sets the second measuring speed for MEASURING MOTION (TYPE 1) and the measuring speed for MEASURING MOTION (TYPE 2). *Allowable error in control system = E (mm) *MEASURING SPEED 2 = F2 (mm/min) *Delay in control system = td (msec) = 0.625 (msec) $E \geqq (F2 \times td) \div 60 \longrightarrow \boxed{F2 \leqq 96 \times E}$ Setting range : 1~5000 mm/min 0.1~196.8 inch/min
STOP DISTANCE BEFORE MSRNG	Sets the distance between the probe end face at the measurement start point and the estimated workpiece surface. When measuring has been skipped for the values preset to STOP DISTANCE, SENSOR SIGNAL OFF alarm will occur. Position of the workpiece surface estimated from the program command value. STOP DISTANCE BEFORE MSRNG MEASURNG TRAVEL LMT DISTANCE Tool radius Setting range : 0.000~99.999 mm 0.0000~9.9999 inch

9

Item	Description
MEASURING TRAVEL LMT DISTANCE	Sets the amount of overtravel when the measuring skip has exceeded the estimated value (program command value). Setting range : 0.000~99.999mm 0.0000~9.9999 inch
MEASUREMENT TOLERANCE 1	When the difference between the measured value and the estimated value (program command value) has exceeded the preset value, MEASD VAL ERR LRG. (1) : will occur. When 0 is set, the value error check is not carried out. Setting range : 0.000 ~ 99.999 mm 0.0000 ~ 9.9999 inch
MEASUREMENT TOLERANCE 2	If the difference between the current measurement result and the previous measurement result exceeds the setting range, MEASD VAL ERR LRG. (2) occurs. However, the difference is not checked in the following cases: · Zero (0) is set. · 1st origin measurement is performed after the power is turned on (1st measurement for each of measurement results 1 to 4). · No previous measurement result exists. · Current G code differs from the previous G code. Setting range : 0.000 ~ 99.999 mm 0.0000 ~ 9.9999 inch
RETURN DISTANCE AFT MEASURNG	Sets the amount that the measuring probe retracts where it has contacted the non measuring object during automatic measurement. *RETURN DISTANCE AFT MEASURNG = Lb (mm) *MEASURING TIME CONSTANT = t (msec) *MEASURING SPEED 2 = F2 (mm/min) $Lb \geqq MAX\ (1.0, F2 \times t/60000)$ Setting range : 0.000~99.999mm 0.0000~9.9999 inch

(Note)
The setting values of MEASURING SPEED, RETURN DISTANCE AFT MEASURNG and so on differ according to the probe mounted. Consult the probe maker and set the values.

The probe's traveling speed during zero measurement, when moving to the measurement start point, and when returning from the measurement point conforms to the positioning movement speed and cutting feed speed specified in the data bank.

Check that the chips are not stuck to the measuring probe tip and the surface of the workpiece to be measured. We shall not bear responsibility for the decreased measurement accuracy due to the above cause.

The mode cannot be changed during automatic measurement.
If mode selection is attempted, DURING AUTO MEASURNG alarm will occur.
To prevent the probe from being damaged, press the **[SINGLE]** key for the first zero measurement and check the condition every single operation.

3 Operation of zero measurement

3.1 Corner

Command form

```
■BLK 01 MEASURE−CORNER ■MSR NO.          1
        ■SHAPE      BOSS
REF POS ■X        50.000 ■Y          30.000
OFFSET  ■X        10.000 ■Y         −10.000
Z POS   ■HGT      50.000 ■Ht         70.000
```

MSR No. ... Selects the register No. that stores measurement results 1 to 4. When this number is specified for **[MEASUREMENT No.]** in the coordinate system setting process, the measured results are automatically reflected in the coordinates.

SHAPE ... Specifies the pocket or boss.

REF. POS X/Y ... Predicted corner value

OFFSET X ... X axis coordinate position when measuring in the Y direction. Offset value from the point (X, Y)

OFFSET Y ... Y axis coordinate position when measuring in the X direction. Offset value from the point (X, Y).

Z POS HGT ... Z coordinate during measurement

Z POS Ht ... Z coordinate return position

Measurment pattern

1. Spindle oriented. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. First measurement is carried out (in the X direction).
4. The prove moves to the Z axis return point.
5. The spindle is oriented. The probe moves to the second measurement start point of the X and Y axes.
6. The probe moves to the Z axis measurement height.
7. The second measurement is carried out.
8. The probe moves to the Z axis return point.

SHAPE ... the boss.

Measurement offset symbol, spindle orientation and measurement skip movement direction

I: Measurement offset value X

J: Measurement offset value Y

a) I > 0 , J > 0

1ST spindle 0°, in the +X direction

2ND spindle 0°, in the +Y direction

b) I > 0 , J < 0

1ST spindle 0°, in the +X direction

2ND spindle 180°, in the -Y direction

c) I < 0 , J > 0

1ST spindle 180°, in the -X direction
2ND spindle 0°, in the +Y direction

d) I < 0 , J < 0

1ST spindle 180°, in the -X direction
2ND spindle 180°, in the -Y direction

SHAPE ... the pocket

a) I > 0 , J > 0

1ST spindle 180°, in the - X direction
2ND spindle 180°, in the - Y direction

b) I > 0 , J < 0

1ST spindle 180°, in the - X direction
2ND spindle 0°, in the + Y direction

c) I < 0 , J > 0

1ST spindle 0°, in the + X direction
2ND spindle 180°, in the - Y direction

d) I < 0 , J < 0

1ST spindle 0°, in the + X direction
2ND spindle 0°, in the + Y direction

3.2 Parallel

Command form

```
■BLK  02  MEASURE－PARALEL■MSR  NO.          3
          ■SHAPE      BOSS
REF  POS■X          40.000 ■Y           30.000
          ■MESR  DIRCTN   X ■WHD         20.000
Z  POS    ■HGT        50.000 ■Ht          70.000
```

MSR No . . . Selects the register No. that stores results 1 to 4. When this number is specified for **[MEASUREMENT No.]** in the coordinate system setting process, the measured results are automatically reflected in the coordinates.

SHAPE . . . Specifies the pocket or boss.

REF. POS X/Y . . . Predicted pocket (boss) center

MESR DIRCTN . . . Specifies the X direction when measuring a parallel shape in the Y direction and the Y direction when measuring a parallel shape in the X direction.

WHD . . . Pocket (Boss) width

Z POS. HGT . . . Z coordinate during measurement

Z POS. Ht . . . Z coordinate return position

Pocket

(Measurement pattern)

1. Spindle orientation 0°. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out.
4. Spindle orientation 180°. The probe moves to the second measurement start point of the X and Y axes.
5. The second measurement is carried out.
6. The probe moves to the Z axes return point.

a) When set in X direction

b) When set in Y direction

Boss

(Measurment pattern)

1. Spindle orientation 0°. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out.
4. The probe moves to the Z axis return point.
5. Spindle orientation 180°. The probe moves to the second measurement start point of the X and Y axes.
6. The probe moves to the Z axis measurement height.
7. The second measurement is carried out.
8. The probe moves to the Z axis return point.

a) When set in X direction

b) When set in Y direction

3.3 Circle

Command form

```
■BLK  03  MEASURE−CIRCLE  ■MSR  NO.          3
          ■SHAPE    POCKET
REF  POS  ■X        50.000  ■Y          30.000
          ■RAD      10.000  ■MESR  POINT     3
Z  POS    ■HGT      50.000  ■Ht          70.000
```

MSR. No	....	Selects the register No. that stores measurement results 1 to 4. When this number is specified for **[MEASUREMENT No.]** in the coordinate system setting process, the measured results are automatically reflected in the coordinates.
SHAPE	...	Specifies the pocket or boss.
REF. POS X/Y	...	Predicted hole (boss) center
RAD	...	Radius of the circle to be measured
MESR POINT	...	Specifies three-point movement or four-point movement.
Z POS HGT	...	Z coordinate during measurement
Z POS Ht	...	Z coordinate return position

Hole ··· Three-point measurement

Measurement pattern

1. Spindle orientation 0°. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out (in the +Y direction).
4. Spindle orientation 0°. The probe moves to the second measurement start point of the X and Y axes.
5. The second measurement is carried out (in the direction of 120° from the first point).
6. Spindle orientation 0°. The probe moves to the third measurement start point of the X and Y axes.
7. The third measurement is carried out (in the direction of 240° from the first point).
8. The probe moves to the Z axis return point.

Boss : Three-point measurement

1. Spindle orientation 180°. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out (in the -Y direction).
4. The probe moves to the Z axis return point.
5. Spindle orientation 180°. The probe moves to the second measurement start point of the X and Y axes.
6. The probe moves to the Z axis measurement height.
7. The second measurement is carried out (in the direction of 120° from the first point).
8. The probe moves to the Z axis return point.
9. Spindle orientation 180°. The probe moves to the third measurement start point of the X and Y axes.
10. The probe moves to the Z axis measurement height.
11. The third measurement is carried out (in the direction of 240° from the first point).
12. The probe moves to the Z axis return point.

Hole : Four point measurement

1. Spindle orientation 0°. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out (in the +X direction).
4. Spindle orientation 180°. The probe moves to the second measurement start point of the X and Y axes.
5. The second measurement is carried out (in the -X direction).
6. Spindle orientation 0°. The probe moves to the third measurement start point of the X and Y axes.
7. The third measurement is carried out (in the +Y direction).
8. Spindle orientation 180°. The probe moves to the third measurement start point of the X and Y axes.
9. The fourth measurement is carried out in the -Y direction).
10. The probe moves to the Z axis return point.

Boss : Four-point measurement

1. Spindle orientation 180° . The probe move to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out (in the -X direction).
4. The probe moves to the Z axis return point.
5. Spindle orientation 0°. The probe moves to the second measurement start point of the X and Y axes.
6. The probe move to the Z axis measurement height.
7. The second measurement is carried out (in the +X direction).
8. The probe moves to the Z axis return point.
9. Spindle orientation 180°. The probe moves to the third measurement start point of the X and Y axes.
10. The probe moves to the Z axis measurement height.
11. The third measurement is carried out (in the -Y direction).
12. The probe moves to the Z axis return point.
13. Spindle orientation 0°. The probe moves to the fourth measurement start point of the X and Y axes.
14. The probe moves to the Z axis measurement height.
15. The fourth measurement is carried out (in the +Y direction).
16. The probe moves to the Z axis return point.

3.4 Z LEVEL

Command form

```
■BLK 04 MEASURE−Z LEVEL■MSR NO.          2
MEASR   ■X        50.000 ■Y        30.000
Z POS   ■HGT      50.000
```

MSR.... Selects the register No. that stores measurement results 1 to 4. When this number is specified for **[MEASUREMENT No.]** in the coordinate system setting process, the measured results are automatically reflected in the coordinates.

REF POS X/Y ... X/Y coordinate of measured value
Z POS HGT ... Predicted Z-axis height

Measurement pattern

1. Spindle orientation 0°. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. The first measurement is carried out (in the -Z direction).

3.5 Rotation

Command form

```
■BLK 05 MEASURE−RTTN (X) ■MSR NO.          1
        ■SHAPE    POCKET
REF POS ■X        50.000  ■Y          30.000
OFFSET  ■X1       10.000  ■X2         20.000
        ■Y        15.000
Z POS   ■HGT      50.000  ■Ht          70.000
```

MSR No. ... Selects 1 to 4 as the register No. that stores the measurements. When this number is specified in the coordinate system setting process, the measurement values can be reflected in the coordinate rotation item (angle and center coordinates X and Y) in the coordinate system setting process.

SHAPE ... Specifies the pocket or boss.

REP POS X/Y ... Predicted center coordinate when coordinate rotates

OFFSET X1 ... X axis coordinate position when measuring for the first time in the Y direction. Offset from the point (X,Y).

OFFSET X2 ... X axis coordinate position when measuring for the second time in the Y direction. Offset from the point (X,Y).

OFFSET Y ... Y axis coordinate position when measuring in the X direction. Offset from the point (X,Y).
Note: For rotation (Y axis, 2 points), enter the measurement offset value to X, Y1, and Y2.

Z POS HGT ... Z coordinate during measurement

Z POS Ht ... Z coordinate return position

(Measurement pattern)

1. Spindle orientation. The probe moves to the first measurement start point of the X and Y axes.
2. The probe moves to the Z axis measurement height.
3. First measurement (first time in the X direction)
4. The prove moves to the Z axis return position.
5. Spindle orientation. The probe moves to the second measurement start point of the X and Y axes.
6. The probe moves to the Z axis measurement height.
7. Second measurement (second time in the X direction)
8. The probe moves to the Z axis return point.
9. Spindle orientation. The probe moves to the third measurement start point of the X and Y axes.
10. The probe moves to the Z axis measurement height.
11. Third measurement (first time in the Y direction)
12. The probe moves to the Z axis return point.

4 Handling of Measurements

4.1 Measurement display

The results of zero measurement are displayed in **[5. MEASUREMENT RESULTS]** on the <PRODUCTION MONITOR MENU> screen. The measured data is updated each time zero measurement is performed.
The measured results can be output to the external device via computer communication (TC slave station).
For details, refer to Slave TC communication.

To change the value of the measurement results, select the desired item and enter a numerical value. Note that the type of the measurement cannot be changed.
To delete measurement results, press the [F4] key. Each time the [F4] key is pressed the data for the next measurement number is deleted.

9

1.Press the [F2] key on the <CUR MEASMNT RESULT> screen and the <PREV MEASMNT RESULT> screen appears. Press the [F2] key again and the display returns to the <CUR MEASMNT RESULT> screen.

Note: The previous measurement results cannot be changed or deleted.

9

4.2 Reflecting measurements in working coordinate system

The measurements can be reflected in the coordinates by specifying **[MEASUREMENT NO.]** on the <COORDINATE SET> screen.

```
■JOB 02 COORDINATE SET   ■MSR. NO      ?
        ■CODE          8
 ●ANGLE ■A             ?  ■B           ?
 ●ZERO P■X         0.000  ■Y       10.000
        ■Z             ?
 ●TOOL RETURN (CODE)      ■Hc           ?
 ●TOOL RETURN (JOB)       ■Hj           ?
 ●ROTATE■ANGLE         ?
 ●CENTER■X             ?  ■Y           ?
```

When the number is entered to **[MEASUREMENT NO.]**, the offset value corresponding to the number is added to the measurements.
For coordinate rotation, the angle and the center (X, Y) specified during program creation are ignored and the measurements are used.

5 Mounting and dismounting of probe

Refer to option for mounding and dismounting the probe to and from the magazine.

CHAPTER 9 (9)

ROTATION AXIS (Index Table)

1. Manual Operation
2. MDI Operation
3. Rotation Axis (Index Table)Parameter Setting
4. Program To Use Index Table

1 Manual Operation

Axes A , B and C can be rotated in manual operation mode.
Rotation is possible in three modes: high-speed, low-speed and stepwise.
Manual operation needs the following keys.

Note:

The 4th axis does not mean axis 4. Axes A, B and C can be assigned as the 4th axis using the [F0], [F1] and [F2] keys.

1.1 Manual operation mode

1. Press **[MANU]** key to enter the manual operation mode.
   The manual conditions list appears on screen, the cursor flickering at the "RAPID FEEDRATE." (Screen 1).
2. Choose and press **[RAPID]**, **[JOG]**, or **[STEP]** key, in the mode chosen for cursor manual operation.
3. (4) indicates the settting conditions of the 4th axis.
   By operating the **[F0]**, **[F1]**, or **[F2]** key, axis 4, 5, or 6 can be assigned as the 4th axis.
   Axis 4, 5, or 6 can also be assigned to either rotation axis A, B, or C from the **[DATA BANK MENU]** screen -> **[6. MACHINE PARAMETER]** -> **[2. SYSTEM 2]**.

Screen 1

MANUAL CONDITIONS

- RAPID FEEDRATE (XYZ) 10%
  - HIGH SPEED (4) 10%
- JOG FREEDRATE (XYZ) 50 mm/min
  - JOG SPEED (4) 0.1min^{-1}
- STEP LENGTH (XYZ) 000.1 mm
  - STEP AMOUNT (4) 0.001°
- SPINDLE SPEED 150 rpm

1.1.1 High-speed operation

This allows 4-axis to rotate at high speed. Speed can be chosen from five preset levels between 10 and 100% of the maximum rpm.

1. Press **[RAPID]** key.
2. Press **[CURSOR DOWN]** key and set the cursor to "HIGH SPEED (4)."
3. Using **[INC]** and **[DEC]** keys, choose "HIGH SPEED(4) " Speed can be chosen from five preset levels, 10, 25, 50, 75 and 100% of "MAX OF HI-SPEED ROTATION B " in parameter 6.
4. Press **[+4]** or **[-4]** key. As long as this key is pressed, 4-axis continues rotating at the speed set in 3. above. (**[+4]** key permits rotation in the positive (+) direction and **[-4]** key in the negative (-) direction.)

1.1.2 Low-speed operation

This allows rotation axis to rotate at low speed . Speed can be chosen from 19 preset levels between 0.1 and 7.5 rpm.

1. Press **[JOG]** key.
2. Press **[CURSOR DOWN]** key and set the cursor to " JOG SPEED (4)."
3. Using **[INC]** and **[DEC]** keys, choose "JOG SPEED." Speed can be chosen from 19 preset levels between 0.1 and 7.5 rpm.
4. Press **[+4]** or **[-4]** key. As long as the key is pressed, 4 axis continues rotating at the speed set in 3. above. (**[+4]** key permits rotation in the positive (+) direction and **[-4]** key rotation in the negative (-) direction.)

   Low speed preset levels
   0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 and 7.5 min^{-1}

1.1.3 Step rotation

Each pressing of **[+4]** or **[-4]** key gives a given angle of rotation (inching). Angle can be chosen from 11 preset levels between 0.001 and 180°.

1. Press **[STEP]** key.
2. Press **[CURSOR DOWN]** key and set the cursor to "STEP ROTATION (4)."
3. Using **[INC]** and **[DEC]** keys, choose "STEP ROTATION."
   Turning angle can be chosen from 11 preset levels between 0.001 and 180°
4. Press **[+4]** or **[-4]** key. Each time the key is pressed, the axis rotates to the angle set in 3. above.

   Turning angle in step rotation
   0.001, 0.01, 0.1,1.0, 5.0, 10.0, 15.0, 30.0, 45.0, 90.0 and 180°/step

1.2 Machine and Index Table zero returns

1.2.1 Machine zero return

This allows X, Y, A, B and C-axes to return to machine zero.

1. Press **[MANU]** key to enter the manual operation mode. Press **[POS]** key.
2. Press **[Z.RTN]** key.
   Z-axis ascends, stopping at the machine zero. Together with X and Y-axes, A, B and C-axes returns to machine zero. (Screen 2)

CAUTION
The B-axis dog zero return direction is the same as that of the motor axis assigned 'B' in the machine parameters. This also applies to to axis A.

```
(PROGRAM 6000)                                PRESENT POS

●MACHINE POS                  ●RESIDUAL MOVEMENT
●X          0.000              X          0.000
●Y          0.000              Y          0.000
●Z        550.000              Z          0.000
●C          0.000              C          0.000
●A          0.000              A          0.000
●B          0.000              B          0.000

●ABSOL POS                    ●SPINDLE LOAD METER
 X          0.000              ▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯
 Y          0.000              0%            100%
 Z        400.000             ●MAGAZN
 C          0.000              TOOL NO.        01
 A          0.000              NEXT TOOL NO.
 B          0.000              POT NO.         08

●CUTTING
 FEED R.    POSTNG
 S. SPEED        0 min⁻¹

●INNR PLT NO. 2

            PREVIOUS PAGE  :  ENLARGEMENT
            NEXT PAGE      :  MODAL

  4TH      5TH      6TH
  AXIS     AXIS     AXIS
  F0       F1       F2       F3       F4
```

9

NOTE: STROKE A, STROKE B (User parameter 2 (switch 2))
For zero return of the rotating axis (A or B), the rotation direction and angle differ depending on the user parameters (Switch 2) of motor axis 4, 5, or 6 assigned to rotating axes A and B.

1) When "STROKE " is "0: NO"

For zero return, B-axis rotates in the direction closer to B-axis machine zero (0°). When the returning angle is the same in either positive or negative direction (e.g., 180°), the axis rotates toward positive.

B-axis machine coordinate

The illustration below shows an example of axis B. This also applies to axis A. B-axis machine positions vary within the range of 0 to 359.999° and therefore more than one B-axis machine zero positions exist every 360ß from B-axis dog type zero position.

NOTE:
This applies to rotation-axis zero return in MDI and memory operations.

9

2) When "STROKE " is "1: YES"

For zero return, rotation-axis rotates toward B-axis machine zero (0°).
The illustration below shows an example of axis B. This also applies to axis A. Since B-axis positions vary from -9999.999 to 9999.999°, only one B-axis machine zero position exists at zero for B-axis dog type zero return.

B-axis machine coordinate

CAUTION
In "B-AXIS STROKE LIMIT YES" the dog type zero is the reference position for the B-axis stroke limit value. Before executing machine zero return, make sure to rotate B-axis in advance in the high-speed operation mode. Without this, the dog type zero position will be dislocated 360° from normal, causing the B-axis stroke limit value to differ 360° from normal as well.

NOTE:
When a [*STROKE OVER B (-), (+)] or [*LIMIT OVER B (-), (+)] error occurs during B-axis dog machine zero return, despite the B-axis being positioned within the B-axis stroke or stroke limit, change [STROKE B (-), (+)] and [SOFTWARE STROKE LIMIT B (-), (+)] of parameter 7 as below.
The same applies to axis A.

1) When dog zero return direction of the motor axis assigned 'B' is (0:+).

For the stroke (-) of the motor axis assigned to 'B', set a regative value twice the dog zero return amount of that axis.
For example, when the dog zero return amount is set to 15.000K, set -30.000K or less (e.g. -40.000K).
Any value can be set to the stroke (+) of the motor axis assigned to 'B'.

2) When dog zero return direction of the motor axis as signed 'B' is (1:-).

For the stroke (+) of the motor axis assigned to 'B', set a value twice the dog zero return amount of that axis.
For example, when the dog zero return amount is set to 15.000K, set 30.000K or more (e.g. 40.000K).
Any value can be set to the stroke (-) of the motor axis assigned to 'B'.

This setting is necessary so that the B-axis can always return to the same machine zero point when using the dog machine zero return function.
This prevents the B-axis becoming entangled with wire.

For instance, provided that the B-axis is currently positioned at 180.000° and it returns to the machine zero point (dog machine zero return) in the positive direction, if the B-axis is returned to the zero point without stroke control, the B-axis moves as shown by arrow A above, resulting in a rotation shift. To prevent this, control the stroke so that the B-axis moves in the negative direction for 180.000° K plus the amount of displacement as shown by arrow B above, and then moves in the positive direction. Doing this enables the B-axis to always return to the same machine zero point and prevents it from becoming entangled with wire.

2 MDI Operation

Used for MDI operation, this mode permits the control of rotation axis rotation.

2.1 Input data for MDI operation

Press **[MDI]** key to enter the MDI mode. With **[PROGRAM]** key pressed, the screen as shown at left appears. (Screen 3)
Settings to be made for commanded rotation-axis (Index Table) rotation are as follows.

Screen 3

```
                                        MDI  OPERATION

●COORDINATE        ■   (1:ON)
●EXT SIGNAL      ■■■
●TOOL              ■■  (1～28:POT NO.)
●COOLANT           ■   (0:OFF 1:ON)
●SPINDLE           ■   (0:STOP 1:CW 2:CCW)
●S.SPEED       ■■■■■    min⁻¹
●AXIS MOVE         ■   (0:DESIGNATE POS
                        1:W.ZERO 2:M.ZERO
                        3:M.ZERO(NO.2)
                        4:M.ZERO(NO.3))
●X  ■■■■■■■■■■    ●Y  ■■■■■■■■■■  ●Z  ■■■■■■■■■■
●A  ■■■■■■■■■■    ●B  ■■■■■■■■■■  ●RAD ■■■■■■■■■■
●FEED              ■   (0:POSITIONING
                        1:CUTTNG 2:TAPPING)
●FEEDRATE        ■■■■■  mm/min
COORDINATE →_

   CENTER    AUTO      6TH
   ALIGN     T.LEN     AXIS
   MENU
   F0        F1        F2        F3        F4
```

-COORDINATE
  1: ON
- AXIS MOVE
  0: DESIGNATEPOS
  1: W.ZERO
  2: M.ZERO
  3: M.ZERO (NO.2)
  4: M.ZERO (NO.3)
-A
- B
- RAD: (specification before cutting)
-FEED
  0: POSITIONING
  1: CUTTING
-FEEDRATE

Item	Description
COORDINATE	Set '1' to set the coordinate system. 1: ON
AXIS MOVE X Y Z A B RAD	Move X, Y, Z, A and B-axes to the following positions; 0: arbitrary 1: machine zero 2: working 3: machine zero (No. 2) 4: machine zero (No. 3) A-axis or B-axis movement requires the input of the cutting plane radius.

9

Item	Description
AXIS MOVE 0:DESIGNATE POS (X) (Y) (Z) (A) (B) (FEED 0: POSITIONING)	The type of axis allowed to move differs depending on the combination of the axes and feed purpose. 1)When "POSITIONING" is chosen for the feed purpose, the following axes and axis combinations can be used. When three axes are specified: XYZ, XYB, XYA, XZA, YZA XZB, YZB When two axes are specified: XY, YB, XZ, YZ, BZ, XA, YA, AZ, XB When an axis specified: X, Y, Z, A, B When "POSITIONING" is specified, B-axis always rotates toward the shorter path. When the turning angle is the same in either positive or negative direction (e.g., 180°), the axis rotates toward positive. The same applies to axis A. **CAUTION** **When "STROKE B (0: NO; 1: YES)" is "1: YES," the axis may rotate toward the farther path or "Limit over" alarm occur depending on the +B/-B stroke limit value.**

In the case of Ex. 3

Although the shorter path is in the negative direction, since the stroke limit (-B) is set to 180 , the farther path is chosen not to exceed the limit value.

Item	Description
AXIS MOVE 0: DESIGNATE (X) (Y) (Z) (A) (B) (FEED 1: CUTTING)	2)When "cutting" is chosen for the feed purpose, the following axes can be used.

When two axes are specified	XY, XZ, YZ, XA, XB, YA, YB, ZA, ZB
When an axis specified	X, Y, Z, A, B

The turning direction of B-axis during positioning differs depending on whether the B-axis set value is positive or negative. The same applies to axis A.

Positive: the axis always rotates in the positive direction.
(The plus sign need not be placed.)

Negative: the axis always rotates in the negative direction.

CAUTION

When "STROKE B (0: NO; 1: YES) is "1: YES," "Limit over" alarm may occur depending on the +B/-B stroke limit value.

B-axis machine coordinate

NOTE

1.When B-axis moves for cutting, no other axes move. Accompanied by no other axis movement.

2.To use B-axis for cutting, the cutting plane radius must be input.

Item	Description
1: W.ZERO	Z-axis returns to the machine zero position. X, Y, A and B-axis in returns to the zero positions set for the memory or MDI operation. Sequence is that Z-axis returns to working zero first, followed by X, Y, A and B returning thereto at the same time. **NOTE** **The turning direction and angle of A, B-axis in returning to working zero differ depending on the setting of "STROKE (0: NO; 1: YES).**
2: M.ZERO	This causes X, Y, Z, A and B-axis in returning to machine zero. Sequence is that Z axis returns to machine zero first, followed by X, Y, A and B returning thereto at the same time. **NOTE** **The turning direction and angle of rotation axis in returning to working zero differ depending on the setting of "STROKE (0: NO; 1: YES)".Refer to Section 1-2-1, Machine zero return.**
RAD (FEEDRATE)	To move rotation for cutting, specify the cutting plane radius. Calculation method for B-axis rotational speed from the specified feedrate Deg: B-axis rotational speed (degree/min) N: B-axis rotational speed (rpm) C: feedrate (mm/min) p: circular constant R: cutting plane radius (mm) Deg (degree/min) = 180 × F / π × R N (rpm) = F / 2 × π × R **NOTE** **If the B-axis rotational speed thus calculated exceeds the "MAX OF HI-SPEED ROTATION B." in machine parameter, speed is fixed at the parameter set value. The same applies to axis A.**
FEED	With regard to the purpose of X, Y, Z, A and B-axes, choose the appropriate one from the following three choices: 0: positioning — This position the axis at the location determined by the high-speed maximum set in machine parameter (system 2). 1: cutting — This moves the axis at the set feedrate. 2: tapping — This permits tapping. The feedrate is determined by the spindle speed and pitch of the tool used for tapping.
FEEDRATE	Specify the axis movement rate (mm/min) when it is moved for cutting.

9

2.2 Execution of MDI operation

2.2.1 Setting the working zero position

Follow procedures below to set the rotation axis working zero position.
How to set the machining zero point of rotation axis is explained using axis B as an example.

1. In the manual operation mode rotate B-axis (Index Table) to the position to be set as working zero.
2. Press **[MDI]** key to enter the MDI mode and display the block operation screen.
3. Specify B-axis in "COORDINATE". Input 1 (= on) and press **[EOB/ENTER]** key.
4. Press START switch.
   With this operation, the B-axis current position is set as working zero.
5. Press **[POS]** key to display the current position screen.
   Check that B-axis working zero is correctly set. (Screen 4)

Screen 4

```
(PROGRAM 1000)                          PRESENT POS

●MACHINE POS                  ●RESIDUAL MOVEMENT
 X      100.000                X        0.000
 Y      150.000                Y        0.000
 Z      450.000                Z        0.000
 C        0.000                C        0.000
 A        0.000                A        0.000
 B       50.000                B        0.000

●WORKING POS                  ●SPINDLE LOAD METER
 X      200.000                □□□□□□□□□□□□□□□□□□□□
 Y      200.000                0%            100%
 Z      300.000               ●MAGAZN
 C        0.000                TOOL NO.          01
 A        0.000                NEXT TOOL NO.
 B        0.000                POT NO.           06

●CUTTING
 FEED R.    POSTNG
 S. SPEED          0 min⁻¹

●INNR PLT NO. 2

            PREVIOUS PAGE  :  ENLARGEMENT
            NEXT PAGE      :  MODAL

 C          A          B
 AXIS       AXIS       AXIS
 F0         F1         F2         F3         F4
```

2.2.2 Arbitrary Indexing (rotation axis (Index Table) positioning)

To position B-axis at 45°:
The same applies to axis A.

1. Press **[MDI]** key to enter the MDI operation mode and display the block operation screen.
2. Set the cursor to "AXIS MOVE" Input "0" (0 : DESIGNATE POS) and press **[EOB/ENTER]** key.
3. Set the cursor to "B." Input "45" and press **[EOB/ENTER]** key.
4. Set the cursor to "FEED." Input "0" (0 : POSITIONING) and press **[EOB/ENTER]** key.
5. Press START switch.
   B-axis rotates at high speed and stops at 45°.
6. Press **[POS]** key to display the current position screen. Check that the B-axis working coordinates are positioned at 45°. (Screen 5)

Screen 5

```
(PROGRAM 1000)                          PRESENT POS

●MACHINE POS                  ●RESIDUAL MOVEMENT
 X      100.000                 X        0.000
 Y      150.000                 Y        0.000
 Z      450.000                 Z        0.000
 C        0.000                 C        0.000
 A       80.000                 A        0.000
 B       95.000                 B        0.000

●WORKING POS                  ●SPINDLE LOAD METER
 X      200.000                 □□□□□□□□□□□□□□□□□□□□
 Y      200.000                 0%            100%
 Z      300.000               ●MAGAZN
 C        0.000                 TOOL NO.          01
 A        0.000                 NEXT TOOL NO.
 B       45.000                 POT NO.           06

●CUTTING
 FEED R.    POSTNG
 S. SPEED          0 min-1

●INNR PLT NO. 2

            PREVIOUS PAGE  :  ENLARGEMENT
            NEXT PAGE      :  MODAL

 C          A          B
 AXIS       AXIS       AXIS
 F0         F1         F2         F3         F4
```

2.2.3 Arbitrary Indexing (cutting movement)

To feed axis B to 180-degree position. The same applies to axis A.

1. Press **[MDI]** key to enter the MDI operation mode and display the block operation screen.
2. Set the cursor to "AXIS MOVE." Input "0" (0 : DESIGNATE POS) and press **[EOB/ENTER]** key.
3. Set the cursor to "B." Input "180" and press **[EOB/ENTER]** key.
4. A message inquiring about the radius appears on the screen.
   To enter 50 mm, input "50" and press **[EOB/ENTER]** key.
5. Set the cursor to "FEED." Input "1" (1 : CUTTING) and press **[EOB/ENTER]** key.
6. Set the cursor to "FEEDRATE."
   Input "200" and press **[EOB/ENTER]** key.
7. Press START switch.
   B-axis rotates 180ß in the positive direction at the feedrate thus specified.
8. Press **[POS]** key to display the current position screen.
   Check that the current B-axis position is 180.000. (Screen 6)

CAUTION
"Limit over" alarm may occur depending on "YES" or "NO" of B-AXIS STROKE setting.
(Reference) Refer to Section 2-1, MDI operation input data.

9

Screen 6

```
(PROGRAM 1000)                          PRESENT POS

●MACHINE POS                  ●RESIDUAL MOVEMENT
 X      100.000                X        0.000
 Y      150.000                Y        0.000
 Z      450.000                Z        0.000
 C        0.000                C        0.000
 A       80.000                A        0.000
 B       95.000                B        0.000

●WORKING POS                  ●SPINDLE LOAD METER
 X      200.000                □□□□□□□□□□□□□□□□□□□□
 Y      200.000                0%            100%
 Z      300.000               ●MAGAZN
 C        0.000                TOOL NO.        01
 A        0.000                NEXT TOOL NO.
 B       45.000                POT NO.         06

●CUTTING
 FEED R.    POSTNG
 S. SPEED        0 min⁻¹

●INNR PLT NO. 2

          PREVIOUS PAGE  :  ENLARGEMENT
          NEXT PAGE      :  MODAL

 C        A        B
 AXIS     AXIS     AXIS
 F0       F1       F2       F3       F4
```

9

3 Rotation axis (Index Table) Parameter Setting

For parameter initial setting values of axes 4, 5, and 6 and their input range, refer to **[DATA BANK MENU]** -> **[USER PARAMETER]** -> **[2. SYSTEM 2]**.
Axes 4, 5 and 6 are assigned to axes A, B, and C from the **[DATA BANK MENU]** screen -> **[6. MACHINE PARAMETER]** -> **[2. SYSTEM 2]**.

4 Program To Use Index Table

4.1 Creation of machining data to use Index Table

When creating new machining data, use of index table can be specified in the program by designating the machining zero point of axes A and B (entering a numerical value other than '?').

NOTE:
Place the index table positioning command before the cutting command in the program file.

4.2 Rotation axis (Index Table) working zero position

For Rotation axis only a working zero position can be set at the head of the program. Specify one of the points in the machine coordinates as the working zero position.

Screen 9

```
(PROGRAM 1000)                    MACHINING DATA
●ZERO P ■X          0.000         ■Y          0.000
        ■Z          0.000
        ■A                        ■B         90.000
●TOOL RETURN HEIGHT               ■HI
●NO. OF WORK PIECES               ■NO.
●WORKPIECE MATERIAL
■MAIN PROGARM END
■SUB PROGRAM END

A/? →_
  -9999.999~9999.999

F0 EDIT      PREV.    NEXT     JOB      JOB
   END       JOB      JOB      IN       OUT
   MODE
   F0        F1       F2       F3       F4
```

Ex.) To specify 90° as this, input "90." and press **[EOB/ENTER]** key. (Screen 9)

To set rotation axis working zero there are two methods: one is the direct input of numerical value as shown above and the other is the input of the numerical value representing the current Rotation axis position itself.

<Method to set B-axis working zero>

1. Press **[MANU]** key to enter the manual operation mode.
2. Manually rotate B-axis to the working zero position wanted to set anew.
3. Press **[EDIT]** key to enter the program editing mode and display the **[EDIT]** screen.
4. Input "1" (= machining data) and press **[EOB/ENTER]** key.
5. Input the program number and press **[EOB/ENTER]** key.
6. Set the cursor to "WORKING ZERO POSITION B."
7. Press **[W.Z.SET]** key.
8. Check the value representing the working zero position displayed on screen. To apply this value, enter **[F0]**. To quit it, press **[F1]**. (Screen 10)
   Check that the B-axis coordinate value is the same as specified on screen 10. (Screen 11)

Screen 10

```
(PROGRAM 1000)     WORKING ZERO BETTING
●MACHINE POSITION
          0.000
  B      45.000

●CURRENT WORKING    ●WORKING ZERO POS
 ZERO POSITION       AFTER SETTING
 B  ■■■■■■■■■■            0.000
                     B   45.000
      SETTING OK?

   B1      B2      NO
   YES     YES
   F0      F1      F2      F3      F4
```

Screen 11

```
(PROGRAM 1000)              MACHINING DATA
●ZERO P ■X          0.000 ■Y        0.000
        ■Z          0.000
        □A         90.000 ■B       45.000
●TOOL RETURN HEIGHT       ■HI
●NO. OF WORK PIECES       ■NO.
●WORKPIECE MATERIAL
■MAIN PROGARM END
■SUB PROGRAM END

A/? →_
  -9999.999~9999.999

   EDIT    PREV.   NEXT    JOB     JOB
   END     JOB     JOB     IN      OUT
   MODE
   F0      F1      F2      F3      F4
```

9

4.3 Rotation axis (Index Table) indexing plane setting job

To use rotation axis, specify "JOB 14 COORDINATE SET." The Rotation axis indexing plane angle can be specified only in this job. Settings made in this job remain valid for all machining processes until the subsequent rotation axis indexing plane is set.
Before operate the cutting work, surely indexing.
When the index table is already indexed at the end of the program, set the indexing angle for the same position before cutting work.

Screen 12

```
(PROGRAM 1000)  JOB01          MACHINING DATA
■JOB 01 COORDINATE SET         ■MSR NO.          ?
        ■CODE              ?
 ●ANGLE ■A                 ?   ■B                ?
 ●ZERO P■X          -100.000   ■Y          -50.000
        ■Z           150.000
 ●TOOL RETURN (CODE)            ■Hc          2.000
 ●TOOL RETURN (JOB)             ■Hj          2.000
 ●ROTATE■ANGLE             ?
  CENTER■X                 ?   ■Y               ?
■JOB 02 CBOR TAP                ■TORSION        RH
 ●THRAD M2.000×0.400            ■CBORφ       5.000
        ■CBORD        2.000    ■DRLD        8.000
        ■CHAMER       0.000
 ●PATRN POINT
 ●ZPOS  ■B.H.          BLIND   ■DEP         5.000
        ■HGT          30.000   ■Ht         33.000

A/? →_

  ?:SAME AS FORMER.  B-AX COORD SET ANGL
E
  0.000~359.999

                                SERCH:JOB/LINE

   EDIT      PREV.    NEXT     JOB      JOB
   END       JOB      JOB      IN       OUT
   MODE
   F0        F1       F2       F3       F4
```

The screen upper shows an example data input related to the B-axis indexing plane.
The same spplies to axis A.

4.3.1 Angle

Specify rotation axis indexing angle within the range of 0 to 359.999ß. The minus sign is not allowed to use. Specify the angle in absolute value.
In transferring a B-axis indexing plane to the next. B-axis is automatically indexed at the angle specified herein. With not a numerical value but "?" input, the angle takes the same value as the one for B-axis indexing at one job before. If B-axis indexing is not executed at one job before, input of "?" does not commence indexing. The same applies to axis A.

JOB 01 B-axis indexing Angle 0.000	0-2-10 Machining process	JOB 11 B-axis indexing Angle 90.000	12-20 Machining process	JOB 21 B-axis indexing Angle 180.000	21-30 Machining process	JOB 31 B-axis indexing Angle ?	32- Machining process
Indexing carried out at 0°and machining started		Indexing carried out at 90°and machining started		Indexing carried out at 180°and machining started		Machining continued at 180°	

CAUTION
B-axis always rotates toward the shorter path. When the rotational angle is the same in either positive or negative direction (e.g., 180°), the axis rotates toward positive.
When "STROKE B (0: NO; 1: YES)" is "1: YES," the axis may rotate in the farther direction by virtue of the +B/-B stroke limit or "Limit over" alarm may occur.
Refer to Section 2-1, MDI operation.

9

4.3.2 Working zero position

This is the zero position to be referred to for machining at the rotation axis indexing angle specified. Specify the value of the zero position as relative amount from the working zero position placed at the head of the program.

Example machining on screen 13

Example machining on screen 14

Screen 13

```
(PROGRAM 1000)                    MACHINING DATA
●ZERO P ■X              0.000  ■Y              0.000
        ■Z              0.000
        ■A                  ?  ■B             90.000
●TOOL RETURN HEGHT             ■Hj          200.000
●NO. OF WORK PIECES            ■NO.                1
●WORKPIECE MATERIAL            SOFT STEEL
■JOB 01 COORDINATE SET         ■MSR NO.            ?
        ■CODE               ?
 ●ANGLE ■A                  ?  ■B              0.000
 ●ZERO P■X          -100.000  ■Y            -50.000
        ■Z           150.000
 ●TOOL RETURN (CODE)           ■Hc            15.000
 ●TOOL RETURN (JOB)            ■Hj             2.000
 ●ROTATE■ANGLE              ?
  CENTER■X                  ?  ■Y                  ?
■JOB 02 CBOR TAP               ■TORSION          RH

X →_

                                SERCH:JOB/LINE

  EDIT     PREV.    NEXT    JOB     JOB
  END      JOB      JOB     IN      OUT
  MODE
  F0       F1       F2      F3      F4
```

Screen 14

```
(PROGRAM 1000)                    MACHINING DATA
●ZERO P ■X              0.000  ■Y              0.000
        ■Z              0.000
        ■A                  ?  ■B             90.000
●TOOL RETURN HEGHT             ■Hj          200.000
●NO. OF WORK PIECES            ■NO.                1
●WORKPIECE MATERIAL            SOFT STEEL
■JOB 01 COORDINATE SET         ■MSR NO.            ?
        ■CODE               ?
 ●ANGLE ■A                  ?  ■B              0.000
 ●ZERO P■X           -80.000  ■Y            -50.000
        ■Z           150.000
 ●TOOL RETURN (CODE)           ■Hc            15.000
 ●TOOL RETURN (JOB)            ■Hj             2.000
 ●ROTATE■ANGLE              ?
  CENTER■X                  ?  ■Y                  ?
■JOB 02 CBOR TAP               ■TORSION          RH

Y/? →_

  ?:SAME AS FORMER WORKING ZERO POINT

                                SERCH:JOB/LINE

  EDIT     PREV.    NEXT    JOB     JOB
  END      JOB      JOB     IN      OUT
  MODE
  F0       F1       F2      F3      F4
```

NOTE:

With not a numerical value but "?" specified, the working zero position value takes the same value as the one for B-axis indexing at one job before. If B-axis indexing is not executed at one job before, input of "?" gives the same value as the one for the B-axis working zero position placed at the head of the program.

4.3.3 Indexing return height

This is the height to which Z-axis should return and at which B-axis can carry out indexing, moving itself to the indexing plane on either positive or negative side adjacent to the axis. Specify the height as relative value from the Z-axis working zero position.
The height should be the maximum of possible heights to which the axis returns after indexing carried out while it sweeps over the indexing angle, moving from an indexing plane to another.

In the case of the workpiece shown above

1) In indexing from 0° to 90°, indexing return height B applies since this at 90° is greater than indexing return height A at 0°.

2) In indexing from 0° to 270° plane, indexing return height A applies since this is greater than D.

NOTE:

1. For an indexing angle, only one indexing return height can be set.

If more than one indexing angle settings exist and if those settings have different indexing return heights from each other, the maximum of those heights is specified as the indexing return height to be sought.
The illustaration below shows an example of axis B. This also applies to axis A.

1st B-axis indexing plane setting

2nd B-axis indexing plane setting

3rd B-axis indexing plane setting

In this example above, the indexing return height for indexing at 90° is C, the greatest.

2. With not a numerical value but "?" specified, the indexing return height takes the same value as the one for B-axis indexing at one job before.
If B-axis indexing is not executed at one job before, input of "?" gives the same value as the tool return height placed at the head of the program.

4.3.4 Tool return

This is the height to which Z-axis should return when the machining process changes from one to another in the coordinate set job. Specify the height as relative value from the Z-axis working zero position.

Ex.)
For tool return during B-axis indexing plane setting at 0°, specify height A.

NOTE:
The illustaration below shows an example of axis B. This also applies to A.

1. With not a numerical value but "?" specified, the indexing return height takes the same value as the one for B-axis indexing at one job before. If B-axis indexing is not executed at one job before, input of "?" gives the same value as the tool return height placed at the head of the program.

2. Movement among workpieces within a same indexing plane setting job is as illustrated below.

As shown above, even when the tool is moved within a same coordinate set job (e.g., 0°), Z-axis returns to the maximum possible return height for that coordinate set job for the sake of safety. This is because during tool movement there is a likelihood that the tool interferes with other workpieces in different B-axis indexing plane setting jobs, depending on their arrangement and machining sequence.

Indexing plane angle 0°	Portion A	JOB 01: B-axis Indexing plane setting : angle 0.000 : Tool return : 100.000 :
		JOB 02: drilling
		JOB 03: tapping
		JOB 04 : tapping
	Portion B	JOB 05 : B-AXIS Indexing plane setting : angle 0.000 : Tool return : 150.000 :
		JOB 06 : drilling
		JOB 07: drilling

4.3.5 Return for tool change

Return height for tool change in the process for setting the B-axis indexing plane as already set in the program can be specified according to a height from the Z-axis working zero position.
When setting the Z-axis height, be sure that there will be no interference between a tool and a workpiece or ATC in rotation and jigs.

Tool withdraw amount of 50mm should be added to the return height in actual tool change.(A+50mm)

0901.ai
0902.ai

Set the height as shown for the return height for the tool change in the process for setting the B-axis indexing plane at 0° .

1) When a return height for the tool change is set lower than a return height between process, the latter value will be effective to be on the safe side.

2) When the process other than the process for setting the B-axis indexing plane is to be executed along with a tool change motion:

(i) The max. return height for tool change at the same indexing plane angle will be effective in case that B-axis indexing plane angle in the next process is the same.

(ii) When the B-axis indexing plane in the next process is different, the larger value of either a return height between coordinates or a return height for tool change will be effective.

3) When [?] is specified instead of numerical values, the return height for tool change set in the previous process for setting the B-axis indexing plane will be effective.

4) Return height for the tool change can be specified by checking RUNNING PREPARATION MENU(4.ATC RETURN HEIGHT) in the beginning of the machining data.

4.3.6 Job 10 AXIS MOVEMENT and rotation axis

B-axis movement can be set as part of machining data.

1. Input "10" (JOB 10 AXIS MOVEMENT) and press **[EOB/ENTER]** key.
2. Choose required items from those which are displayed in the guide data area as shown below and **[EOB/ENTER]** key. (Screen 15)

Screen 15

```
(PROGRAM 1000)  JOB12      MACHINING DATA
■JOB 01 AXIS MOVEMENT      ■POS XY-DESIGN
        ■X      -150.000   ■Y    -100.000
■JOB 02 AXIS MOVEMENT      ■POS M. ZERO
■JOB 03 AXIS MOVEMENT      ■POS W. ZERO
■JOB 04 AXIS MOVEMENT      ■POS M. ZERO (Z)
■JOB 05 AXIS MOVEMENT      ■POS Z-DESIGN
        ■Z        50.000
■JOB 06 AXIS MOVEMENT      ■POS M. ZERO (B)
■JOB 07 AXIS MOVEMENT      ■POS W. ZERO
■JOB 08 AXIS MOVEMENT      ■POS ANG DSG B
        ■B       100.000
■JOB 09 AXIS MOVEMENT      ■POS M. ZERO (A)
■JOB 10 AXIS MOVEMENT      ■POS W. ZERO (A)
■JOB 02 AXIS MOVEMENT      ■POS ANG DSG A
        ■A         0.000
■JOB 12 AXIS MOVEMENT        POS

TYPE OF MOVEMENT →_■
1. XY-DESIGNATE      6. M. ZERO RETURN (B)
2. M. ZERO RETURN    7. W. ZERO RETURN (B)
3. W. ZERO RETURN    8. ANGLE DESIGNATION B
4. M. ZERO RETURN (Z)
5. Z-DESIGNATE            NEXT MENU

  EDIT     PREV.    NEXT     JOB      JOB
  END      JOB      JOB      IN       OUT
  MODE

  F0       F1       F2       F3       F4
```

6. MACHINING ZERO RETURN (B)
7. WORKING ZERO RETURN (B)
8. ANGLE DESIGNATION B
11. MACHINING ZERO RETURN (A)
press
12. WORKING ZERO RETURN (A)
13. ANGLE DESINGANTION A

(Reference)
For methods for B-axis machine and working zero returns and the turning direction toward the specified angle, refer to Section 1-2, manual operation and Section 2-1, Input data for MDI operation.

4.4 Motion program

4.4.1 Classification of rotation axis (Index Table) operations

The following operation programs to use B-axis are added as follows.

1. Positioning group of operation

Operation Item To Be within	Operation Call Job	Description
MACHINING ZERO RETURN (A)		This turning A-axis to return to machine zero. **NOTE:** **The turning direction and angle of A-axis in returning to machine zero differ depending on the setting of "STROKE A".** **Refer to Section 2-1, Input data for MDI operation.**
WORKING ZERO RETURN (A)		This allows B-axis to return to working zero. **NOTE:** **The turning direction and angle of B-axis in returning to working zero differ depending on the setting of "STROKE B".** **Refer to Section 2-1, Input data for MDI operation.**
MACHINING ZERO RETURN (B)		This allows B-axis to return to working zero. **NOTE:** **The turning direction and angle of B-axis in returning to working zero differ depending on the setting of "STROKE B".** **Refer to Section 2-1, Input data for MDI operation.**
WORKING ZERO RETURN (B)		This allows B-axis to return to working zero. **NOTE:** **The turning direction and angle of B-axis in returning to working zero differ depending on the setting of "STROKE B".** **Refer to Section 2-1, Input data for MDI operation.**
AXIS	Arbitrary three axes of X, Y, Z and B	This positions the tool at the coordinate determined by the specified three axes.
AXIS + SPINDLE	Arbitrary two axes of X, Y, Z and B, direction and rotation speed.	This permits positioning at the coordinates determined by the specified three axes, concurrently turning the spindle.

9

2. Cutting group of operation

Operation	Item To Be within Operation Call Job	Description
AXIS	X, Y, Z, A and B Feed Radius	This allows the axis to move for cutting to the specified position at the specified feedrate. Applicable axes axis combination -When two axes are specified : XY, XZ, YZ, XB, YB, ZB, XA, YA, ZA -When a axis is specified : X, Y, Z, A and B
AXIS +SPINDLE	X, Y, Z, A and B. X and Y-directions, rotational speed, feed and radius.	This allows the axis to move for cutting to the specified position at the specified feedrate, concurrently turning the spindle. Applicable axes and axis combination -When two axes are specified : XY, XZ, YZ, XB, YB, ZB, XA, YA, ZA -When a axis is specified : X, Y, Z, A and B

Numerical value setting range in operation programs

Item	Input range
A	POSITIONING (ABSOLUTE) 0~359.999 POSITIONING (INCREMENTAL) -9999.999~9999.999 CUTTING (ABSOLUTE) -359.999~359.999 CUTTING (INCREMENTAL) -9999.999~9999.999
B	POSITIONING (ABSOLUTE) 0~359.999 POSITIONING (INCREMENTAL) -9999.999~9999.999 CUTTING (ABSOLUTE) -359.999~359.999 CUTTING (INCREMENTAL) -9999.999~9999.999
RAD	0.001~999..999

NOTE:
Upon receipt of incremental command for positioning or cutting, Rotation axis rotates to the commanded amount (the axis does not rotate toward the shorter path).
The illustration below shows an example of axis B
This also applies to axis A.

B-axis working coordinate

4.4.2 Rotation axis (Index Table) cutting specification in motion

The feedrate is expressed in mm/min.

NOTE
Rotation axis turning direction and speed during cutting differ depending on the presence or absence of the minus sign and the setting of user parameter (switch 2) " STROKE B (0: NO 1: YES) ".
Refer to Section 2-1, Input data for MDI operation.

NOTE:
The calculation method for the B-axis rotational speed from the specified feedrate is as follows. This also applies to Axis A.

Deg: B-axis rotation speed (degree/min)
N: B-axis rotation speed (rpm)
C: feedrate (mm/min)
p: circular constant
R: cutting plane radius (mm)

Deg (degree/min) = 180 × F / π × R N (rpm) = F / 2× π × R

4.5 Current position screen

With regards to an optional axis assigned to an axis, when '1' is set for machine parameter 2 (system 2) and axis B is mounted correctly, the present coordinate value of axis B is displayed on the <PRESENT POSITION> screen. (The same applies to axes A and C.) (Screen 18)

Since rotation axis constitutes a rotational coordinate system, the method to indicate the axis differs from that for X, Y and Z-axes.

Screen 18

```
(PROGRAM 6000)                    PRESENT POS

●MACHINE POS                  ●RESIDUAL MOVEMENT
 X          0.000              X          0.000
 Y          0.000              Y          0.000
 Z        550.000              Z          0.000
 C          0.000              C          0.000
 A          0.000              A          0.000
 B          0.000              B          0.000

●WORKING POS                  ●SPINDLE LOAD METER
 X          0.000               □□□□□□□□□□□□□□□□□□□□
 Y          0.000              0%            100%
 Z        400.000            ●MAGAZN
 C          0.000              TOOL NO.          01
 A          0.000              NEXT TOOL NO.
 B          0.000              POT NO.           08

●CUTTING
 FEED R.    POSTNG
 S. SPEED          0 min⁻¹

●INNR PLT NO. 2

            PREVIOUS PAGE  :  ENLARGEMENT
            NEXT PAGE      :  MODAL

  C          A          B
 AXIS       AXIS       AXIS
 F0         F1         F2         F3         F4
```

The indication method differs depending on the stroke of axes 4, 5 and 6 set for user parameter 2 (switch 2).

1) When "STROKE B" is "0: NO" (The same applies to axis A.)

In both machine and working coordinates the current B-axis position is indicated within the range of 0 to 359.999°.

NOTE:
Whether machine or working, zero positions exist every 360°.

2) When " STROKE B " is "1: YES" (The same applies to axis A)

The current B-axis position is indicated within the range of -9999.999 to 9999.999° in the machine coordinates and 0 to 359.999° in the working coordinates.

NOTE:
The machine zero position exists for the dog type zero return only and the working zero position exists only when working coordinates are determined in the machine coordinates.

4.6 A-axis and B-axis provided with the clamp mechanism

4.6.1 A axis and B axis rotation (servo off type when clamped B axis)

To rotate B-axis, follow the procedures below. (The same applies to axis A.)

1. Unclamp B-axis. With this, B-axis servo turns on.
2. Wait for "WAITING TIME AFT B UNCLAMPED " (machine parameter 2 (system 2)) elapsed from the moment the unclamp check signal is input.
3. Rotate B-axis.
4. After rotation, wait for "WAITING TIME AFT B POSITIONING " (machine parameter 2 (system 2))
5. ClampB-axis.
6. Wait for "WAITING TIME AFT B CLAMPED " (machine parameter 2 (system 2)) from the moment the clamp check signal is input.
7. B-axis servo turns off. (Operation completed)

4.6.2 A axis and B axis rotation (Servo on type when clamped B axis)

To rotate B-axis, follow the procedures below (the same applies to axis A).

1. UnclampB-axis.
2. Wait for "WAITING TIME AFT B UNCLAMPED" (machine parameter 2 (system 2)) elapsed from the unclamp check signal is input.
3. Rotate B-axis.
4. After rotation, wait for "WAITING TIME AFT B POSITIONNG" (machine parameter 2 (system 2))
5. ClampB-axis.
6. Wait for "WAITING TIME AFT B CLAMPED" (machine parameter 2 (system 2)) from the moment the clamp check signal is input.

NOTE:
When B-axis rotation and tool replacement occur at the same time or when the operation following B-axis rotation is other than cutting, B-axis unclamping and clamping may operate at the same time as other operation.

4.6.3 Operation with rotation axis remaining unclamped

Although B-axis is normally unclamped when not in use, if signal output 440 (B-axis unclamp command) is specified, B-axis can be operated with itself remaining

Code	Explanation
440	B-axis is unclamped. Once B-axis is thus unclamped, the axis unclamping and clamping are not automatically controlled. (B-axis remains unclamped.)
441	B-axis is clamped. Once B-axis is thus unclamped., the axis unclamping and clamping are not automatically controlled.
442	A-axis is unclamped. Once B-axis is thus unclamped, the axis unclamping and clamping are not automatically controlled. (A-axis remains unclamped.)
443	A-axis is clamped. Once A-axis is thus clamped, the axis unclamping and clamping are automatically controlled.

Signal outputs 440, 441, 442, and 443 can be specified via "PRE-/POST-CUTTING AUXILIARY FUNCTION" in "AUXILIARY FUNCTION" and "TOOL ALLOTMENT" in the "SIGNAL OUTPUT JOB" and "OPERATION CALL JOB."

If either of the following is carried out during execution of signal output 440 (B-axis unclamp command), B-axis is clamped, subsequently maintaining the same condition as signal output 441 is executed. The same applies to axis A.
- Execute operation to terminate the program;
- Press **[RESET]** key;
- Reset operation;

Set the beginning point.
Execute zero return, tool replacement and the like in the manual or MDI mode.

Sample program

Program head

```
(PROGRAM 1000)          MACHINING DATA
●WORKING    ■X      0.000    ■Y       0.000
 ZERO PO    ■Z      0.000    ■B       0.000
●TOOL RETURN HEIGHT  ■HI   200.000
●NO. OF WORK PIECES  ■NO.        1
●WORKPIECE MATERIAL      ALUMINUM
```

Program for machining plane 1, 0°

```
(PROGRAM 1000) JOB01bbbbMACHINING DATA
■JOB 01 B INDEX SET  ■ANGLE 180.000
●WORKING             ■X -100.000
                     ■Y-50.000
 ZERO PO             ■Z  150.000
●INDEX RETURN        ■Hi      15.000
●TOOL RETURN(JOB)    ■Hj       2.000
■JOB 02 CBOR TAP     ■TORSION RH
●THRAD M2.000×0.400  ■CBORΦ    5.000
                 ■CHMFR 0.000
●PATRN LINE          ■N.M.        2
          ■S.A.  0.000  ■PITCH  20.000
●ZPOS     ■B.H.  BLIND  ■DEP     5.000

          ■HGT   0.000  ■Ht      2.000
●XYPOS    ■X    10.000  ■Y      10.000
●P.F.     ■P,S,R,100%   ■FEED R.  100%

■JOB 03 HOLE         ■HOLE     5.000
                 ■CHMFR 0.000
●PATRN POINT
●ZPOS     ■B.H.  BLIND  ■DEP     5.000

          ■HGT   0.000  ■Ht      2.000
●XYPOS    ■X    20.000  ■Y      10.000
●P.F.     ■P,S,R,100%   ■FEED R.  100%
```

40
[JOB 02 tapping]
M2P04 depth 5
0° plane
10
10
10
10
Ø 5
DepthØ5 [JOB 03 drilling]

20
20
10
90°° plane
M2P0.4 counterbore diam.
Ø5[JOB 05 tapping for
counterbore]
10

9

[JOB 07 tapping]
M2P0.4depth 5
40
[JOB 08 drilling]
Ø5 depth 5
20
10
180° plane
10
10
10
10
270° plane

20
[JOB 10 tapping for counterbore]
M2P0.4 counterbore diam. Ø5
20
10
10

Tool return
Indexing return
position 15 Z
15
Z-axis
working zero
position
2
B-axis (Index Table)
rotation center

Program for machining plane 2, 90°

```
■JOB 04 B INDEX SET      ■ANGLE   90.000
 ●WORKING■X   -50.000    ■Y      -50.000
  ZERO PO■Z   150.000
 ●INDEX RETURN           ■Hi       5.000
 ●TOOL RETURN(JOB)       ■Hj       2.000
-----------------------------------------
■JOB 05 CBOR TAP         ■TORSION RH
 ●THRAD M2.000×0.400     ■CBORΦ    5.000
          ■CBORD 2.000
          ■CRLD    8.000
          ■CHAMFR0.000
 ●PATRN POINT
 ●ZPOS   ■B.H. BLIND     ■DEP      5.000
         ■HGT   0.000    ■Ht       2.000
 ●XYPOS  ■X    10.000    ■Y       10.000
 ●P.F.   ■P,S,R,100%     ■FEED R.   100%
```

9

Program for machining plane 3, 180°

```
■JOB 06 B INDEX SET        ■ANGLE 180.000
 ●WORKING■X -100.000       ■Y     -50.000
  ZERO PO■Z  150.000
 ●INDEX RETURN             ■Hi     15.000
 ●TOOL RETURN (JOB)        ■Hj      2.000
-------------------------------------------
■JOB 07 TAP                ■TORSION RH
 ●THRAD M2.000×0.400       ■CRLD    5.000
                           ■CHAMFR  0.000
 ●PATRN POINT
 ●ZPOS    ■B.H.  BLIND     ■DEP     5.000
          ■HGT   0.000     ■Ht      2.000
 ●XYPOS   ■X    20.000     ■Y      10.000
 ●P.F.    ■P,S,R,100%      ■FEED R.  100%

■JOB 08 HOLE               ■HOLE    5.000
                           ■CHAMFR0.000
 ●PATRN LINE               ■N.M.       2
          ■S.A.  0.000     ■PITCH  20.000
 ●ZPOS    ■B.H.  BLIND     ■DEP     5.000
          ■HGT   0.000     ■Ht      2.000
 ●XYPOS   ■X    10.000     ■Y      10.000
 ●P.F.    ■P,S,R,100%      ■FEED R.  100%
```

Program for machining plane 4, 270°

```
■JOB 09 B INDEX SET      ■ANGLE 270.000
 ●WORKING■X  -80.000     ■Y     -50.000
  ZERO PO                ■Z    150.000
 ●INDEX RETURN           ■Hi      5.000
 ●TOOL RETURN(JOB)       ■Hj      2.000
-----------------------------------------
■JOB 05 CBOR TAP         ■TORSION RH
 ●THRAD M2.000×0.400     ■CBORΦ   5.000
        ■CBORD 2.000     ■CRLD    8.000
        ■CHAMFR0.000
 ●PATRN POINT
 ●ZPOS   ■B.H. BLIND     ■DEP     5.000
         ■HGT  0.000     ■Ht      2.000
 ●XYPOS  ■X   10.000     ■Y      10.000
 ●P.F.   ■P,S,R,100%     ■FEED R.   100%
```

(This page is a blank.)

CHAPTER 9 (10)

Z AXIS MEASUREMENT SYSTEM

1 Cautions
2 Installation
3 Parameter
4 Z-axis Thermal Displacement Offset
5 Tool Breakage Detection
6 Automatic Tool Length Measurement

Appendix.
Alarm list (Z Axis Measurement System)

1 Cautions

We thank you very much for your purchase of Z-axis Measurement System (hereinafter "the product"). The following sections describe the features, parts configuration, precautions on use and compatibility between data bank and machining data of the product and important points in your studying this manual.

Precaution

M406 signal is used for air blow. This signal cannot be used for other purposes.
The tool length measurement device is used fastened on the sub-table.
This decreases available surface area of the table. In installing workpieces and jigs, exercise due care not to strike the tool length measurement device.
Take the same care in removing these.
Make sure of the Z-axis position. Inaccurate positioning may cause collision with the tool length measurement device, workpieces and jigs.
After use, remove chips and other debris depositing inside the cover.
Particularly be sure to thoroughly remove cutting oil and the like adhering to the contact area.

Feature

This product precisely detects the Z-axis position of the tool tip. This function permits three functions: Z-axis thermal displacement offset, tool breakage detection and automatic tool length measurement. The tool length detector is used for detection. The following are the brief description of each function.

9

Z-axis thermal displacement offset:

Restricts dimensional displacement due to Z-axis elongation within a given range. Displacement is measured to correct the machine position. Measurement is executed with signal output.

Tool breakage detection:

Detects tool breakage during operation. Tool breakage detection is executed with signal output.

Automatic tool length measurement:

Permits the measurement of tool length with the tool remaining set on the spindle. A maximum of 10 tools can be measured. You can enter the automatic tool length measurement mode on the block operation screen for the MDI operation mode.

Parts Configuration

The product includes the following parts. Check for the numbers. If anything is missing, please contact us at the store where you bought the product or a nearby branch of our company.

Instruction manual :	1 copy
Tool length measurement device :	1 unit
Relay plate :	1 pc
M10 bolt :	2 pcs
Flat washer :	2 pcs
T-slot nut :	2 pcs
Electric wire :	1 pc
Reference tool :	1 pc

Data Compatibility

Data compatibility between a machine with the function of this product and another without is as follows. The list below shows compatible data. Data 1 thru 5 are in the data bank. Data 6 was prepared by the user.

[Data list]

Of these data the parameter has been added as a result of function addition. The additional function is as follows.

1. TOOL MENU
2. TOOL PATTERN
3. HOLE SIZES BEFORE TAPPING
4. CUTTING CONDITION
5. PARAMETER
6. MACHINING DATA

Transmission from a machine without the function to another with:

Parameters related to this function are read as blank (unset condition).

Transmission from a machine with this function to another without:

All parameters are read.

9

Important Points in Studying the Manual

If you use a single function only, read the description of that function, tool length measurement device installation method and parameters. In setting parameters, choose only those which are required for the function. Alarm codes are listed at the end with alarm causes and remedy therefore provided. Use the list in the event of alarm.

Technical Terms

In this manual alarm messages, parameters and operation indications are written in capitals. In explaining key operation key names are written in capitals as well and enclosed in **[ ]** as shown below.

Example for indicating key operation

"Press **[RESET]** key." Since "reset" is the key name, it is enclosed in **[ ]**.

2 Installation

This chapter describes the installations of the tool length measurement device, reference tool and relay plate, connection. Although the product can be used for three different purposes, the installation method for the tool length measurement device is the same.

2.1 Installation of the Tool Length Measurement Device

The diagram below shows the names of parts of the measurement device.

Setting the measurement device in place

Place the tool length measurement device so that it does not contact jigs and tools on the table. Consider the position of the tool that it is assumed to take during working.
Do not allow the measurement device air tubes and cables to enter the spindle center movement range. Pass them on the right side of the table.
Place the contact area inside the the cover within the spindle center move ment range (see the diagram).
The relay plate installation position differs depending on whether the tool length measurement device is placed on the right side of the table.

W002. pict

Fastening the tool length measurement device

Fasten the measurement device to the table using provided M10 hexagonal bolts and nuts, two sets, and two flat washers. Using the holes provided on the installation stage of the measurement device, fasten at two points.
When installing the measurement device on a jig, drill tapped holes or the like for installation.

W003. pict

Height of the workpiece jig and tool length measurement device

It is advisable to adjust the height of these for the following reasons.
When the product is used to offset Z-axis thermal displacement, the offset precision on the Z coordinate for measuring thermal displacement becomes the highest.
A good method to achieve this is to adjust the workpiece jig height of the surface to be worked. For the same reason, the length of the reference tool should be neared the length of the tool requiring precision. One of the methods to achieve this is cutting the reference tool.

2.2 Installation of Reference Tool

Install the provided reference tool in the tool holder as shown in the diagram below.

W004.pict

3 Parameter

This section describes parameters related to Z axis measurement system.
For the parameters list, refer to Chapter 5 Data bank - User parameter (Z axis measurement) in the Operation Manual.

3.1 Setting

There are a number of parameters not included in the Parameter List. The following explain such parameters.

MSMT DEV INSTALL POSITN

This sets the coordinates of the measurement device placed on the sub-table. Begin setting this 1 h or more after turning the machine power off. Heat remaining in the machine may affect operation.

Procedures

1. Install the tool length measurement device. For the method, refer to page.
2. Install the provided reference tool in the tool holder. For the method, refer to page.
3. Install 2 in the magazine.
4. Register the reference tool in the tool menu and on the magazine screen.
   In choosing the type of tool to be used, specify the centering tool in the advisable data.
   Check that the tool length value is correctly input.
5. Detaching the tool now on the spindle, attach the reference tool thereon.
   Press **[ZERO RETURN]** key.
6. In the key input mode display the block operation screen and set the coordinates required.
   Machining coordinates are as follows.
   X-axis: same as on the machine coordinates
   Y-axis: same as on the machine coordinates
   Z-axis: machine coordinates - reference tool length
7. Adjust position in manual operation. Adjust Z-axis in the increment of 0.001mm.
   X- and Y-axes: Move the reference tool tip to the center of the tool length measurement device contact face.
   Z-axis: Upon completion of X- and Y-axis positioning, adjust Z-axis as follows.
   Z-axis positioning: Display the I/O screen (slave). Descend the spindle until its tip contacts the contact face. Further descend the spindle until the numeral on the screen changes from "0" to "1."
   Input 4 FE 10
   0 0
   ↑
   Changes from "0" to "1."
8. Press **[CURRENT POSITION]** key. Note down the machining coordinates indicated on the screen.
9. Ascend Z-axis. Set the value noted down above in the parameter.
   With this the setting of measurement device installation position is completed.

9

THERMAL MEASUREMENT MOTION COND.

This sets conditions for measurement motion.

EVERY COMMAND

This specifies a series of measurement motion to be performed each time the command is issued.

WATCHING

With this parameter, measurement motion is not performed each time the command is issued, because frequent measurement is not necessary when elongation due to heat on Z-axis is constant. Based on displacement measured, the subsequent measurement motion is canceled. The premise for WATCHING is that environment of the machine remains unchanged. When room temperature is radically fluctuating and when work replacement time is not constant, WATCHING does not correctly operate. In that case set the thermal measurement motion conditions to EVERY COMMAND.

TOTL DISPMT

NUMBER OF PROGRAM
"EVERY COMMAND"

TOTL DISPMT

NUMBER OF PROGRAM
"WATCHING"

More about WATCHING

Normal operation of WATCHING requires the setting of the following parameters.

Z-AXIS MACHINING ACCURACY

THERMAL MATCH DISPLACMT AMNT

NUMBER OF THERMAL WATCHING

NO. OF THERMAL WATCHING CANCEL

INITIAL SET NO. OF THERMAL MSMT

THERMAL WATCHING STOP TIME

In setting these, although the initial set values are used as a rule, values must be changed in some cases depending on the type of works to be machined and work replacement time.

The next page presents examples of such change.

Example changing of set value

Procedures

1. Check a cycle time (work replacement time) of the machine program.
2. Set THERMAL MEASUREMENT MOTION COND. to EVERY COMMAND and begin machining.
3. Upon completion of 280 to 290 or so cycles or 1 h before the end of working hours, stop the machine for a period twice longer than work replacement time.
4. Repeat machining once again (only once).
5. Referring to the thermal measurement data on the I/O screen, set respective parameters as follows.

Z-AXIS MACHING ACCURACY

Set that machining accuracy which must be at least maintained.
The value thus set is used to only check the range of displacement, not to keep the machining accuracy within itself.

(Ex.) Set 0.020 when +/-20μ is required.

THERMAL WATCH DISPLACMT AMNT

Set about half the Z-axis MACHINING ACCURACY. The value thus set is used to judge displacement. Based on the result of judgment, update the frequency of watching.

THERMAL WATCHING STOP TIME

If displacement after work replacement time is increased twofold (displacement in 4. above) is within THERMAL WATCH DISPLACMT AMNT, set time twice longer than work replacement time.
If the value exceeds this amount, set THERMAL MEASUREMENT MOTION COND. to EVERY COMMAND. In this case presume that WATCHING is impossible.
The value set herein indicates time to initialize the watching conditions.

THERMAL WATCHING STOP TIME

This sets the number of watching motions at which displacement becomes stable within THERMAL WATCH DISPLACMT AMNT after machining is began.
The value thus set indicates the frequency of measurement unconditionally taken after machining is began.
Parameters for watching are valid for works of the same type. When the type of work is changed, change parameters as well.

Caution

Do not turn machine power off until all setting is completed. Turning power off before this causes thermal measurement data on the I/O screen to be lost.

DWELL

Use this to secure a given length of time before entering the measurement mode so as to remove chips and cutting oil.

XY POSITION RADIUS SHIFT DIRCTN, THERMAL MEASUREMENT TOOL NO. 1-5

Use this depending on the tool used.

COOLANT AUTO OPE

This sets coolant operation as to whether or not it should be automatic. Normally use automatic operation. When automatic operation is chosen, coolant is turned off during measurement motion. Coolant is returned to the original condition after measurement is completed.

SPINDLE ROTATION WN MSRING DISP

The initial set value for this is **[1: YES]**. The spindle is rotated during measurement so as to remove debris and chips. Do not change this setting since it affects measuring accuracy. However, when other tools than the provided reference tool are used for measurement, set the initial set value to **[0: NO]**. If the spindle is caused to rotate during measurement with general tools, the spindle may collide with the jigs and tool length measurement device.

THRM OFFSET AMT LIMIT VALUE, RETRACT AMNT AFT MEASUREMENT

Do not change this unless special reasons are justified.

MSMT FEEDRATE B TOOL DIAMTR

For measurement feedrates 1 and 2, A or B applies depending on the tool diameter. This parameter sets the diameter of a tool to which feedrate B applies.

MEASUREMENT FEEDRATE 1 A, MEASUREMENT FEEDRATE 2 A

Set a feedrate not to cause tool breakage. When a tool with a small diameter is caused to contact the tool length measurement device, choose the slower rate. Otherwise the tool may break.

MEASUREMENT FEEDRATE 1 B, MEASUREMENT FEEDRATE 2 B

Set this to 3,000 mm/min or lower. Setting of a larger value than this may break the tool length measurement device.

MEASUREMENT FEEDRATE 2 A, MEASUREMENT FEEDRATE 2 B, THERMAL MEASUREMENT FEEDRATE

Set this to 50 mm/min or lower.

4 Z-axis Thermal Displacement Offset

This chapter explains thermal displacement offset and the offset method using thermal measurement data.

4.1 Offset Capacity

As shown below.

Offset Capacity	Conditions
+/-0.01mmmax./day	Aluminummachining Room temperature fluctuation +/-2° Machining at the same height as the measuring height Reference tool is used. Thermal displacement detection is executed immediately before machining.

The offset capacity varies with environment in the factory. Use these conditions only as a guideline.
Offset requires time to complete thermal displacement detection, which is some 12 s or shorter per operation.

4.2 For Correct Thermal Displacement Offset

Observe the following instructions not to cause errors in offset.

Measuring tool

Use reference tools. Do not use cutting tools. The following explain reference tools and cutting tools.

Reference tool: Tools used for measurement only are called reference tools in this manual. In registering reference tools, designate the type of tool "centering tool." Centering tools are replaced with signal output. Centering tool replacement can be executed also in the operation calling process. Although a place on the magazine available for tool installation is occupied, it is advisable to use the reference tool for accurate measurement.

Cutting tool: This indicates a tool used for practical machining. If a cutting tool is used as measuring tool, position detection is executed under the influence of worn cutting edge, tool thermal expansion and chip adhesion. The machine deems the position detected as Z-axis thermal displacement in correcting it. Although measurement is possible with cutting tools, it is advisable to use the reference tool for accurate measurement.

Caution: When using tools other than the provided reference tools for measurement, always set SPINDLE ROTATION WN MSRING DISP to **[0: NO]**. Otherwise the measurement device may break.

9

Measurement of measuring tool length

Use the automatic tool length measurement function.
To eliminate the effect of thermal displacement during setting, begin measurement 1 h or more after power is turned off.
For the method for automatic tool length measurement, refer to Chapter 6.
Do not measure measuring tool length after executing thermal displacement offset.

Programming

Place the command before machining which requires accuracy.
If the tool is left installed on the spindle for over 2 or 3 min under heat generating in the spindle, heat conducting via the spindle elongates the tool, consequently deteriorating accuracy. Therefore, write the program such that the reference tool and the cutting tool requiring accuracy are not installed on the spindle.

Measuring height

Adjust insomuch as possible the measuring height to that at which practical machining is carried out. For the method, refer to page.

Machining environment

Maintain room temperature as constant as possible.
Maintain air current in the factory as constant as possible.
Do not add coolant during machining. Otherwise coolant temperature changes, affecting tool elongation.
When machining has to be stopped for over 20 or 30 min, cut coolant off. If the coolant motor is kept turning without circulating coolant, coolant temperature abnormally increases.
Firmly fasten jigs so that works do not chatter or deflect. In jigs with the motor, heat develops in the motor, causing thermal expansion to the jigs. This may deteriorate accuracy in some cases.

4.3 Command

This section describes the commanding method and valid conditions for commanding. An example program is presented as well.

Commanding method

Use signal output to issue commands. Measurement can be taken at the following three positions.

Signal out 206 - - - - the center of the tool length measurement device

Signal out 207 - - - - a point dislocated from the center of the tool length measurement device by the amount of the tool radius. Set the dislocating direction via a parameter. Dislocation is hereinafter called shift.

Signal out 208 - - - - X position specified by the program

Determine the tool to measure thermal displacement. Set the number of the tool thus determined in THERMAL MEASUREMENT TOOL NO. 1-5 for user parameter 6. When one of the signal outputs has been commanded in advance, measurement motion takes place immediately after tool replacement, i.e., immediately after the tool to measure thermal displacement is installed on the spindle.

Effective conditions

After execution of signal output 206, 207 or 208 in the memory operation mode, these outputs are made invalid at either of the following operations or commands.

Replacement of the tool with a measuring tool

Reset

Program completion (including program completion during the execution of the schedule program)

Setting the memory operation program

Setting the start point

Signal outputs 206, 207 and 208 cannot be set in the MDI operation mode.

Radius shift amount

Tools are classified into ones with the small diameter and ones without.

The radius shift amount to be used is as follows.

For tools with the small diameter

The radius shift amount is half the small diameter.

EX: C.DRILL, CHFTOOL, CBRTOOL, CHFDRL, STPDDRL, DRLTAP, DRLRMR, CHFCTR, TOUCH P

For tools without the small diameter

The radius shift amount is half the outer or nominal diameter.

EX: DRILL, CBDRILL, S.TAP, P.TAP, H.TAP, R.TAP, REAMER, EMIL R, EMIL F, CBEMILR, CBEMILF

9

```
●WORKING   ■X      −100.000   ■Y     −100.000
 ZERO PO   ■Z       200.000
●TOOL RETURN HEIGHT           ■Hj          50.000
●NO. OF WORK PIECES           ■NO               1
●WORK PIECES MATERIAL          ALUMINUM

■JOB 01 SINGNALOUT            ■CODE           206

■JOB 02 SINGNALOUT            ■CODE           501

■JOB 03 COOLANT               ■ON/OFF          ON

■JOB 04 CENTER HOLE
         ■C. φ        1.000  ■ANGLE      90.000
 ●PTARN POINT
 ●ZPOS ■B. H.             *  ■DEP              *
         ■HGT         0.000  ■Ht           2.000
 ●XYPOS   ■X          0.000    ■Y         0.000
 ●P. F.  ■P. S. R.      100% ■FEED R.      100%

■JOB 05 COOLANT               ■ON/OFF         OFF

■MAIN PROGRAM END
■SUB PROGRAM END

   F0      F1      F2      F3      F4
```

EXAMPLE OF PROGRAM

Conditions: Use the reference tool as measuring tool.
Allot 1 to the reference tool number.
Register the reference tool as centering tool.
Specify THERMAL MEASUREMENT TOOL NO. 1 for parameter 6.

JOB 01..... "206" is input already to permit measurement motion at the center of the measurement device.

JOB 02..... "501," tool replacement command to be issued to tool No. 1 in the tool menu, is input already.This allows tool No. 1 in the tool menu to be installed on the spindle. A series of operations for Z-axis thermal displacement offset follows this installation.This series of operations will be explained on the next page.

JOB 03..... The cutting process begins at this stage. Feed coolant.

JOB 04..... Center holes are machined here.

JOB 05..... (Machining completed) Cut coolant off.

4.4 Operation

This section describes a series of Z-axis thermal displacement offset operations. Offset operations consist of the following (1) thru (21). There are two methods for Z-axis thermal displacement offset. One method is to rotate the spindle during measurement. The other is not to rotate it during measurement.

	----- Operation Display -----	----- Description -----
(1)	THRM MEASURE ON	Judgment of watching conditions
(2)	SP ORIENT(0°) M.ZERO RETURN(Z) COOLANT OFF	This operates when the parameter is set for automatic coolant operation. Set coolant to OFF.
(3)	ATC MGZN NO.** POS X ***.*** Y ***.*** M406 ON	This allows XY coordinates to be positioned at the measurement point. (When signal output 208 is in use, positioning is omitted.) Air blow ON
(4)	COVER OPEN CHCKIG	Operation is halted until the tool length measurement device cover opens. If the cover does not open after 10 s, alarm *COVER DOESN'T OPEN occurs.
	----- (PARAMETER6: SPINDLE ROTATION YES) -----	
(5)	SP CCW 60rpm POS Z ***.***	Z-axis positioning (Measurement device installation position + Measurement beginning position)
	----- (PARAMETER6: SPINDLE ROTATION NO) -----	
(5)	SP ORIENT(0°) POS Z ***.***	Z-axis positioning (Measurement device installation position + Measurement beginning position)
(6)	DWELL *.*sec	When the parameter is set to "0," DWELL is 0.0 s.
(7)	SENSOR OFF CONFTN	If the detection signal does not turn off, alarm *DETECTION SIGNAL ON occurs.
(8)	MEASURMENT -ON1 Z ***.*** *****mm/min	Measurement motion (at MEASUREMENT FEEDRATE1) Commanded position (Measurement device installation position + Measurement stop range)
(9)	SENSOR ON CONFTN1	

9

----- (PARAMETER6: SPINDLE ROTATION YES) -----

(12a)DWELL1.0sec	
(12b)FEED Z ***.*** *****mm/min	Apply MEASUREMENT FEEDRATE 1 to the command rate.
(12c)SP ORIENT(0°)	

----- (PARAMETER6: SPINDLE ROTATION NO) -----

(12a)DWELL 0.0sec	
(12b)FEED Z ***.*** *****mm/min	Apply MEASUREMENT FEEDRATE 1 to the command rate.
(13)SENSOR OFF CONFTN	If the detection signal does not turn off, alarm *DETECTION SIGNAL ON occurs.
(14)MEASURMENT-ON1 Z ***.*** *****mm/min	Apply THERMAL MEASUREMENT FEEDRATE to the command rate. Command position (Measurement device installation position - Measurement stop range)
(15)SENSOR CONFTN	If the detection signal does not turn on, alarm *DETECTION SIGNAL OFF occurs. If the detection signal turns on between R and D earlier than normal, alarm *DETECTION SIGNAL ON occurs.
(16)CALCULATION3	Position data take-in
(17)M.ZERO RETURN(Z)	
(18)CALCULATION4	Position correction If Z-axis is not on the zero point, alarm *THRM COMP POS ERR occurs. If the offset amount exceeds the thermal offset limit (parameter value), alarm *THRM COMP AMT OVER occurs.
(19)M406 OFF	Air blow OFF
(20)COOLANT ON	This operates when the parameter is set for automatic coolant operation. If coolant is ON before COOLANT OFF in operation (2) above is executed, coolant is returned to ON. If coolant is already OFF, air blow OFF is not executed.
(21)POS X ***.*** Y ***.***	Positioning for machining

9

R:Measurement start position
D:Measurement stop renge

Supplementary explanation

Measurement motion may be canceled in some cases during operation in the watching mode. Accompanying this, the following processes and operation are canceled as well. Operation canceled varies with the type of tool. There are two types of tool as shown below. The reference tool is handled as centering tool.

Centering tool:	a process for replacing the current tool with the centering tool is canceled.
Signal output process:	when thermal measurement is not taken, tool replacement is not executed.
Operation calling process:	when thermal measurement is not taken, tool replacement is not executed nor all operation within the process.
Cutting tool:	only operation for thermal measurement is canceled. Tool replacement is executed.

When the tool specified for thermal displacement measurement is replaced with a standby tool during memory operation, the subsequent memory operation continues thermal displacement measurement using that standby tool.

Commanding frequency is updated during execution of THERMAL WATCH COND. JDGMENT.

With power turned off, the position offset amount due to thermal displacement is reset.

In setting user parameter 6 THERMAL MEASUREMENT FUNCTION to invalid, if the measuring tool is a reference tool, the signal output and operation processes are invalid.

When memory operation is started with signal output 406 remaining on, alarm *M406 IS ON occurs.
Dry run during measurement
When dry run is valid, the frequency of commanding thermal displacement measurement is not counted.
When dry run is valid, measurement movement and detection signal confirmation are not executed.
[DRY RUN] key is invalid during execution of a series of measurement motions.

4.5 Thermal Measurement Data Screen

The current state of measurement can be referred to on the I/O screen. This screen can display the results of a maximum of 300 measurements taken in the past. These data can be browsed for reference only. The screen below presents data of the first thru the third measurements.

```
THRM MESRMENT DATA      PRODUCTION MONITOR
 ●PRT POS COMP                  ■    0.000
 ●PRST NO. OF CMND              ■        0
 ●MSR FRQ        ●TOOL NO.      ●DISPMT AMT
                 ●NO OF CMND    ●TOTL DISPMT
 ●               ■              ■
                 ■              ■
 ●               ■              ■
                 ■              ■
 ●               ■              ■
                 ■              ■
 ●               ■              ■
                 ■              ■
 ●               ■              ■
                 ■              ■
  PROD
  MONITR
  MENU
  F0      F1      F2      F3      F4
```

Explanation

PRT POS COMP.....indicates how much the offset has been achieved until Z-axis is in the current position.
This screen indicates offset of _0.061.

PRST NO. OF CMND.....represents the number of commands issued by now.
This screen indicates that the command is the third.

MSR FRQ.....represents the number of measurements taken.

TOOL NO.....represents the number of the tool used for measurement registered in the tool menu.

DISPMT AMT.....represents displacement measured.

TOTL DISPMT.....represents total displacement.

* Measurement data are displayed from here.

Caution:

Turning power off causes all data to be lost.

4.6 Outputting Thermal Displacement Measurement Data to the Computer

With the aid of the optional external communications equipment, thermal displacement measurement data can be output to the computer. Data are in the text form. The use of table calculation software makes possible data analysis.

Data possible to be output: MSR FRQ
TOOL NO.
NO OF CMND
DISPMT AMT
TOTL DISPMT

The file name output is "V".
Data format
A line consists of 35 bytes. Each item is sectioned in a fixed length.

MSR FRQ	TOLL NO.	OF CMND	DISPMT AMT	TOTL DISPMT	Line feed
6 bytes	2 bytes	7 bytes	7 bytes	7 bytes	
* * * * * * SP	* * SP	* * * * * * * SP	* * * * * * * SP	* * * * * * * SP	(0Dh)(0Ah)

When an attempt is made to output data when corresponding measurement data are not present, alarm *SPECIFIED DATA ABSENT occurs.
For details of communications, refer to Chapter 11, External Communications Equipment, of the Instruction Manual for Optional Equipment.

4.7 Example Parameter Setting and Alarm

This section presents an example of parameter setting. When the value set in the parameter is not as specified, the corresponding alarms occur. Such alarms are explained in this section as well.

Example setting

The following example shows a case where a cycle time in the program is short when periodical measurement is wanted.

ITEM	Setting
THERMAL MEASUREMENT MOTION COND	1(WATCHING)
Z-AXIS MACHINIG ACCURACY	0.999
THERMAL WATCH DISPLACMT AMNT	0.999
NUMBER OF THERMAL WATCHING	1
NO.OF THERMAL WATCHING CANCEL	5
INTIAL SET NO.OF THERMAL MSMT	1

For THERMAL WATCHING STOP TIME, refer to page.
Measurements are taken at the first, second, fourth and eighth commands. After the eighth, measurements are taken every five commands, namely at the 13th, 18th, 23rd and so on.

Alarm occurrence

*TRM DISPMT AMT OVR occurs at the beginning of machining after turning power on.
The cause is considered unstable displacement at the beginning of machining.
Increase INITIAL SET NO. OF THERMAL MSMT.
*TRM DISPMT AMT OVR occurs not only at the beginning of machining after turning power on, but also at other occasions.
Increase NUMBER OF THERMAL WATCHING and decrease THERMAL WATCH DISPLACMT AMNT.
With larger NUMBER OF THERMAL WATCHING, measurement begins only after displacement stabilizes better than otherwise. This is because past measurement data are referred to the number of times equal to the number of thermal watching settings.
THERMAL WATCH DISPLACMT AMNT provides a criterion by which it is judged whether or not measurement can be canceled. With smaller THERMAL WATCH DISPLACMT AMNT, measurement is canceled only after thermal displacement stabilizes better than otherwise.
Should *TRM DISPMT AMT OVR occurs even after these operations, set THERMAL MEASUREMENT MOTION COND. to EVERY COMMAND.

4.8 Example Offset

This section presents an example of practical offset using a time-course change graph of Z-axis thermal displacement and thermal measurement data.

Graph of Z-axis thermal displacement

0018.pict

9

THERMAL MEASUREMENT DATA

The following lists parameters setting values.

THERMAL MEASUREMENT MOTION CMND.....WATCHING
Z-AXIS MACHINIG ACCURACY.....0.020 (mm)
THERMAL WATCH DISPLACMT AMNT..... 0.010 (mm)
NUMBER OF THERMAL WATCHING.....2 (TIMES)
NO. OF THERMAL WATCHING CANCEL.....10 (TIMES)
INTIAL SET NO.OF THERMAL MSMT.....10 (TIMES)

MSR FRQ	NO OF CMND	DISPMT AMT mm	TOTL DISPMT-A		
1	1(1)	0.020	0.020		
2	2(1)	0.018	0.038	Measurement are taken unconditionally until 10 commands are issued.	
3	3(1)	0.015	0.053		
4	4(1)	0.010	0.063		
5	5(1)	0.008	0.071		
6	6(1)	0.007	0.078		
7	7(1)	0.006	0.084		
8	8(1)	0.006	0.090		
9	9(1)	0.006	0.096	( )indicates MSR FRQ	
10	10(1)	0.005	0.101		(1)
11	11(1)	0.005	0.106	A(11)-A(9)=0.010 A(12)-A(10)=0.009	
12	12(1)	0.004	0.110		(2)
13	14(2)	0.006	0.116		
14	16(2)	0.004	0.120	A(16)-A(12)=0.010 A(18)-A(14)=0.008	
15	18(2)	0.004	0.124		(3)
16	22(4)	0.005	0.129		
17	26(4)	0.004	0.133	A(26)-A(18)=0.009 A(30)-A(22)=0.008	
18	30(4)	0.004	0.137		(4)
19	38(8)	0.006	0.143		
20	46(8)	0.004	0.147	A(46)-A(30)=0.010 A(54)-A(38)=0.003	
21	54(8)	-0.001	0.146		(5)
22	64(10)	0.000	0.146		
23	74(10)	0.001	0.147		
24	84(10)	-0.011*	0.136		(6)
25	89(5)	0.003	0.139		
26	94(5)	0.001	0.140	A(99)-A(89)=0.001	
27	99(5)	0.000	0.140	A(104)-A(94)=0.000	
28	104(5)	0.000	0.140		(7)
29	114(10)	-0.001	0.139		
30	124(10)	0.021*	*****	"*TRM DISPMT AMT OVR"	
		( ) indicates the frequency of watching			(8)

9

Interpretation and explanation of thermal measurement data

The previous page shows the data of the first thru 30th measurements.
The data are divided by lateral lines into eight sections (1) thru (8).
The following give explanation by section.

(1) INITIAL SET NO. OF THERMAL MSMT is 10.
Measurements are taken unconditionally until 10 commands are issued.
Watching frequency is initially set to 1. For the meaning of watching f requency, refer to the section describing parameters.

(2) From the 11th measurement onwards, judgment as to whether or not measurement motion should be canceled begins. Since the watching frequency is 1, judgment concerns possibility whether or not the frequency can be 2 (1×2).
The judging method is as follows.
Since watching frequency is wanted to be 2, subtract total displacement A obtained two measurements before from total displacement A at the current measurement.
The resulting value is checked if it is within THERMAL WATCH DISPLACMT AMNT.
If it exceeds this amount, that indicates that thermal displacement has not stabilized yet, making judgment that the watching frequency cannot be updated.
If the resulting value of subtraction is within THERMAL WATCH DISPLACMT AMNT, since the NUMBER OF THERMAL WATCHING is 2, subtract total
displacement A obtained three measurements before from total displacement A obtained a measurement before.
The resulting value is checked if it is within THERMAL WATCH DISPLACMT AMNT.
If it is within, since the difference between two successive displacements A and another A is within THERMAL WATCH DISPLACMT AMNT, thermal displacement is judged stabler than before, consequently setting watching frequency to 2. Thus, cancellation is executed once in every two measurements from the subsequent measurement onwards. This process can be summarized as follows.
Judgment is made to see if watching frequency can be made twice larger than the current setting.
If judged possible, the watching frequency is updated and cancellation takes place at that frequency.
Based on in this judgment is the difference between total displacement A at the current measurement and total displacement A obtained (watching frequency×2) measurements before, which is checked if it is within THERMAL DISPLACMT AMNT and if it remains so at all measurements taken the number of times equalto the NUMBER OF THERMAL.

(3) Since watching frequency is 2, judgment is made to see if the frequency can be made 4 (2 ×2). At the 18th command specified conditions are met, making it possible to update watching frequency to 4.

(4) Since watching frequency is 4, judgment is made to see if the frequency can be made 8 (4×2).
At the 30th command specified conditions are met, making it possible to update watching frequency to 8.

(5) Since watching frequency is 8, judgment is made to see if the frequency can be made 16 (8×2).
At the 54th command specified conditions are met, making it possible to update watching frequency.
However, since NO. OF THERMAL WATCHING CANCEL is 10, the watching frequency is set to 10.

(6) Since watching frequency is 10, judgment is made to see if the frequency can be made 20 (10×2). Since the NO. OF THERMAL WATCHING CANCEL is 10, it is impossible to have 20 for watching frequency.
Measured displacement registers –0.011 at the 84th command.
This value falls between Z-axis MACHINING ACCURACY and THERMAL WATCH DISPLACMT AMNT, which suggests that thermal displacement begins to lose stability.
Hence, the watching frequency should be updated to 5 (10÷2).

(7) Since watching frequency is 5, judgment is made to see if the frequency can be made 10 (5×2).
At the 104th command specified conditions are met, making it possible to update watching frequency to 10.

(8) Displacement registers 0.021 at the 124th command. Since this value exceeds the Z-axis machining accuracy, alarm *TRM DISPMT AMT OVR occurs, stopping the machine.
The flowchart of this method is as shown on the next page.
It is designed to help your understanding.

Flowchart

Start
Program end?
No
Read one motion from machining data
Measurement command?
Yes
No
Execute a machining data
Operation hold time > Thermal watching stop time?
Yes
Initialize thermal measurement conditions
No
Watching frequency yet to be omitted = 0?
Yes
Execute measurement and compensation
No
Number of command:= Number of command +1
Revise measurement history
Watching frequency yet to be omitted: = Watching frequency yet to be omitted − 1
Watching frequency renewal decision
End

Flowchart

Watching frequency omission judgment start
Measurement result (displacement) > THERMAL WATCH DISPLACMT AMNT
Yes
No
Judging pointer ← Current no. of commands issued
Watching frequency ≠ 1
Yes
No
Judgment to be made at the frequency equal to NUMBER OF THERMAL WATHING completed
Yes
No
From judgment pointer Total thermal displacement in the section of 2 × watching frequency <= THERMAL WATCH DISPLACMT AMNT
Yes
No
Watching frequency updating unallowable
Watching frequency updating allowable
Judging pointer ← Judging pointer watching frequency
Measurement result (displacement) > Z-axis MACHINING ACCURACY
Yes
No
Watching frequency ← Watching frequency/2 ※ When watching frequency/2 is less than 1, assume it as 1. When the value is not an integer, discard decimals.
Thermal measurement conditions initialization
Alarm *TRM DISPMT AMT OVR occurs.
All updating possible & Initial measurement completed
Yes
No
Watching frequency ← 2* watching frequency ※Watching frequency is clamped within the number of thermal watching cancel.
Watching frequency yet to be omitted ← Watching frequency -1
Watching frequency updating judgment completed
0020.eps

5 Tool Breakage Detection

This chapter describes operation to detect tool breakage. For the method for installing the measurement device, refer to Chapter 2. Relevant parameters are provided in the parameter list in Chapter 5. Choose from the list the ones required for this function and set.

5.1 Command

The following explain the commanding method and valid conditions.

Commanding method

Issue commands as signal output. Set required commands in the signal output process for machining data or as the supplementary function for allotted data. The signal is classified into the following three types. The measuring position differs according to the type of signal.

Signal out 203.....the center of the tool length measurement device

Signal out 204.....a point dislocated from the center of the tool length measurement device by the amount of the tool radius. Set the dislocating direction via a parameter. Dislocation is hereinafter called shift.

Signal out 205 .....Measurements are taken at the XY position specified in the program. After the execution of the signal output command, tool breakage detection takes place before beginning tool replacement with the subsequent tool.

Effective conditions

After execution of signal output 206, 207 or 208 in the memory operation mode, these outputs are made invalid at either of the following operations or commands.

Replacement of the tool with a measuring tool

Reset

Program completion (including program completion during the execution of the schedule program)

Setting the memory operation program

Setting the start point

Signal outputs 203, 204 and 205 cannot be set in the MDI operation mode.

Radius shift amount

Tools are classified into ones with the small diameter and ones without.

The radius shift amount to be used is as follows.

For tools with the small diameter

The radius shift amount is half the small diameter.

EX: C.DRILL, CHFTOOL, CBRTOOL, CHFDRL, STPDDRL, DRLTAP, DRLRMR, CHFCTR, TOUCH P

For tools without the small diameter

The radius shift amount is half the outer or nominal diameter.

EX: DRILL, CBDRILL , S.TAP, P.TAP, H.TAP, R.TAP, REAMER, EMIL R, EMIL F, CBEMILR, CBEMILF

5.2 Operation

This section describes a series of tool breakage detection operations.

	..... Operation display	..... Description .....
(1)	M.ZERO RETURN(Z) COOLANT OFF	P21(2)
(2)	M406 ON POS X ***.*** Y ***.***	P21(3)
(3)	COVER OPEN CHCKIG	P21(4)
(4)	SPORIENT(0°) POS Z ***.***	P21(5)
(5)	DWELL *.*sec	P21(6)
(6)	SENSOR OFF CONFTN	P21(7)
(7)	MEASURMENT -ON1 Z ***.*** *****mm/min	P21(8)
(8)	TOOL BREAK CHCKIG	If the detection signal does not turn on, alarm *TOOL BROKEN ERROR occurs. If the detection signal turns on between R and D earlier than normal, alarm *DETECTION SIGNAL ON occurs.
(9)	M.ZERO RETURN(Z)	P22(19)
(10)	M406 OFF	
(11)	COOLANT ON	P22(20)
(12)	SP ORIENT(0°) M.ZERO RETURN(Z)	
(13)	ATC MGZN NO.** POS X ***.*** Y ***.***	

9

R: Measurement start position
D: Measurement stop renge

Supplementary explanation

If **[RESET]** key is pressed after alarm *TOOL BROKEN ERROR occurs, the service life setting of the broken tool is reset to zero (0).

Tool replacement (magazine rotation) is not executed if tool replacement is commanded to the same tool after the execution of signal output 203, 204 or 205, and tool breakage detection is executed after Z-axis returns to the zero point. Tool replacement applied to the same tool after the execution of signal output 203, 204 or 205 is commanded to the last tool remaining to be processed in the program.

This command is issued as well in machining programs wherein only one tool is used.

In machines provided with the Z-axis measurement system, when signal output 406 is on, memory operation cannot be started. If memory operation is started nevertheless, alarm *M406 IS ON occurs.

Dry run during operation with broken tools

When dry run is valid, measurement movement and detection signal confirmation are not executed.

[DRY RUN] key during operation with broken tools is invalid.

6 Automatic Tool Length Measurement

This chapter describes operation to automatically measure tool length.
For the method for installing the measurement device, refer to Chapter 2.
Relevant parameters are provided in the parameter list in Chapter 5.
Choose from the list the ones required for this function and set.

6.1 Command

Commanding method

Automatic measurement of tool length: command this on the screen. First display the block operation screen in the MDI operation mode.

```
                                        MDI  OPERATION

●COODINATE          ■   (1:ON)
●EXT SIGNAL       ■■■
●TOOL               ■■  (1～18:POT NO.)
●COOLANT            ■   (0:STOP 1:CW 2:CCW)
●SPINDLE            ■    min⁻¹
●S. SPEED         ■■■■  (0:DESIGNATE POS
●AXIS MOVE          ■    1:W. ZERO 2:M. ZERO
                         3:M. ZERO (NO. 2)
                         4:M. ZERO (NO. 3)
●X ■■■■■■■■■   ●Y ■■■■■■■■■   ●Z ■■■■■■■■■
●A ■■■■■■■■■   ●B ■■■■■■■■■   ●RAD ■■■■■■■
●FEED               ■   (0:POSITIONING
                         1:CUTTNG 2:TAPPING)
●FEEDRATE         ■■■■   mm/min
TOOL →_
SP                            T. LEN
POT 01                        T. LEN
    02                        T. LEN
    03                        T. LEN
    04                        T. LEN
                               NEXT MENU
   CETER
   ALIGN
   MENU
   F0      F1      F2      F3      F4
```

Method to display automatic tool length measurement screen

With **[F1]** key pressed on the MDI operation screen, the machine enters the automatic tool length measurement mode, displaying the automatic tool length measurement screen as shown on the next page.

9

```
                    AUTO TOOL LEN MEASUREMENT

●POT NO.     ■■■■■  (0～18:ST/END 0:SP)
●M. POS      ■      (0:MSMT DEV CENT
                     1:MSMT DEV CENT + RAD
                     2:DESIGNATE POSITION)
             ■X   ■■■■■■■■■■ ■Y   ■■■■■■■■■■

 --- RST OF MSR ---    --- TOOL MENU ---
 ●T. LEN AFT MSMT      ●TOOL NO.  98
     ■■■■■■■■■■        ■TOOL      EMIL R
                       ■T. LEN    150.000



POT NO.  →_



   MDI                                TEACH
   OPERTN                             POSI
                                      LOAD
   F0      F1      F2      F3      F4
```

Setting method

Tool

A single tool or more than one tools can be measured. Set the magazine number for the tool(s) to be measured.

Ex: When the setting is "1": ..... the tool in a magazine 1 is measured.

When the setting is "1/10": ..... tools in a magazine from 1 to 10 are measured successively in the order that the magazine magazines number increases.

When the setting is "2/1":..... tools in a magazine from 2 to 1 are measured successively in the order that the magazine number increases. Since this case begins with "2," measurement ends with "1."

Measurements are taken of those tools only which are registered in pots.

When measuring more than one tools, the measuring position is all the same.

Measuring position

For "0": ..... XY position is equal to TOOL LENGTH MSM DEV INSTALL POSITN.

For "1": ..... XY position is equal to TOOL LENGTH MSM DEV INSTALL POSITN + tool radius. Set the radius shift direction via XY POSITION RADIUS SHIFT DIRECTN.

For "2": ..... Set the machining XY coordinates position. When the cursor is on X or Y items, with **[F4]** key pressed, the current machining coordinates are taken in.

Reference

Once these values are set, they remain on the screen even after operation is completed. To clear the screen, press **[DELETE]**.

6.2 Operation

This section explains a series of operations for automatic measurement of tool length. The following show operation indications to appear on the screen and the description of the operations indicated.

..... Operation display		..... Description .....
(1)	M.ZERO RETURN(Z)	
(2)	SP ORIENT(0°)	
(3)	ATC MGZN NO.**	
(4)	POS X ***.*** Y ***.***	This allows XY coordinates to be positioned at the commanded point.
(5)	M406 ON	Air blow on
(6)	COVER OPEN CHCKIG	P21(4)
(7)	SPORIENT(0°)	
(8)	SENSOR OFF CONFTN	P21(7)
(9)	MEASURMENT -ON1 Z ***.*** ***** mm/min	Measurement motion (at MEASUREMENT FEEDRATE1) Commanded position (under the Z axis travel)
(10)	SENSOR ON CONFTN	If the detection signal does not turn on, alarm *DETECTION SIGNAL OFF occurs.
(11)	CALCULATION3	P21(10)
(12)	CALCULATION1	P21(11)
(13)	FEED Z ***.*** *****mm/min	P21(12b)
(14)	SENSOR OFF CONFTN	P21(13)
(15)	MEASURMENT -ON1 Z ***.*** *****mm/min	Measurement motion (at MEASUREMENT FEEDRATE2) Commanded position (under the Z axis travel)

9

..... Operation display		..... Description .....
(16)	CALCULATION 5	Position data take_in. Measurement display (T.LEN AFT MSMT)
(17)	TOOL LENGTH SET	If PROTECT switch is ON, alarm *PROGRM PROTECT occurs. If tool menu is being edited, alarm *TOOL MENU EDITING occurs.
(18)	M.ZERO RETURN(Z)	
(19)	SP ORIENT(0°)	
(20)	ATC MGZN NO.**	Measurement starts with tools in the next magazine number.
(21)	POS X ***.*** Y ***.*** ↓ repeat (6) TO (16)	Air blow is kept on until all measurements are completed.
	↓	
(22)	TOOL LENGTH SET	
(23)	M.ZERO RETURN(Z)	
(24)	M406 OFF	Air blow off

Supplementary explanation

Use **[SINGLE]** key for single operation.
Manual operation in the key input operation mode is possible.
With **[MANUAL OPERATION]** pressed while pressing **[MDI OPERATION]** key, axis movement is possible with **[JOG]** key even if the current mode is set to automatic tool length measurement. Axis movement is possible with **[INCREASE/ DECREASE] [HIGH SPEED] [LOW SPEED]** and **[STEP]** keys.
If **[START]** key is pressed ahead of other keys, alarms may occur. Relationship between circumstances under which the key is pressed and the resulting alarms is as shown below.

Circumstances under which the key is pressed	Resulting alarm
PROTECT switch is ON.	"*PROGRM PROTECT"
Tool menu is being edited.	"TOOL MENU EDITING"
Tool is absent.	"*NO TOOL IN MGZN"
Specified XY position is absent.	"DATA IMCOMPLETE"

[F1] key for automatic tool length measurement and **[TOOL OFFSET]** key
When the automatic tool length measurement screen is on display, **[TOOL OFFSET]** key on the operation panel is invalid.
If magazine tools are changed during automatic measurement of tool length, alarm *CHG TOOL DG WK occurs.
Single stop in operation (8), SENSOR OFF CONFTN
When FEEDRATE A for the small diameter is chosen for measurement in operation (9), even if the current operation is cyclic, execute single stop before performing operation (8). At this operation the machine becomes ready for accepting manual operation in the key input operation mode, thus displaying message AFTER LOWERING Z MANUALLY CLOSE TO MEASUREMENT DEVICE, PRESS START KEY.
Press **[-Z]** key to move Z-axis to the vicinity of the measurement device and thereafter re-start.
This shortens measurement time.

9

Appendix List of alarm

NO.	STOP LEVEL	RESET LEVEL	ERROR MASSAGE	CAUSE	SOLUTION
1246	4	2	TRM DISPMT AMT OVR	Displacement measured in Z-axis thermal displacement offset mode exceeded parameter Z-AXIS MACHININGACCURACY.	See “parameter setting and change Z-axis thermal displacement offset witching motion to appropriate conditions.
1247	4	2	THRM COMP POS ERR	Thermal displacement compensation was attempted for areas other than Z-axis machine zero position.	Do not move the axis in manual mode.
1248	4	2	THRM COMP AMT OVER	Offset at stroke end exceeded THRM OFF-SET AMT LIMIT VALUE in Z-axis thermal displacement offset mode.	Check if parameter measuring device installation position Z and tool length menu are correct. Check the measuring section of the tool length measuring device for chip adhesion.
1249	4	2	COVER DOES’T OPEN	When COVER OPEN CHCKING is executed, cover opening cannot be comfirmed within 10 seconds.	Check tool length measuring device cover.
1250	4	2	NO Z-AX MEASURMENT	Tool breakage detection command or thermal mea-surement command was attempted to be executed for machines without optional Z-axis measurement system.	Change program.
1252	4	2	PROGRAM PROTECT	An attempt is made to modify the data while the PROTECT SW is ON.	Set the PROTECT switch to OFF, and modify the data.
1289	4	2	CAN’T SET TOOL LEN	The [protect] switch was turned on as soon as [tool length set] was executed in automatic tool length measurement mode or [tool length set] could not be executed for some reason.	Multiple errors have occurred concurrently. Check the causes on the <alarm> screen and eliminate them.

9

NO.	STOP LEVEL	RESET LEVEL	ERROR MASSAGE	CAUSE	SOLUTION
2520	1	1	MEASUREMENT ON	Switching the mode was attempted during zero position measurement.	Complete zero position measurement.
2521	1	1	M406 IS ON	M406 signal was on when memory operation was executed.	Output M407 signal in MDI operation mode (block operation) to turn M406 signal off.
2611	1	1	TOOL LEN SETTING ON	1)Changing mode was attempted during automatic tool length measurement. 2)The **[m. lck]** key was pressed.	Complete automatic tool length measurement.
3210	4	2	NO TOOL IN SPINDLE	Tool break checking (signal output M120) was executed with no tool set on spindle.	Check program.
3254	4	2	TOOL MENU EDITING	Tool length set was executed during editing of tool menu in automatic tool length measurement system.	Inform us of circumstances under which this error occurred.
4564	1	1	TOOL MENU EDITING	[start] key was pressed in automatic tool length measurement mode during tool menu editing.	Complete editing tool menu.

9

(This page is a blank.)

CHAPTER 9 (11)

OIL HOLE SYSTEM

1. Cautions for handling
2. System outline
3. Piping and cable connection
4. Sketch drawing of the oil hole system
5. Filter cleaning

1 Cautions for Handling

⚠ DANGER

High voltage parts are present in the control box. Touching such parts by mistake may result in serious injury or death.
Only operators qualified for electrical work and familiar with the electrical circuits of this machine are allowed to maintain and inspect electrical components.

Use the oil hole holder shown in the sketch drawing.
Only the oil hole holder manufactured by Nikken is accepted.

Do not remove the holder cover, as a lot of chips and water splash upward. If the holder cover is not installed, machining chips penetrate into the tool magazine, resulting in machine damage or problems. In addition, chips stuck to the tool taper may hinder machining.

Adjoining each of the oil hole holder on the magazine is defective.
Skip the space to set each of the oil hole holder.
Even if the oil holder with a cover is used, mist and chips may stick to the tool shank, and adversely affect the machining accuracy.
When highly accurate machining is required, take utmost care to prevent chips from sticking to the tool shank.
Rotating the oil hole holder without coolant in it damages the holder seal section.
The maximum rate of the oil hole holder is 4000 min^{-1}.
Rotating the holder faster than this damages the seal and bearing.
When installing a drill to the oil hole holder, observe the following:

Limit of the machine tool length
(200mm from the taper gauge line to the tool tip).
Weight limit of the machine (3kg).

Regulary check the filter (30 mesh) in the tank and the suction filter (100 mesh 2 pcs.) connected to the pump inhale port, and remove the chips.
The frequency of cleaning differs depending on the operating conditions.
If cleaning is ignored, the amount of discharge and discharge pressure will decreace, and the though hole of the tool will be clogged with chips, leading to decrease in service life of the oil hole trochoid pump and holder seal section.
Refer to the filter cleaning sectiuon for the cleaning mathod.
Fill the tank with coolant so that the coolant reaches the upper level of the oil pot.
When there is insufficient coolant the trochoid pump will inhale air, which causes an abnormal sound, resulting in a drastic decrease in service life.

For installation of the oil hole holder to the magazine, refer to section '4.How to use the oil holder system'.
While installing, be careful of the cutting tool, and match the key and key groove. If the ATC is actuated when these are not matched correctly, the magazine grip may be damaged.
Do not discharge the coolant without mounting the oil hole holder to the spindle, or without mounting the cutting tool even if the oil hole holder is mounted.
For the chucking section, materials other than SK-10 and SK-16 are accepted. However, it is required that the holder manufacture makes a drawing in accordance with the user's specifications, and the machine manufacturer Brother checks it.
When designing and installing the coolant tank, be sure to use an oil hole holder with a cover exclusively for BROTHER's Tapping Center.
To prevent main spindle motor and Z ball screw problems due to splashed coolant, be sure to install the magazine rear cover made by BROTHER.
When designing the jigs, pay sufficient attention so that the oil hole holder cover does not contact the jig.
Rotate the trochoid pump in the direction of the arrow.
If rotated reversely, the oil seal will be damaged.(Refer to section of "Cable Connection."

If air is being blown in the ← direction, the pump is rotating in the correct direction.

2 System outline

The oil hole system is constituted as below.

10W39.doc

3 How to Use the Oil Hole System

3.1 Oil hole holder installation to the magazine

When installing an oil hole holder, move the gripper to the specified tool installation position. Install the oil hole holder to the magazine by rotating it as shown in the drawing below.
Engage the gripper key and oil hole holder key groove, and gripper pin and oil hole holder V groove. Insert the oil hole holder to the end of the gripper and secure the holder. Install the holder so that the protruding side of the holder faces outside.

オイルホール. pm6

3.2 Starting Oil Hole Pump

Turn on the coolant motor switch on the operation panel.
To start, output the signal output code 408.
To stop, output the signal output code 409.

3.3 Caution for stopper block handling

オイルホール. pm6

If coolant is leaking from section A while using the oil hole holder, check the O ring in the stopper block.
If the O ring is damaged or not installed, replace or install it.

Name	Norminal
O ring	P12

693307001
0706 (1)