

# MA-4 MANUAL

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# Chapter 1 Precautions for safe operation

## 1. Introduction

Thanks for purchasing the products of MANIX Co. Ltd.

This user manual records precautions and safe measures for your safety and precautions. Careless preparation and operation can be a cause of unexpected accidents during the operation.

Please read all instructions and understand all details before you use the machine.

## 2. Safety measure

### 2.1 Precautions

The following indicated items explain the features of the equipment, types, and required functions.

To prevent dispersion of chips, other dusts, and tools, please follow the operation according to the subsequent safety conditions. To prevent fatal accidents due to damage of the equipment and other erroneous operations, it is highly important to follow the safety measures and appropriate controls.

To prevent non-professionals from handling the devices, attention on the equipment is required as well as operating the equipment safely.

To prevent physical damage from the machine, please follow all safety measures, handling instructions, and installation guide recorded in this manual.

## 2.2 Safety rules

For the prevention of accidents, the following precautions must be kept! All operations must follow the instructions in this manual and notice the end users regarding the all preparations for the installation.

### 2.2.1 Please read this manual thoroughly and carefully

- (1) Please be familiar with the potential and limited specific application items of the tools and mechanical details.
- (2) Please do not install the product arbitrarily or disassemble the inside of the product as well as repairing and replacing some parts.

### 2.2.2 Avoid dangerous surrounding work environment

- (1) Do not operate the equipment in a wet or moisture place.
- (2) Do not install the machine in the bright place.
- (3) Do not install the machine in the dry place or condition.
- (4) Do not install the equipment near heat or place where fire can occur.
- (5) Use the machine cleanly always.
- (6) Place the machine in the horizontal position.

### 2.2.3 Be careful of electric shock

- (1) To prevent electric fire shock or explosion, grounding must be done properly.
- (2) "Power OFF" must be checked before connecting the power line.
- (3) Once power is on, do not touch electric boxes and circuits.
- (4) If the inspection on electric parts is required, manufacturer's approval must be obtained.
- (5) If machine warming or inspection is required, the power switch is turned "ON" followed by standing by for about five minutes to check all parts are ready to operate safely.
- (6) During the machine operation, do not touch the machine with wet hands.

### 2.2.4 Wear appropriate cloth for operations

- (1) Wear appropriate cloth for operations.  
Loose cloth may contact with parts or the machine.
- (2) Dusts can be generated during operations so if required, were a face protective band or mask.
- (3) If hair condition of an operator is too long, tie the hair to operate the machine.

### 2.2.5 Inspect whether the parts are correctly attached

- (1) Do not shock the machine.
- (2) Prior to the operation of the machine, check all the parts are correctly attached. Incorrect attachments may cause malfunction and problems.

**2.2.6 Install the machine in a place where maintenance is convenient**

- (1) Clean the surrounding place of the machine.  
Operation under a untidy space may cause careless accidents.
- (2) Put away unnecessary items around the operation space.
- (3) The operation space should have enough space to put or discard the equipment.

**2.2.7 Keep children or unskilled operators away from the machine**

- (1) Keep all visitors to take safety measures and maintain safety distance.
- (2) It is necessary to be careful for children or unskilled operators not to touch the main switches and operation keys of the machine.

**2.2.8 Store the machine under the optimum condition**

- (1) Keep the machine clean at all time.
- (2) Please keep the dusts and chips occurred during the operation away from the machine since they may be stuck to the parts and interfere with the reliable operation of the machine.
- (3) In case of sudden breakage occurrence, remove the problem immediately and check the safety status. After this, run the machine again carefully.
- (4) The surrounding temperature of the installation place shall maintain 2°C to 32°C for the operation.

**2.2.9 Use the standard parts**

- (1) Use the genuine parts and follow the manual.  
Non-authentic or unstandardized parts may cause a problem to the machine.

**2.2.10 Other safety measures**

- (1) Do not dispose of industrial wastes and parts irresponsibly.  
Follow the normal classification and disposal process for industrial wastes.
- (2) Follow the manual for the installation and movements of the machine according to the machine load.

## 2.3 Safety code for the machine use

- (1) Avoid contact with the machine during the operation.
- (2) Do not operate the machine while opening the door of the machine.
- (3) While the main axis is rotated, avoid contact with the machine and do not replace the tools.
- (4) Do not remove the safety device.
- (5) Do not use the flammable materials under no circumstance.
- (6) Do not use the controller PC during the machine operation except for the purpose of the machine operation.
- (7) Be familiar with the safety rules specified in the user manual of the machine.

## 2.4 Safety measures for the electric part

- (1) Make sure that the safety of the work place is the most priority.
- (2) The use power must be supplied with standard voltage.
- (3) Avoid wet and humid places for the machine operation.
- (4) Do not touch the machine with wet hands under no circumstance.
- (5) Connect and install circuit breakers for the power source.
- (6) Grounding must be installed. (Use a grounded capacitor)
- (7) Do not disassemble or remove the electric parts already installed arbitrarily.
- (8) Power must be turned off before the machine is moved.
- (9) Check frequently whether the power cords connected to the machine are not broken.
- (10) Do not mount the parts by replacing or modifying them arbitrarily.

## 3. Preparation and checklist of the machine purchaser

### ◆ Computer designer and operator

- Do we have an employee who is good at computer operations?
- Make sure that there is personnel who can design using CAD/CAM or software for the dental purpose.

### ◆ Software for design

- Do we have suitable software for dental design?  
e.g.) DentCAD, XO CAD, 3SHAPE CAD etc.

### ◆ Place for the machine installation

- Do we have suitable places for machine installation?

### ◆ Power source

- 220V single-phase installation (depending on the optional power )

◆ User training

- Users who operate the equipment

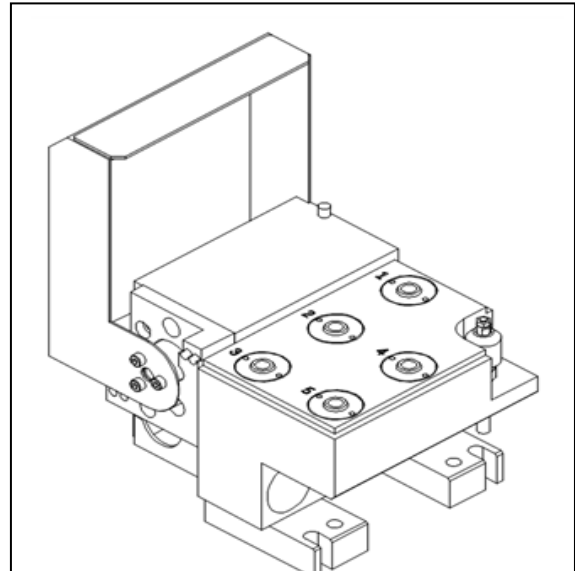
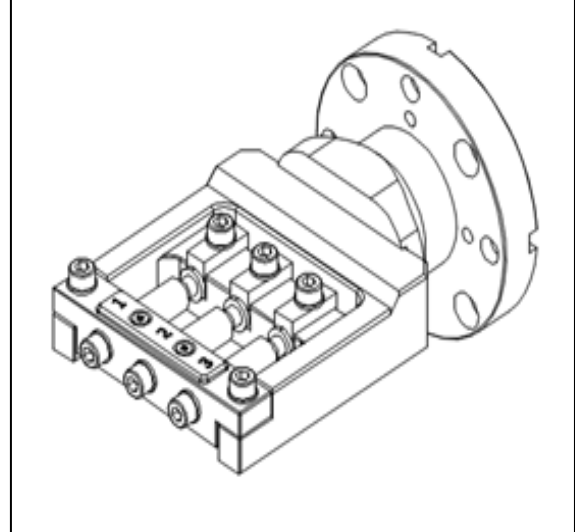
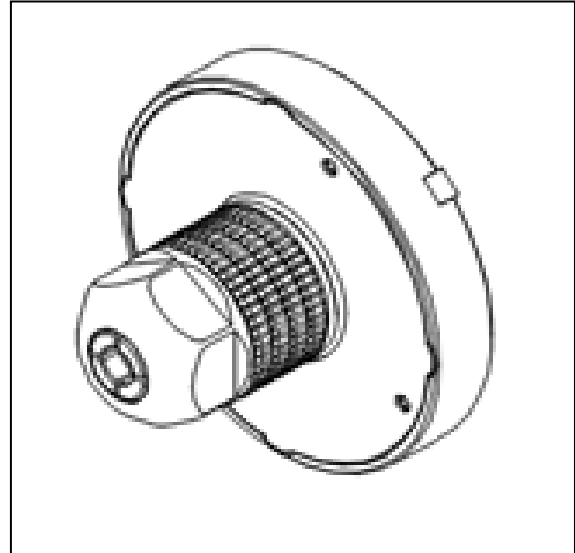


## 4. Precautions for users regarding the use of the equipment

- (1) Clean the place around the machine.
- (2) Do not shock the equipment excessively.
- (3) Check the power grounding condition and power imbalance (due to high-frequency effect) frequently.
- (4) Make sure that the rubber feet under the table are correctly fixed to hold the equipment firmly.
- (5) Make sure that the surrounding temperature of the installation place maintains 2℃ to 32℃.
- (5) Make sure that the pressure gauge scale of the air unit is in a range of 0.5 to 0.6MPa.
- (7) Make sure that the coolant tank has sufficient coolant and supplies it without any problem.
- (8) Make sure that the parts are not damaged during cleaning and do not use air blower.
- (9) Be careful to avoid computer virus while using USB memory sticks or local area networks.
- (10) Make sure that the PC controller is terminated gracefully.  
(Internal data may be damaged if the PC controller is terminated abnormally due to power failure.)
- (11) Inspect the wear condition of the tool edges due to the use of the tools for processing.

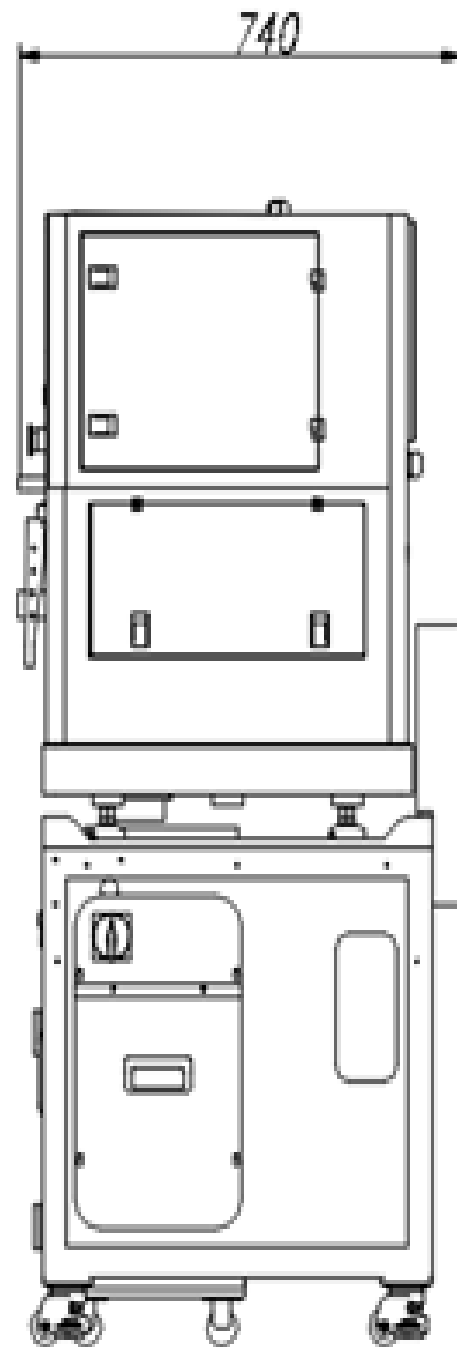
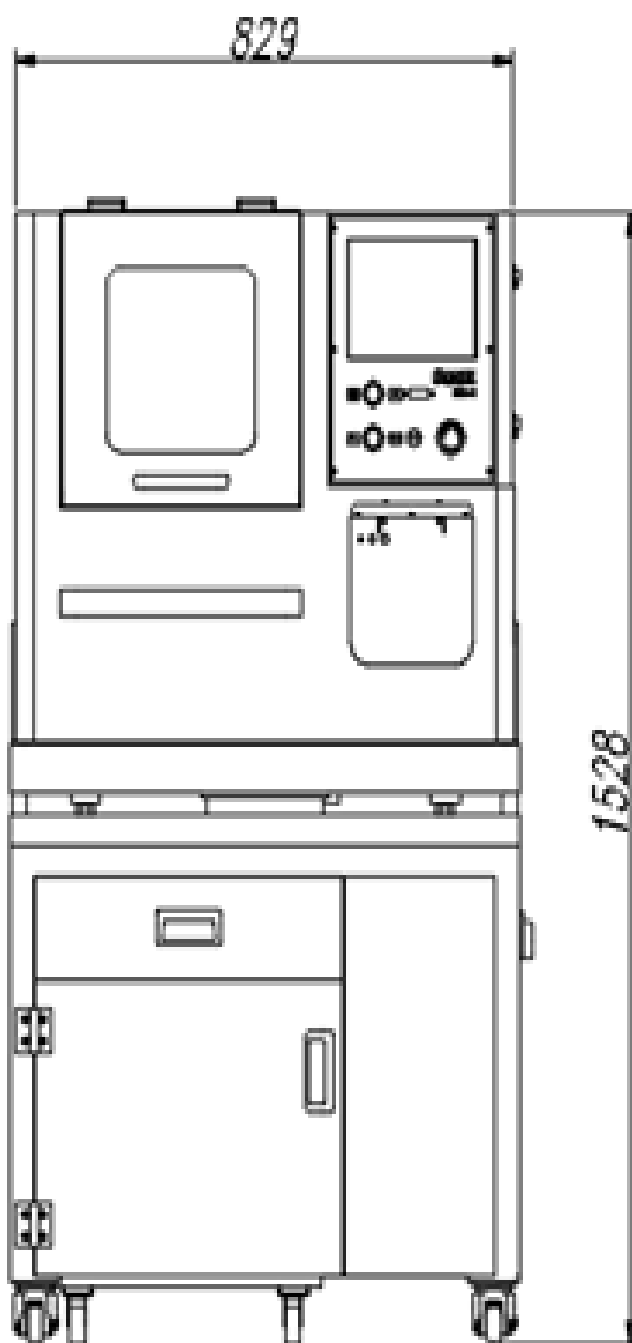
## Chapter 2 Equipment Information

### 1. External view of the equipment



## 2. Equipment specification

■ Dimension (mm)

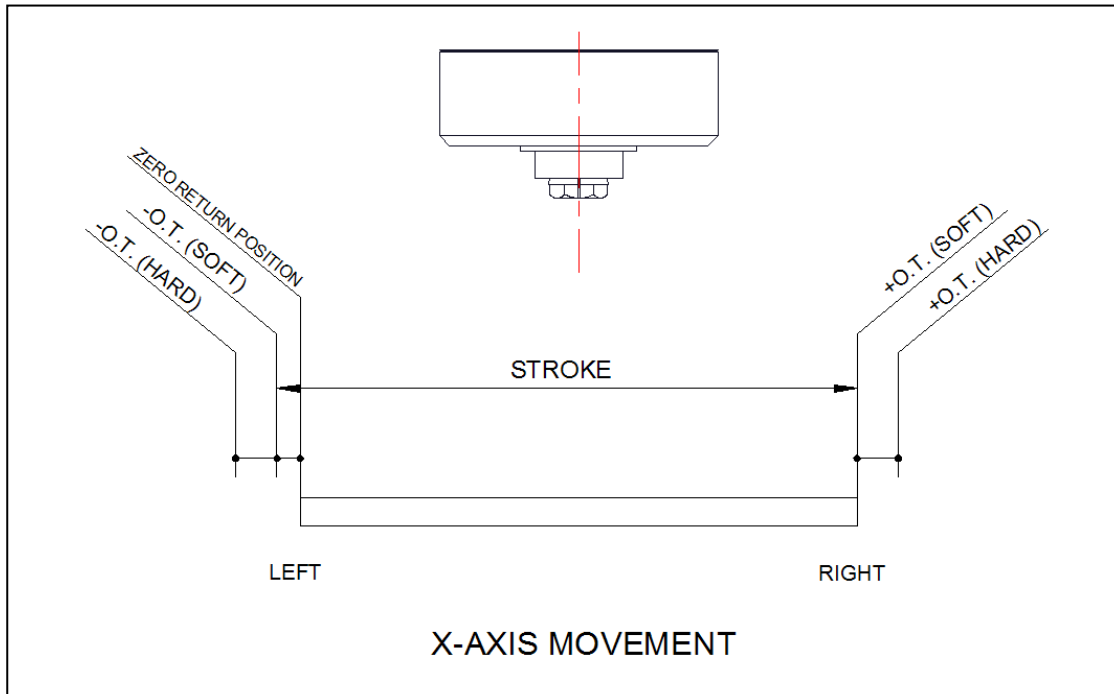


< Table 1 >

Items		Unit	Specification
Transfer distance	X axis	mm	195
	Y axis	mm	96
	Z axis	mm	97
	A axis	Deg.	0~360
Table	Table size	mm	320 x 260 x 20
	Inner diameter of the index jig	∅	95
Spindle	Spindle speed	r.p.m , W	High Frequency 21,000 , 750W
	Spindle collet	∅	8.5
	Collet size	∅	CHR – 6
Transfer	Rapid transfer rate	mm/min	15000
	Cutting transfer rate	mm/min	1~6000
Automatic tool replacement device	Tool coupling method	-	Direct connection
	The number of tools held	ea	3 ( 5 )
	Tool shank diameter	∅	6
	Tool maximum diameter	∅	5
	Tool maximum length	mm	30
	Tool selection method	-	Fixed type
	Tool replacement time	sec	14
Dimension of the machine	Machine installation area (length * width)		1200 * 1400
	Machine height		1800
	Machine body weight	kg	380
Others	Drives	-	Precise ball screw, Dovetail Guide
	Driving Motor	-	AC Servo
	CNC SYSTEM	-	CSCAM
	Power supply		220V, Max. 5A
	Air pressure	MPa	5.5~6

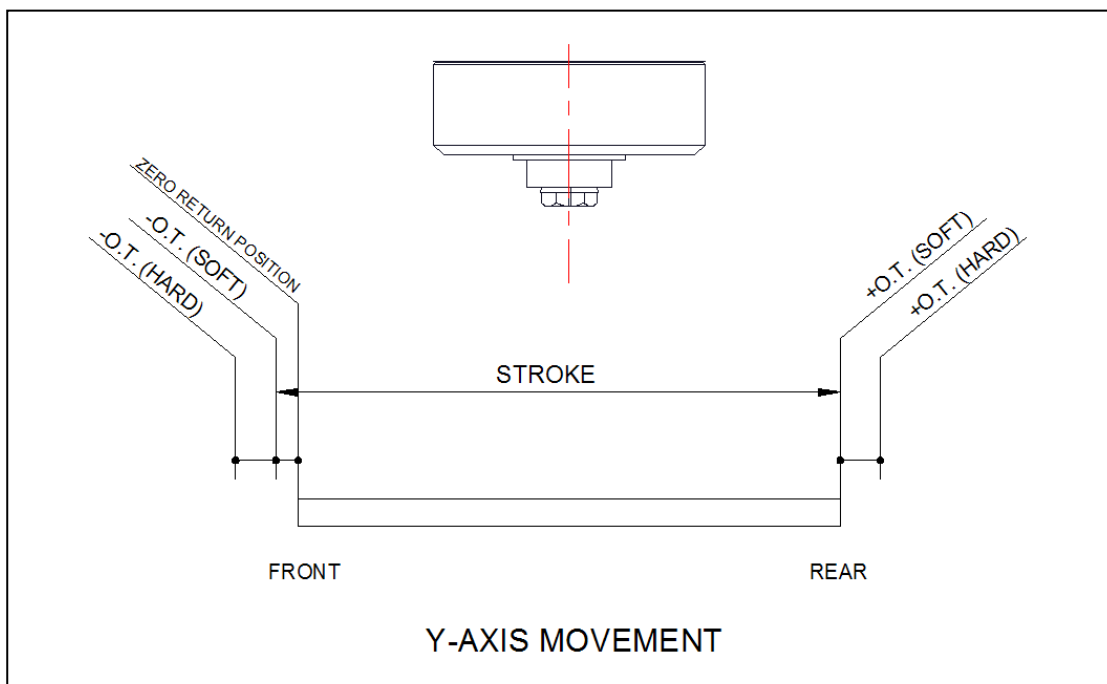
### 3. Stroke and zero return position of each axis

#### 3.1 Stroke of the X axis = 195mm



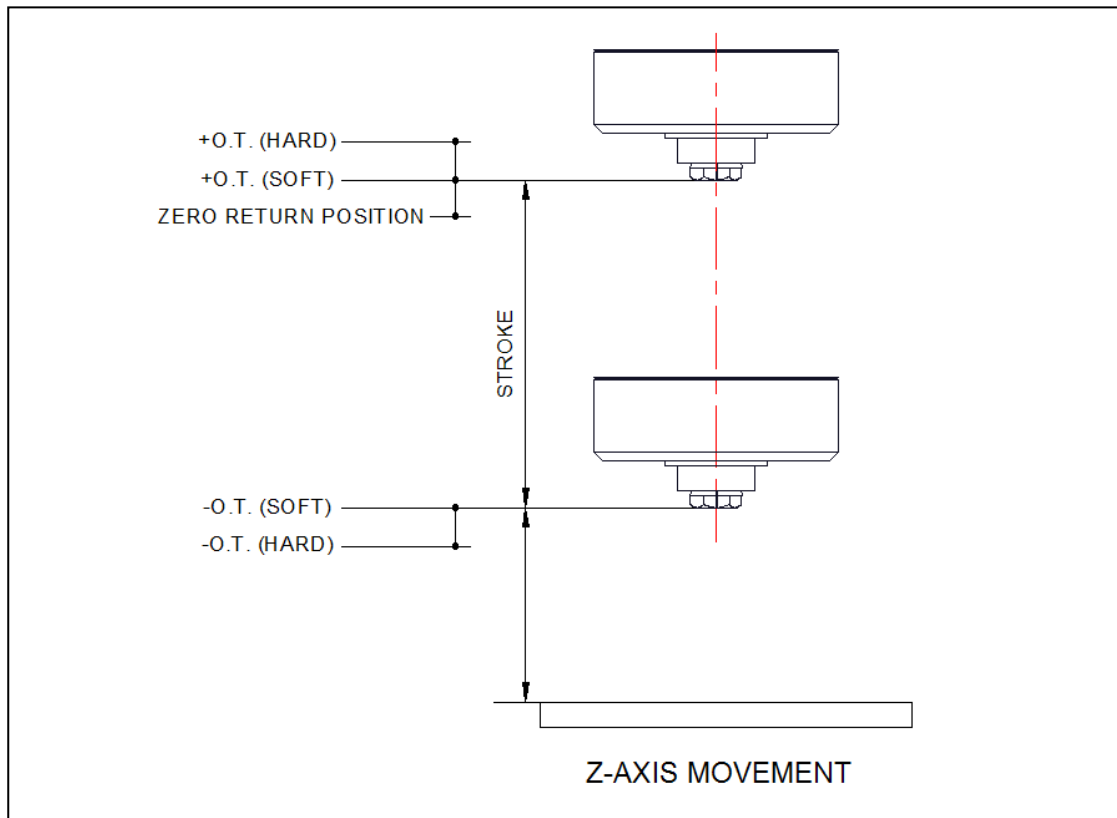
< Fig. 1 >

#### 3.2 Stroke of the Y axis = 96mm



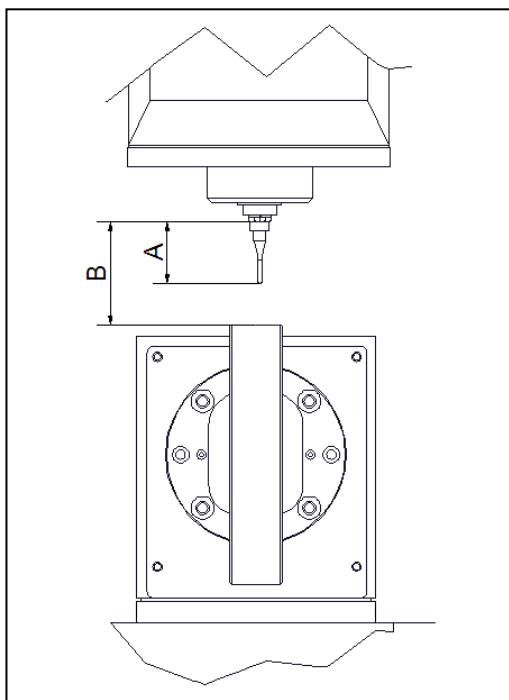
< Fig. 2 >

### 3.3 Stroke of the Z axis = 97mm



< Fig. 3 >

## 4. Relationship between the tool length and the index



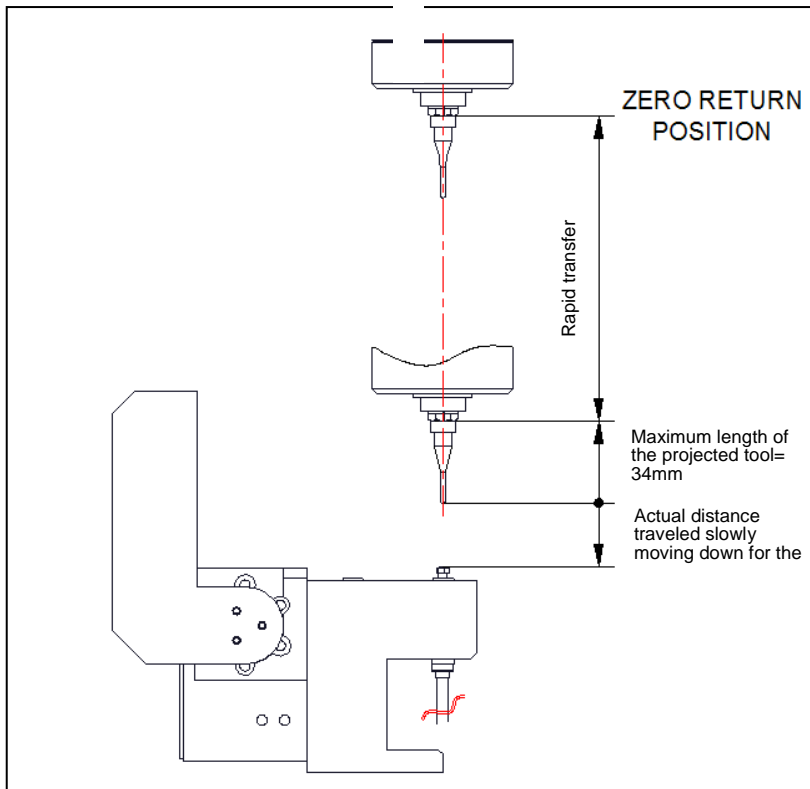
If the projected total length of A in the tool, which is clamped by the spindle, is too long, it may interfere with the index to collide when the index rotates. The maximum length of A is 34mm. Therefore, if the length of A is longer than that of B, the tool's position should keep a distance from the turning radius of the index thereby having the safe rotation of the index.

< Fig. 4 >

## 5. Relationship between the tool length and the Z sensor

The maximum projected length of the tool clamped to the spindle shall be less than 34mm.

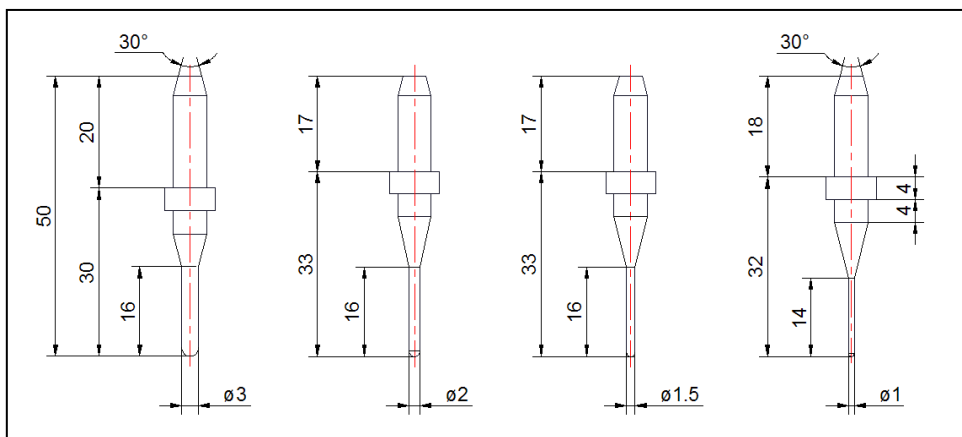
If the projected length exceeds 34mm, it may be sensed as a rapid transfer so that accurate dimension may not be produced.



< Fig. 5 >

◆ Note: Tools for processing chrome cobalt blocks and titanium blocks

These are tools for processing chrome cobalt and titanium blocks. (Tools may be changed.)



< Fig. 6 >

## Chapter 3 Installation and setup

### 1. Machine installation method

#### 1.1 Safe installation method of the machine

##### 1.1.1 Mechanical part

- (1) The machine should be placed on the floor where the machine's load can endure.
- (2) While putting a leveler on the machine table and checking the level, the rubber feet are fixed on the ground.
- (3) Coolant is filled up to the "H" position in the coolant tank .
- (4) Air is supplied to the air unit while checking the pressure of 5.5~6.0MPa in the pressure gauge.
- (5) Check whether the cables are correctly connected.

##### 1.1.2 Power connection and operation

- (1) A plug is inserted to the 220V single phase capacitor, which is grounded. (It may differ country to country.)
- (2) Turning the main electric switch to turn on the power.
- (3) Push the POWER ON button in the front panel of the equipment. (Lighting is on.)
- (4) Push the START button to turn on the PC controller. (Windows and other application programs are run.)
- (5) After confirming the zero return position of the controller is pushed, push the START button to return to the zero point.

#### - Checklist for the commissioning test-

##### ◆ In the JOG mode

- Check whether the pointer in the touch monitor is correctly running
- Transfer of each axis (X+, X-, Y+, Y-, Z+, Z-, A+, A-)
- Check whether the LIMIT of each axis is working correctly (including soft LIMIT)
- Check RUN / STOP whether the spins rotate correctly
- Check CLAMP / UNCLAMP of the spindle collet operation
- Check the tool magazine cover operation OPEN / CLOSE
- Check whether coolant is correctly supplied using ON / OFF

##### ◆ In the AUTO mode

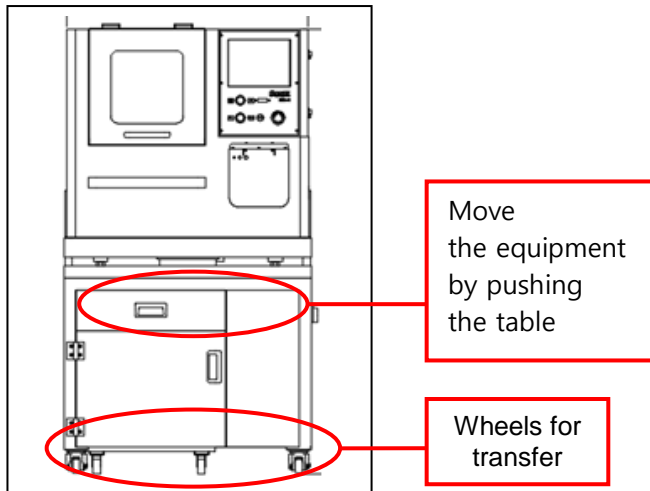
- Check whether Auto Tool Changer ( ATC ) is correctly working.
- Check whether the calibration is finally correct.
- Run the machine with sample processing over the air.
- Try sample processing.



## 2. Equipment movement and transportation

### 2.1 Movement in the flat plane

If the equipment is placed on the work table, move the equipment by pushing the work table.



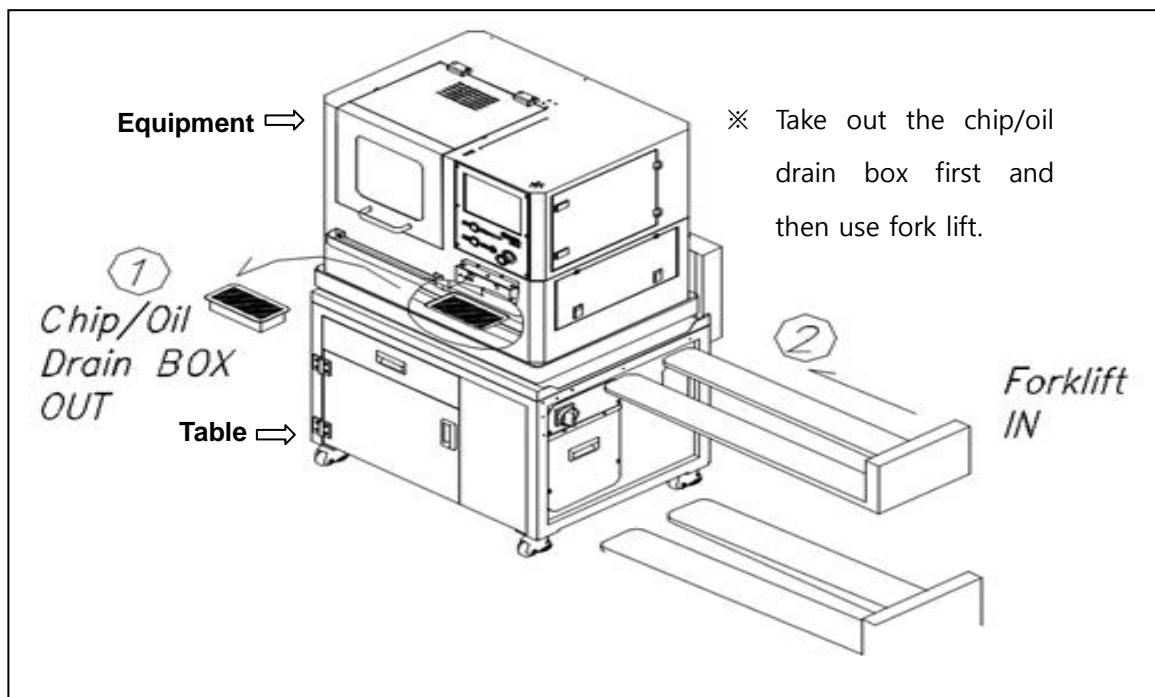
< Fig. 1 >

#### ◆ Precautions

If using a forklift, handle the equipment carefully.  
In particular, be careful not to make a fall of the equipment by holding the equipment.

### 2.2 Movement by lifting high

- (1) Cables connected between the equipment and the table should be separated.
- (2) The equipment should be lifted first using a forklift to move.
- (3) Move the table using a forklift. (Note: it should be lifted from the side.) )
- (4) The equipment is placed on the table.
- (5) Cables are connected again between the equipment and the table.



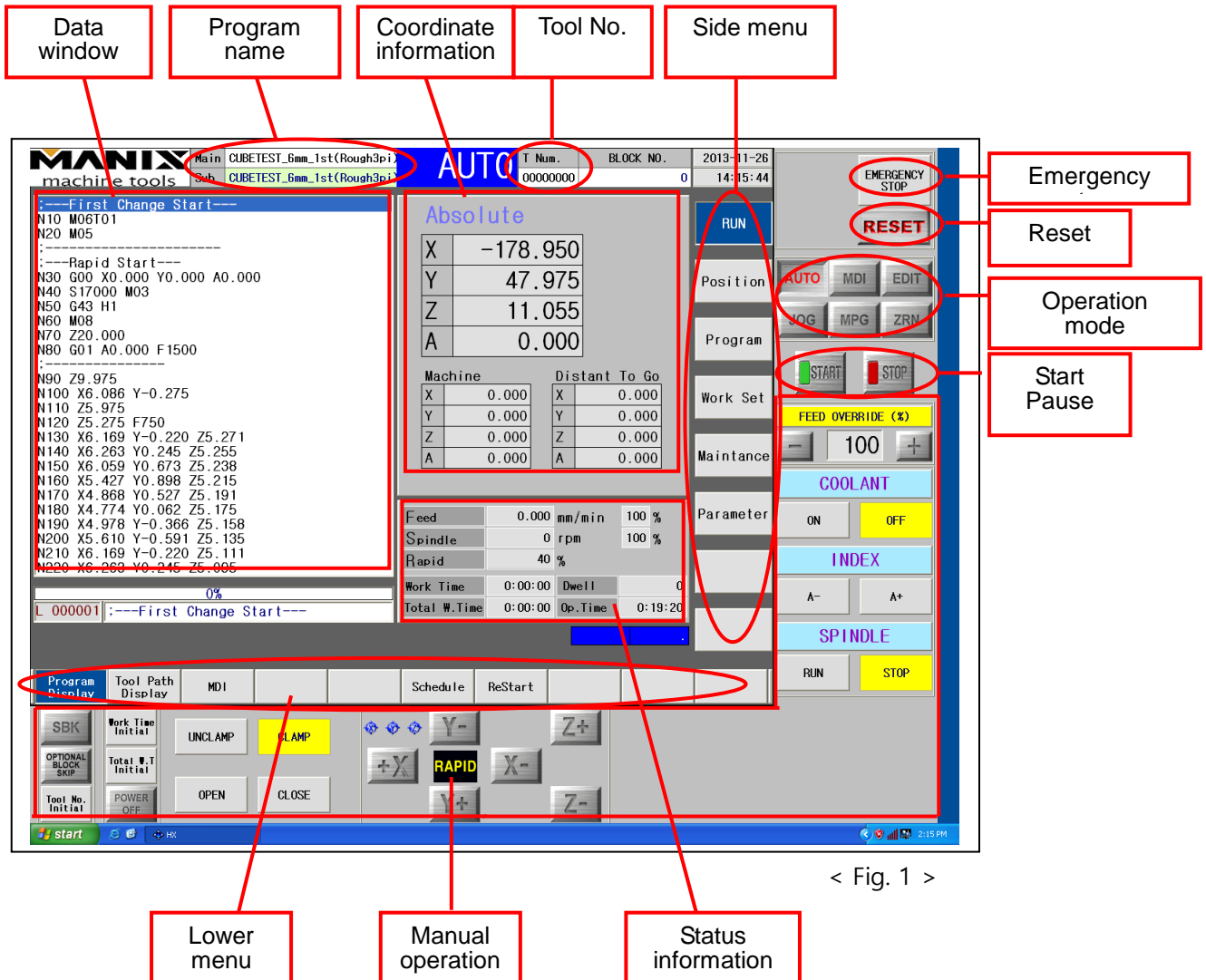
< Fig. 2 >

# Chapter 4 PC-NC Controller

## 1. Monitor

### 1.1 Configuration of the operation program screen

All the information related to the equipment is shown in this monitor.



< Fig. 1 >

### 1.2 Input device

The menus in the monitor are run by the resistive touch input so they can be selected by soft touch.

- ◆ If the pointer of the touch is not located in the touch area, the pointer should be corrected (It can be corrected in eGalax Touch located in the lower right side in the screen.)



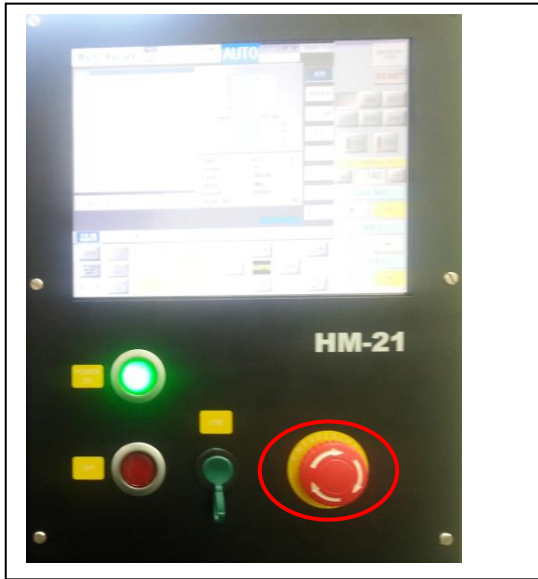
< Fig. 2 >

## 2. Equipment start-up and shut-down

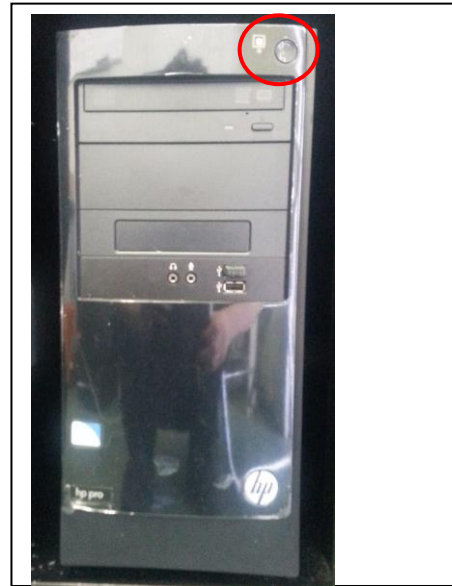
### 2.1 Equipment start-up

To start the equipment, both of the machine part and PC controller should be turned on at the same time.

- (1) Push the POWER ON button in the machine part. (2) Push the POWER ON button in the PC controller.

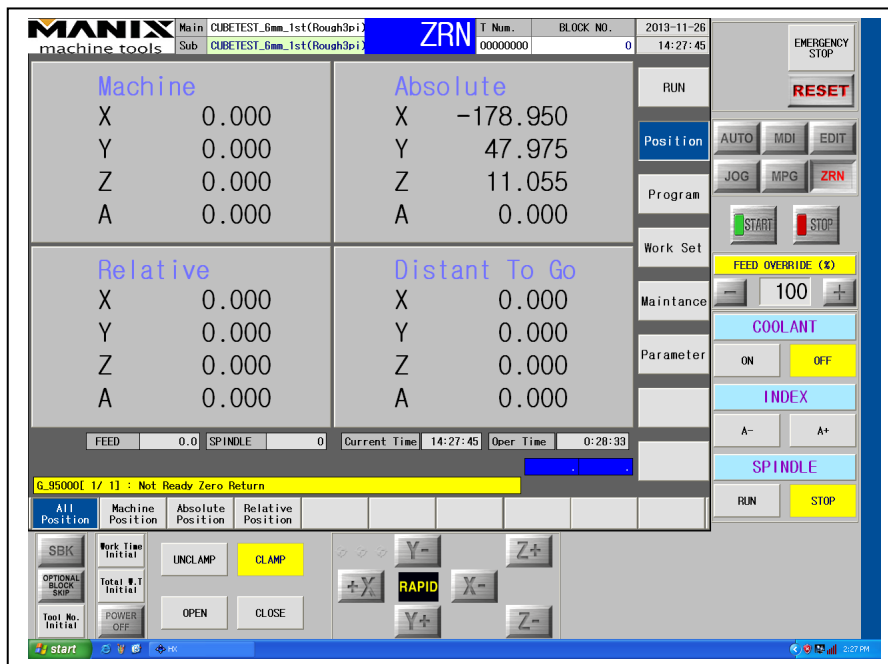


< Fig. 3 >



< Fig. 4 >

- (3) The operation program is executed automatically.

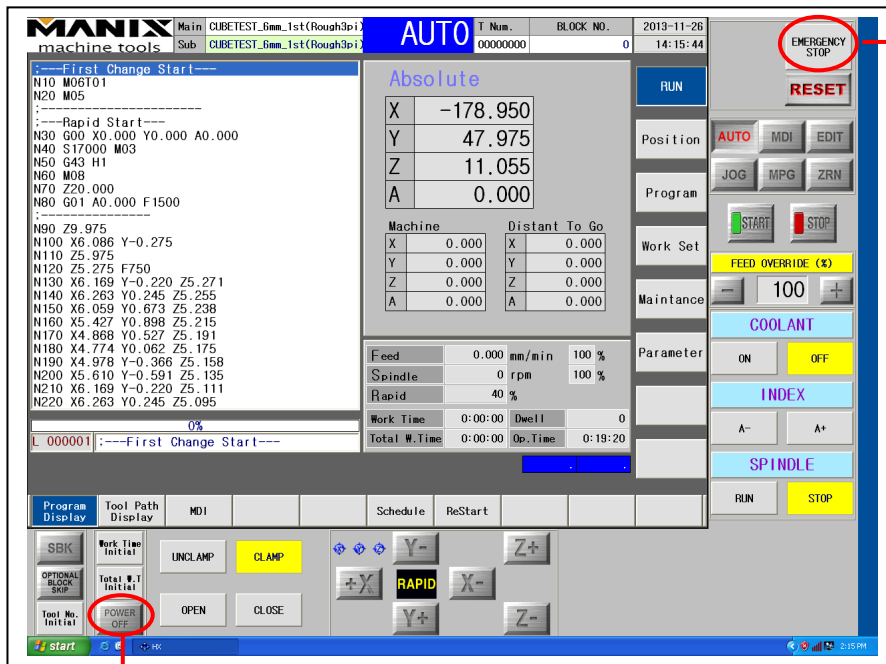


< Fig. 5 >

## 2.2 Equipment shutdown

To shut down the equipment, both of the PC controller and the machine part should be turned off at the same time.

- (1) After pushing the EMERGENCY button, hold down the POWER OFF button for three sec. (PC controller)



1-1. Push the EMERGENCY button.

1-2. Hold down the POWER OFF button for 3 sec.

< Fig. 6 >

- (2) Push the POWER OFF button of the machine power. (Machine part)



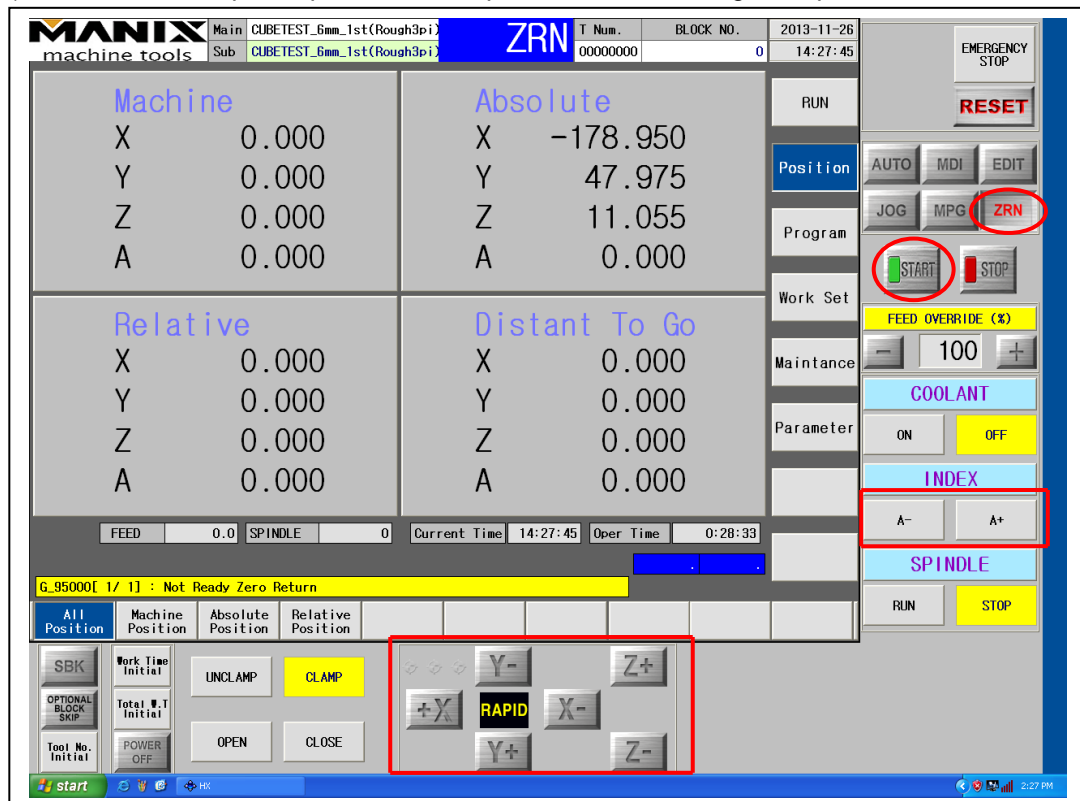
2. Push the POWER OFF button of the machine power.

< Fig. 7 >

### 3. Zero Return (ZRN) of the machine

Generally, once a CNC device is POWER ON, zero position return of the machine must be performed. The operation sequence can be two: one is to return by pushing the transfer button of each axis under the operation mode ZRN and the other is to return of total axes by pushing the START button in the ZRN.

\* Note – If an individual axis performs zero position return, the Z axis must be done the first.  
(It is because the spindle part, the index part, and the tool magazine part can collide one another.)



< Fig. 8 >

#### 3.1 All axes zero position return (Recommended)

ZRN -> START

#### 3.2 Zero position return of each axis

- ZRN -> Z+
- ZRN -> A+
- ZRN -> Y+
- ZRN -> X-

\* Additional note

Once the equipment is POWER ON and zero position returned, COOLANT ON is pushed to circulate coolant for one minute.

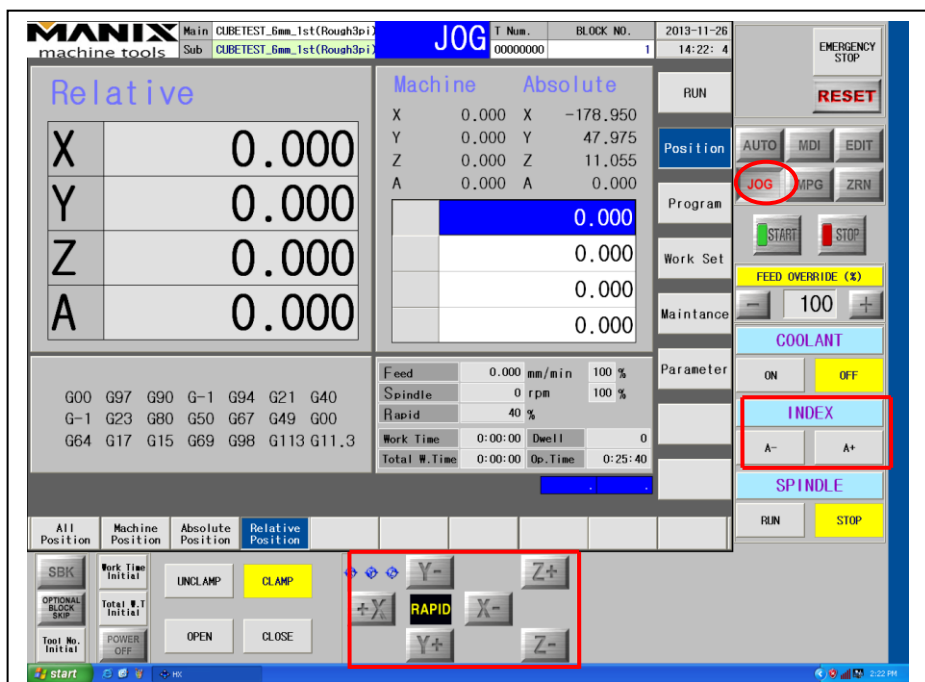
## 4. Manual operation (JOG)

Using the JOG, the machine can be moved to approximate positions by each axis.

It can also execute OPEN and CLOSE of the tool magazine cover and CLAMP and UNCLAMP of the collet as well as RUN and STOP of the spindle and COOLANT ON and OFF.

### ◆ Note

1. When each axis is moved, it should be careful not to collide with the spindle axis, the index, and the tool magazine.
2. If the Over Travel alarm goes off while the axis is moved, it means excessive movement of the axis mechanically. Thus, if the axis is moved to the opposite direction, the alarm is turned off. (Before the Over Travel alarm goes off, the Soft Limit alarm may go off, which is set to prevent mechanical collision in advance. Thus, moving the axis in the opposite direction will turn off the alarm.)
3. When the tools are removed from the spindle using the collet UNCLAMP, the tool initialization button must be held down for three seconds to reset the tool number to 0. (Tool collision may occur during the tool change.)



< Fig. 9 >

### ◆ Additional note

#### - How to respond to tool damage during processing in the Auto mode -

1. The STOP button in the screen or the STOP button in the front panel is pushed to stop the program.
2. The STOP button of the spindle is pushed to stop the spindle.
3. The JOG mode is pushed to move to the safe position (the Z axis is moved first).
4. Hold the damaged tool (to prevent a fall of the tool) and the collet UNCLAMP button is pushed to remove the tool.
5. The OPEN button of the tool magazine cover is pushed to open and the tool is inserted into the number of the damaged tool.

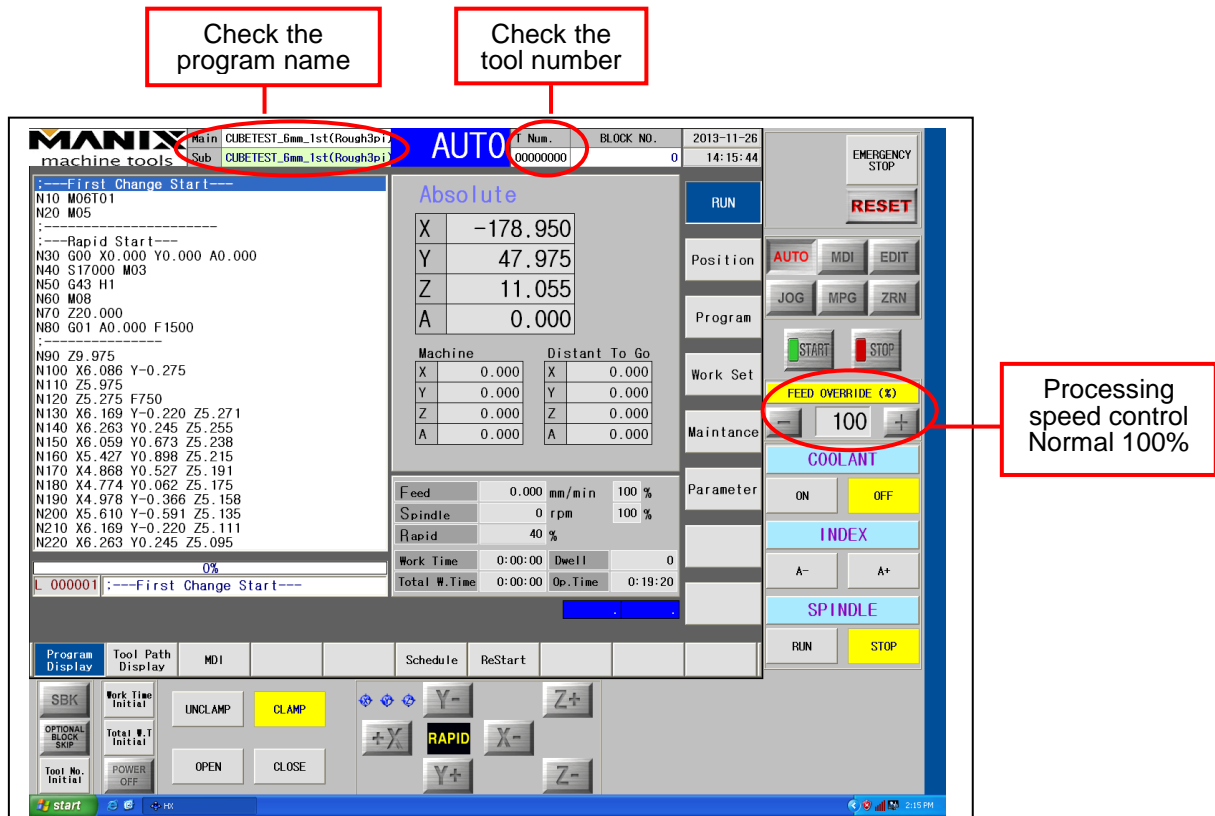
6. The CLOSE button of the tool magazine cover is pushed to close the cover.
7. The initialization button of the tool is held down for three minutes to notice there is no tool in the spindle.
8. The AUTO mode is pushed followed by the RESET button to initialize the status to the processing initialization status.
9. A program for processing is selected and the START button is pushed to process.

## 5. Automatic operation (AUTO)

A program (\*.nc) for processing is selected and the START button is pushed for processing.

### ◆ Checklist before the START button is pushed in the automatic operation mode

1. Check whether a correct program is loaded for the product.
2. Check whether a jig is suitable for the program and mounted with preset material.
3. Check whether tools appropriate for the program are inserted to the tool magazine.
4. Check the tool number in both of the screen and the spindle.  
(Without tools in the spindle, the tool number in the screen should be 0, and if No. 2 tool is mounted in the spindle, the tool number should be 2.)
5. Check whether warming-up is done sufficiently.
6. Check whether coolant is supplied correctly and coolant tank has sufficient coolant.
7. Check whether the air pressure maintains the proper pressure between 5.5 and 6.0MPa (Alarm message is displayed if the air pressure is too low.)
8. Check whether the feed override is 100%.



◆ Note

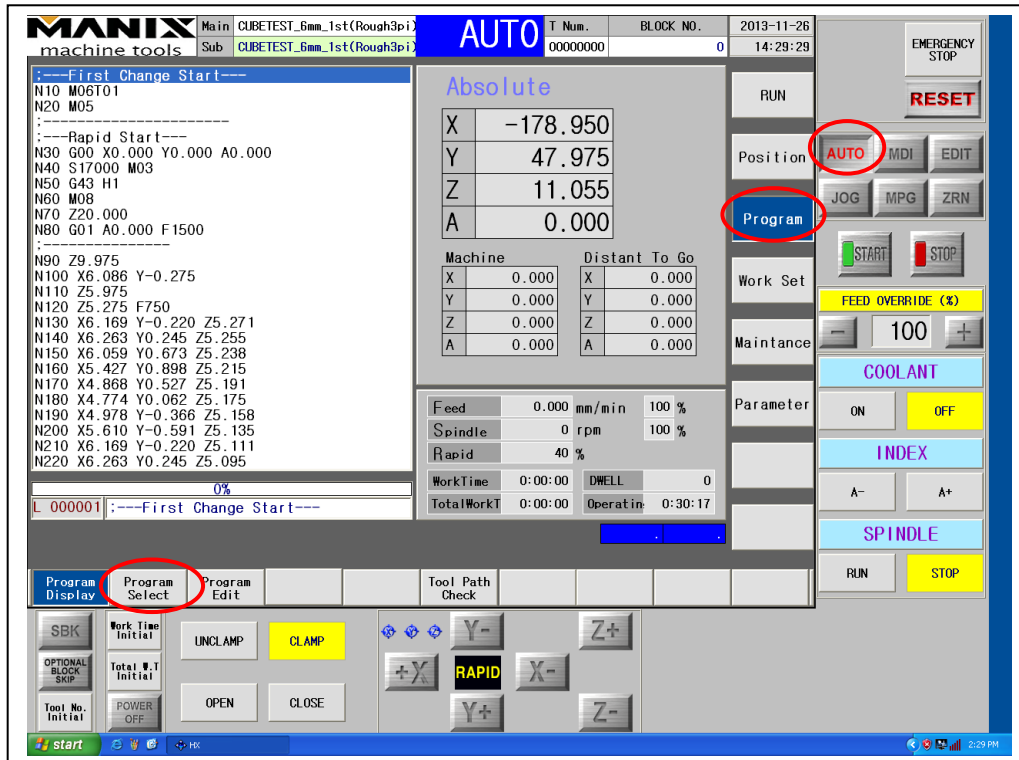
< Fig. 10 >



- Although the processing speed can be set between 0% and 150%, it should be set to 100% in the specialized dental program because it is optimized in the CAM.
- If the processing speed % is set to more than 100%, the equipment may overrun. On the other hand, if the processing speed % is set to less than 100%, a processing time will increase.

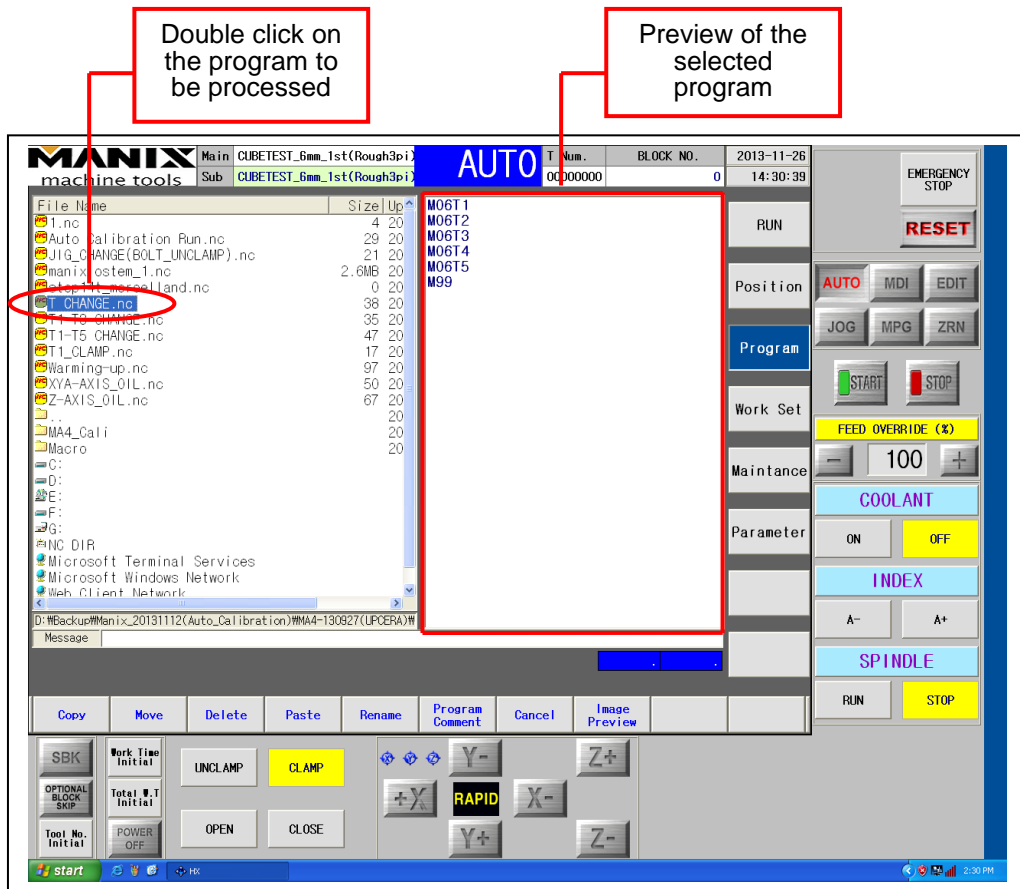
## 5.1 Fetch the processing data

AUTO mode -> Program (Side menu) -> selection of program (Lower menu) -> Double clicking on the program name for processing (extension: \*.nc)



< Fig. 11 >



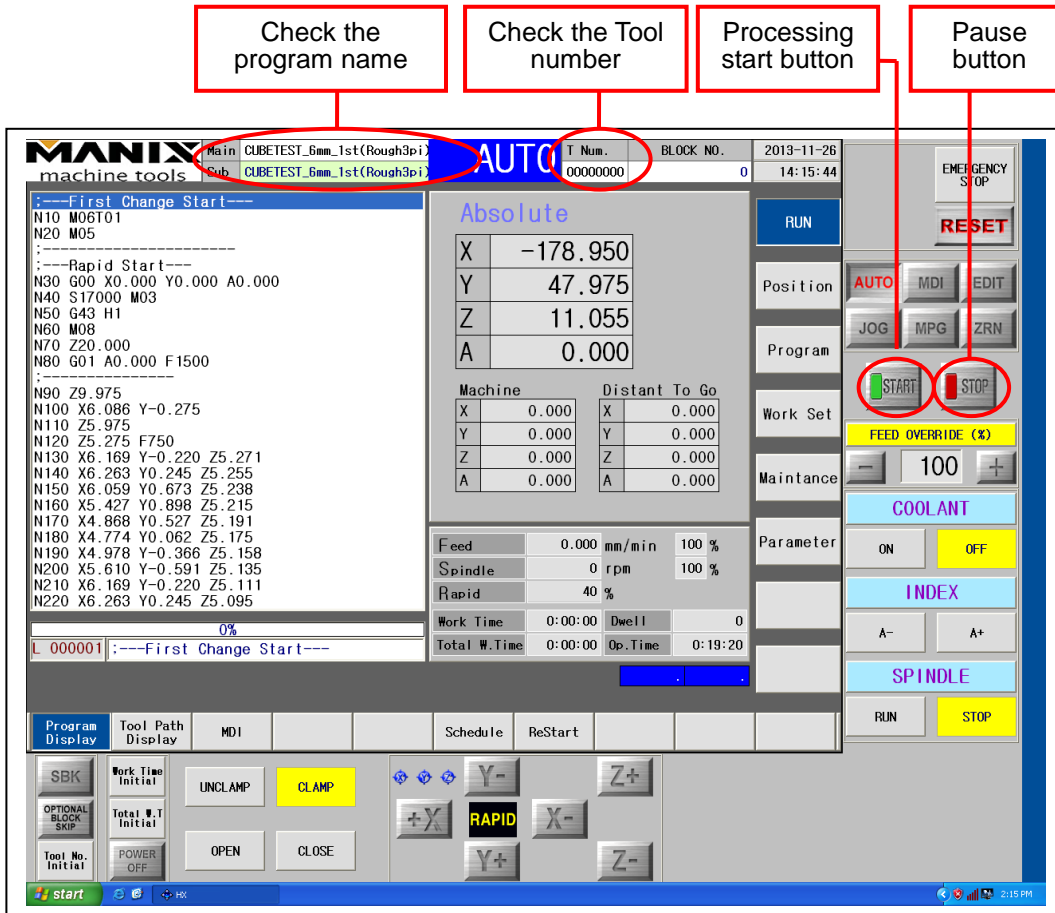


< Fig. 12 >

## 5.2 Processing start and pause

The START button is pushed to start processing.

The STOP button is pushed to pause the processing temporarily.



< Fig. 13 >

- ◆ **Additional note** – Coolant plays an important role in cooling action for the tools and tool's life increase. Therefore, a coolant level in the coolant tank should be checked if sufficient coolant is not applied to the tools or materials. On the other hand, if coolant is filled sufficiently but the supplied flow of coolant is weak, foreign materials may block the pipe for coolant supply.

## Chapter 5 Maintenance and management

### 1. ATC system

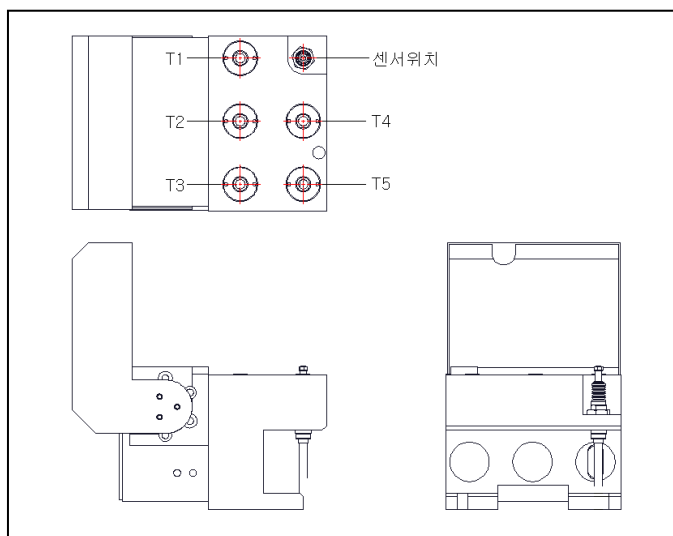
#### 1.1 Overview

It is a device that replaces the tools automatically for the improvement on operation convenience.

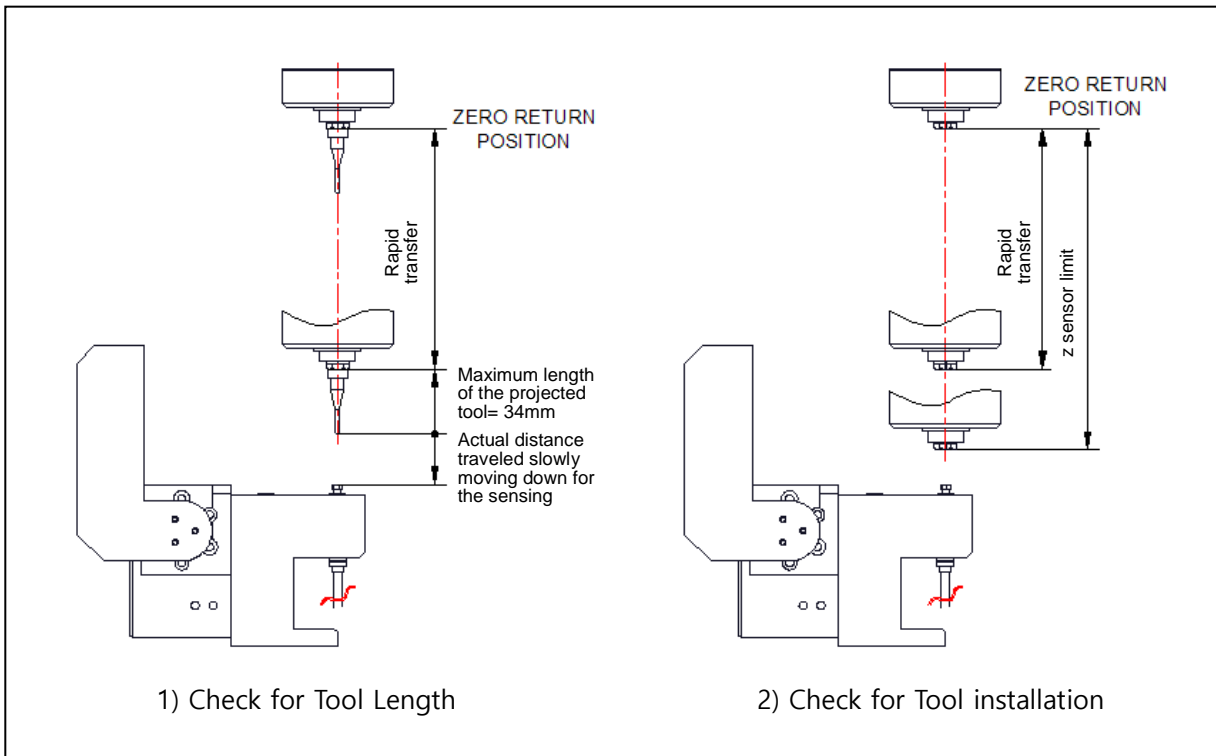
This device selects a required tool from the tool magazine and replaces existing tool with the selected tool automatically.

#### 1.2 ATC operation order

- ◆ If the tool number of the controller is 0 and the tool to be changed is No. 1  
Zero return of the Z axis -> ATC cover open -> Spindle collet unclamp -> Transferred to No. 1 tool position  
-> Rapid transfer of the Z axis -> Transfer to the clamp position of the Z axis -> Spindle collet clamp -> Slow tool withdrawal of the Z axis  
-> Zero return of the Z axis -> Transfer to the sensor position -> Rapid transfer of the Z axis -> Z axis sensing -> Re-measurement of the tool length  
-> Zero return of the Z axis -> ATC cover close
- ◆ If the tool number of the controller is 2 and the tool to be changed is No. 1  
Zero return of the Z axis -> ATC cover open -> Transferred to No. 2 tool position-> Rapid transfer of the Z axis  
-> Slow transfer of the Z-axis to the unclamp position -> Spindle collet unclamp -> Rapid transfer of the Z axis  
-> Transfer to the sensor position -> Confirmed operation to check correct withdrawal of the tool -> Rapid transfer of the Z axis  
-> Transferred to No. 1 tool position -> Rapid transfer of the Z axis -> Transfer to the clamp position of the Z axis -> Spindle collet clamp  
-> Slow tool withdrawal of the Z axis-> Zero return of the Z axis -> Transfer to the sensor position -> Rapid transfer of the Z axis -> Z axis sensing  
-> Re-measurement of the tool length -> Zero return of the Z axis -> ATC cover close



< Fig. 1 >

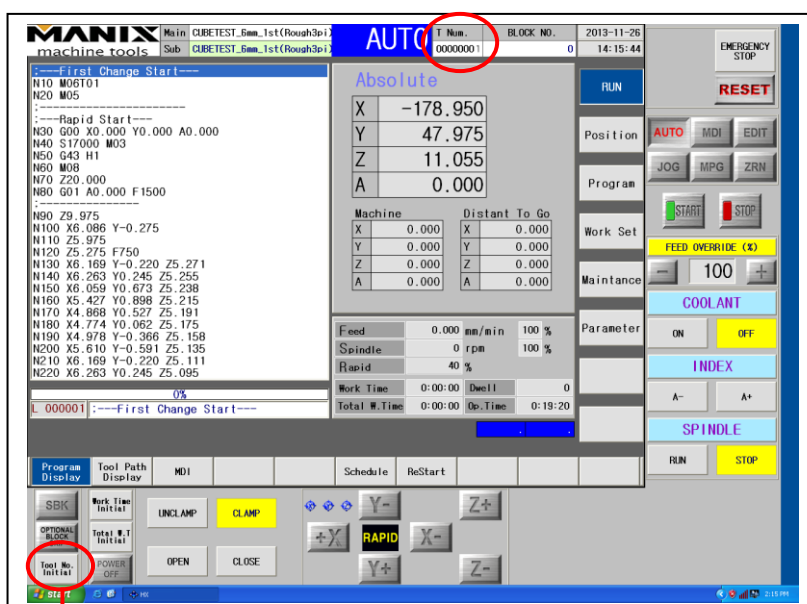


< Fig. 2 >

### 1.3 Initialization of the tool numbers

The tool number initialization is to notice the equipment that there is no tool in the spindle when tools are damaged so that damaged tools are removed by UNCLAMP manually.

Once the Tool No. Initial button is held down for three seconds, Tool No. is initialized to '0'.



Tool No. Initial button

< Fig. 3 >

## 2. Lubrication system

Grease is coated in the surface of the equipment basically to prevent the wear of the guide surface. Oil injection opening is placed in every axis to inject way lube three times a day using an oil gun.

◆ Location of the way lube injection opening

X-axis oil injection opening



< Fig. 4 >

Can inject to the Dovetail in the X-axis directly



< Fig. 5 >

Y-axis oil injection opening

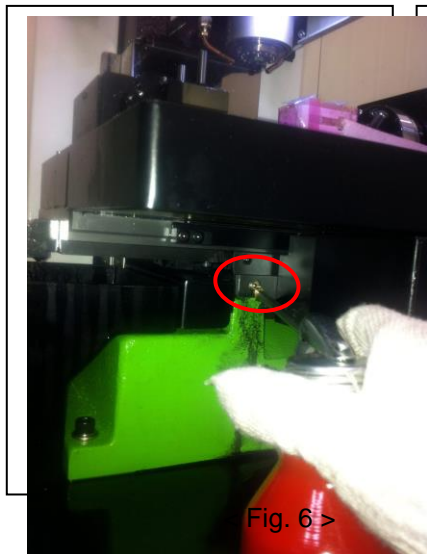


Fig. 6 >

Z-axis oil injection opening



< Fig. 7 >

A-axis oil injection opening



< Fig. 8 >

◆ Oil gun



< Fig. 9 >

◆ Lubricant

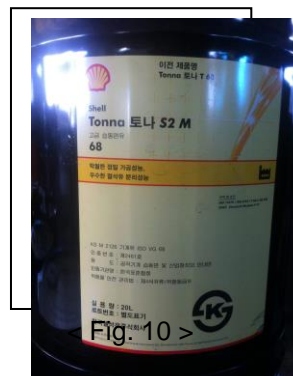


Fig. 10 >

### 3. Pneumatic system

#### 3.1 Overview

The pneumatic system consists of regulators, lubricators, air solenoid valve, and piping components.

- (1) Compressed air is introduced through the pipe.
- (2) The introduced compressive air is adjusted to proper pressure for the equipment via the regulator.
- (3) The adjusted compressive air is sent to the air solenoid value to run the air systems.

#### 3.2 Use of the compressive air

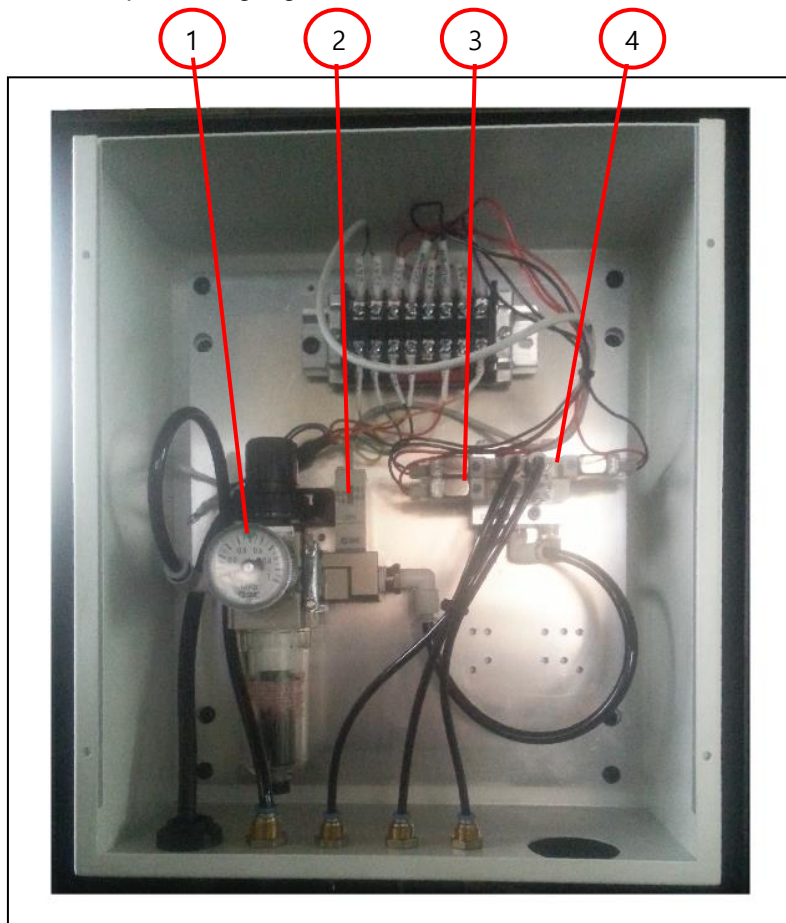
ATC door cover (Open, Cross)

Spindle collet (Clamp, Unclamp)

#### 3.3 Adjustment of the supplied air pressure

If a lever located in the upper end of the regulator is pulled up and turned clockwise, supplied air pressure is increased. On the other hand, the lever is turned counter-clockwise, air pressure is decreased.

The pressure gauge should indicate 5.5 to 6 MPa.



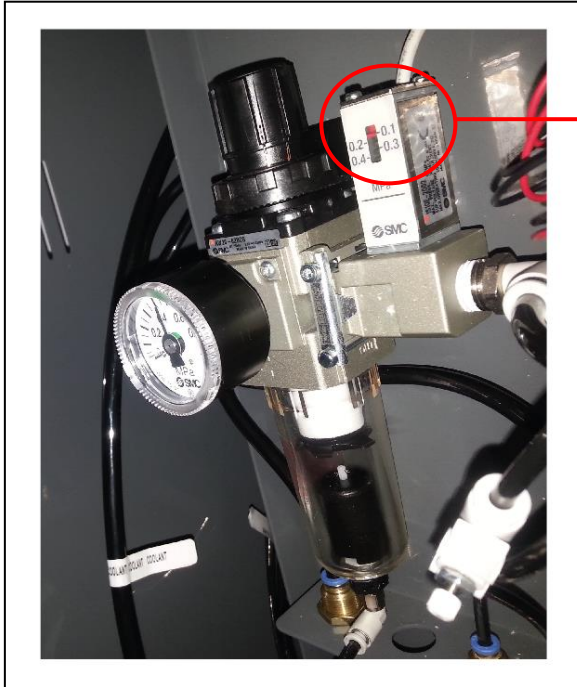
1. Regulator (filter type)
2. Pressure switch
3. One-solenoid valve  
(Collet CLAMP)
4. Two-solenoid valve  
(ATC cover OPEN and CLOSE)

< Fig. 11 >



### 3.4 Adjustment of the pressure switch

Once the supplied air pressure is reached below the setting value, an alarm sign appears in the monitor by means of the switch that opens and closes the electric contact as the air pressure decreases.



< Fig. 12 >

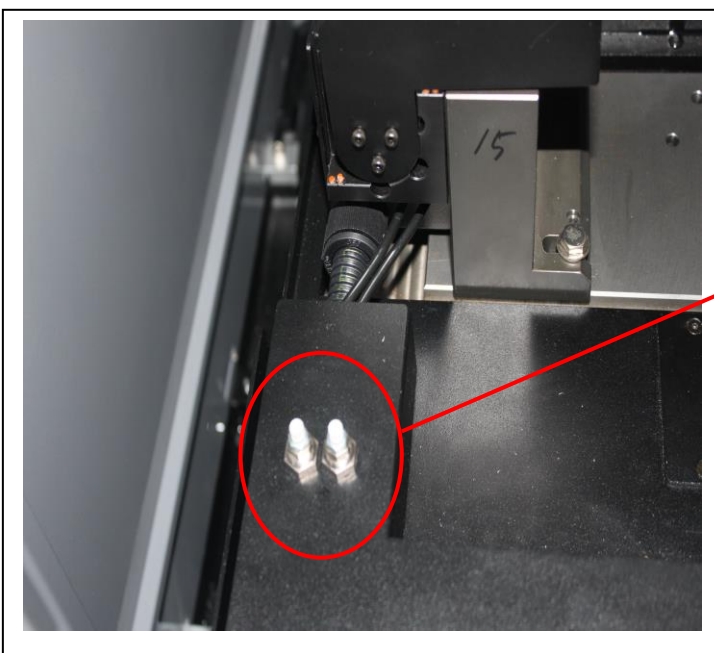
◆ Adjustment of the pressure switch

A pressure can be set by turning a slot-head “-“located on the front side into + or - direction using a screwdriver.

(It is set to -0.4 as factory default)

### 3.5 Speed adjustment of the ATC door

If the air amount is too small, the ATC door may not open. On the other hand, if the air amount is too large, the ATC door may be closed heavily to make loud sound. Here, the air amount supplied can be adjusted by means of the value.



< Fig. 13 >

◆ When door is not opened well,

Air speed is adjusted using the ATC door open valve.

## 4. Coolant system

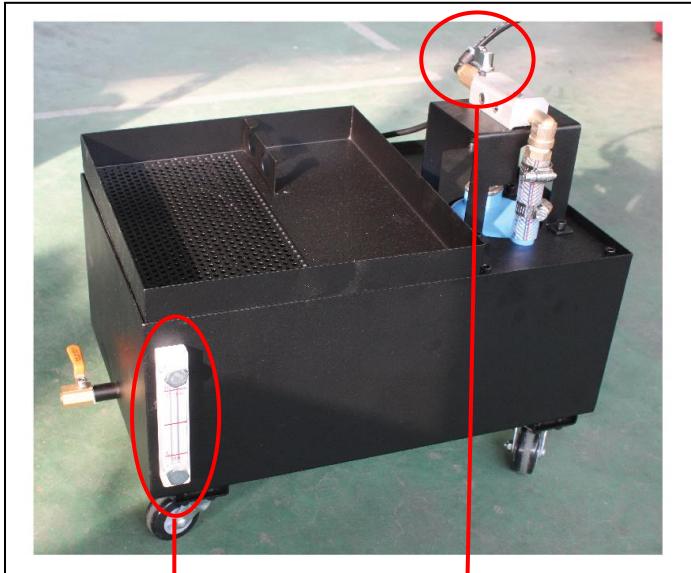
### 4.1 Overview

The coolant introduced to the coolant pump from the coolant tank is discharged to the tools and work pieces from the spindle side through the piping.

The discharged coolant is returned back to the coolant tank.

### 4.2 Coolant

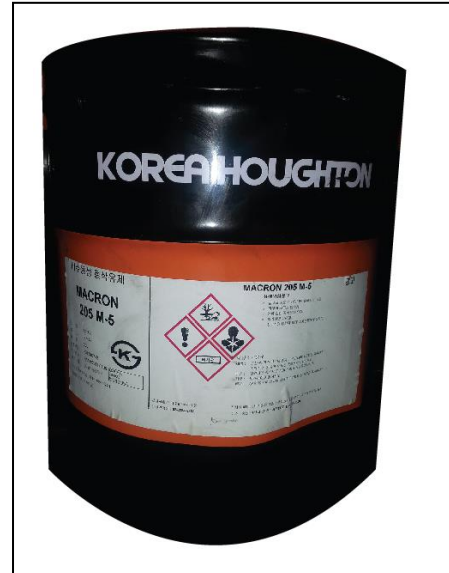
- (1) Non-water-soluble coolant whose viscosity is equivalent to  $7\text{mm}^2/\text{s}$  at  $20^\circ\text{C}$  should be used.
- (2) The adjustment of the discharged coolant can be set by adjusting the valve located in the coolant tank.
- (3) The coolant amount should not be below  $2/3$  in the gauge indicator.  
(With the low coolant amount, a pump may perform idling causing the pump failure.)



< Fig. 14 >

Coolant  
amount  
indicator

Control valve of the  
coolant discharge  
amount



< Fig. 15 > Recommended coolant



### 4.3 Cleaning of the coolant tank

When cutting chips are accumulated inside the coolant tank, a proper coolant amount will not be discharged even with the right coolant amount in the tank.

If the coolant pump pumps the coolant with such large amount of fine chips, it shortens the life of the equipment.

The tank should be cleaned at least once a six month.

## 5. Daily and periodic inspection

### 5.1 Overview

An operator should understand the functions and performance of the machine sufficiently and be familiar with how to use in order to operate the machine correctly with the highest performance and functions.

In addition, daily inspection should be conducted based on the daily inspection checklist in this chapter.

### 5.2 Checklist of the daily and periodic inspection

MA4 Daily inspection checklist

< Table 1 >

Inspection area	Inspection item	Inspection time		Period	Inspection method	Inspection criteria	Action
		Under operation	Pause				
1. Transfer surface (X,Y,Z) lubricant	Lubrication of way lube		○	Daily	Check visually before the machine start-up	Check the proper amount	Lubrication
2. Index lubricant	Lubrication of way lube		○	Daily	Check visually before the machine start-up	Check the proper amount	Lubrication
3. Air unit	Checking the regulator water drain		○	Daily	Visual check	Check the proper amount	Cleaning
	Air pressure	○		Daily	Visual check	5.5MPa~6.0MPa	Adjustment
4. Spindle motor	Noise, vibration	○		Weekly	Check during machine operation	No abnormal operation during the operation	Repair
5. Spindle collet	Collet wear	○		Monthly	Defective product created due to tools forced to move	Product dimension produced abnormally	Replacement
6. Tool magazine collet	Collet wear	○		Monthly	A fall of tool into the tool magazine	Abnormal tool replacement	Replacement
7. Tool ring location	Ring location		○	Daily	Visual check before the mounting of tools	Dimension check	Adjustment

8. Tool replacement process	Replacement condition of tools	○		Daily	Replacement condition check after new tool mounted	Replacement should work as expected	Correction
9. Coolant nozzle	Spray location of coolant	○		Daily	Visual check	Check the proper amount	Cleaning
10. Inspection after use	Cleaning of processing chips		○	Daily	Visual check around the table	Check the proper amount	Cleaning
	Coolant leakage check		○	Daily	Visual check	No unnecessary partial leakage found	Repair
11. Coolant circulation device	Coolant level check		○	Monthly	Coolant supply is weak	Check the proper amount	Filling up

A proper warming-up time should be programmed under no load condition prior to the operation thereby facilitating the movement of the sliding surfaces of the axes as well as bearing rotation of the spindle.

#### GC4 Daily inspection checklist

Inspection area	Inspection item	Inspection time		Period	Inspection method	Inspection criteria	Action
		Under operation	Pause				
1. Index lubricant	Lubrication of way lube		○	Daily	Check visually before the machine start-up	Check the proper amount	Lubrication
2. Air unit	Checking the regulator water drain		○	Daily	Visual check	Check the proper amount	Cleaning
	Air pressure	○		Daily	Visual check	5.5MPa~6.0MPa	Adjustment
3. Spindle motor	Noise, vibration	○		Weekly	Check during machine operation	No abnormal operation during the operation	Repair

4. Spindle collet	Collet wear	○		Monthly	Defective product created due to tools forced to move	Product dimension produced abnormally	Replacement
5. Tool magazine collet	Collet wear	○		Monthly	A fall of tool into the tool magazine	Abnormal tool replacement	Replacement
6. Tool ring location	Ring location		○	Daily	Visual check before the mounting of tools	Dimension check	Adjustment
7. Tool replacement process	Replacement condition of tools	○		Daily	Replacement condition check after new tool mounted	Replacement should work as expected	Correction
8. Coolant nozzle	Spray location of coolant	○		Daily	Visual check	Check the proper amount	Cleaning
9. Inspection after use	Cleaning of processing chips		○	Daily	Visual check around the table	Check the proper amount	Cleaning
	Mixed coolant leakage check		○	Daily	Visual check	No unnecessary partial leakage found	Repair
10. Coolant circulation device	Mixed coolant level check		○	monthly	Coolant supply is weak	Check the proper amount	Filling up
11. XYZ axes LM guide	Noise, vibration		○	Yearly	Check during machine operation	Inquiry to the manufacturer	

A proper warming-up time should be programmed under no load condition prior to the operation thereby facilitating the movement of the sliding surfaces of the axes as well as bearing rotation of the spindle.

## Chapter 6 Response to the alarm occurrence

A type of alarms and how to respond to them

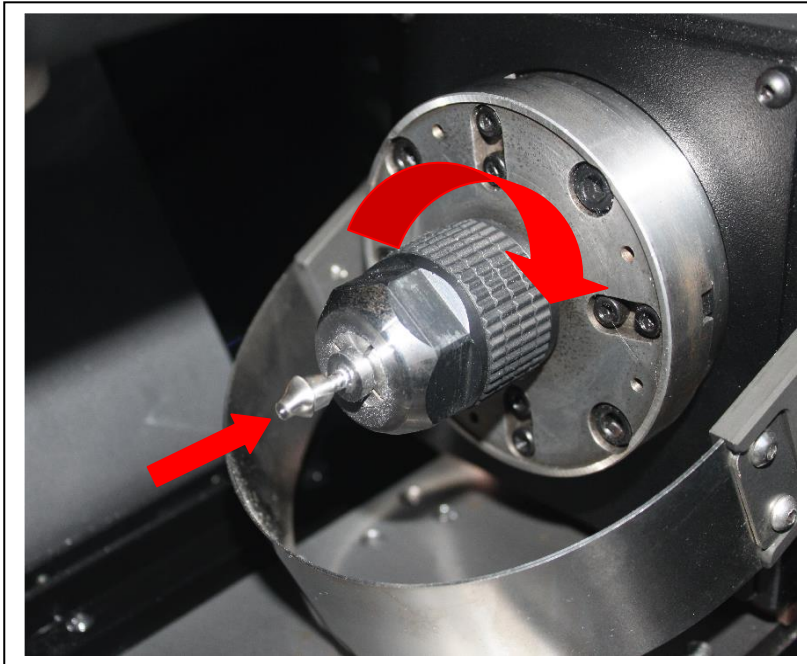
Explanation and cause of the alarm	Response
<p>* OVER TRAVEL of each axis-&gt; It occurs when the limit switch installed in the limit point of the machine stroke is touched. e.g.) X Axis - OVER TRAVEL Y Axis + OVER TRAVEL</p>	<p>Alarm is automatically turned off if the axis that caused the alarm moves to the opposite direction in the JOG mode.</p>
<p>* Out of the soft limit of each axis -&gt; e.g.) No. 1 axis is out of the soft limit zone. (X-axis No. 1 axis, Y-axis No. 2 axis, Z-axis No. 3 axis, A-axis No. 4 axis)</p>	<ol style="list-style-type: none"> <li>1. Alarm is automatically turned off if the axis that caused the alarm moves to the opposite direction in the JOG mode.</li> <li>2. Check whether fixture is set in the DentMill (if fixture is not set in the DentMill, X-axis soft limit is caused)</li> </ol>
<p>* When the equipment is stopped during processing -&gt; 1. This alarm occurs when data communication between PC controller and the machine is not properly done. 2. This alarm occurs when a USB is removed in the middle of the data read from the USB. 3. When an insufficient air amount is introduced to the equipment due to momentary excessive use of main air at the dental lab, an alarm goes off along with suspension of the equipment operation.</p>	<ol style="list-style-type: none"> <li>1. Check whether power is connected to the ground.</li> <li>2. Check whether PC controller contains computer virus.</li> <li>3. Check the cable connector.</li> <li>4. Check whether USB is correctly connected.</li> <li>5. Supply air in the dental lab reliably.</li> </ol>
<p>* Collision in the equipment during the processing -&gt; 1. Processing is conducted with the excessive load more than allowable load. 2. Alarm goes off when transfer is stopped due to mechanical collision.</p>	<ol style="list-style-type: none"> <li>1. Friction force increases due to tool's wear thereby generating the alarm -&gt; Replace the tool.</li> <li>2. Contact the manufacturer immediately if there is a collision in the equipment.</li> </ol>
<p>* Auxiliary pin strikes tools during tool change -&gt; 1. This alarm occurs when tool initialization is not done while auxiliary pin is loaded in the spindle and the tool is put in the tool magazine.</p>	<p>Tool initialization should be done.</p>
<p>* During tool change, a tool hanged over the spindle is fallen while performing tool change -&gt; 1. If tool change is performed when the tool number in the screen is 0, this symptom occurs.</p>	<p>If the tool number in the screen is 0, a tool that is loaded in the spindle should be removed using manual mode and inserted to the tool magazine.</p>

<p>* If tracking error occurs in each axis -&gt; e.g.) Tracking error of No. 1 axis occurred.</p>	<ol style="list-style-type: none"> <li>1. Parameter setup in the PC controller is inspected.</li> <li>2. Check whether excessive load is applied to the axis.</li> </ol>
<p>* "Servo not ready" occurred in each axis -&gt; This alarm occurs when the driver and the machine are not connected with each other. e.g.) No. 1 axis Servo not ready</p>	<ol style="list-style-type: none"> <li>1. Driver of the axis where the alarm occurred is inspected.</li> <li>2. The connection condition of the cable is inspected.</li> </ol>
<p>* G_90007 INVERTER ALARM</p>	<ol style="list-style-type: none"> <li>1. Check whether the alarm occurred in the inverter of the control box.</li> <li>2. When excessive load is applied to the spindle, this alarm goes off. -&gt; Cutting overload due to wear of the tool -&gt; Bearing damage due to shock of the spindle.</li> </ol>
<p>* The cover of the tool box is not opened well</p>	<ol style="list-style-type: none"> <li>1. Check whether the pressure gauge of the main air indicates 5.5~6.0 MPa -&gt; Adjust the speed controller for the cover.</li> <li>2. Check whether the toolbox cover interferes with the plastic stopper.</li> </ol>
<p>* During the program(CSCAM) running, Fail IPO is highlighted with red</p>	<p>A folder backed up in My Document is pasted into the place where the current program is running.</p>
<p>* During the program(CSCAM) running, NC Card Isn't detected!" is highlighted with red.</p>	<p>Controller NC card is damaged. Need to replace. (For replacement, the manufacturer should be contacted)</p>
<p>* F_82012 syntax error.</p>	<p>Check whether the template is set to other company template when processing data is collected.</p>
<p>* The processing object is not positioned correctly</p>	<p>It may be caused by the damage of the setup data. Therefore, backup folder is pasted into the place where current program is running.</p>
<p>* Tool is not gripped properly</p>	<p>Tool may not be placed vertically. Check whether tool is put into the inside of the tool box. When gripping with a little force -&gt; a tool sensor may be damaged.</p>
<p>Others</p>	<p>Other problems other than above issues should contact the manufacturer.</p>

## Chapter 7 Simple operation method

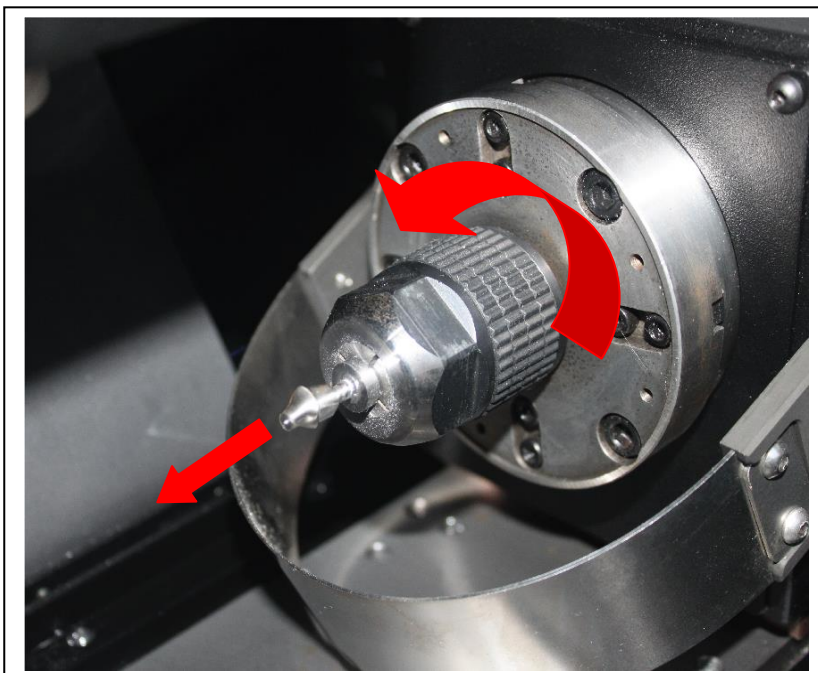
### 1. Material (Round bar) clamping method

#### 1.1 Material (Round bar) clamp



< Fig. 1 >

#### 1.2 Material (Round bar) unclamp

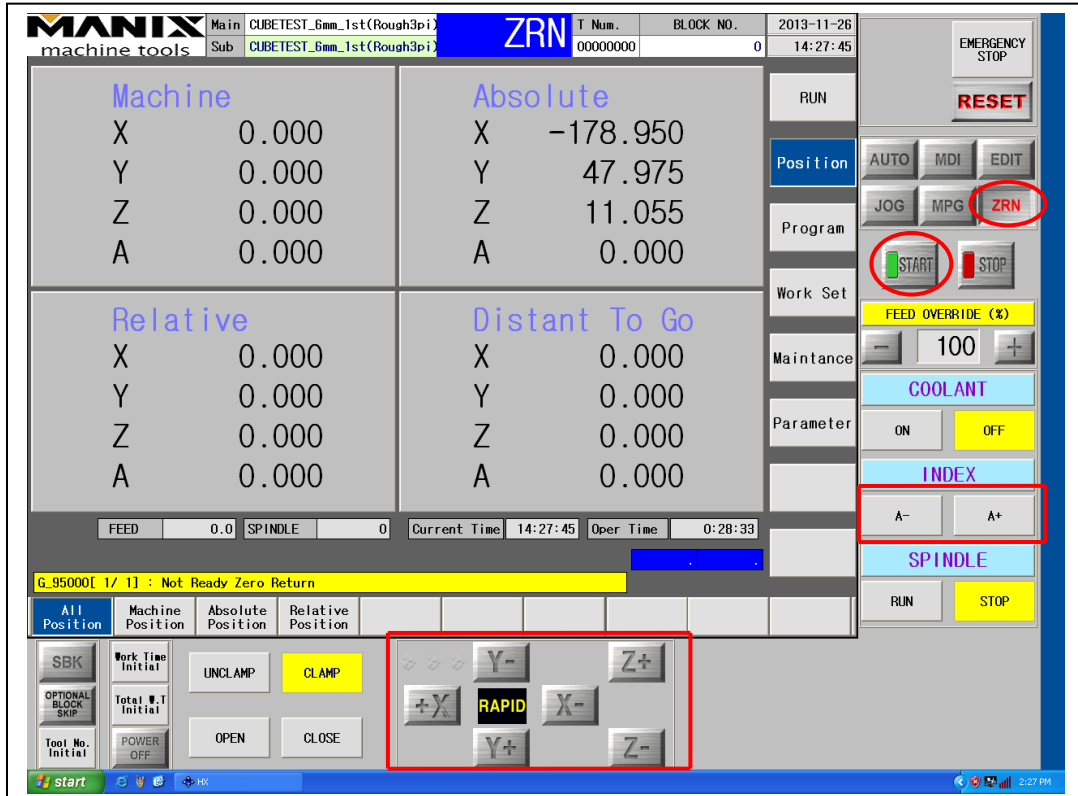


< Fig. 2 >

## 2. Equipment zero return

### 2.1 All axes zero return

ZRN -> START

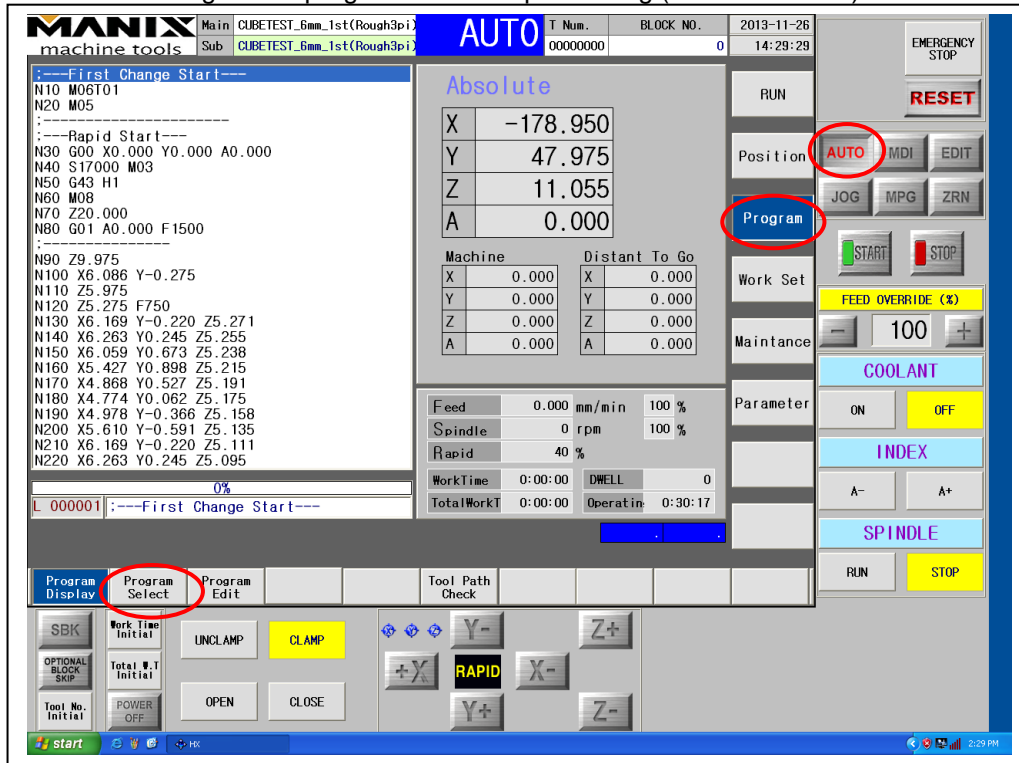


< Fig. 3 >



### 3. Program loading

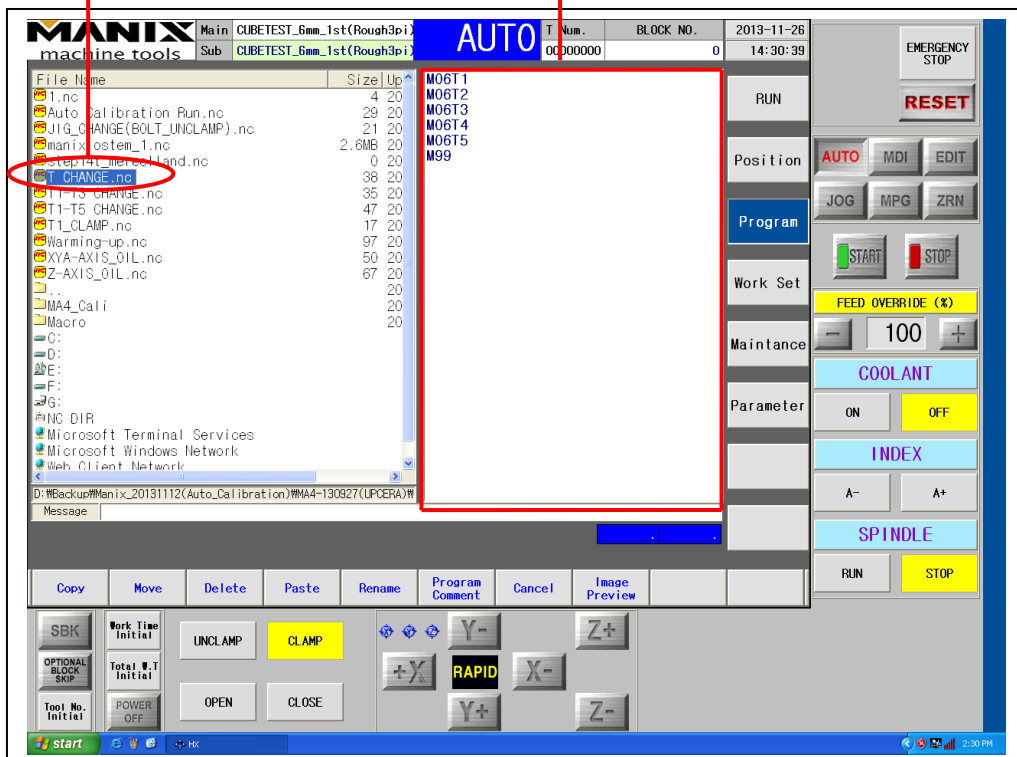
AUTO mode -> Program (Side menu) -> selection of program (Lower menu)  
-> Double clicking on the program name for processing (extension: \*.nc)



< Fig. 4 >

Double click on the program to be processed

Preview of the selected program



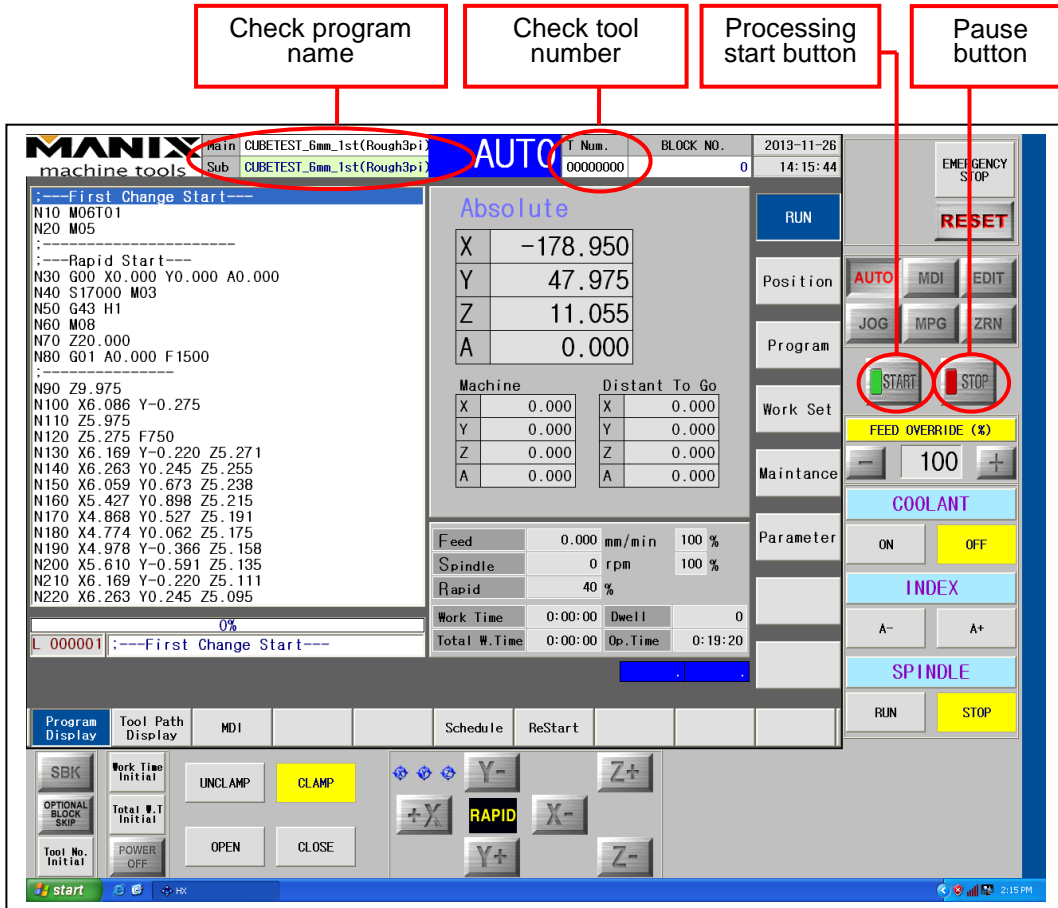
< Fig. 5 >



## 4. Processing start

The START button is pushed to start processing.

The STOP button is pushed to pause the processing temporarily.



< Fig. 6 >