# AUTOMATED NUCLEIC ACID ISOLATION SYSTEM

## GENE PREP STAR
## NA-480/PI-480
## GENEPREP/FLEXSTAR

SERVICE MANUAL
(Version 1209-1)

**- Read and understand this manual before operating.**
**- Save this manual**

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# Important information

Thank you for your choosing Automated Nucleic Acid Isolation system, GENE PREP STAR.

**⚠WARNING**

1. Read and understand this manual before operating the instrument.
2. Save this manual close at hand and use for reference during operation.
3. Obey intended operation procedure of the instrument and operation procedure instructed in this manual.
4. Obey and understand safety instruction in this manual.

You must obey the instruction described above.
Not obeying these instruction may result in injury or accident.

## [About this manual]

1. KURABO INDUSTRIES LTD. reserves the right to revise this manual without notice.
2. No part of this manual may be reproduced in any form by any means without prior written permission from KURABO INDUSTRIES LTD.
3. Contact your sales representative, if you lose this manual
4. Contact your sales representative, if you find unclear or improper description in this manual.
5. KURABO INDUSTRIES LTD. cannot anticipate every possible circumstance that might involve a potential hazard.
   The warnings in this manual and on the instrument are therefore not all inclusive.

# Safety precautions

## General Precaution and Warnings

1. Whenever handling used instruments the service personnel should be gloved, and where appropriate clothing and eye wear to protect against injury.

2. Shock Hazard

There are exposed primary line voltages and other dangerous secondary high voltages contained and generated within this instrument. All service personnel must use extreme caution whenever working on this unit with the covers removed.

3. ESD Sensitive Components

Many electronic components contained within this instrument are extremely sensitive to Electrostatic discharge (ESD). All service personnel are required to wear an anti-static wrist strap and observe standard ESD precautions when servicing this equipment. Damage caused by ESD does not always manifest itself in an immediate component failure, rather component parameter specifications may go out of tolerance or fail completely at some further date due to gradual degradation of the component as a result of the initial Electrostatic Discharge damage.

4. Safety Ground

There are several protective safety ground wires utilized within the system. To ensure that the instrument is safe against shock hazards for the operator and service personnel these ground must be replaced before re-powering the instrument if they are ever removed for any reason. The instrument should also be properly grounded at the wall outlet for safety purpose.

Any fuses or protective components contained within the instrument are to be replaced with like value, direct replacement components to prevent the risk of fire or shock hazards.

The items described in these instructions and on the instrument are very important so that you can use the instrument safely and prevent injury to yourself and other people around you and prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown below and then continue to read the manual. Make sure that you observe all warnings given.

Explanation of marking

**Warning**

Indicates that errors in operation may lead death or serious injury.

**Caution**

Indicates that error in operation may result in minor or moderate injury or damage to equipment.

**Note**

Indicates useful information for operating the instrument.

# Meanings of symbols

Indicates prohibition(Don’t do it)
What is prohibition will be described in or near the symbol in either text or picture form.

Indicates something mandatory(must be done)
What is mandatory will be described near the symbol in text form.

# Warnings and instructions

## Installation/Operation

Warning

Install and operate the instrument while keeping horizontal.
Installation at a place with inclination may result in damage of the instrument or accident with injury.

## No fire

Warning

Install and operate the instrument in a well ventilated room.
This instrument has no countermeasure to fire.

## Disassemble/modify

Warning

Never disassemble or modify the instrument.
That may result in malfunction of the instrument or injury.

## Repairing

Warning

Immediately stop operation and call your service representative if the instrument get trouble.
Do not repair by an unqualified person or do not continue operation.
Those may result in malfunction of the instrument or injury.

## Emergency situation

Warning

If you find smoke or abnormal sound from the instrument, immediately stop operation, turn power switch off and unplug the power plug from wall receptacle.
Then, call your service representative.

## Power plug

| | |
|---|---|
| ⚠ Warning | Do not touch the plug by wet hand. That may result in electric shock.<br>Grip the plug when pull the plug out of the receptacle.<br>Do not pull the power cable. |

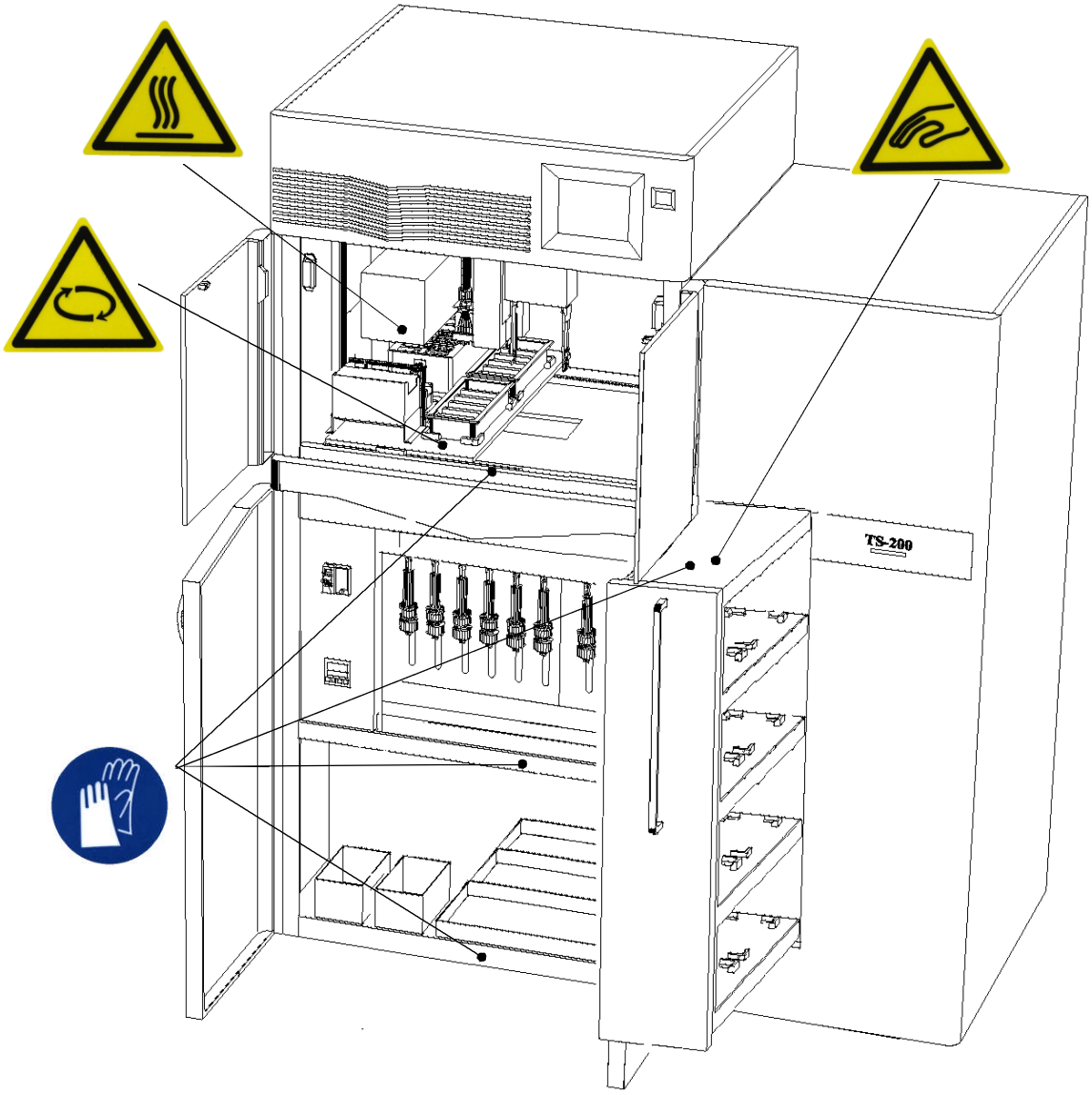
## Power cable

| | |
|---|---|
| ⚠ Warning | Do not bend, pull, twist or splice power cable.<br>That may result in malfunction of the instrument or fire. |

| | |
|---|---|
| ⚠ Warning | If you find crack or breaking of the power cable or improper connection of plug, immediately stop operation of the instrument and call your service representative. |

# Warning on the instrument

On the instrument, the following symbols are used to highlight important user and safety information.



**This symbol indicates the warning, do not open the centrifuge door while the rotor rotating.**
**May get injury.**

**This symbol indicates the warning, do not enter you hand/body.**
**(This warning label is on the optional sample stacker)**

**This symbol indicates the caution, hot surface.**
**(This label is on the optional heater module)**

**This symbol indicates the warning, safety gloves must be worn.**
**May be toxic, corrosive or flammable.**

# Warranty

## LIMITED WARRANTY

KURABO INDUSTRIES LTD. at its option, will repair or replace any part returned intact to KURABO INDUSTRIES LTD., which KURABO INDUSTRIES LTD. upon inspection, will determine to be defective in material and/or workmanship.

KURABO INDUSTRIES LTD. MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, EXCEPT AS PROVIDED HEREIN, INCLUDING WITHOUT LIMITATION THEREOF, WARRANTIES AS TO MARKETABILITY, MERCHANTABILITY, FOR A PARTICULAR PURPOSE OR USE, OR AGAINST INFRINGEMENT OF DAMAGES OR CONSEQUENTIAL DAMAGES INCLUDING WITHOUT LIMITATION THEREOF DAMAGES OR OTHER COSTS RESULTING FROM ANY ABUSE, MISUSE, MISAPPLICATION OF THIS EQUIPMENT.

# TABLE OF CONTENTS

## 1-1 Specification of the GENE PREP STAR

## Specifications of the GENE PREP STAR

| Item | Specification |
|---|---|
| Trade name | Automated Nucleic Acid Isolation System |
| Model | GENE PREP STAR PI-480 / NA-480 |
| Major component | Centrifuge, Pipette mechanism, Control Panel |
| Tube unit | Specially designed 8 hole tube*<br>Specially designed 6 hole tube<br>Specially designed 5 hole tube |
| Maximum samples | 48 Samples(16 Sample interval):Using 8 hole tube unit<br>36 Samples(12 Sample interval):Using 6 hole tube unit<br>30 Samples(10 Sample interval):Using 5 hole tube unit |
| Protocol* | For PI-480 and NA-480:<br>Plasmid, Animal tissue DNA, Plant DNA Ver.1 and Plant DNAVer.2<br>For NA-480 only:<br>2ml WB, 7ml WB, FG Fresh, FG Frozen, Compromised WB, Saliva DNA |
| Isolation and purification method | Centrifuge isolation method |
| Major components | <Centrifuge unit><br>Six bucket swing rotor method<br>Maximum rotational speed and force : 3,900rpm 2,500g<br><Agitation unit><br>Eccentric rotation shaking method<br><Reagent channel dispenser unit><br>Number of channel dispenser PI-480: 6 lines NA-480: 9 lines<br><Transfer Robot unit><br>Y・Z axis drive<br><Moving rack unit><br>X axis drive |
| Range of centrifuge speed | 1000, 2000, 3000, 3500, 3900 (rpm) |
| Range of centrifuge time | 0-99(min) |
| Range of agitation speed | PI-480: 0-600(rpm) NA-480: 0-700(rpm) |
| Range of agitation time | 0-99(min) |
| Range of dispensing amount | 0-8.00(ml) |
| Speed of dispensing reagent | 3 choices (1:LOW, 2:MIDDLE, 3:HIGH) |
| Operation Screen | 5.7type LCD touch panel |
| Switch | Main power supply breaker, Power Switch |
| Dispensing accuracy | CV value: 10% or less In case when the GENE PREP dispenses 50ul of $ddH_2O$*. |
| Electricity | Voltage: One of AC 100/115/120/200/210/220/230/240V, single phase*<br>Capacity: 1.0 KVA<br>Frequency: 50 or 60 Hz |
| Dimension | PI-480: W720x D670xH 1535(mm) NA-480: W720xD760xH1535(mm) |
| Weight | PI-480: 245 kg NA-480: 275kg |

*1: Do not use the different tube unit at a same run.

*2: New protocols may be released.

*3: CV=standard deviation/ average X 100 %.
*4 : Working voltage determine by internal connector

## Specification of the TS-200(Option unit)

| | |
|---|---|
| Trade name | Sample Stacker |
| Model | TS-200 |
| Maximum process number*1 | 192 Samples(16 Sample interval):Using 8 hole tube unit<br>144 Samples(12 Sample interval):Using 6 hole tube unit<br>120 Samples(10 Sample interval):Using 5 hole tube unit |
| Major components | <Tube rack storage space><br>Sample rack : 4 rack<br>DNA rack : 4 rack<br><Transform Robot><br>X and Z axis drive |
| Dimension | W450 X D670 X H1330(mm) *2 |
| Weight | 110 kg |

*1: It is impossible to operate the TS-200 unit without the GENE PREP STAR.The maximum process number indicates the number where the TS-200 is aligned with the GENE PREP STAR.
*2: The size of the TS-200 is W465mm and the size of the TS-200 is W450mm aligned with the GENE PREP STAR.

## Specification of the heater unit

| | |
|---|---|
| Trade name | Heater unit |
| Major components | <Heater box><br>Far infrared ray ceramic heater:100V 400W<br>Internal circulation fan<br><Drive mechanism><br>Z axis drive<br><Thermo regulator> |

*Option unit for PI-480
*NA-480 equipped with the Heater Unit.

## Specification of the channel dispensers

| | |
|---|---|
| Trade name | the optional 3-channel dispensers |
| The number of channel dispensers*1 | 9 channel dispensers |

* Option unit for PI-480
* NA-480 equipped with 9 channel dispensers.
*1 The table above indicates the number of the channel dispensers in the PI-480 when installing the optional channel dispensers.

## 1-2 The name of each component

Figure 1 and 2 illustrate the major hardware components of the GENE PREP STAR system.

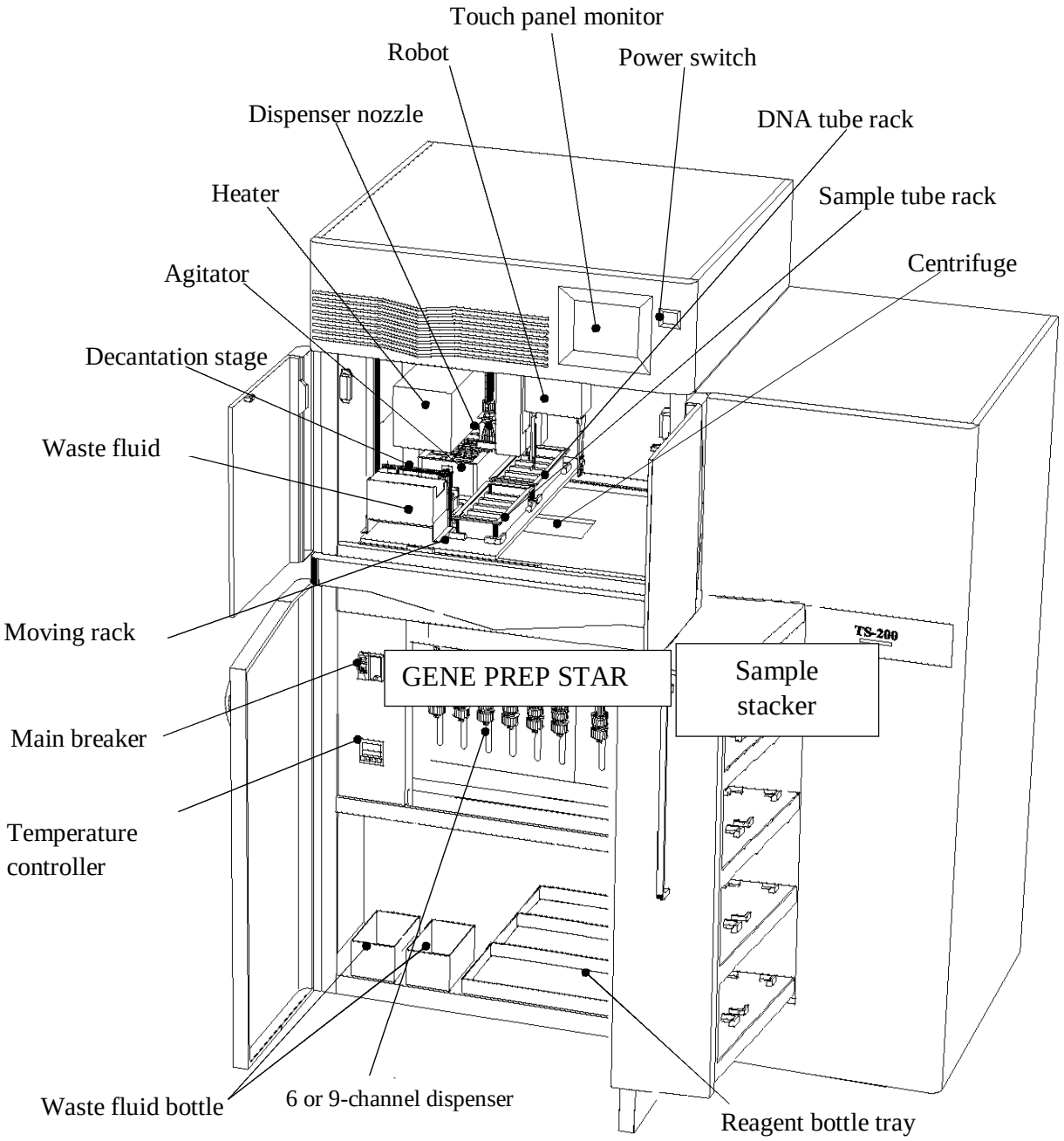



Fig1. Major Components of the GENEPRER STAR, Front View

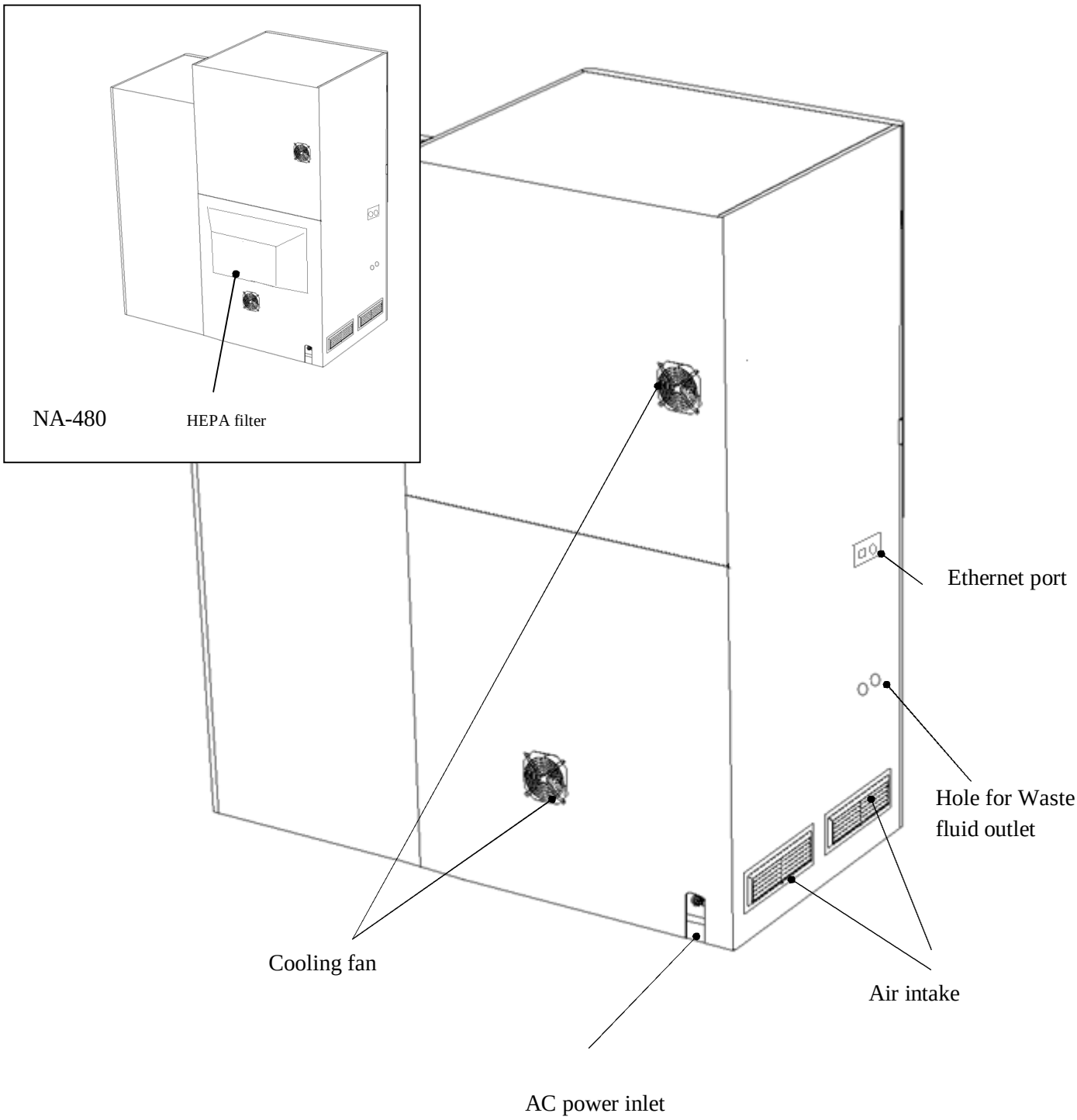



Fig2. Major Components of the GENE PRER STAR, Back and Left View

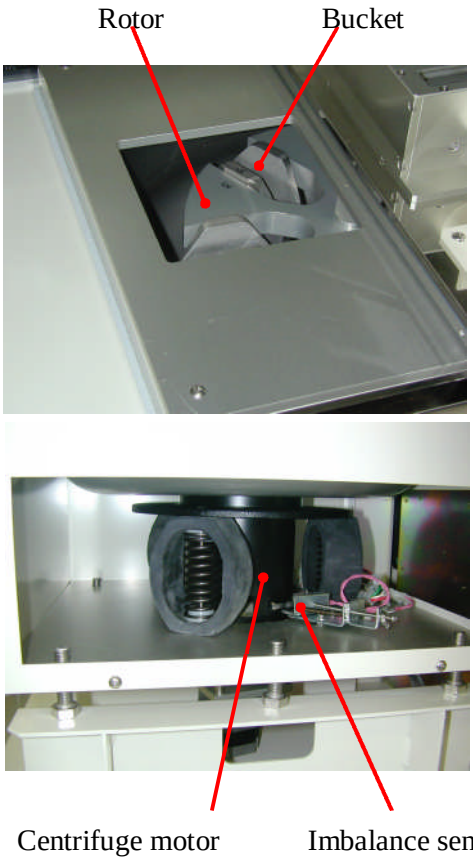
## 1-3 Function of Each Part

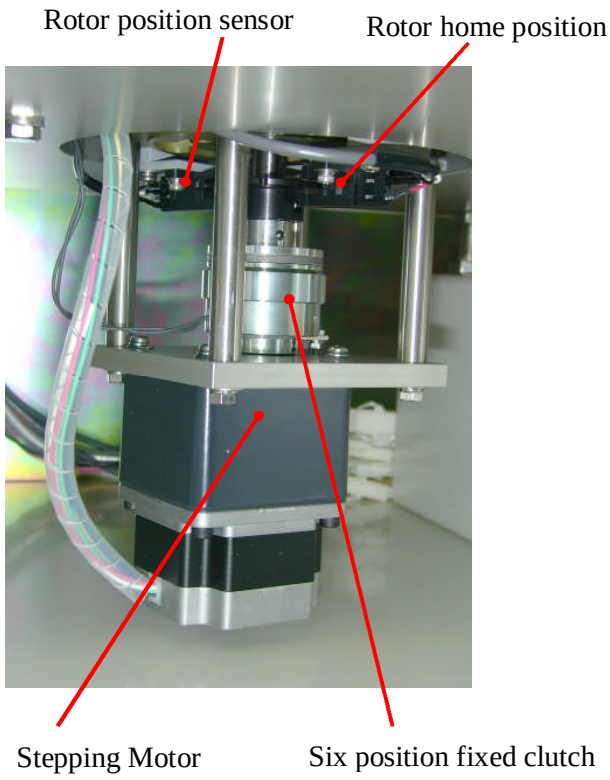
## 1-3-1Centrifuge unit

Centrifuge unit is used to centrifuge the specially designed tube units.
The clutch and the position sensor control the six positions of the bucket.

[Major specification]
Six bucket swing rotor method
Maximum centrifuge speed: 3,900rpm
Maximum centrifuge force: 2,500g

[Major composition]
Centrifuge motor (blushless motor)
Rotor
Six buckets
Detecting sensor of opening and closing door
Fixed clutch
Stepping motor
Centrifuge home position sensor
Centrifuge rotation sensor
Imbalance sensor




**1-3**

## -2 Tube transfer robot

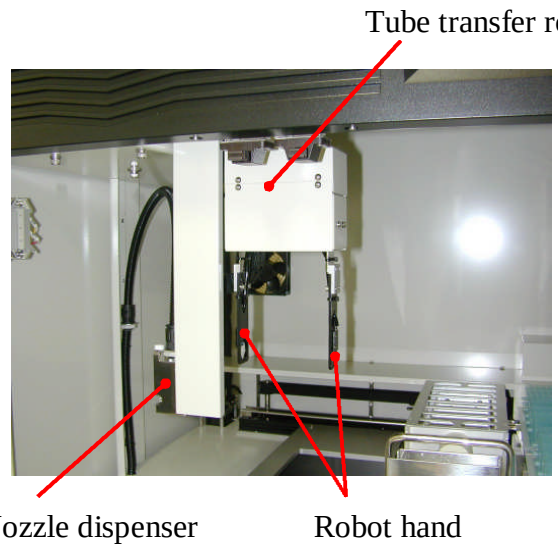
The tube transfer robot uses the opening and closing drive of the robot hand and two axes drives (Y axis; front and back, Z axis; up and down) to transfer a tube unit, waste fluid, and transfer a supernatant. As a dispenser nozzle is attached to the tube transfer robot, it moves together during dispensing the reagent.

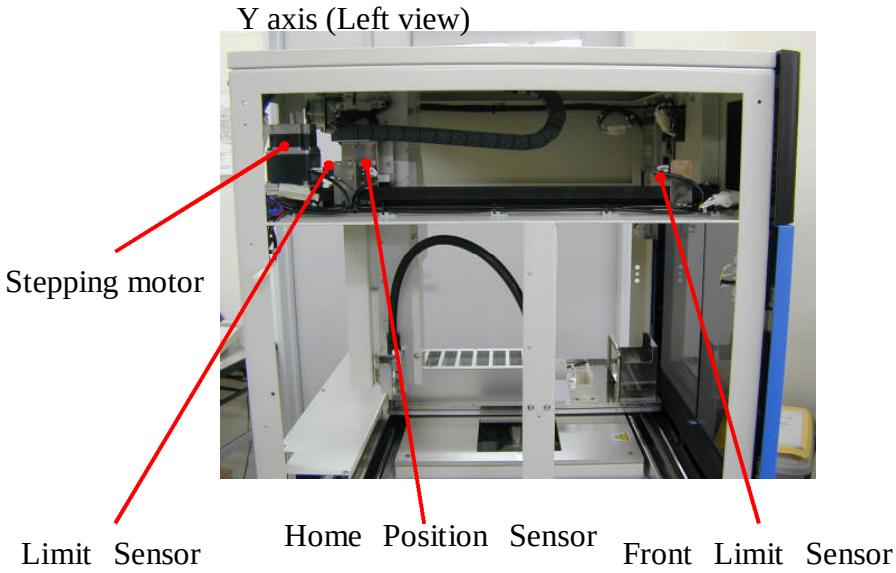
[Major specification]
Two axes drive (Y axis: font and back, Z axis: up and down)
Position accuracy: ±1mm

[Major constitution]
Y axis (front and rear) drive
Y axis drive motor (stepping motor)
Home Position Sensor
Rear Limit Sensor
Front Limit Sensor

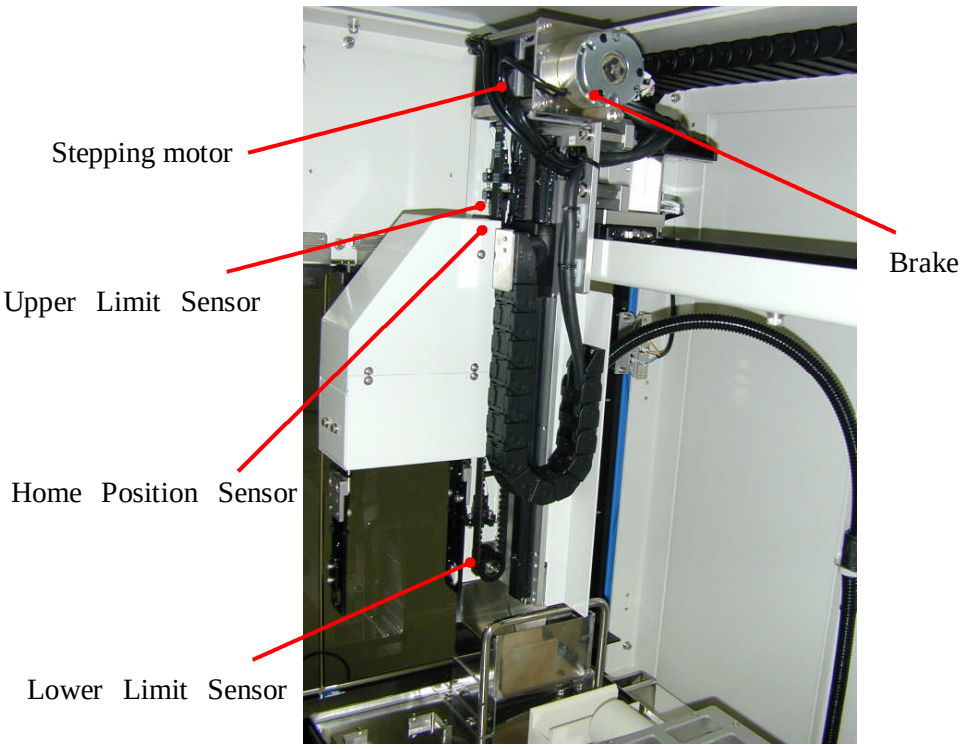
Z axis (up and down) drive
Y axis drive motor (stepping motor)
Brake
Home Position Sensor
Upper Limit Sensor
Lower Limit Sensor

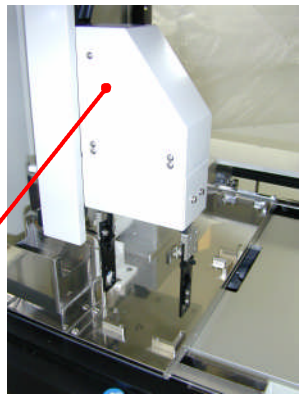
Opening and closing robot hand drive
Home position sensor / Hand open sensor
Hand grip sensor



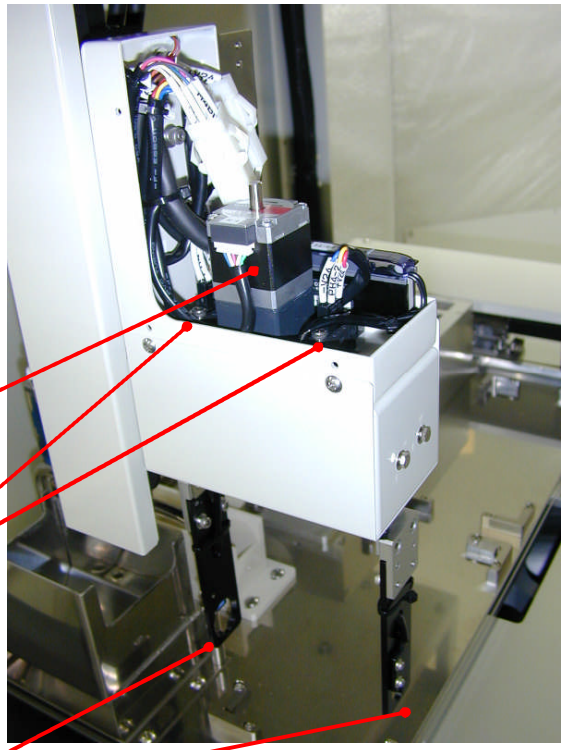



Z axis (Back view)



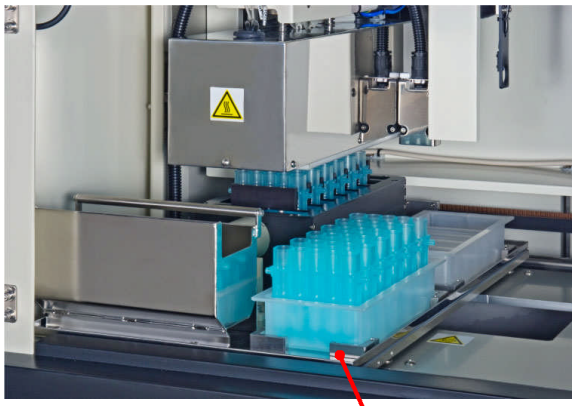

Remove cover 'A'



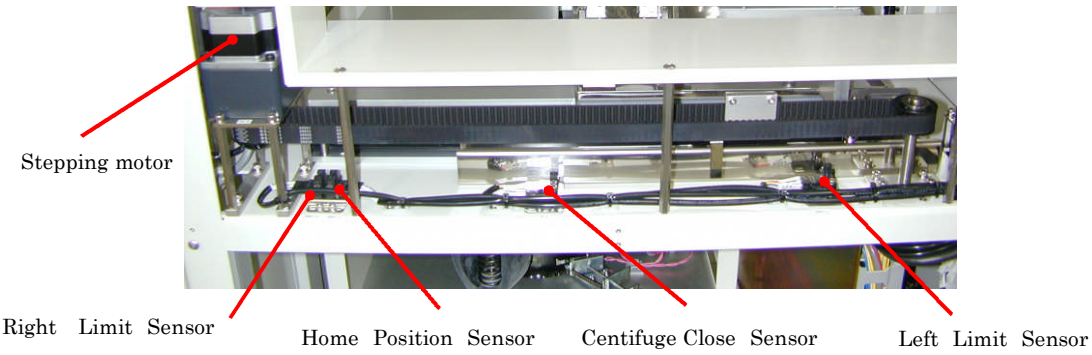
## 1-3-3 Table

The table moves only horizontally by the one axis drive during dispensing reagents step and agitation step etc.

[Major specification]
One axis drive (X axis: left and right)
Position accuracy: ±1mm
X axis drive motor (stepping motor)
Home Position Sensor
Left Limit Sensor
Right Limit Sensor
Centrifuge Close Sensor




X axis drive rack (Back View)

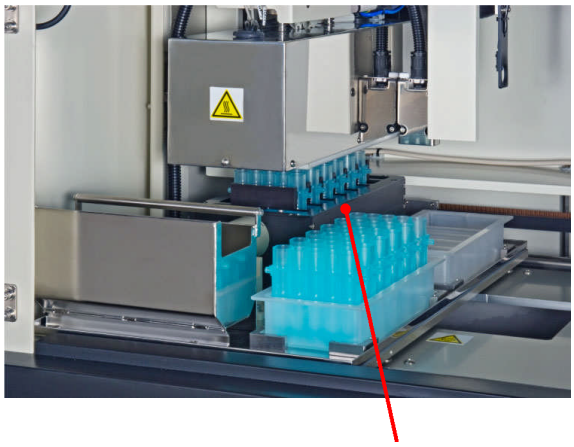


## 1-3-4Agitation unit

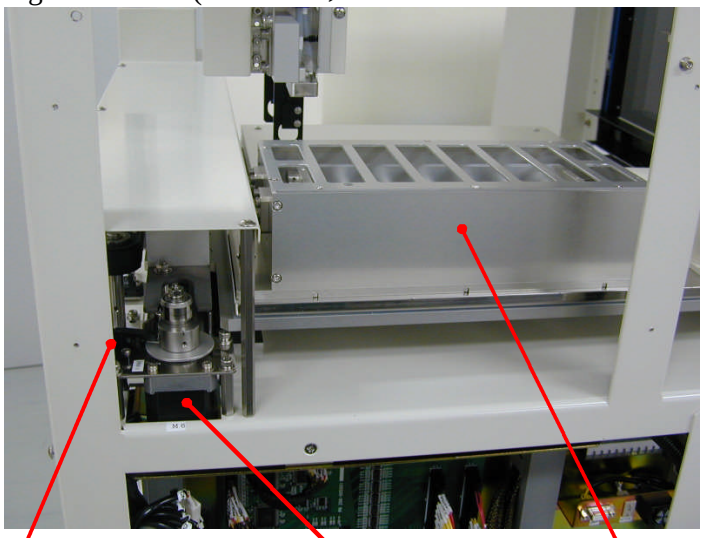
The agitation unit is used to agitate the samples in the sample tube units from front to back.

[Major specification]

Shaking six tube units from front to back method
Maximum rotation number:
PI-480:600rpm NA-480:700rpm
Agitation motor (stepping motor)
Home position sensor




Agitation unit (Left View)



## 1-3-5 Dispenser channel unit

The dispenser channel unit is used to dispense reagents into the tube units

[Major specification]

Number of channel dispenser: PI-480 (6) NA-480(9)

*It is possible to install three optional channel dispensers for PI-480.

Volume of syringe: 10ml

Maximum amount of dispensing reagent: 8.0ml /sample

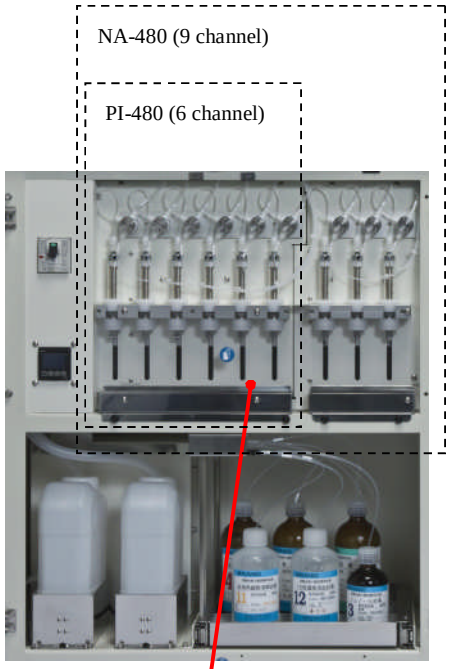
[Major components]

Syringe

Three directions electromagnetic valve

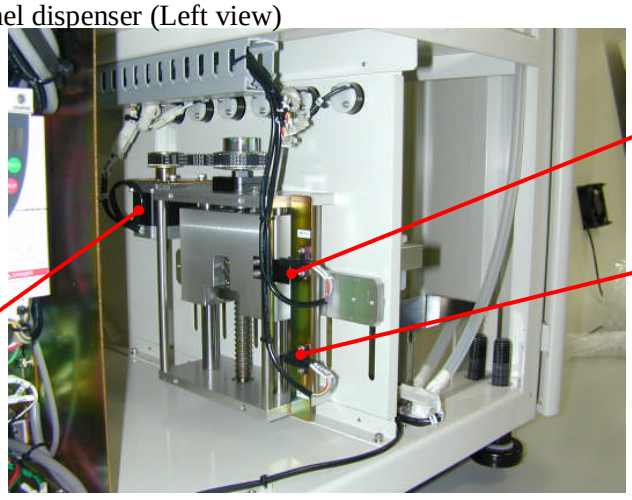
Upper limit sensor

Lower limit sensor




Channel dispenser unit (Front View)


Channel dispenser (Left view)

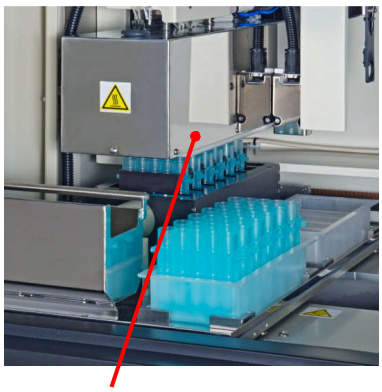


## 1-3-6 Heater unit

The heater unit is used to warm tube units for dry and chemical reaction.
To dry tube units, the heater chamber unit covers the agitation unit using Z axis drive (up and down) and warms samples. The heater unit consists of a heater chamber unit and a thermo regulator box.

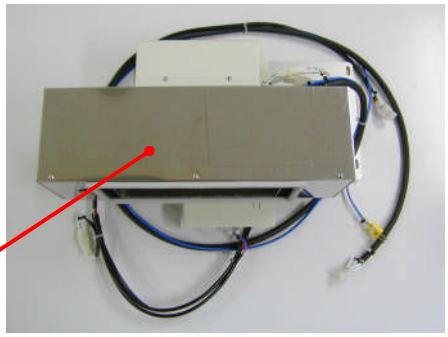
[Major specification]
Heater output
Thermo regulator box

[Major components]
Heater chamber
Far-infrared radiation ceramic heater
DC motor
Circulation fan
Upper limit sensor
Lower limit sensor
Air conditioner box



Heater chamber unit

Thermo regulator box

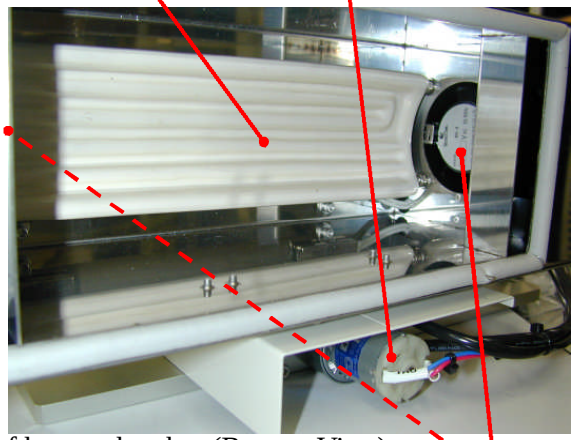


Heater chamber

Heater chamber unit (Back view)

Far-infrared radiation ceramic heater

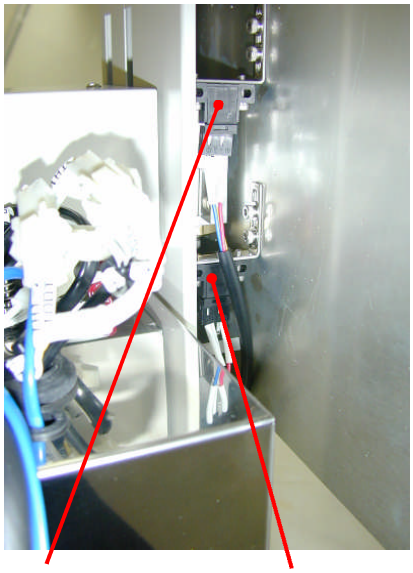
Up and down drive motor



Interior of heater chamber (Bottom View)

Circulation fan

There is another fan on the back side.



Upper limit sensor

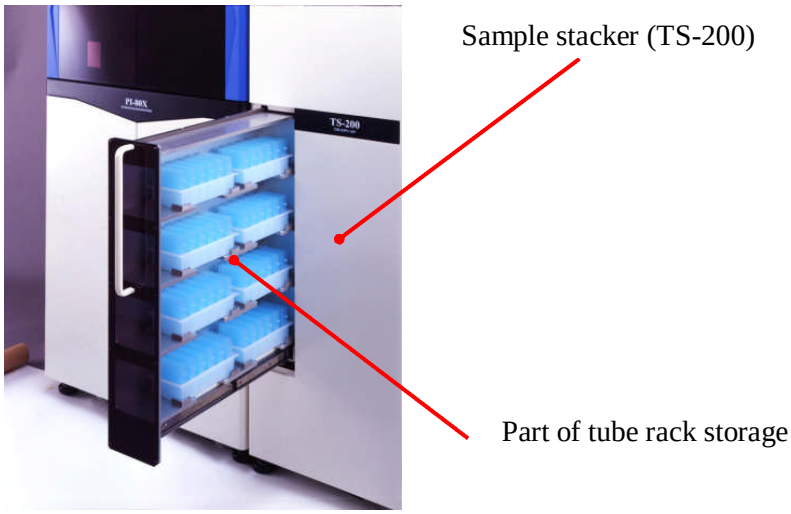
Lower limit sensor

## 1-3-7 Sample stacker (TS-200)

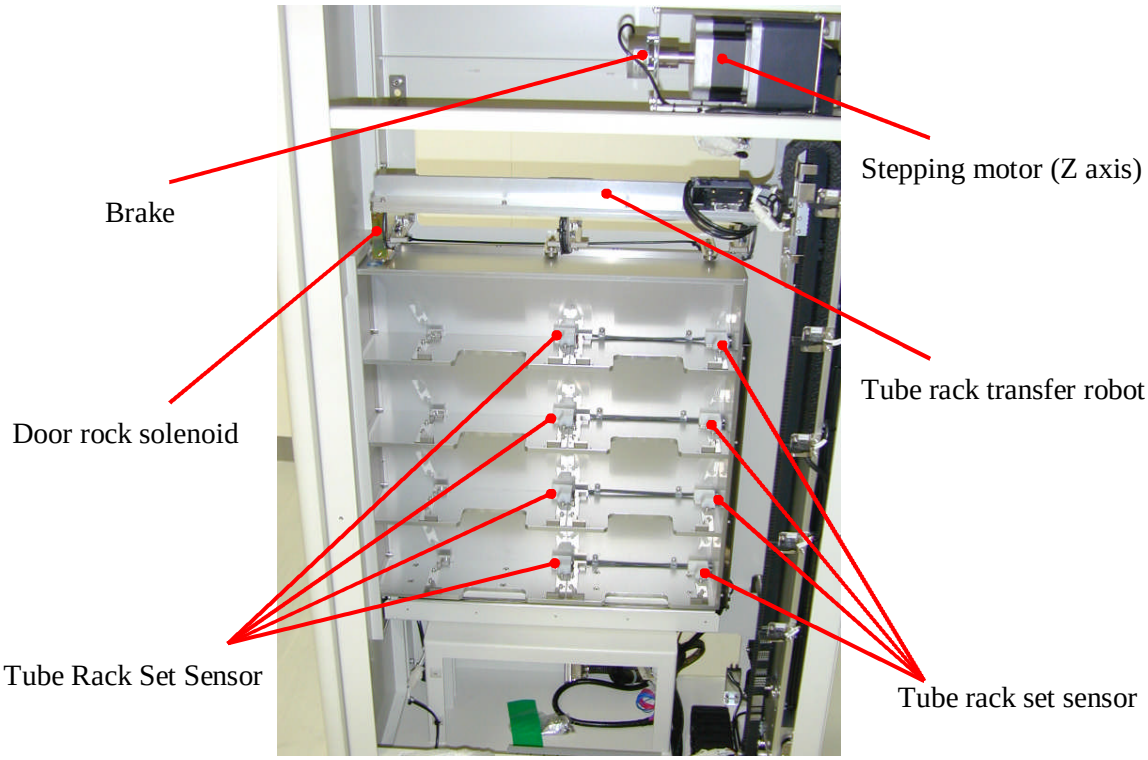
In case when the TS-200 is aligned with the GENE PREP STAR, it is possible to process a maximum of 192 samples. The tube rack storage part of the TS-200 is four layers. Set one sample tube rack and one DNA tube rack on each layer. The sample tube rack and the DNA tube rack on each layer are transferred between the GENE PREP STAR and the TS-200 using the X drive (left and right) and Z drive (up and down) of the transfer robot.

[Major specification]
Heater output
Thermo regulation

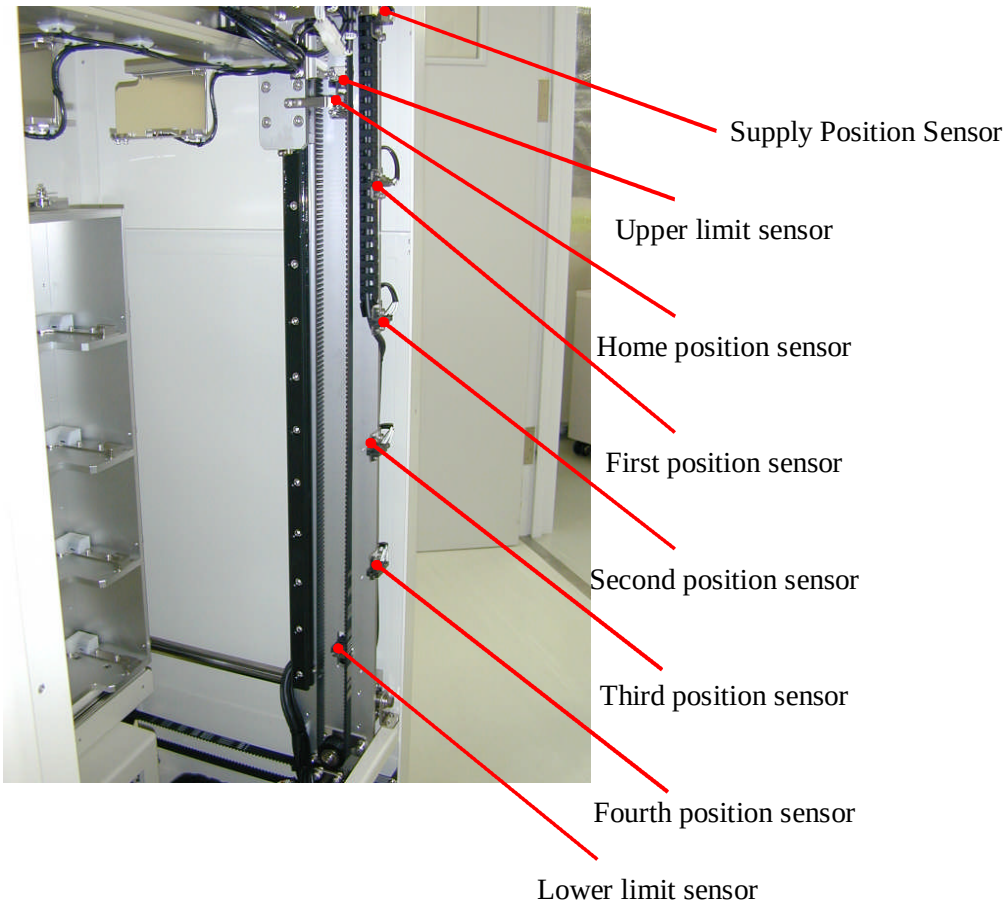
[Major component]
Tube rack storage
Tube rack transfer robot
Door rock solenoid
Brake
Z axis drive motor (stepping motor)
Tube rack set sensor
Home position sensor
Upper limit sensor
Lower limit sensor
First position sensor
Second position sensor
Third position sensor
Fourth position sensor
X axis drive motor (Stepping motor)
X axis home position sensor
Left limit sensor
Right limit sensor
Tube rack supply position sensor
Tube rack catch position sensor
Tube rack catch sensor



TS-200 (Right view)




TS-200 (Right view)



Tube rack supply position sensor

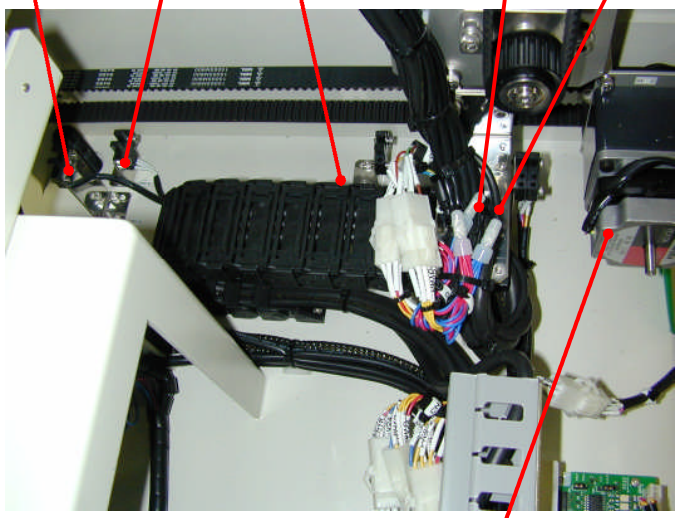
Home position sensor

Left limit sensor

Tube rack catch position sensor

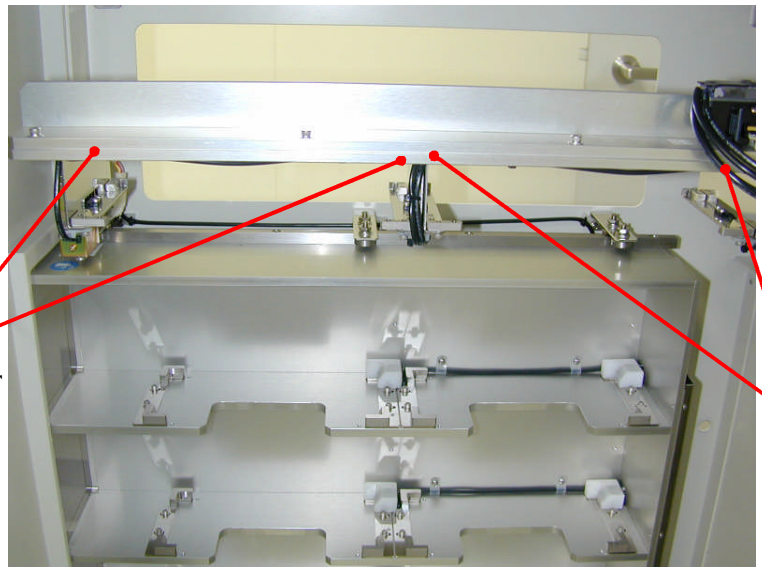
Right limit sensor

TS-200 (Right view)



Stepping motor (X axis)

TS-200 (Right view)



Tube Rack Catch Sensor

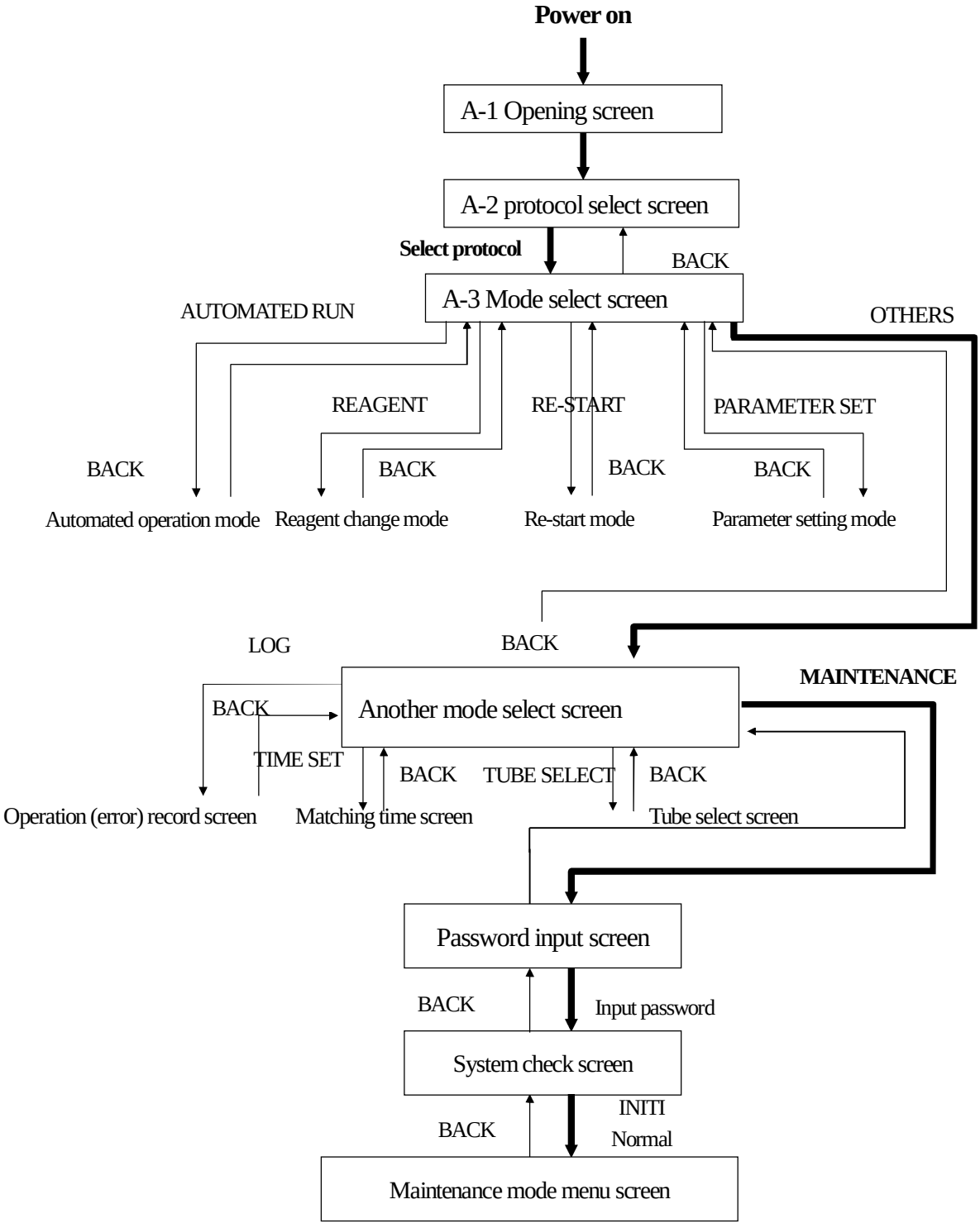
Tube rack catch sensor

## 2-1 Introduction

The maintenance mode is a mode to set the system parameters for confirming the operation of the centrifuge unit, agitation unit, channel dispenser unit, transfer robot, moving rack, heater unit, the sample stacker and the dispend movement.

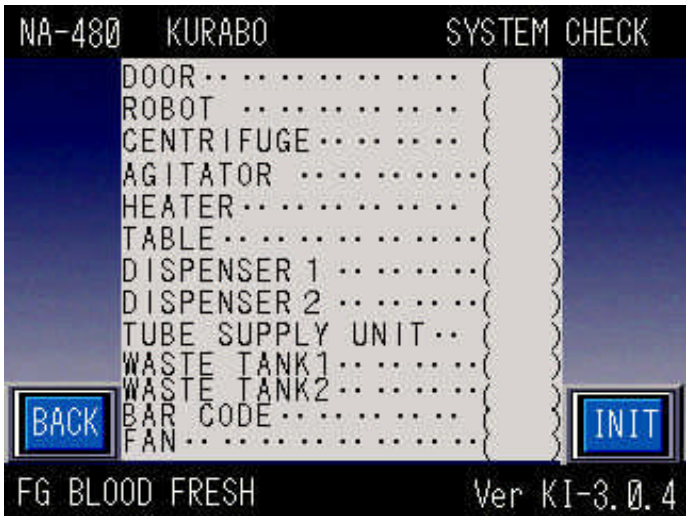
## 2-2 Start maintenance menu screen

Input your password to enter the maintenance mode. Display the password input screen according to the following flow chart.

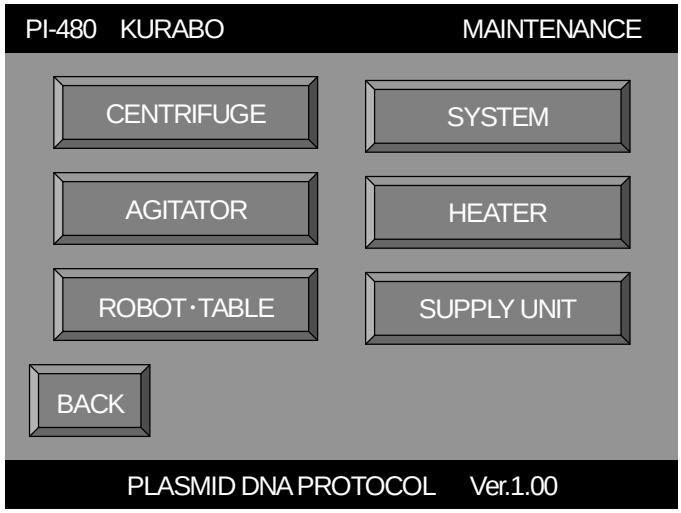


Press the [ENT] button after inputting the password using the numeric key pad.
- Password: 741953


Press [INT] button on the screen to start system check.

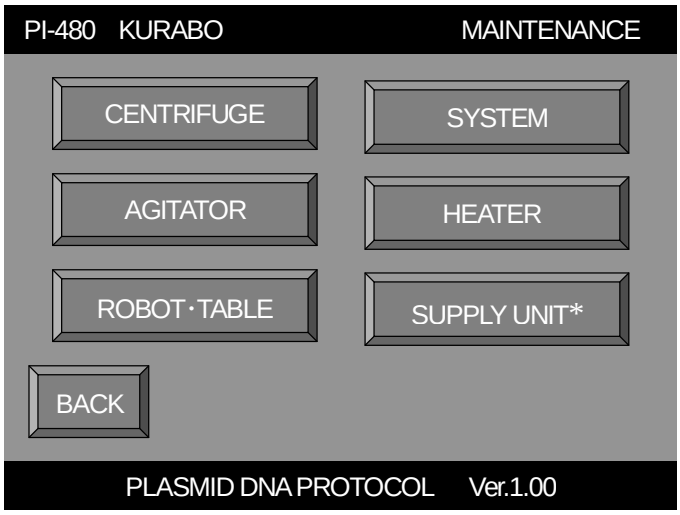



After completing the system check without any abnormality, the 'Maintenance Menu Screen' will be displayed.



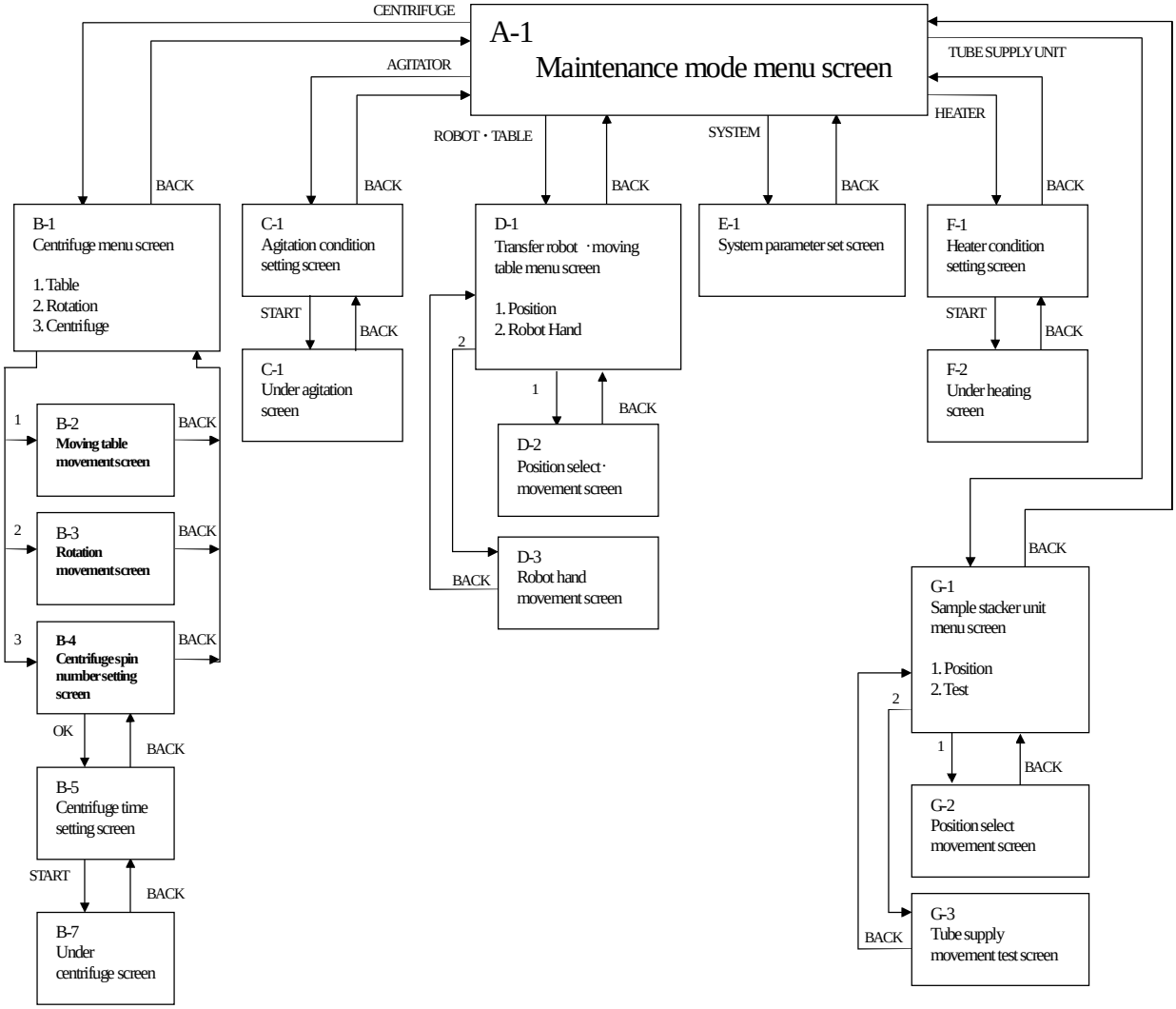
## 2-3 Maintenance mode

The maintenance menu has six items.



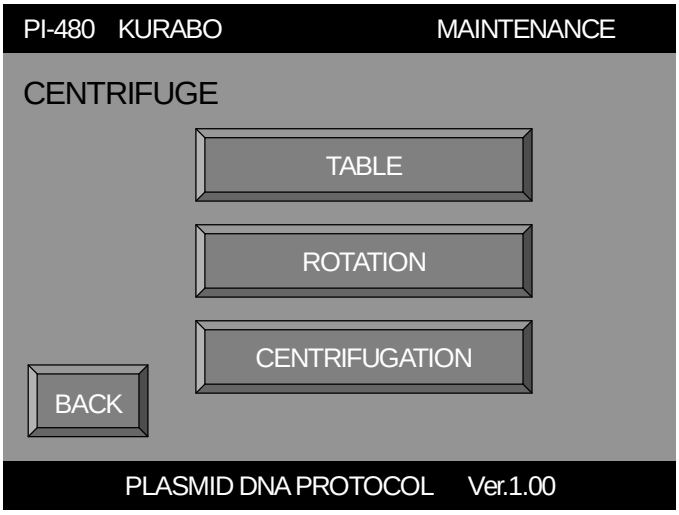

[CENTRIFUGE], to check the centrifuge (Refer to 2-3-2)
[AGITATOR], to check the agitator (Refer to 2-3-3)
[ROBOT ・ TABLE], to check robot and rack table (Refer to 2-3-4)
[SYSYTEM], to access to system parameter input screen (Refer to 2-3-4)
[HEATER], to check the heater unit (Refer to 2-3-5)
[SUPPLY UNIT], to check the tube unit stacker (Refer to 2-3-6)
* Optional
[BACK], uses to return the 'System check' screen (Refer to 2-3-7)

## 2-3-1 Maintenance mode flow chart



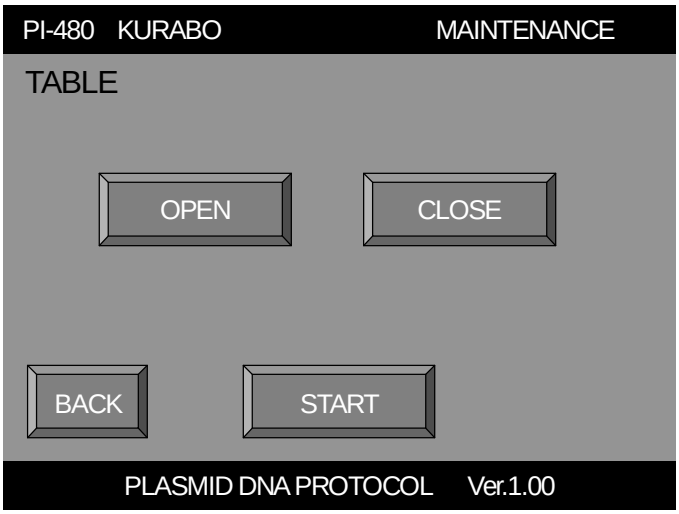
## 2-3-2 Centrifuge mode

Following screen is the centrifuge menu screen. Select your desired movement by pressing a button.




Press the [TABLE] button to slide the table which is also door of the centrifuge.
Press the [ROTATION] button to rotate the centrifuge rotor.
Press the [CENTRIFUGATION] button to centrifuge.
Press the [BACK] button to return to the maintenance menu screen.

Table
Press the [OPEN] button to slide the table at the position where the robot gripper can handle the tube unit from or to the centrifuge bucket.
Press the [CLOSE] button to slide the table so that it covers the opening of the centrifuge.
Press [OPEN] or [CLOSE] button and then press [START] button to start the movement.



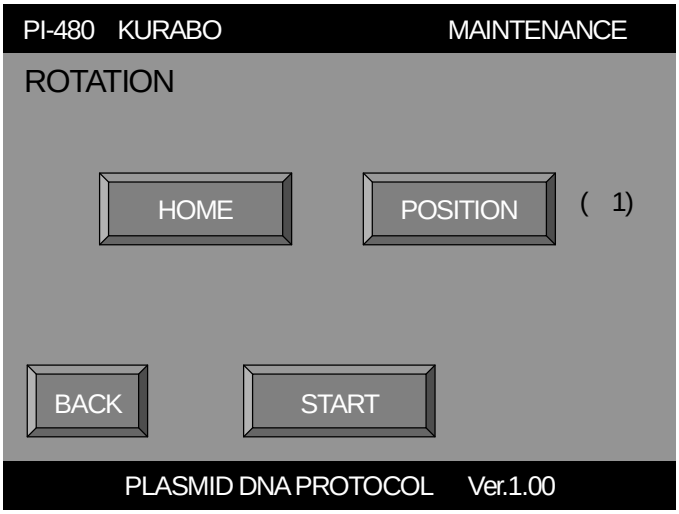

Press the [BACK] button to return to the previous screen.

Rotation

Press the [HOME] button to rotate the centrifuge rotor to its home position (No.1 bucket position, at the 90 clock position)

To move the rotor to the home position, press the [HOME] button and the press [START] button.

Press the [POSITION] button to select bucket No. where you want to rotate the rotor. Every time you press the [POSITION] button, bucket No. indicated in the parenthesis incrementally changes 1 through 6. After selecting the bucket No., press [START] button to start rotation.

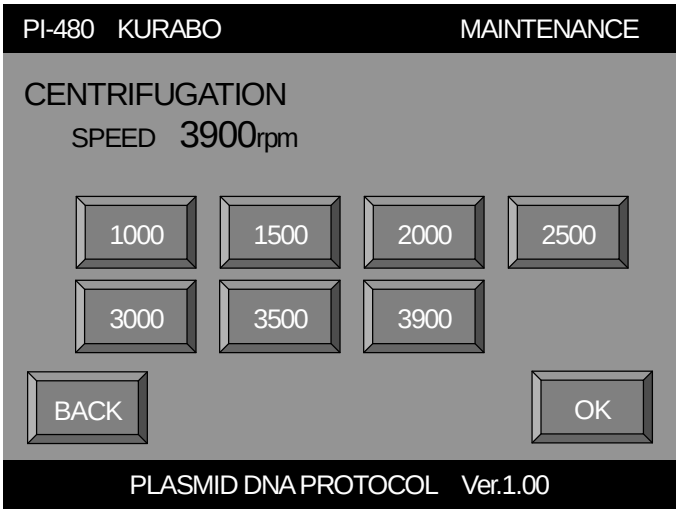



Press the [BACK] button to return to the centrifuge menu screen.

Centrifugation

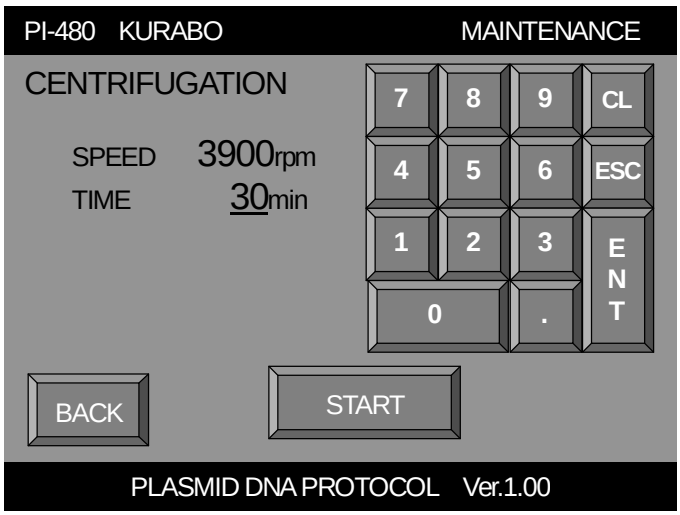
After pressing [CENTRIFUGATION] button on the centrifuge menu screen, following centrifugation speed setting screen displays.

Select a spin speed by pressing one of the speed buttons, and press [OK] button to fix the selection and enter into the next screen. The selected spin speed is displayed at upper left on the screen.




Press the [BACK] button to return to the centrifuge menu screen.

Following screen displays to input centrifugation time and to start the centrifuge. Select centrifuge time using numeric key pad, and press the [START] button to start the centrifuge.
After the table slides to close position, the centrifuge starts spinning.

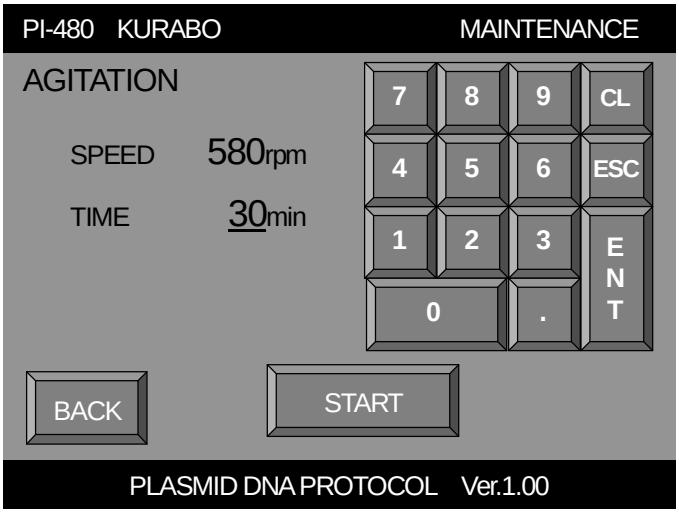



Press the [ENT] button on the numeric key pad to fix the input.
Press the [START] button to start the centrifugation.
Press the [BACK] to return to the “centrifugation speed” input screen.

## 2-3-3 Agitation Mode

After pressing the [AGITATOR] button on the maintenance menu screen, the following agitation condition input screen will be displayed. Input agitation speed and agitation time using the numeric keypad.
The following table summarizes limit of the input.

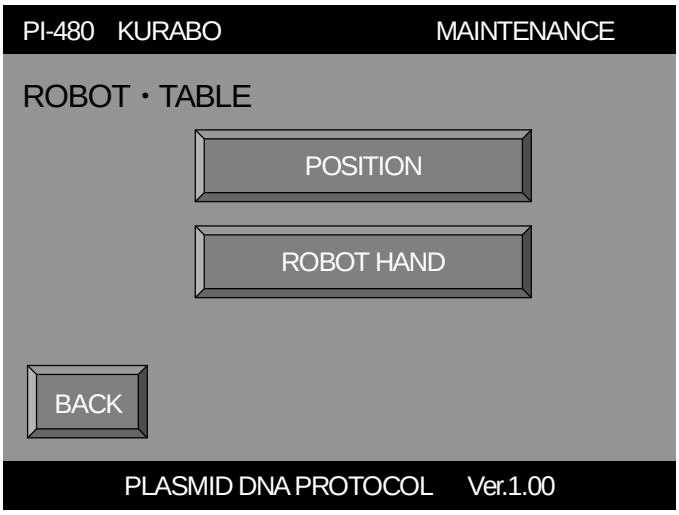
| Parameter | Limit of input |
|---|---|
| Agitation speed | PI-480:0~600 (rpm) NA-480:0~700 (rpm) |
| Agitation time | 0~99 (min) |



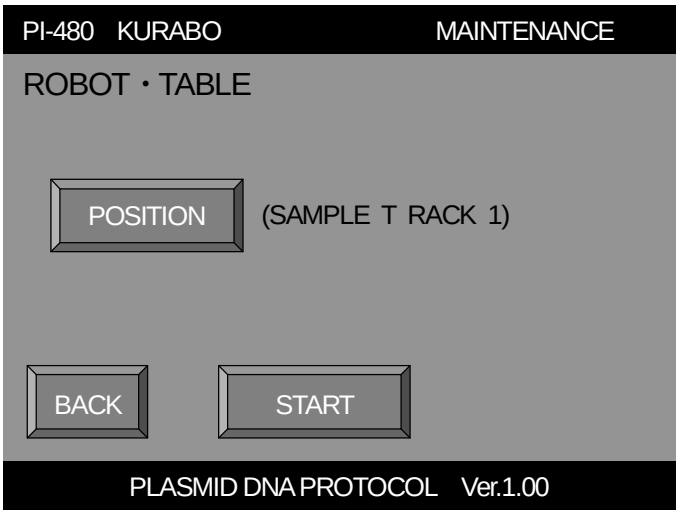

Press the [ENT] button on the numeric key pad to fix the input and enter into the next changeable parameter.
Press the [DEL] button on the numeric key pad to erase the currently input one character.
Press the [CLR] button on the numeric key pad to erase the currently input parameter.
Press the [BACK] button to return to the maintenance menu screen.
After pressing the [START] button, the table slides to the agitation position and start agitation. During agitation, an actual agitation speed and remaining agitation time displays on the touch panel screen. Remaining spin time counts down.

## 2-3-4 Transfer Robot and Table Mode

After pressing the [ROBOT/TABLE] on the maintenance menu screen, the following screen will be displayed. The [POSITION] button is used to move the transfer robot and the table to 14 specific positions. Press the [ROBOT HAND] button to open and close the robot gripper.




**Position**
After pressing the [POSITION] button, the following screen will be displayed. Press the [POSITION] button to select one of 14 positions. For selecting a position, press the [POSITION] button until position indicated in parenthesis at the right of the button becomes your desired position. Press the [START] button to start the movement.



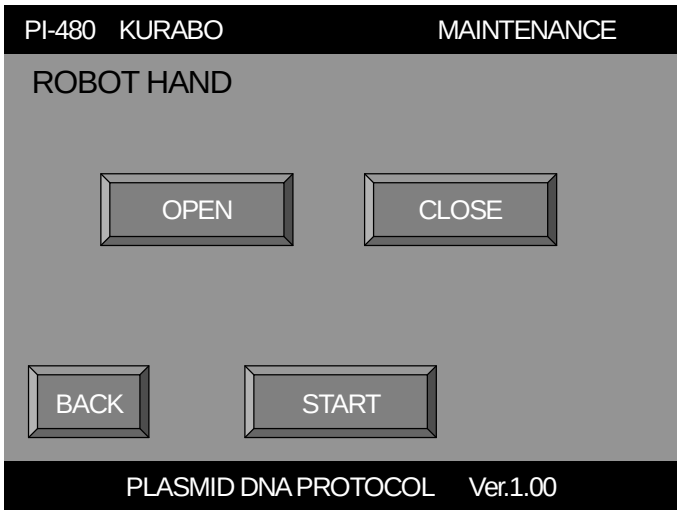

Press the [BACK] button to return to menu screen of the Robot・Table.

Transfer Robot and Table Position List

| No. | Position indicated on the screen | Description |
|---|---|---|
| 1 | INITIAL POSITION | Home position of the robot and table. |
| 2 | SAMPLE T RACK 1 | Position of No. 1 tube unit on the sample tube rack. |
| 3 | SAMPLE T RACK 6 | Position of No. 6 tube unit on the sample tube rack. |
| 4 | STORAGE T RACK 1 | Position of No. 1 tube unit on the DNA tube rack. |
| 5 | STIRAGE T RACK 6 | Position of No. 6 tube unit on the DNA tube rack. |
| 6 | CENTRIFUGE BUCKET | No.1 bucket of the centrifuge. |
| 7 | AGITATOR 1 | Position of No. 1 tube unit on the agitator. |
| 8 | AGITATOR 6 | Position of No. 6 tube unit on the agitator. |
| 9 | DISPENSE 1 | Dispensing position to No. 1 tube unit. |
| 10 | DISPENSE 6 | Dispensing position to No. 6 tube unit. |
| 11 | WASTE GUIDE | Position where dispenser nozzle is at the waste guide |
| 12 | DECANT BAR1 | Position of the original tube unit at fluid transfer step. |
| 13 | DECANT BAR2 | Position of the tube unit at fluid waste step. |
| 14 | DECANT STAGE | Decantation stage (position of reservoir tube unit) |

**Robot hand**

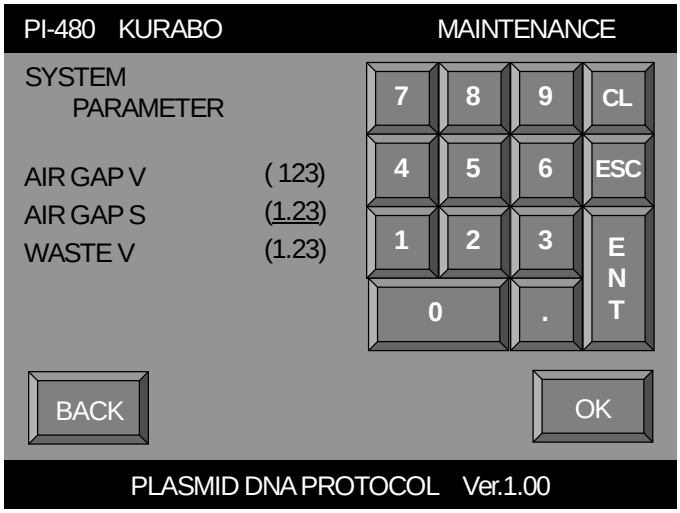
After pressing the [ROBOT HAND] button, the following screen will be displayed on the touch panel.
Press the [OPEN] and [START] button in this order to open the gripper.
Press the [CLOSE] and [START] button in this order to close the gripper.
Press the [BACK] button to return to the menu screen of the [ROBOT・TABLE].



## 2-3-5 System Parameter Mode

After selecting the [SYSTEM] on the maintenance menu screen, the following screen will be displayed. System parameters are used to maintain accurate dispensing reagents.
To prevent the drop of reagent from nozzle, allow for an air gap to the tip of the nozzle.
[AIR GAP V] is volume of air which is introduced into the nozzle/tubing after dispensing of reagent.
[AIR GAP S] is suction speed of air to make air gap.
To maintain accurate dispensing reagents, the nozzle is primed with reagent by discarding reagent to the waste tray before dispensing into the tube unit. [WASTE V] is reagent volume to be discarded.
Input parameter using the numeric key pad.
The following table summarizes limit of the input.

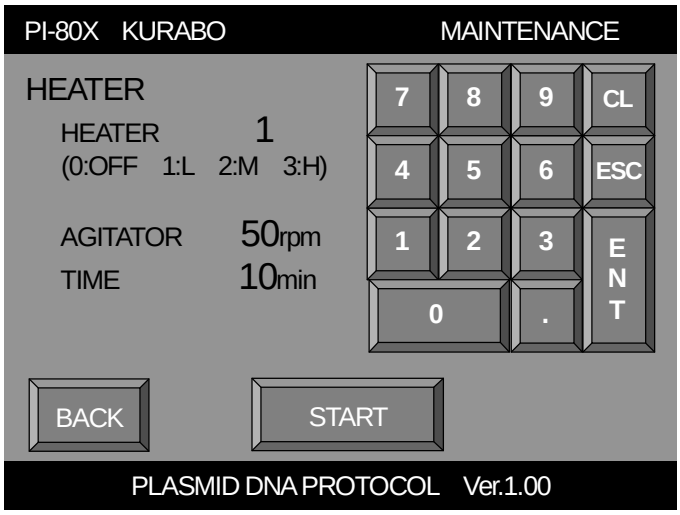
| Parameter | Limit of input |
|---|---|
| AIR GAP V (Air gap volume) | 0.00~0.99 (ml) |
| AIR GAP S (Aspiration speed of air) | 1~10 (factor) |
| WASTE V (Waste reagent volume) | 0.00~0.99 (ml) |




Press the [ENT] button on the key pad to fix the input and move to the next changeable parameter.
Press the [DEL] button on the key pad uses to erase the current input one character.
Press the [CL] button on the key pad to erase the current input parameter.
Press the [OK] button to save the modified parameter.
Press the [BACK] button to return to the maintenance menu screen.

## 2-3-6 Heater Mode

After selecting the [HEATER] button on the maintenance menu screen, the following heating condition input screen will be displayed. Input the heater temperature, agitation speed rate of the agitator and heating time using the numeric keypad.



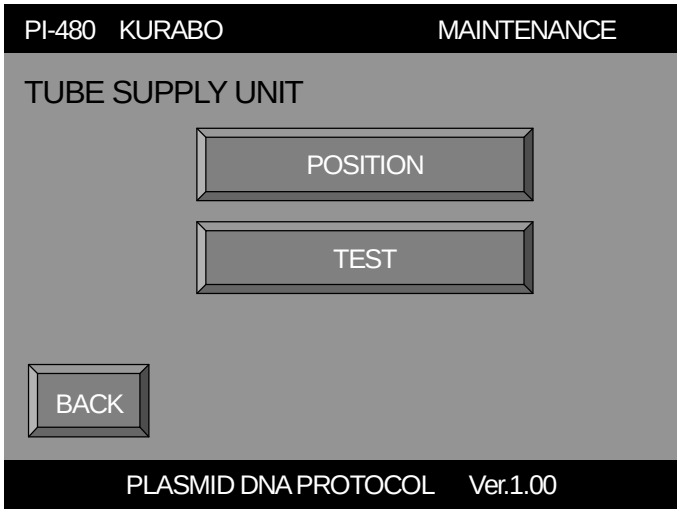

Input parameter using the numeric key pad
Press the [ENT] button on the key pad to fix the input and enter into the next changeable parameter.
Press the [DEL] button on the key pad to erase the current input one character.
Press the [CL] button on the key pad to erase the current input parameter.
Press the [BACK] to return to the maintenance menu screen.
Following table summarizes limit of the input.

| Heater setting | | Air conditioner setting item | Air conditioner (Default) |
|---|---|---|---|
| 0 | OFF | SP0 | 0℃ (OFF) |
| 1 | LOW | SP1 | 40℃ |
| 2 | MID | SP2 | 55℃ |
| 3 | HIGH | SP3 | 65℃ |

After pressing the [START] button, the table moves to the agitation position and docks with the heater unit, and then the heater starts heating. During heating, an actual agitation speed and remaining heating time display on the touch panel.

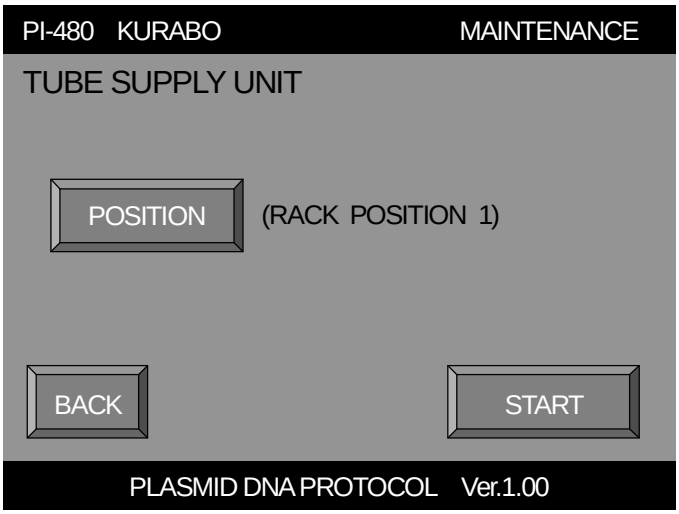
## 2-3-7 Sample Stacker Mode (TS-200; Stacker is an optional unit of PI-480)

After selecting the [TUBE SUPPLY UNIT] button on the maintenance menu screen, the following screen will be displayed.




The [POSITION] button is used to verify the 6 destination position of the feeder. The [TEST] button is used to access the mode to verify the pick up and placement of the tube racks by the feeder.
Press the [BACK] button to return to the maintenance menu screen.

**Position**
After selecting the [POSITION] button, the following screen will be displayed.

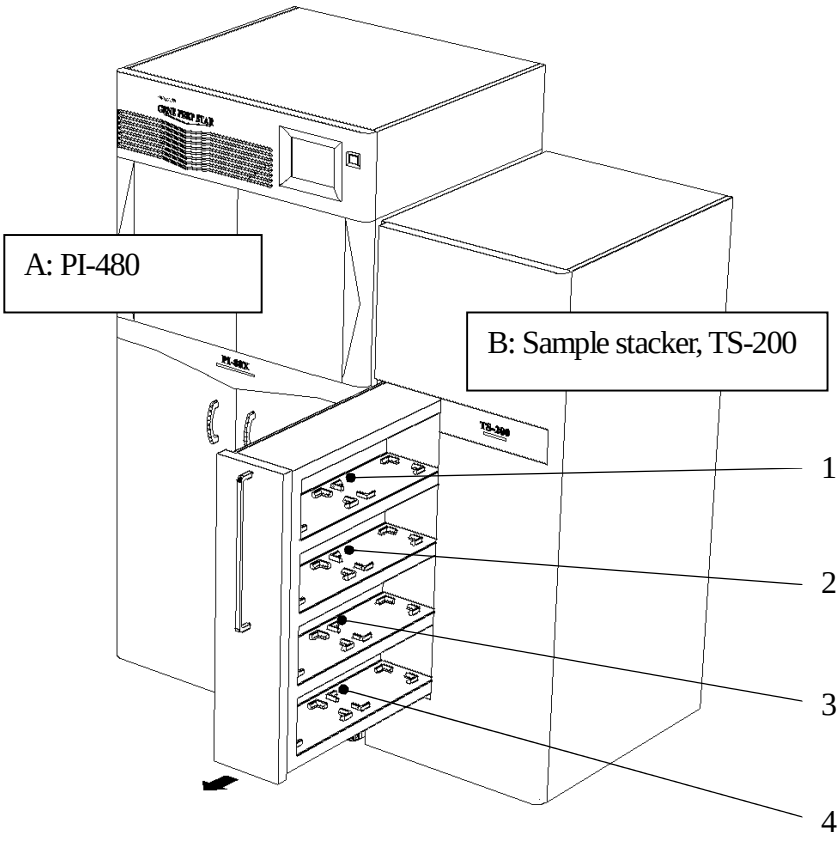



The desired feeder destination position is displayed. For selecting a position, press the [POSITION] button until the desired feeder destination position is displayed. Press the [START] button to start the movement.

Press the [BACK] button to return to the menu screen of the tube supply unit

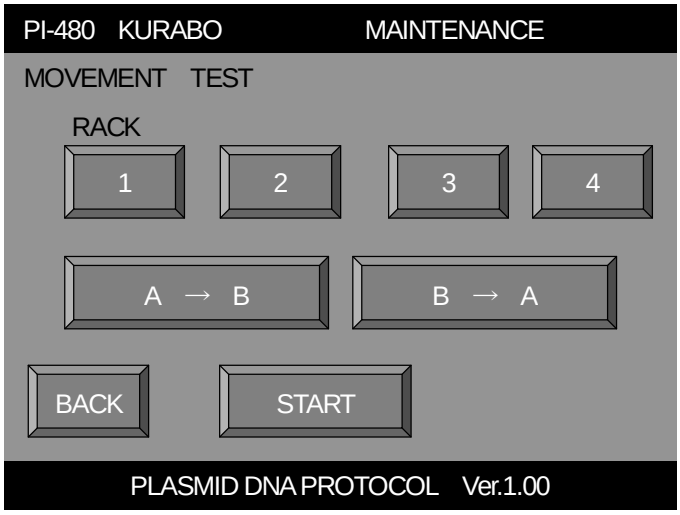
Sample Stacker and Unit Position List

| No. | Position indicated on the screen | Description |
|---|---|---|
| 1 | INITIAL POSITION | Home position of the transfer robot. |
| 2 | RACK POSITION 1 | Position of No. 1 tube rack. |
| 3 | RACK POSITION 2 | Position of No. 2 tube rack. |
| 4 | RACK POSITION 3 | Position of No. 3 tube rack. |
| 5 | RACK POSITION 4 | Position of No. 4 tube rack. |
| 6 | SUPPLY POSITION | Position where the tube rack slide from the stacker to the main unit. |



## 2-3-8 Test Mode

After selecting the [TEST] button, the following screen will be displayed.
[1]~ [4] buttons are used to select a tube rack inside the stacker you want to transfer between the stacker and main unit.
Press the [A>B] button to select transferring the tube rack from the main unit to the stacker
Press the [B>A] button to select transferring the tube rack from the stacker to the main unit.
After selecting the rack number and movement, press the [START] button to start movement.

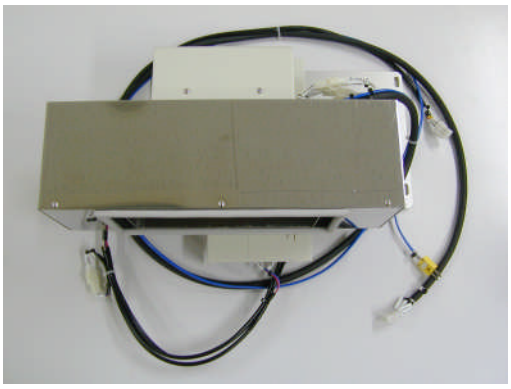



Press the [BACK] button to return the previous screen.

# 3-1 Heater unit

## 3-1-1 Composition of the heater unit

The heater unit consists of the heater chamber unit and thermo regulator box.

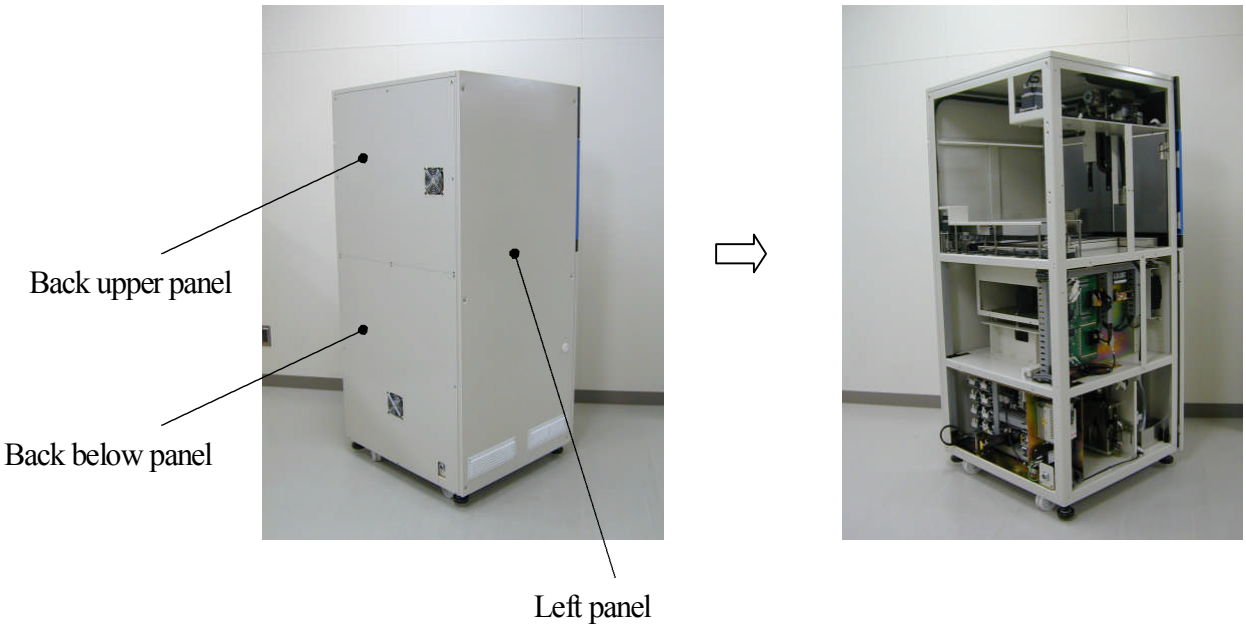


Heater chamber unit

Thermo regulator box

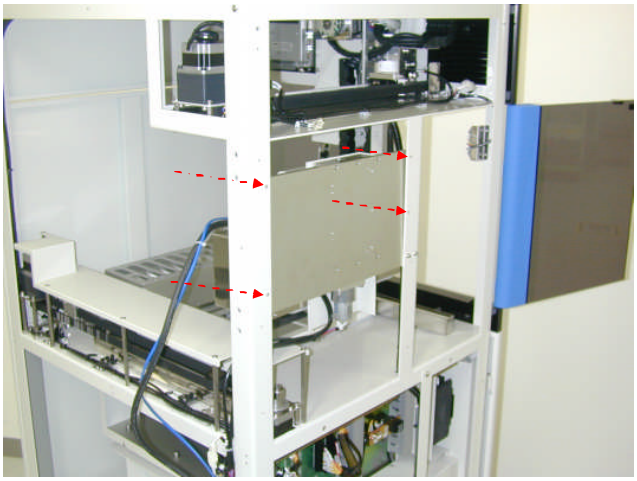
## 3-1-2 Heater chamber unit installation

1. Remove the left panel and the back upper and below panels of the PI-480/NA-480. As the fan cable is attached to the back upper and below panels, remove the fan cable, too.



2. Install the heater chamber unit where is marked by red circle temporarily using the four fixed machine screws (4 mm hex-head wrench) from inside of the machine

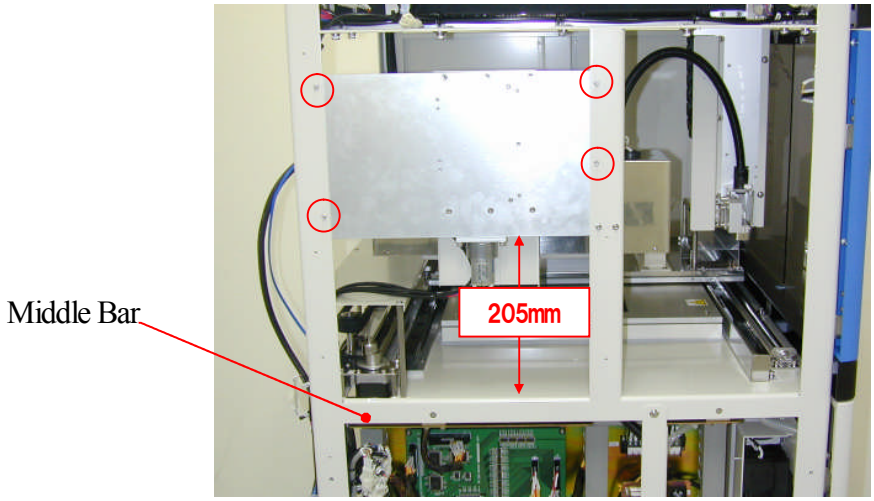
Installation position of the heater chamber



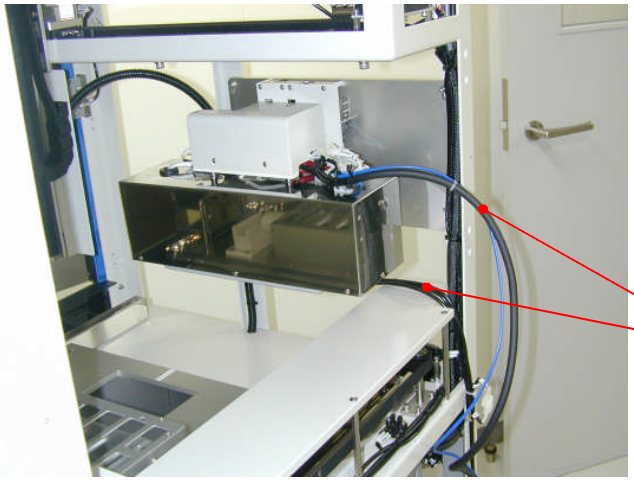
**Warning**

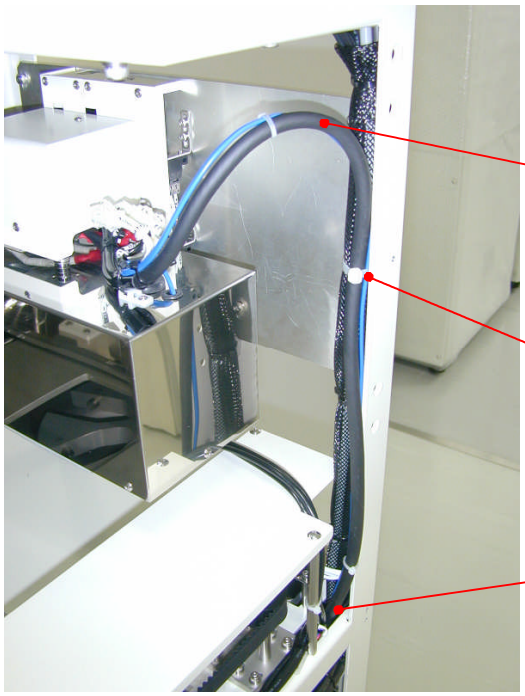
**The weight of the heater chamber unit is approximately 7kg. Take caution when installing it in the PI-480/NA-480 temporarily.**

3. Tighten up the four fixed machine screws (4mm hex-head wrench) which are fixed temporarily as in the previous step, so that the distance from the bottom of the aluminum board of the heater chamber unit to the middle bar of the PI-480/NA-480 can become 205mm.




4. Pass the cables of the heater chamber through middle section and fix it using cable ties.




**Caution**

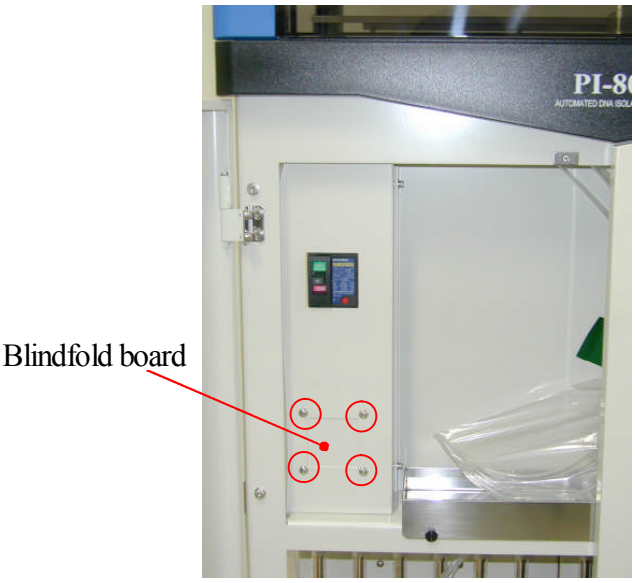
**Allow for the adequate length of the cables not to burden when fixing them with cable ties, as the heater chamber moves up and down.**

**Caution**

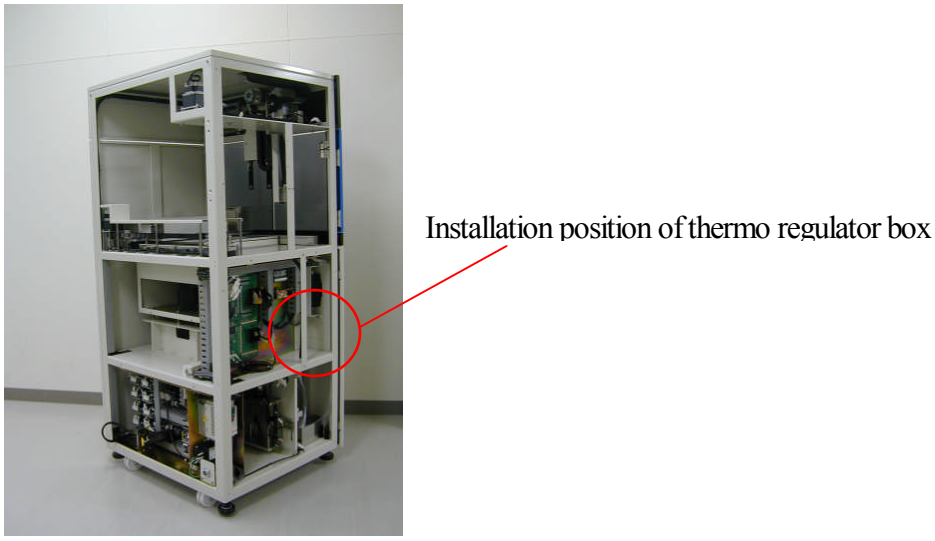
**Pay attention to the joint of the agitation motor home position sensor while adjusting the cables.**

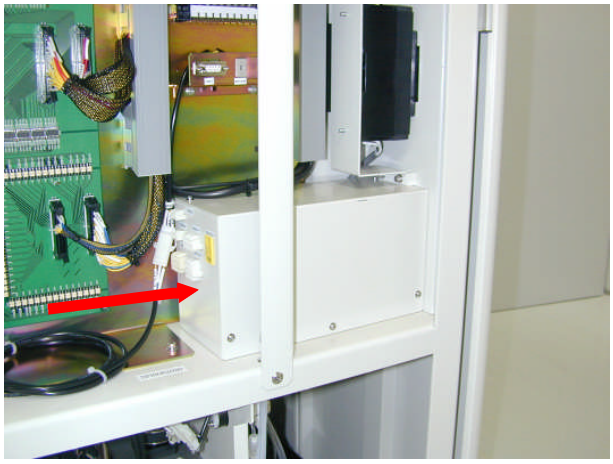
## 3-1-3 Thermo regulator box installation and cable connection

1. Open the below door on the front of the PI-480/NA-480 and remove the blind board after unscrewing the four fixed machine screws (marked by red circles) using a plus driver.




2. Set the thermo regulator box as in the below figure (marker red circle) from rear.



3. Open the below left door on the front of the PI-480/NA-480 and screw the four fixed machine screws (marked red circles) using a plus driver to install the thermo regulator box.


4. Connect the cable (CN101,CN102,CN43,CN44,CN45,CNTS1) to the back of the thermo regulator box.

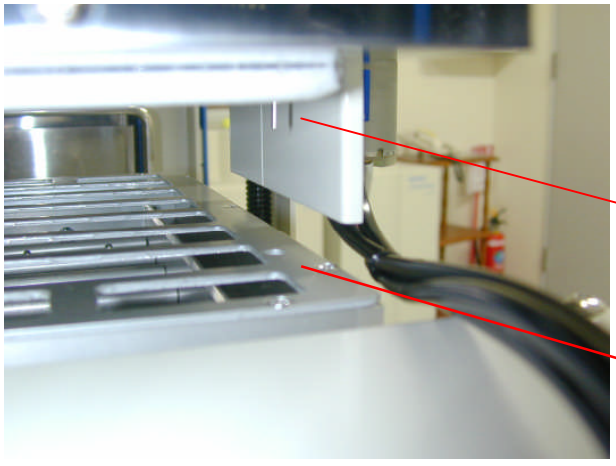

5. Group the cables of the heater chamber unit and fix them using cable ties.


## 3-1-4 Movement and position

After installing the thermo regulator box and the heater chamber unit, and connecting the cable, confirm the movement of the heater unit and the position of the thermo regulator box and agitation unit. When the position is correct, the temperature sensor of the heater chamber unit can be inserted the hole on the agitation unit without any contact.
The command for confirmation and adjustment are in factory mode, (default mode) when the PI-480/NA-480 is shipped from the factory, and they are used to confirm the position and adjustment.

**Caution**

**The factory mode is used to confirm the position and adjustment. The factory mode is protected by the password which is different from that of the maintenance mode. The important position data of each unit is saved in this mode and it is impossible to change the default. This service manual explains only the basic things for the position and movement confirmation, and adjustment. Obey the following procedures precisely.**



Transfer the table to the drive position of agitation unit.

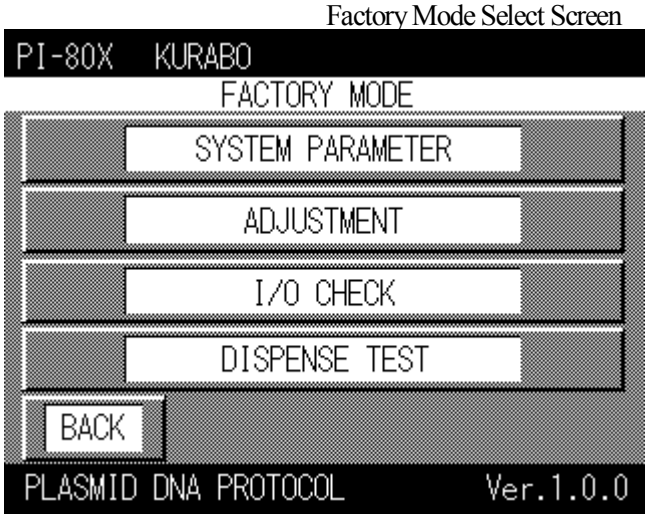
1. Turn on the PI-480/NA-480 and press the [OTHERS] button.


2. Press the [MAINTENANCE] button.

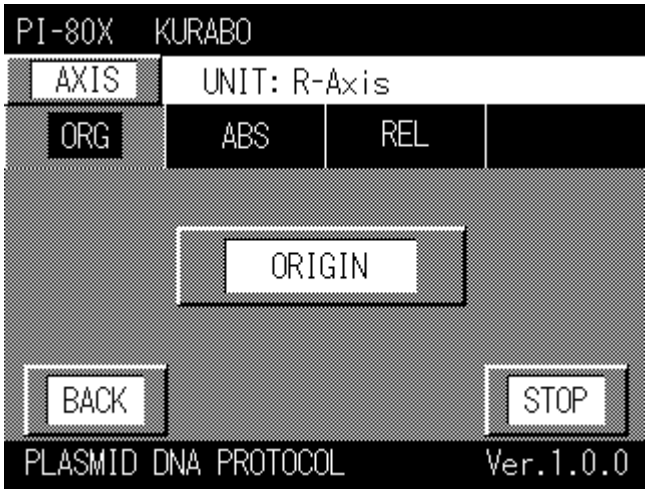

3. Input the password of factory mode (741895) and press the [ENT] button to display 'factory mode select screen'. * The password of factory mode is different from that of maintenance mode.

4. Press the [ADJUSTMENT] button (adjustment mode).

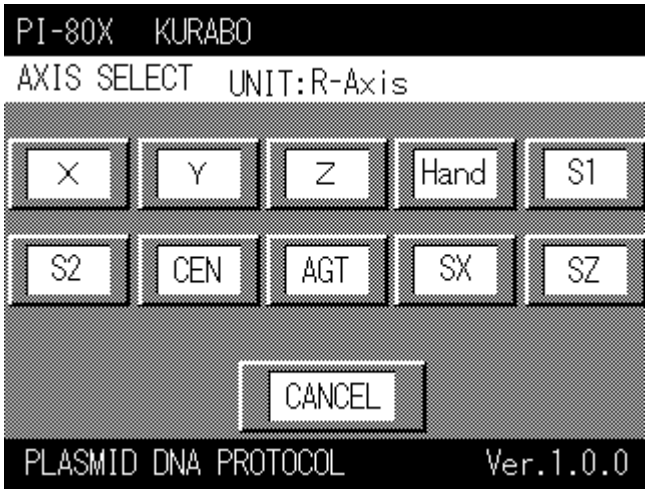
Factory Mode Select Screen



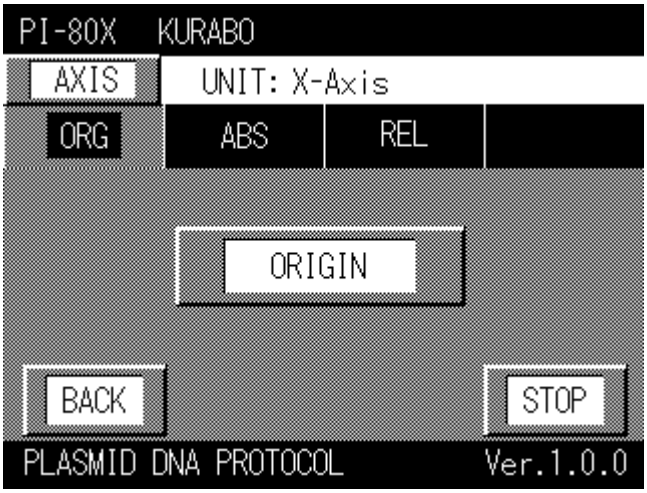

5. Press the [AXIS] button (drive axis select)



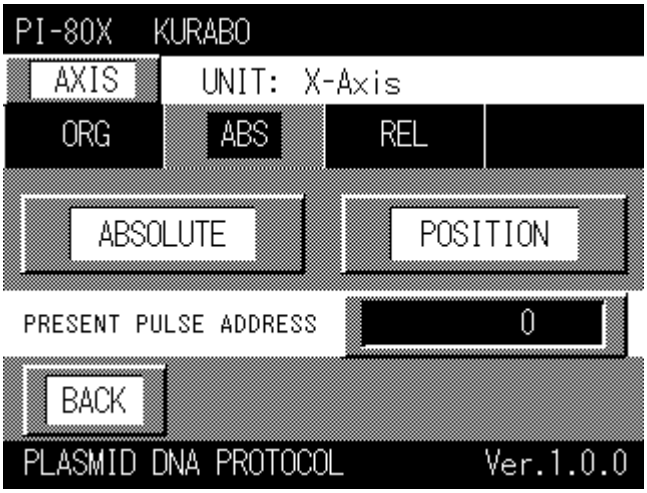

6. Press the [X (axis)] button to move the table.



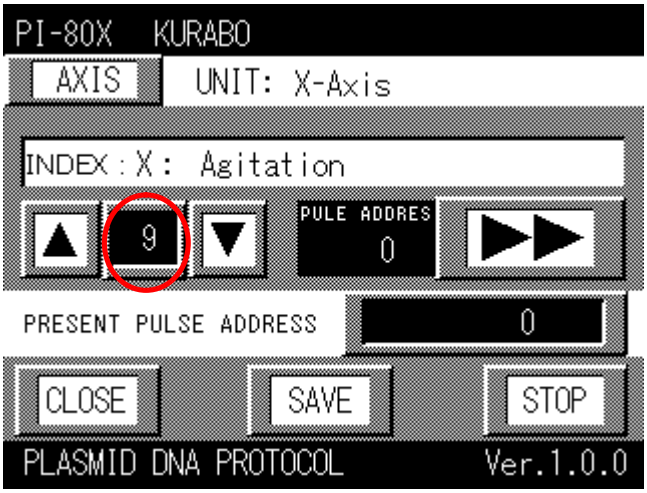
7. Press the [ABS] button (position confirmation and adjustment mode).



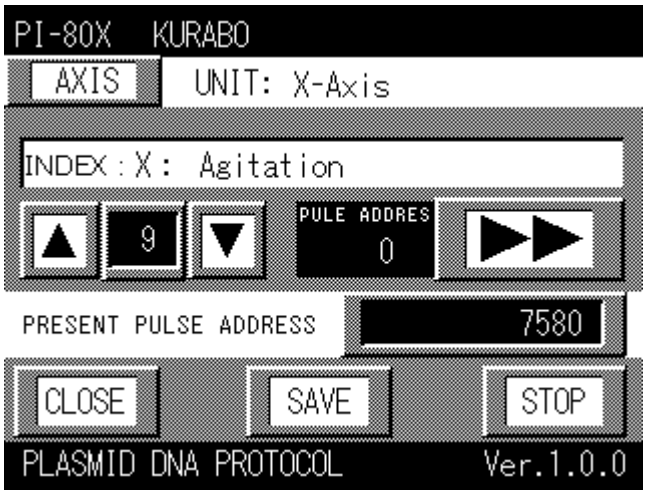

8. Press the [POSITION] button (position confirmation).



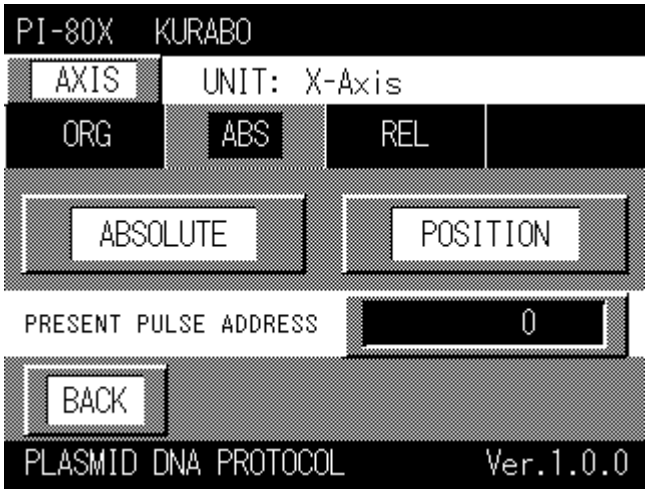

9. Press the ▼ button until the number marked by red circle become 9(table agitation position).



10. Press the ▶▶ button to move the table to the agitation unit drive position.
Press the [CLOSE] button after completing the movement.

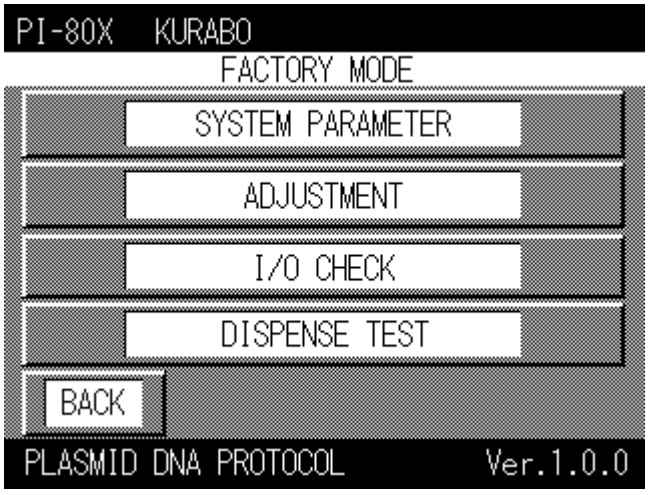



11. Press the [BACK] button to return 'Factory Mode Select Screen'.




⇩

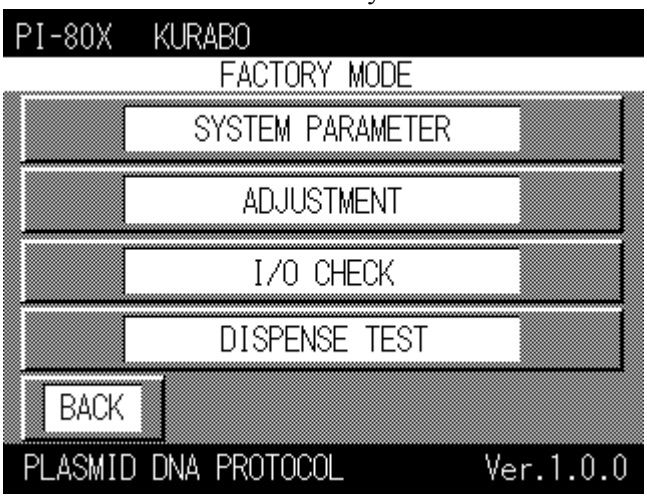
Factory Mode Select Screen



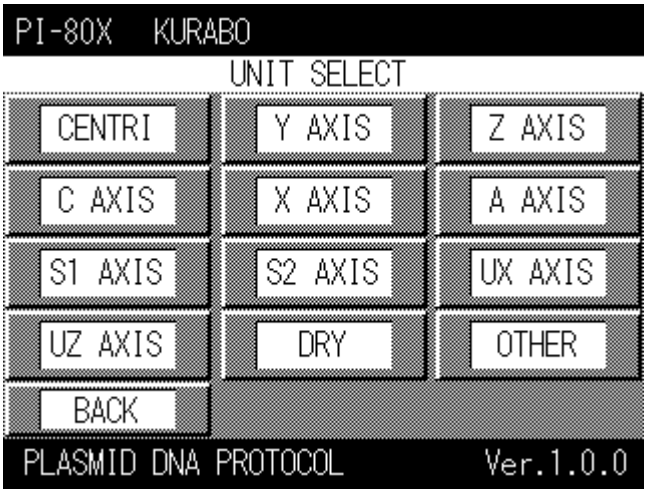
Lower the heater unit and confirm whether temperature sensor is inserted the hole on the agitation unit without contact.

12. Press the [I/O CHECK] button (input / output check).

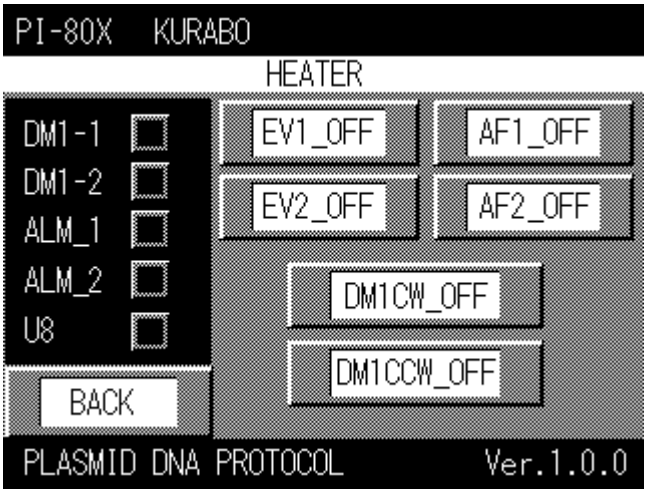
Factory Mode Select Screen




13. Press the [DRY] button (heater unit I/O confirmation).

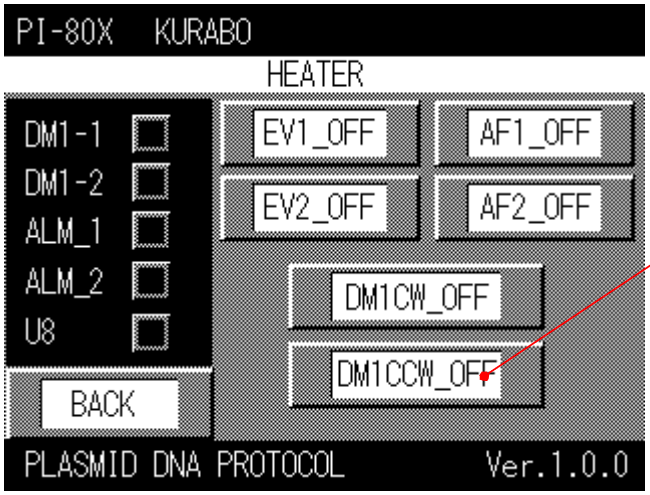



14. After pressing the [DM1CW_OFF] button, the heater chamber unit rises. After pressing the [DM1CCW_OFF] button, it lowers. Read and understand the following page before operating the heater chamber unit.

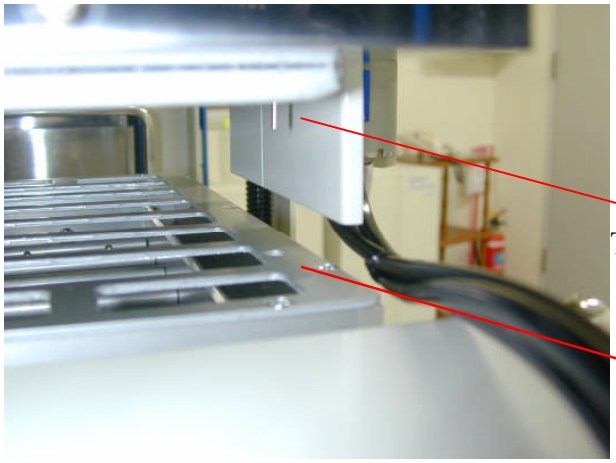


**Caution**

**The DM1CW_OFF button, (heater chamber unit rise button) and the DM1CCW_OFF button (heater chamber unit fall button) only operate while they are pressed. There is a time lag between pressing the button and the actual operation. When releasing the button, the heater chamber still operates for approximately two seconds. Especially take caution not to damage the temperature sensor when lowering the heater chamber unit. When the sensor turns on, it automatically stops even still pressing the buttons as the heater chamber has the upper and lower limit sensor**




Confirm whether the temperature sensor inserts the hole on the agitation unit without contact by pressing and releasing the [DM1CCW_OFF] button not to damage it.



Temperature sensor

Hole on the agitation unit

Press the [BACK] button until 'Operation mode select screen' is displayed and turn off the PI-480/NA-480.

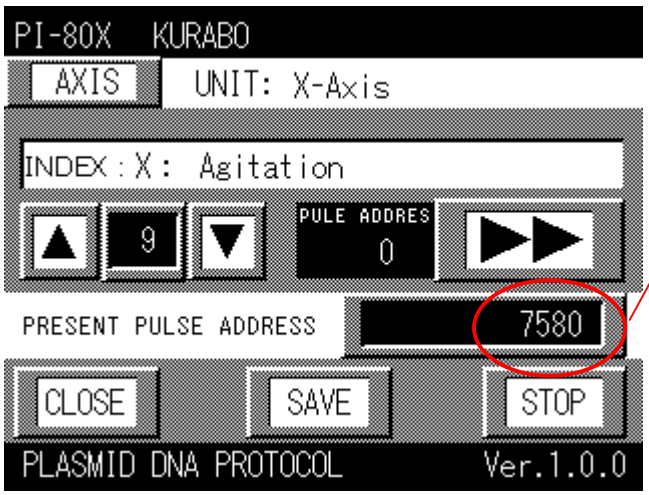
3-1-5 Adjusting the agitation unit drive position of X axis table.

In case when the temperature sensor cannot be inserted the hole on the agitation unit (X axis), adjust the agitation unit drive position of X axis table according to the following procedures.

**Caution**

**The command for confirmation and adjustment are in factory mode, (default mode) when the PI-480/NA-480 is shipped from the factory, and they are used to confirm the position and adjustment. The factory mode is protected by the password which is different from that of the maintenance mode. The important position data of each unit is saved in this mode and it is impossible to change the default. This service manual explains only the basic things for the position and movement confirmation, and adjustment. Obey the following procedures precisely.**

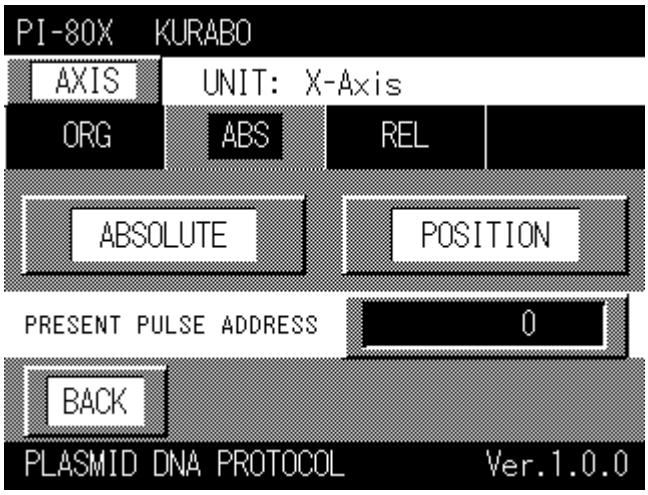
1. Transfer the X axis moving rack to the agitation unit drive position according to the procedure of movement and position confirmation (refer to 3-1-4). Record the number in the 'PRESENT PULSE ADDRESS' field (positional pulse data). The following screen displays 7580 in the field and this value is default for the agitation unit drive position data of X axis table. This value is different from that of each instrument. After recording the number in the 'PRESENT PLUSE ADDRESS' field, press the [CLOSE] button.



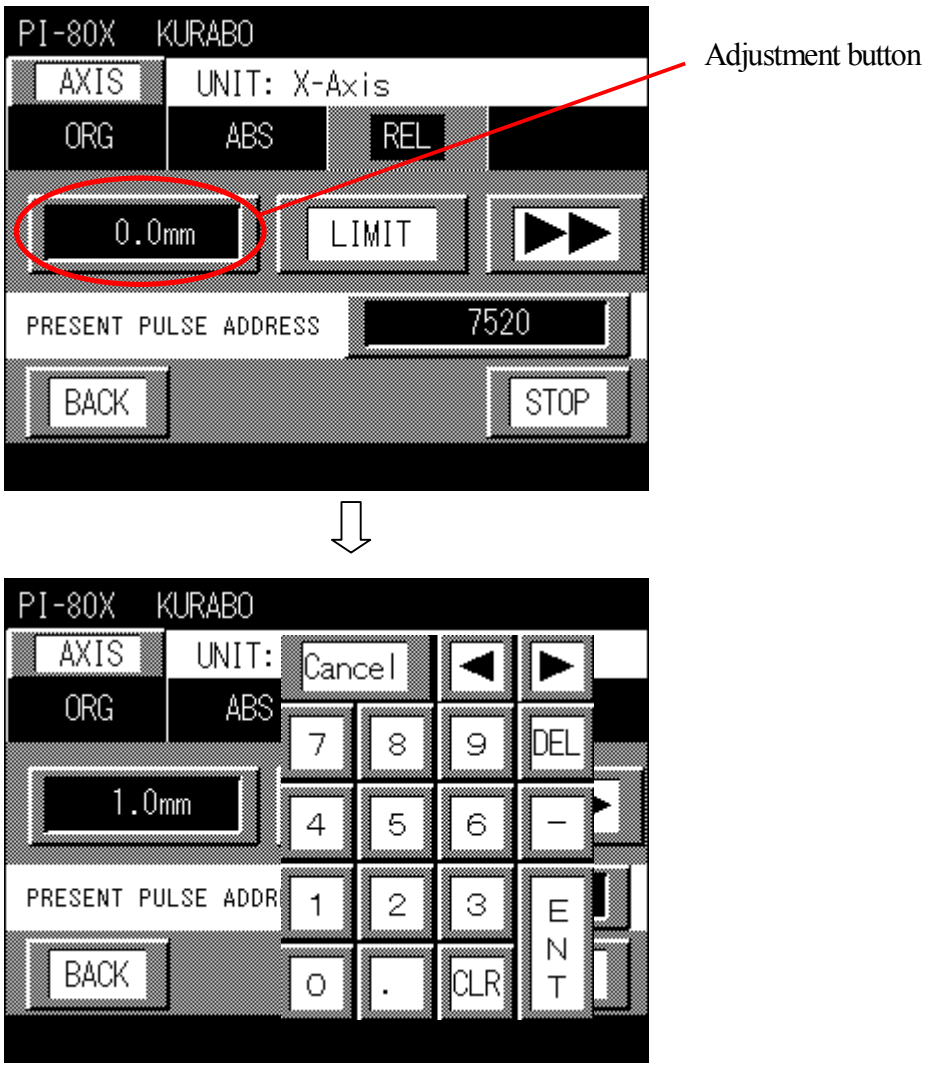

**Caution**

**Record the number on the 'PRESENT PULSE ADDRESS (position pulse data)' precisely.**

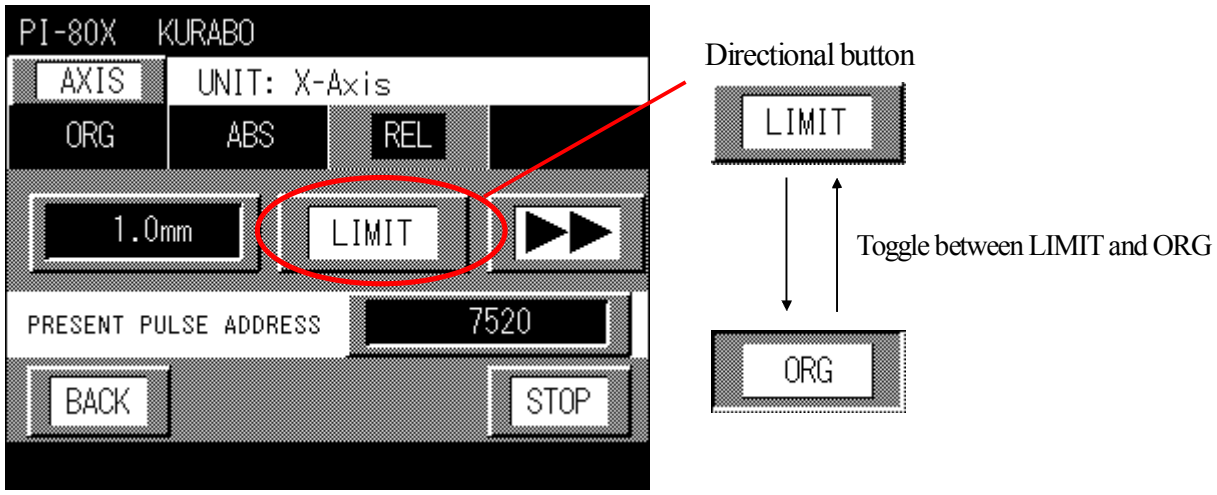
2. Press the [REL] button (position adjustment).



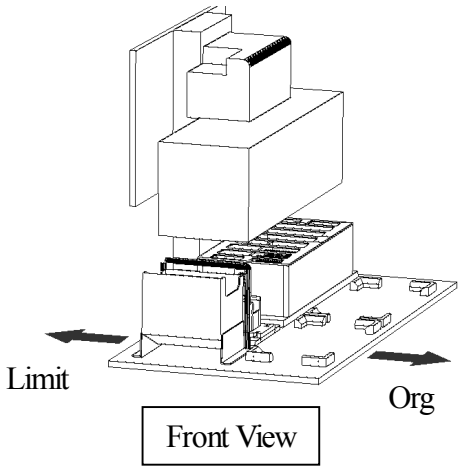
3. Press the adjustment button (marked red circle) to open the numeric keys.
After adjusting the position by 1.0mm, press '1' using the numeric key and the [ENT] button. After pressing the [ENT] button, the numeric keys will close.



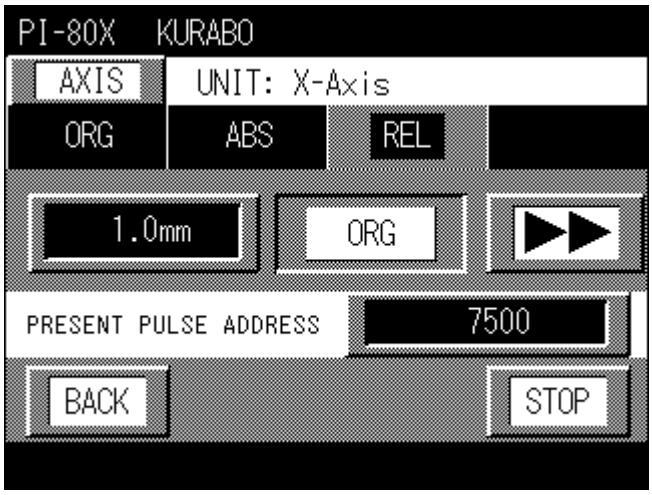

4. Decide the adjustment direction by the directional buttons. The display toggles between LIMIT (Left) and ORG (Right) whenever pressing the directional buttons. Refer to the next page for directions



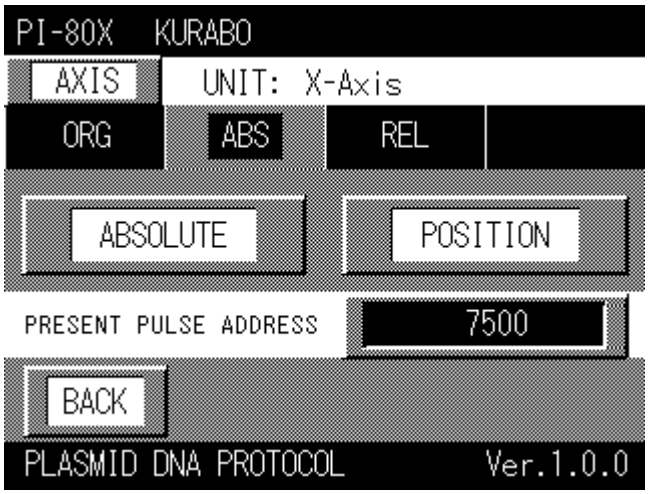
When adjusting the moving rack to left, press the [LIMIT] button.
When adjusting the moving rack to right, press the [ORG] button.



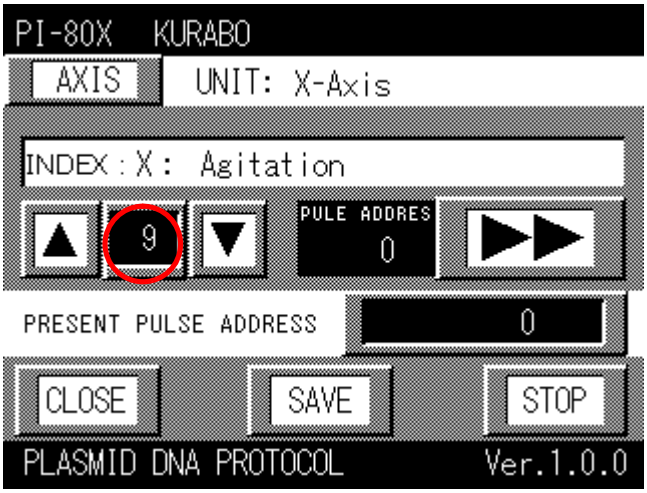

5. Press the ▶▶ button after deciding the direction. Check whether the table moved and the number on PRESENT PULSE ADDRESS was changed. Below figure indicates the table will move to right by 1mm.



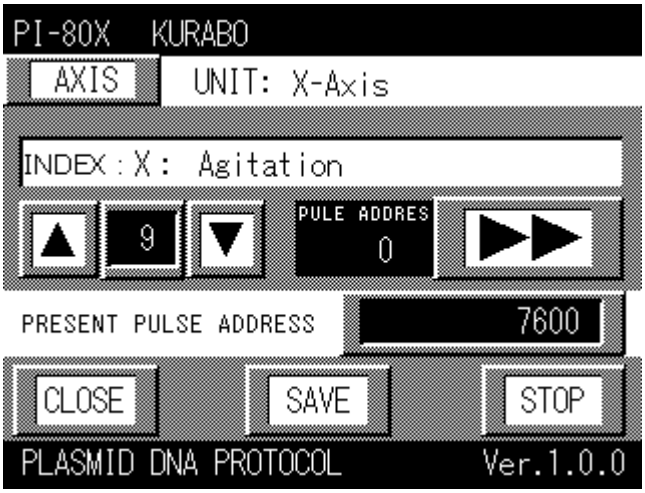

6. Press the [ABS] button after adjusting the position and then press the [POSITION] button.



7. Press the ▼ button until the value which is marked by red circle becomes 9.




8. When pressing the [SAVE] button, the value of PRESENT PULSE ADDRESS, (position pulse data) is changed This means that the agitation unit drive position of the X axis table is adjusted right by 1mm.



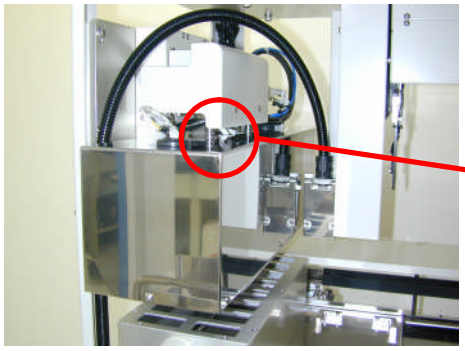

Press the [CLOSE] button after completing adjustment to return the previous screen. Press the [BACK] button to return operation mode select screen and then turn off the PI-480/NA-480.

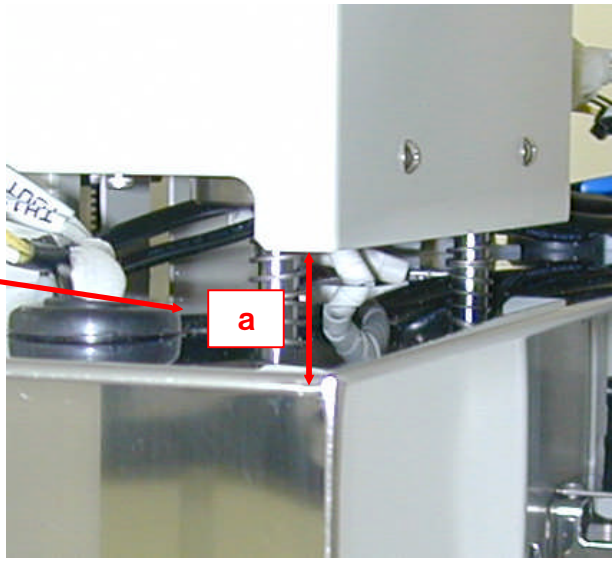
Operation Select Mode Screen

3-1-6 Adjusting the press distance of the heater chamber unit

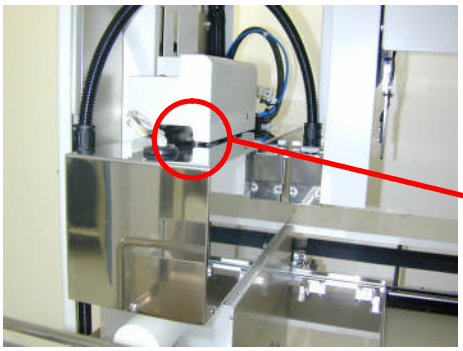
The heater chamber unit has a mechanism where the spring presses the agitation unit to tighten the seal after the heater chamber unit lowered and combined the agitation unit. Adjust that the distance of the heater chamber unit between raise position (‘a’) and lower position (‘b’) becomes 4mm.

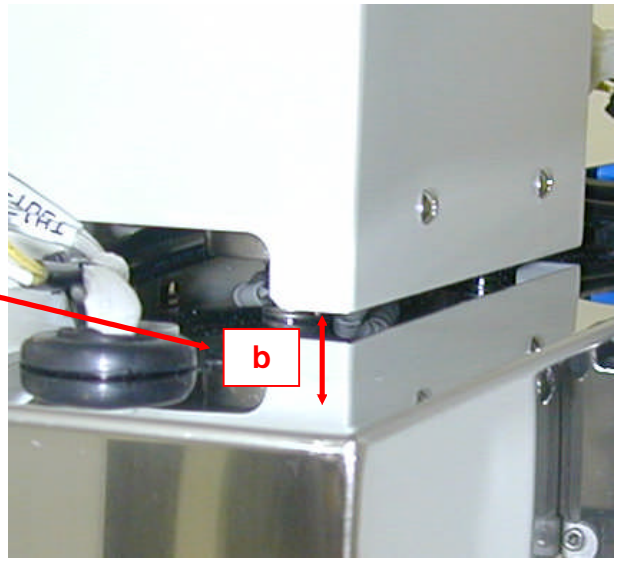
The time when the heater chamber rises



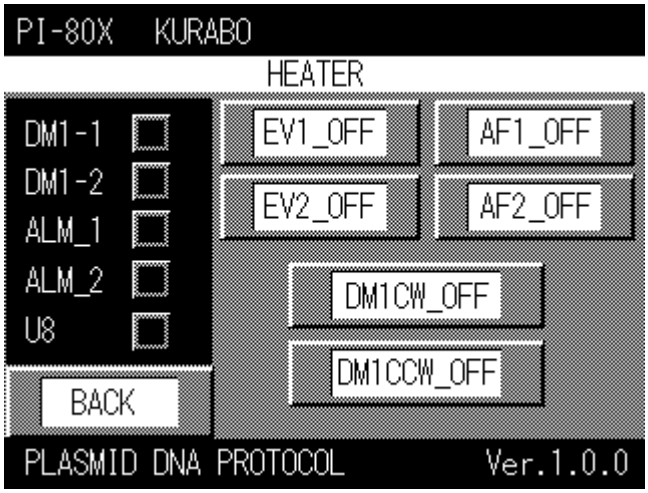



The time the heater chamber lower

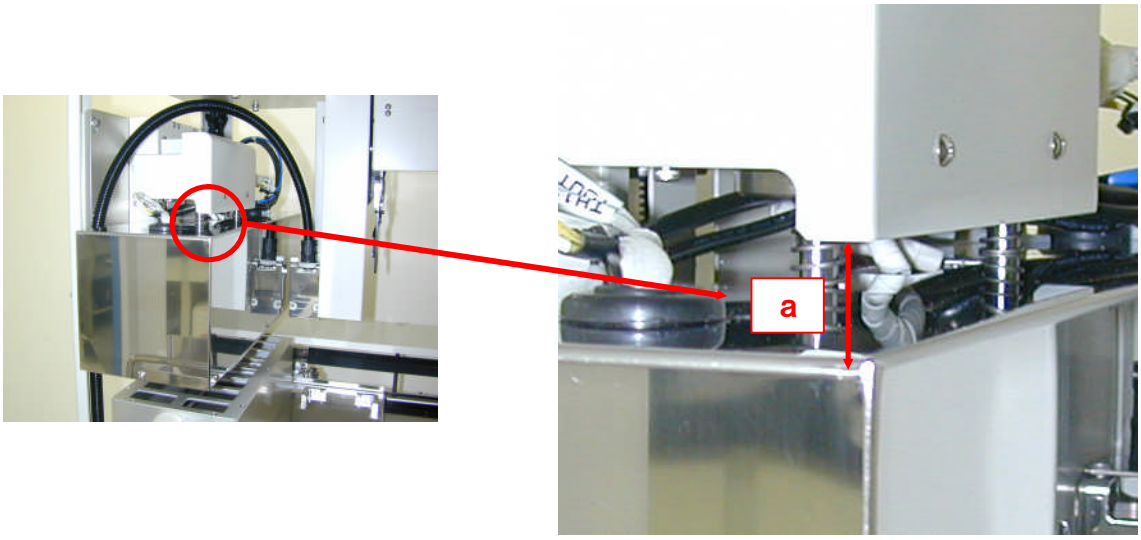




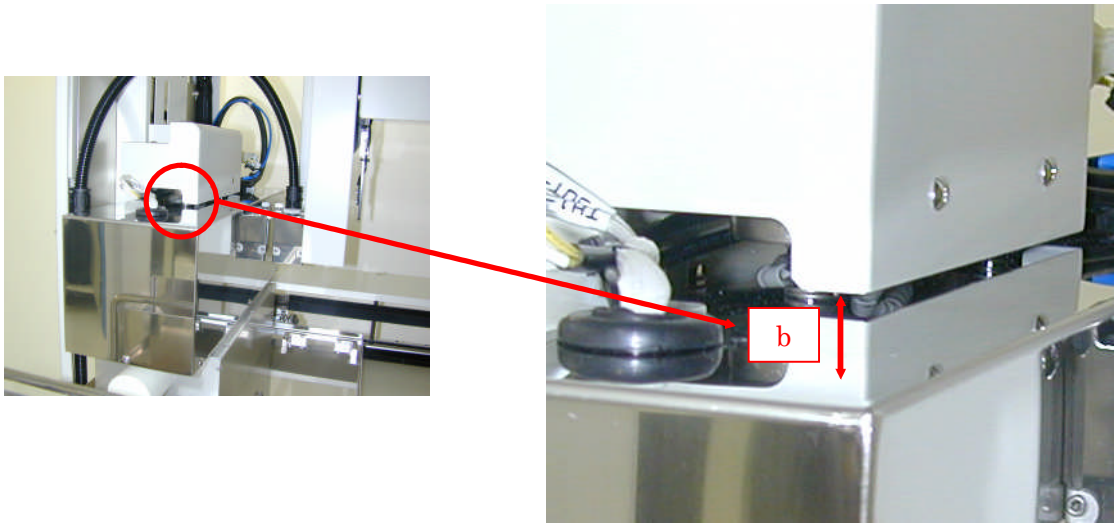
1. Display the 'I/O check screen' of heater unit according to 'operation and position confirmation, 3-1-4'
After pressing the [DM1CW_OFF] / ([DM1CCW_OFF]), the heater chamber rises (lowers).



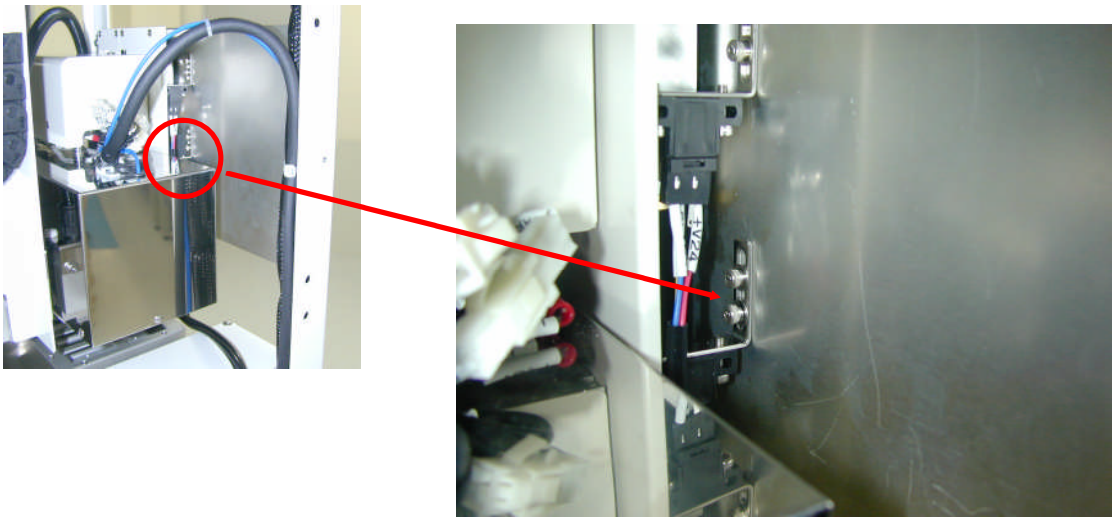

2. Continue pressing the [DM1CW_OFF] button until the heater unit chamber stops at upper limit position. Next measure the distance 'a'.
*In cases when the heater unit is at upper limit position, it does not operate.




3. Continue pressing the [DM1CCW_OFF] button until the heater chamber unit stops at lower limit position. Next measure the distance 'b'.



4. Adjust the position of the lower limit sensor of the heater chamber so that the distance between ‘a’ and ‘b’ becomes 4mm. The sensor is attached using two fixed machine screws (2.5mm hex-head wrench).



Keep pressing the [BACK] button to return ‘operation mode select screen’ after completing the adjustment and turn off the PI-480/NA-480.

Operation Mode Select Screen

## 3-1-7 Air conditioner set

It is possible to select 4 choices (OFF, LOW MID and HIGH).Set the SP0 to SP3 referring to the following table.

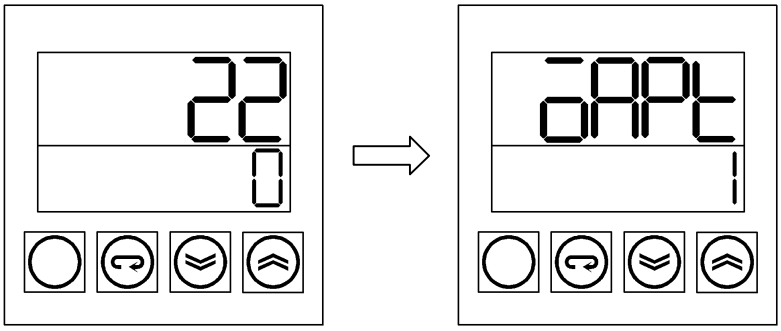
| Heater set on operation screen | | Setting item | Thermo regulator set temperature (default) |
|---|---|---|---|
| 0 | OFF | SP0 | 0 *OFF |
| 1 | LOW | SP1 | 40℃ |
| 2 | MID | SP2 | 55℃ |
| 3 | HIGH | SP3 | 65℃ |

**Caution**

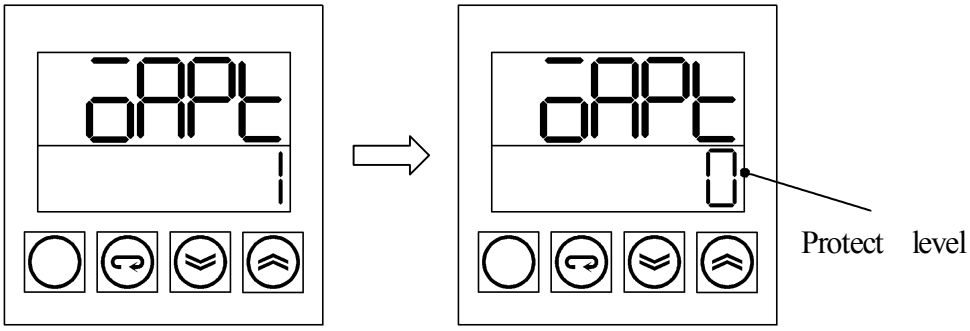
**Do not change any of these default values.**

1. Press the ◯ button and the ⟲ button at a same time at least for three seconds to display the 'operation / adjustment protect screen'.

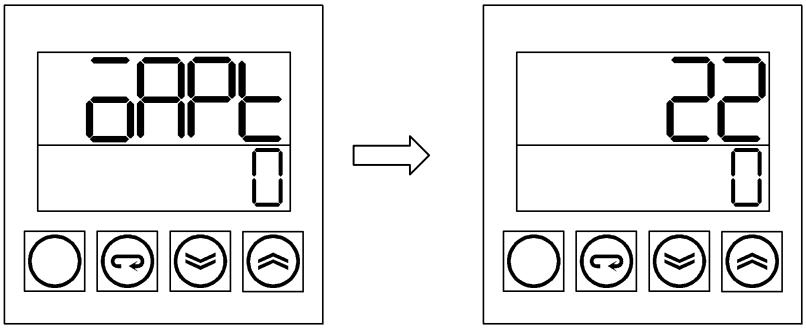
Operation / adjustment protect screen



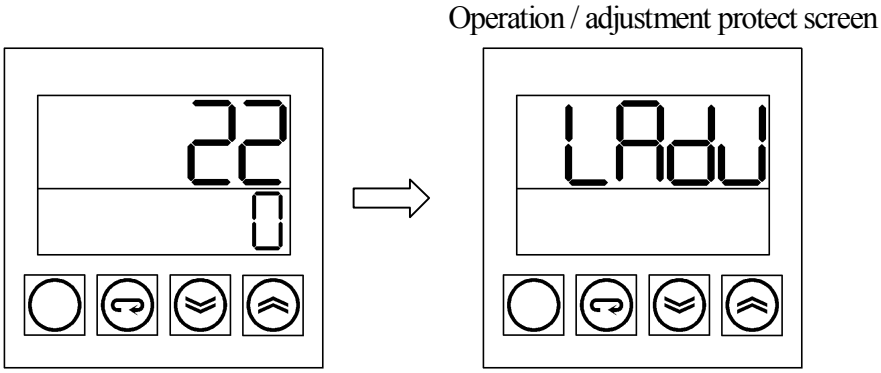

2. Press the ≪ button to adjust the protect level so that the number on the screen becomes 0.



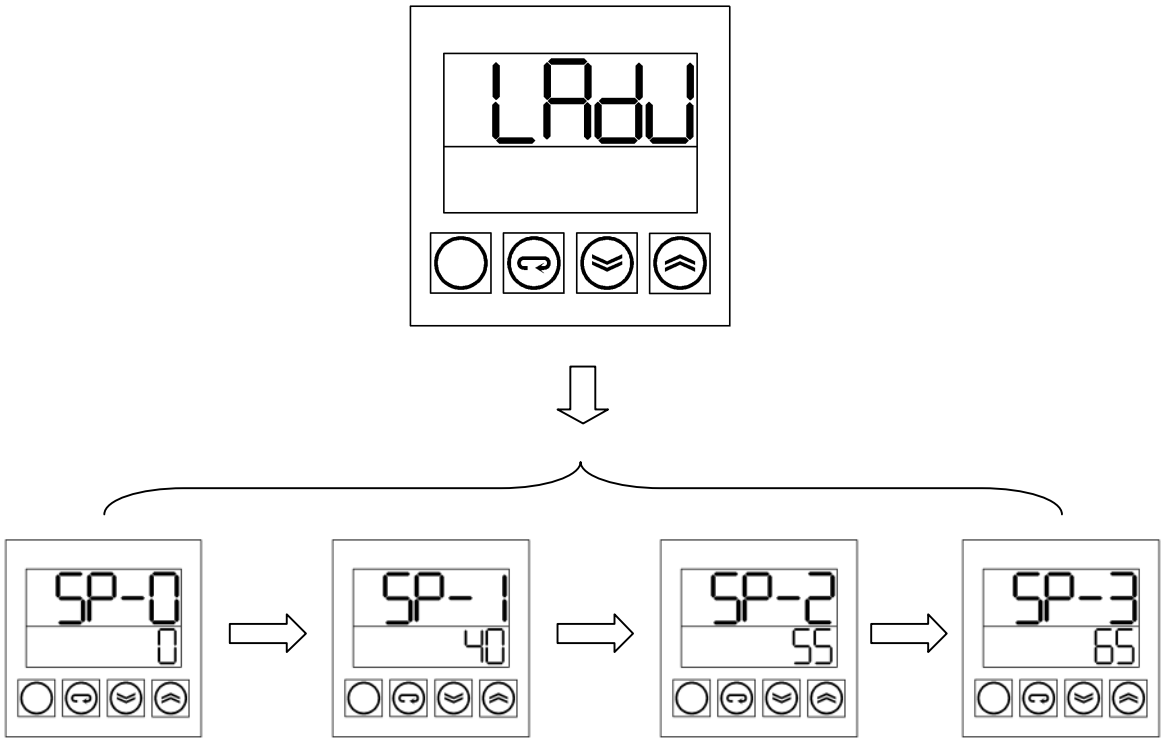
3. Press the button and the button again at a same time at least for three seconds to return the initial screen.



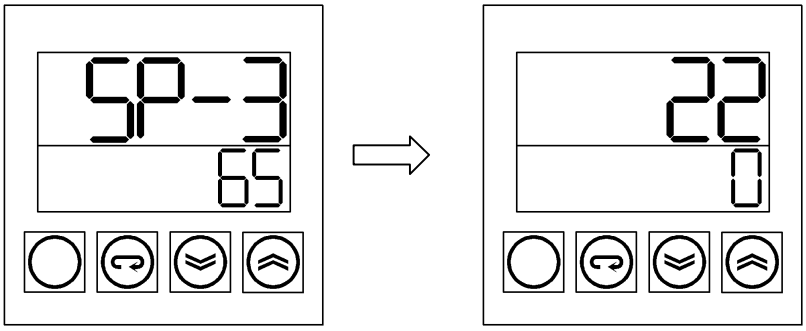

4. Press the button for less than one second to display the 'Set Screen'.



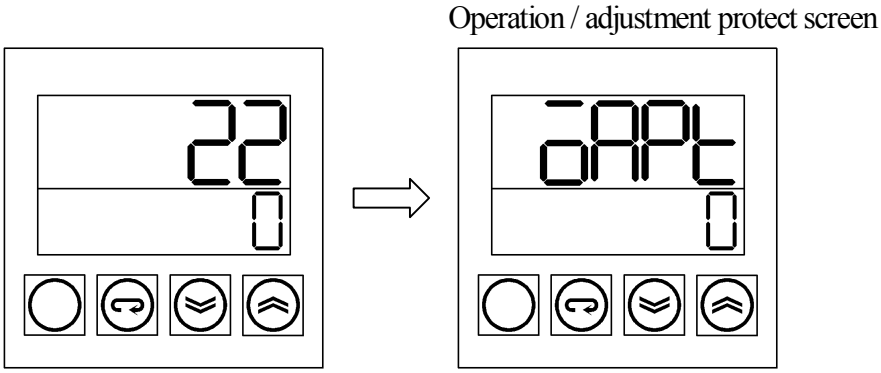

5. Press the button several times so that the value of SP0, SP1, SP2 and SP3 become 0, 40, 55 and 65C using the and the button.



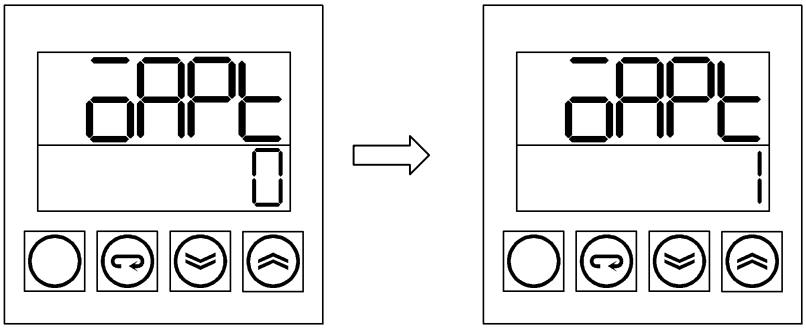
6. Press the ◯ button for less than one second to return the 'initial screen'.



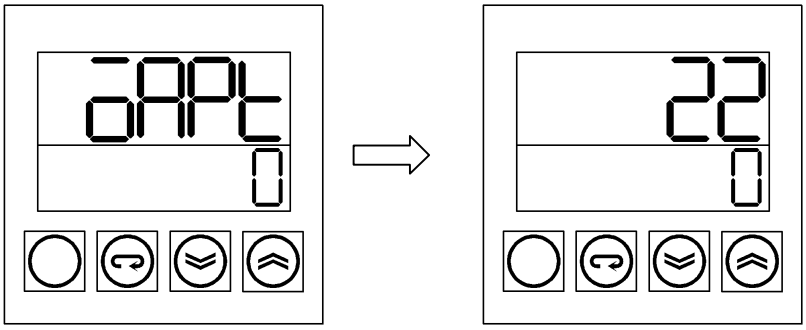

7. Press the ◯ button and the ⟲ button at a same time at least for three seconds to display 'operation / adjustment protect screen'




8. Press the ⩓ button to adjust the protect level so that the number on the screen become 1.



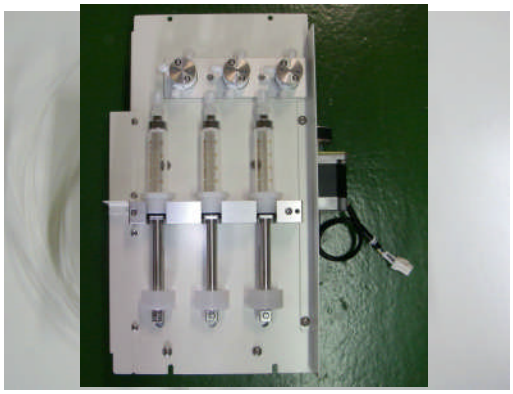

9. Press the ◯ button and the ⟲ button at a same time at least for three seconds to return the 'initial screen'.



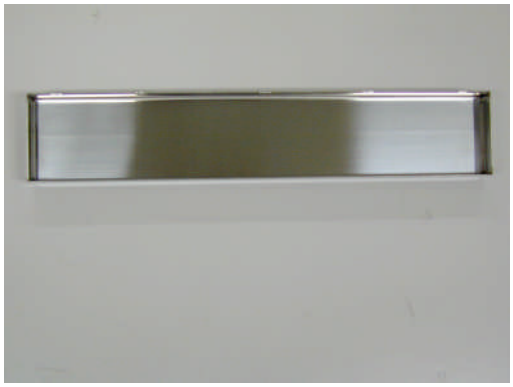
## 3-2 Optional channel dispenser

### 3-2-1 Composition of the optional channel dispenser

The following illustrations show the composition of the optional channel dispenser.

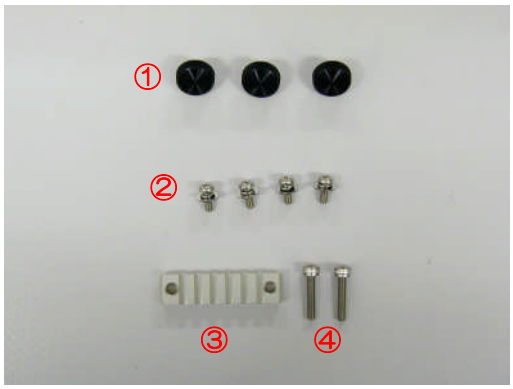


Optional channel dispenser



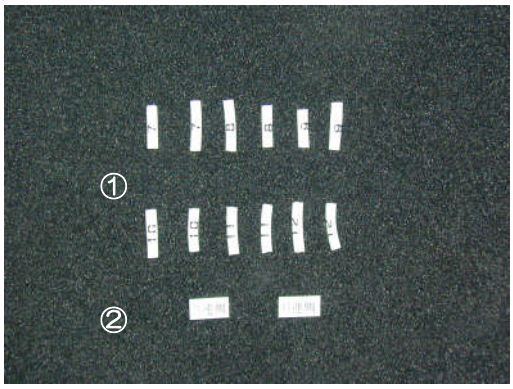
Reagent bottle reagent

Cable




1.Reagent tray machine screw 2. Driver fixed machine screw
3. Nozzle bracket 4. Nozzle bracket fixed machine screw

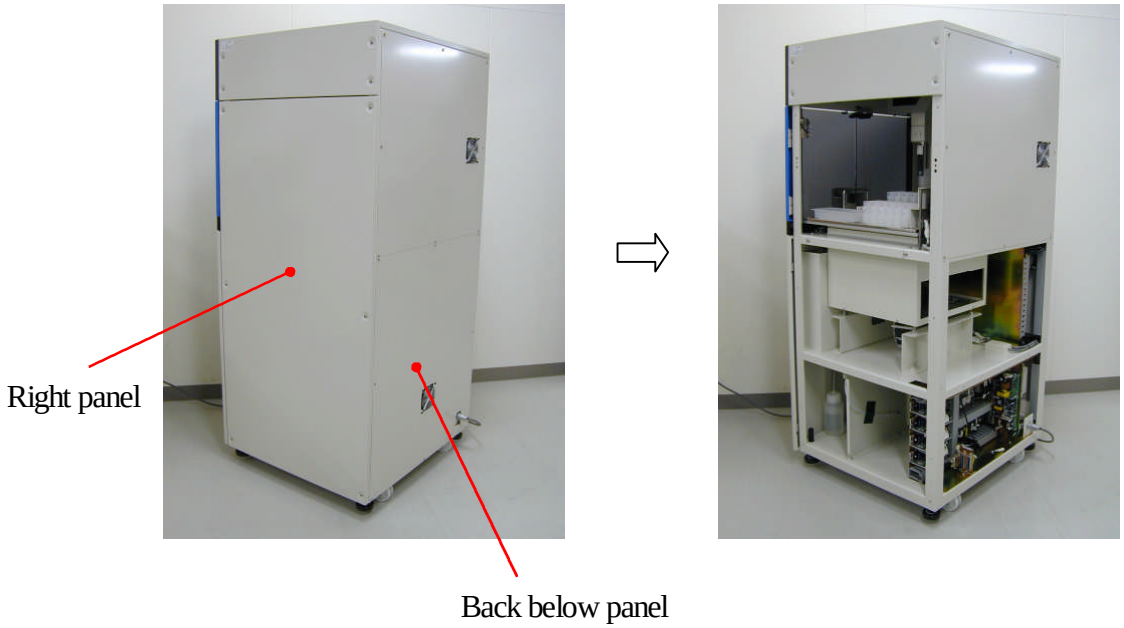
Motor driver



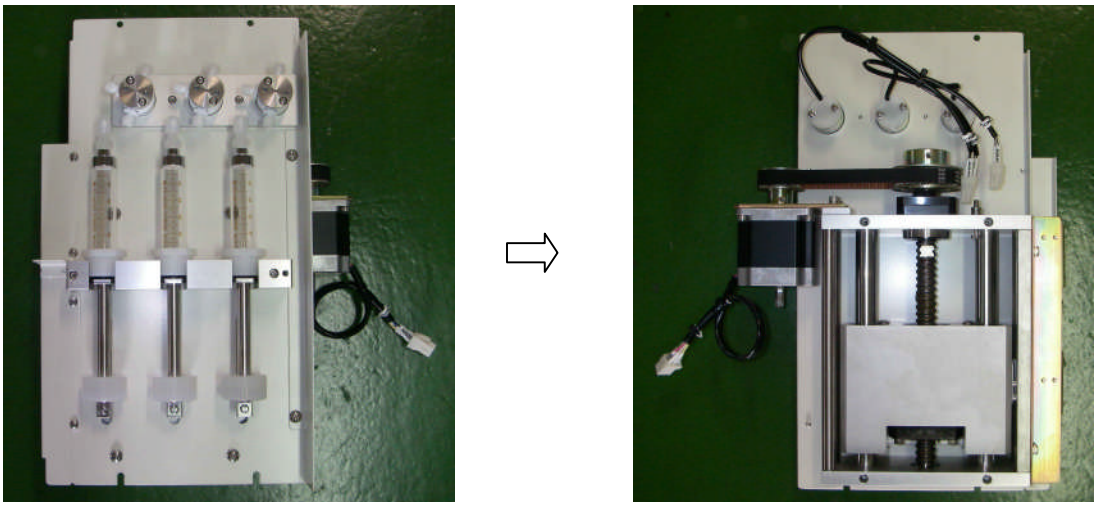

1. No. label
2.Three optional channel dispenser identification seal

## 3-2-2 Installing the optional channel dispenser

1. Remove the right and back below panel of the PI-480/NA-480. As the fan cable is connected to the back below panel, remove the fan cable, too.

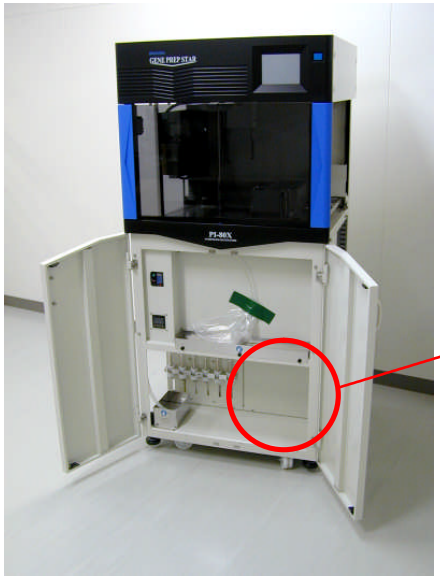



2. Connect the motor cable (CN201), valve cable (CN202, CN203, CN204, CN205, CN206, CN207) and sensor cable (PH8-1, PH8-2) to the optional channel dispenser.

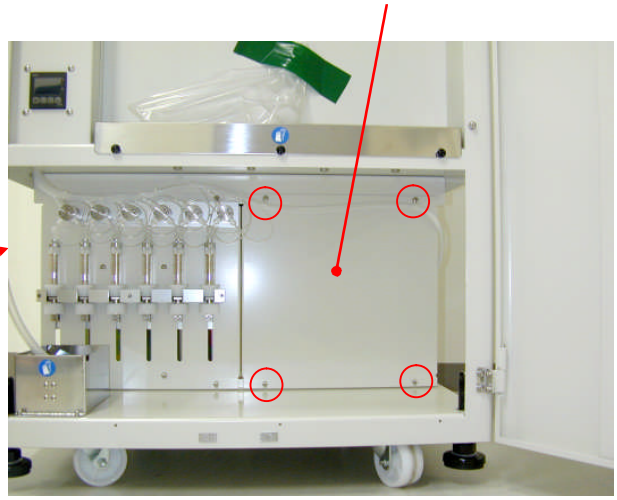


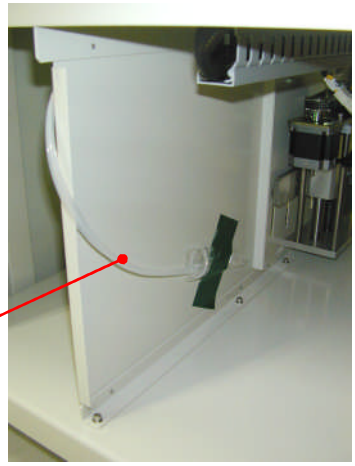
3. Remove the blind board to install the optional channel dispenser. The blind board is fixed by the four machine screws. Unscrew the four screws using a plus driver and then remove it.
As the grouped Teflon tubes (dispenser nozzle three directions valve) for installing the optional channel dispenser are fixed with vinyl tape on the rear side of the blind board, remove them, too.

The installation position of the optional channel dispenser



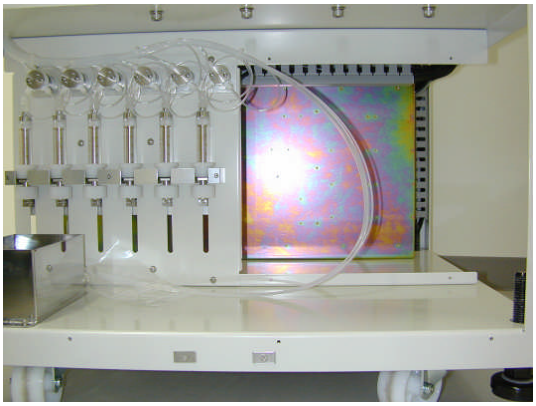
Blind board and the position of the machine screw

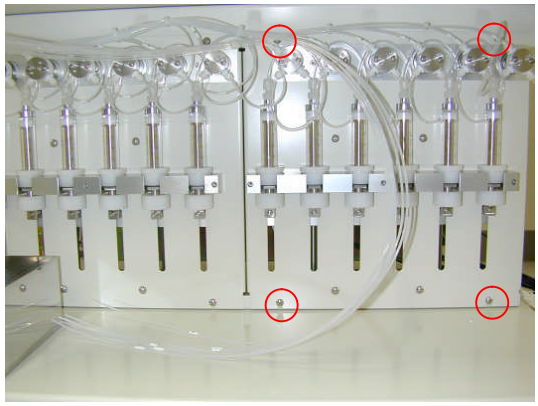




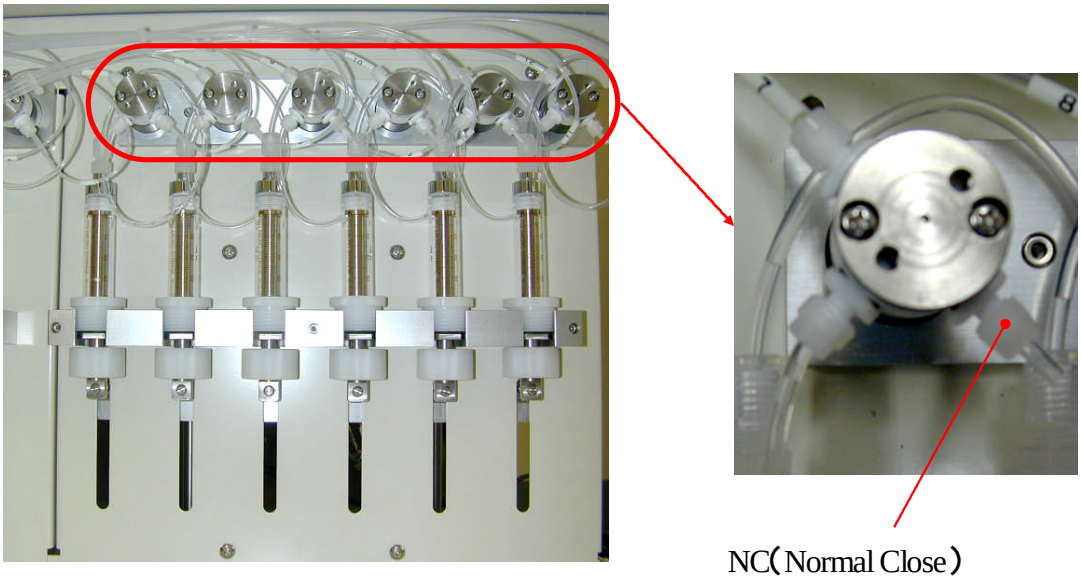
Teflon tube for the optional channel dispenser

4. Install the optional channel dispenser on the blind board which was removed in the previous step using the machine screws.



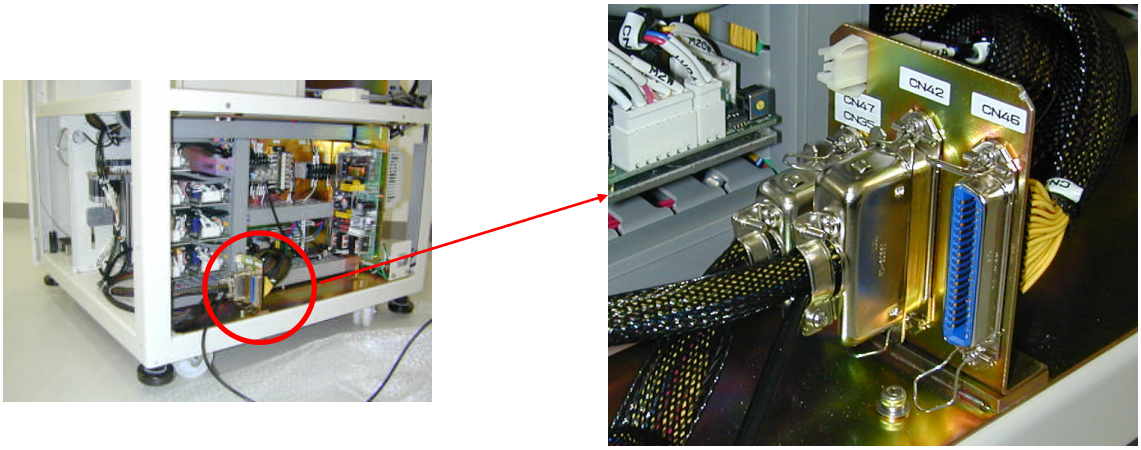


5. Connect the Teflon tubes for the optional channel dispenser removed in the procedure '3' to the valve of each dispenser channel. In case when the dispenser No. label is not stuck on the each Teflon tube, stick the attached labels on the tubes.

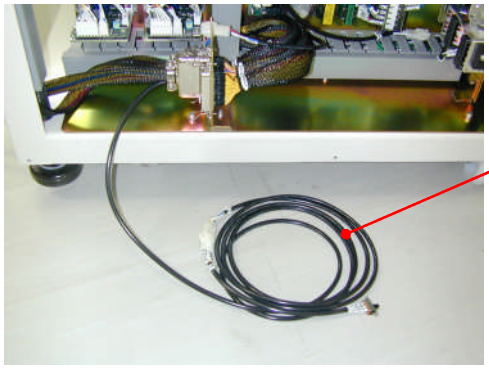


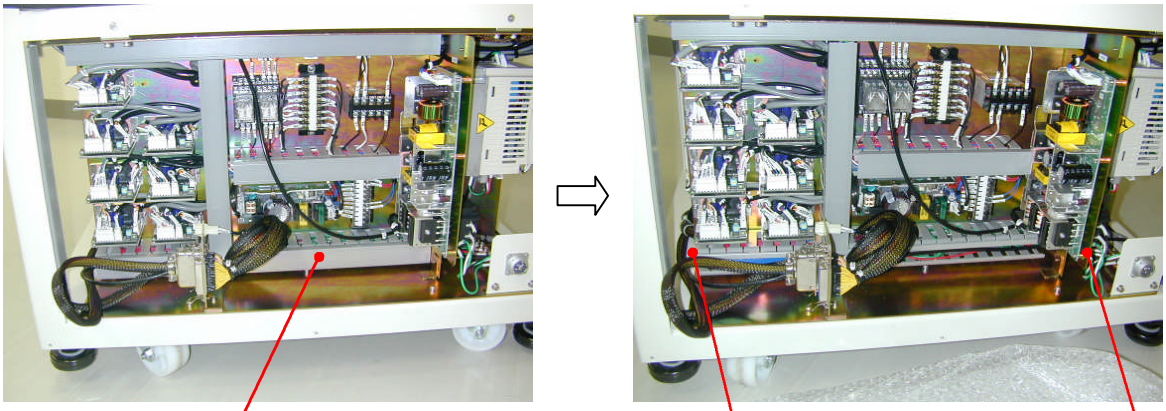

6. Group the cables and fix them using cable ties.

7. Connect the connector (CN42) as follows.

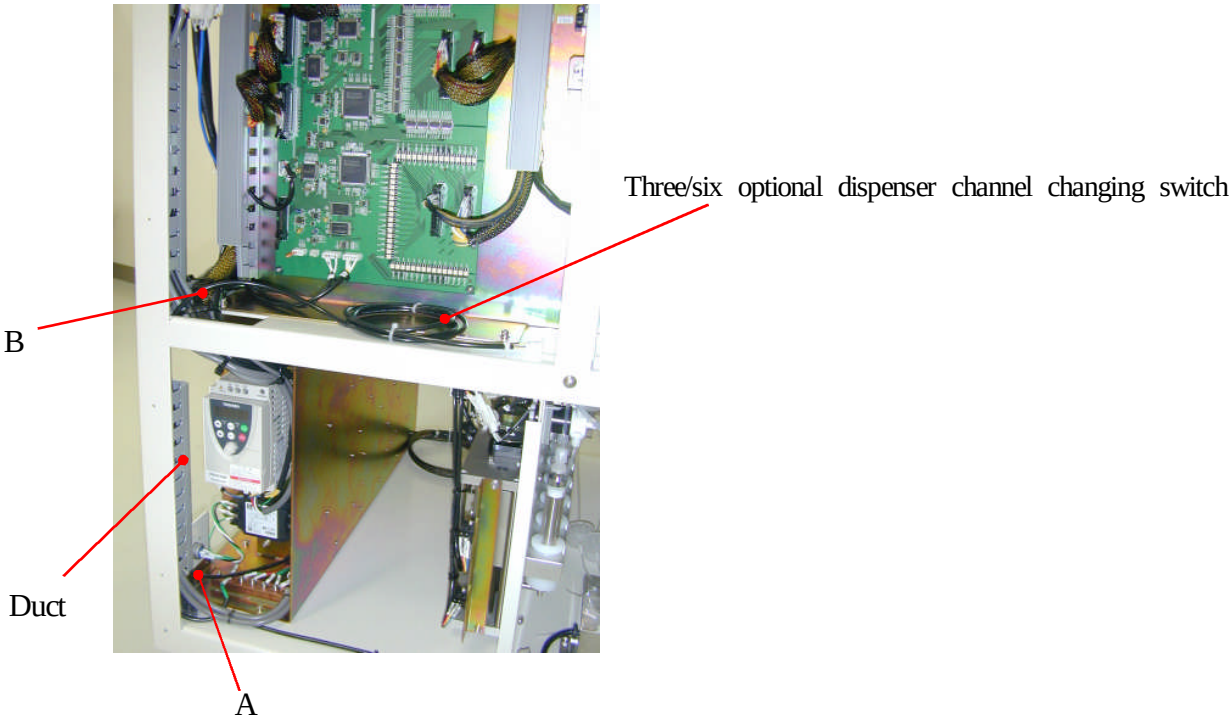


8. Open the lid of the duct and then pass the three/six optional dispenser channel changing switch cable from 'A' through to 'B'. Then close the lid of the duct.

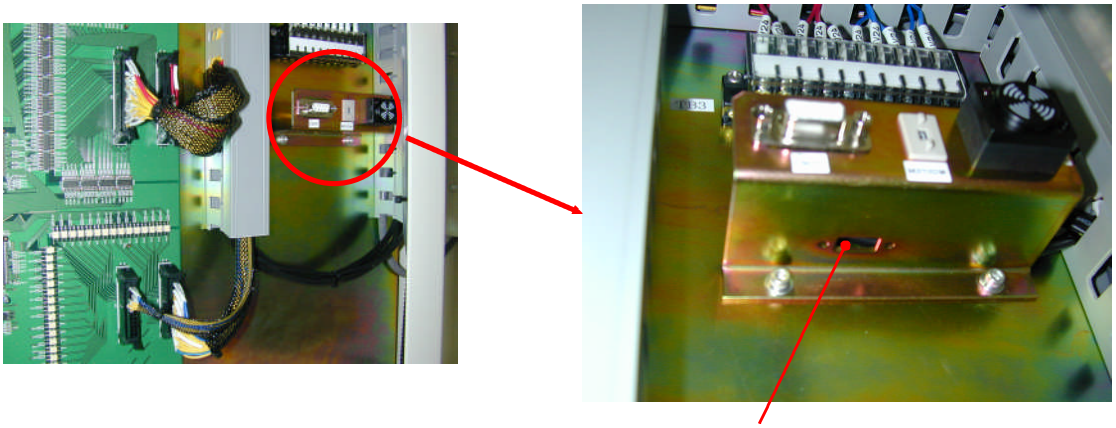



Open the lid of the duct and then pass the three/six optional dispenser channel changing switch cable from 'A' through to 'B'. Close the lid of the duct.

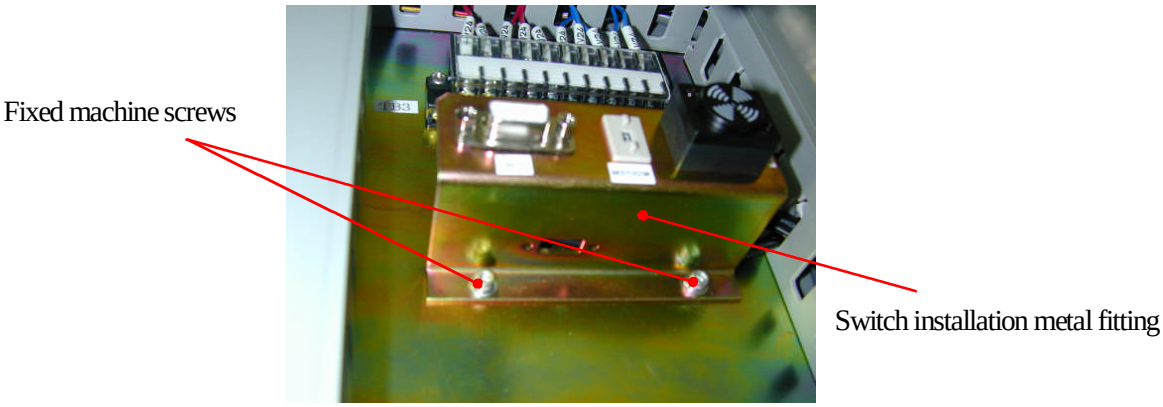


The following illustrations indicate the position where the three/six optional dispenser channel changing switch cable is installed.

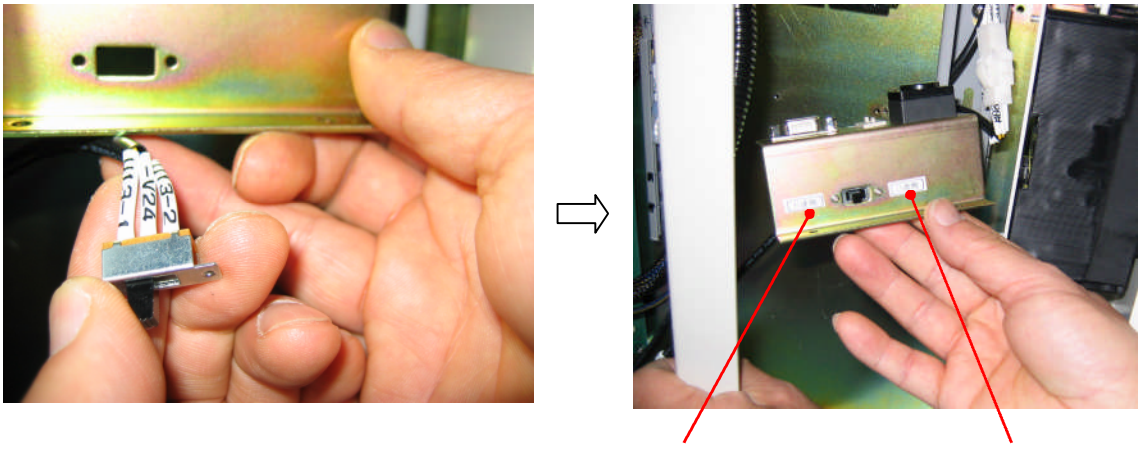


Position of Three/six optional dispenser channel changing switch

10. The switch installation metal fitting is fixed with the two machine screws. Remove the switch installation metal fitting after unscrewing the two machine screws.



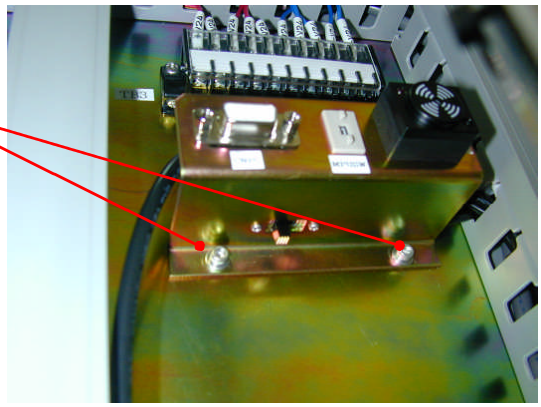

11. Fix the three/six optional dispenser channel changing switch onto the switch installation metal fitting with the attached fixed machine screws using a precise plus driver so that US-13-1 side is facing left on the back of the switch installation metal fittings. Stick the three/six optional channel dispenser identification seal on both switch's side.



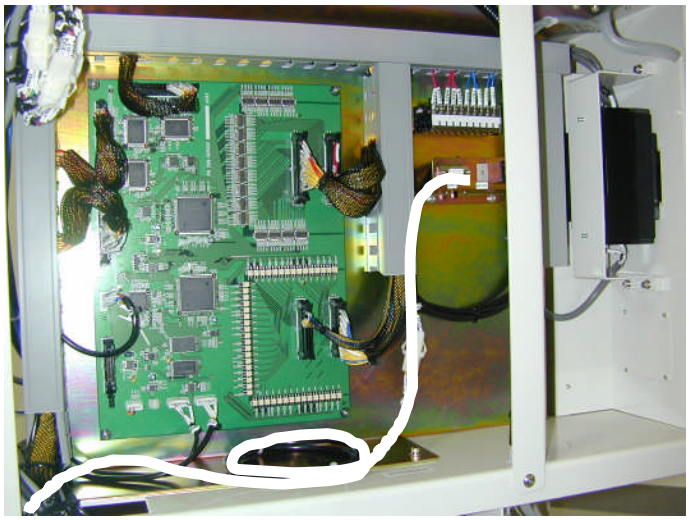
Six optional dispenser side (US13-1) Three optional dispenser side (US13-2)

12. Attach the switch installation metal fittings with the two fixed machine screws.

Fixed machine screw



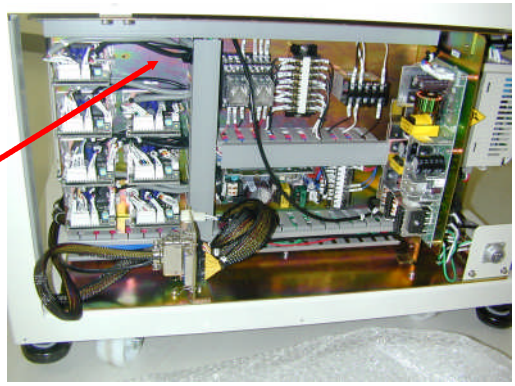
Final wiring chart



## 3-2-3 Attaching and adjusting the motor driver

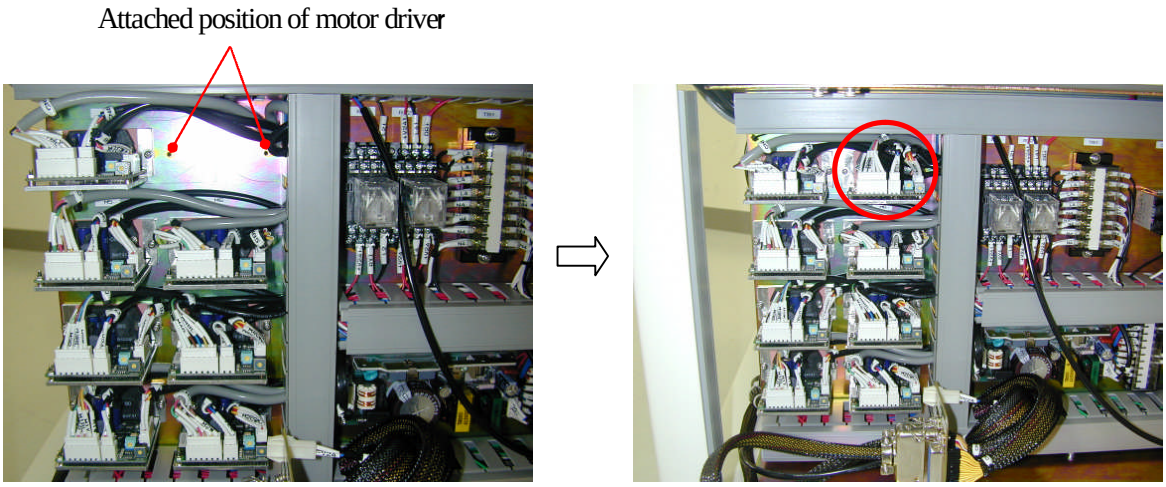
1. Remove the back lower panel of the PI-480/NA-480.(Refer to 3-2-2 'installing the optional channel dispenser') As the fan cable is connected to the back below panel, remove the fan cable, too.

The following illustrations indicate the place where the motor driver is attached.

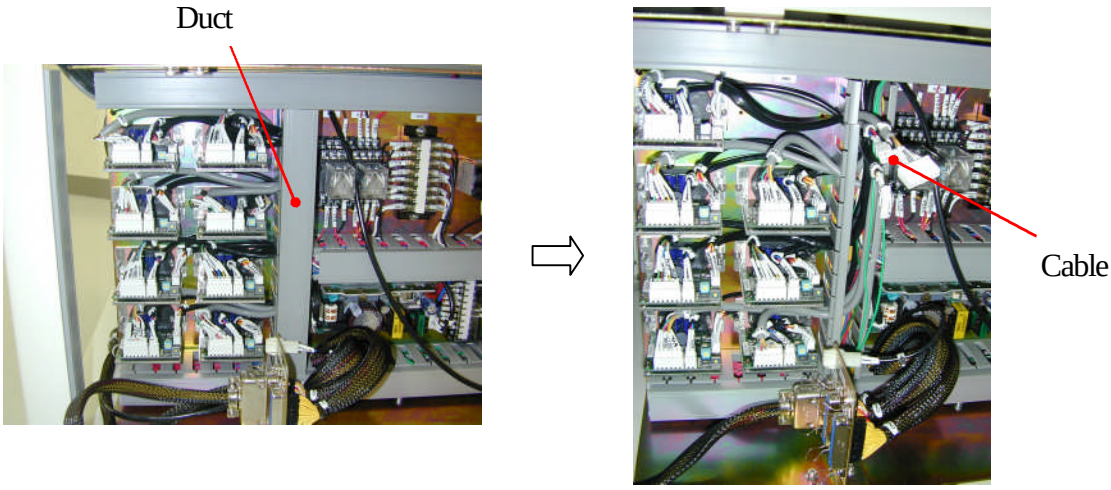


Motor driver

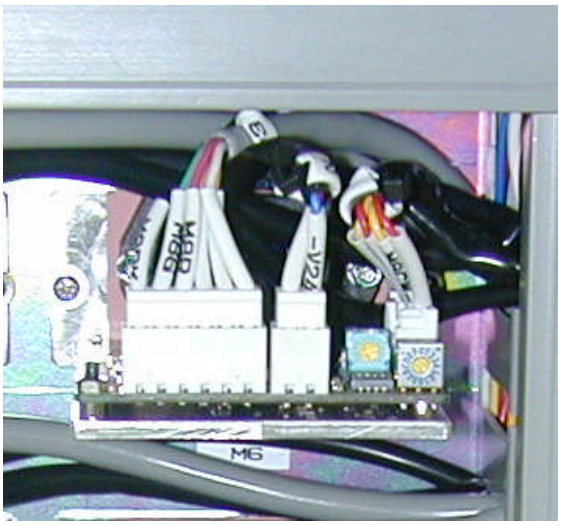
2. Fix the motor driver with the two attached driver fixed machine screws using a plus driver as follows.



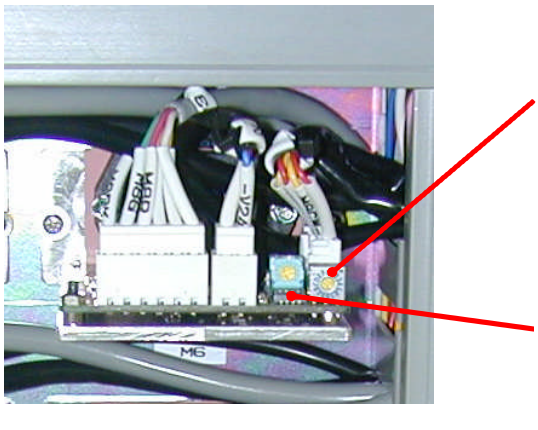

3. Open the duct and remove the motor cables, (CN91, CN92, CN93) and then close the duct.




4. Connect the motor cables, (CN91, CN92, CN93) to the motor driver.

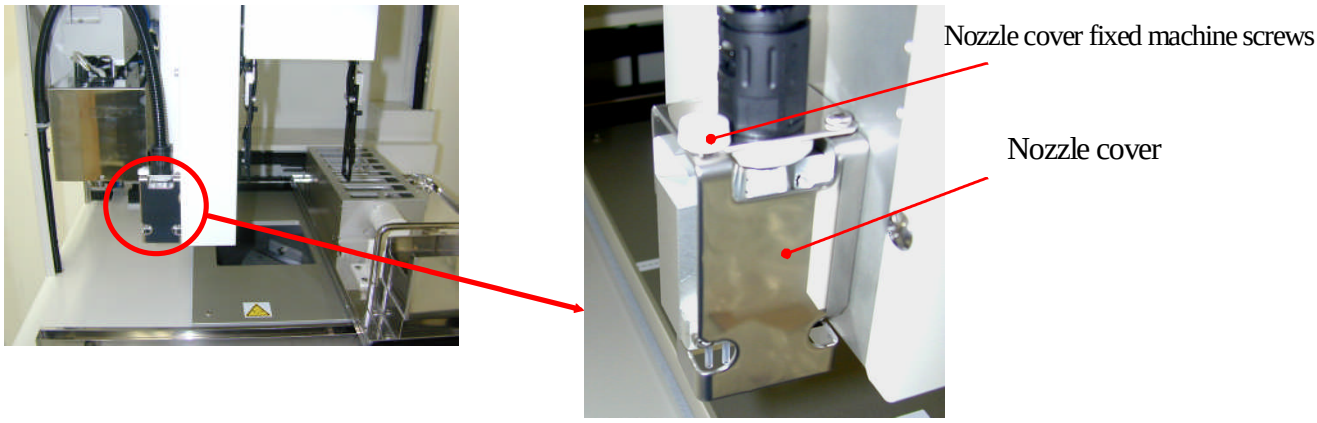


5. Set the motor driver trimmer and the switch as follows.

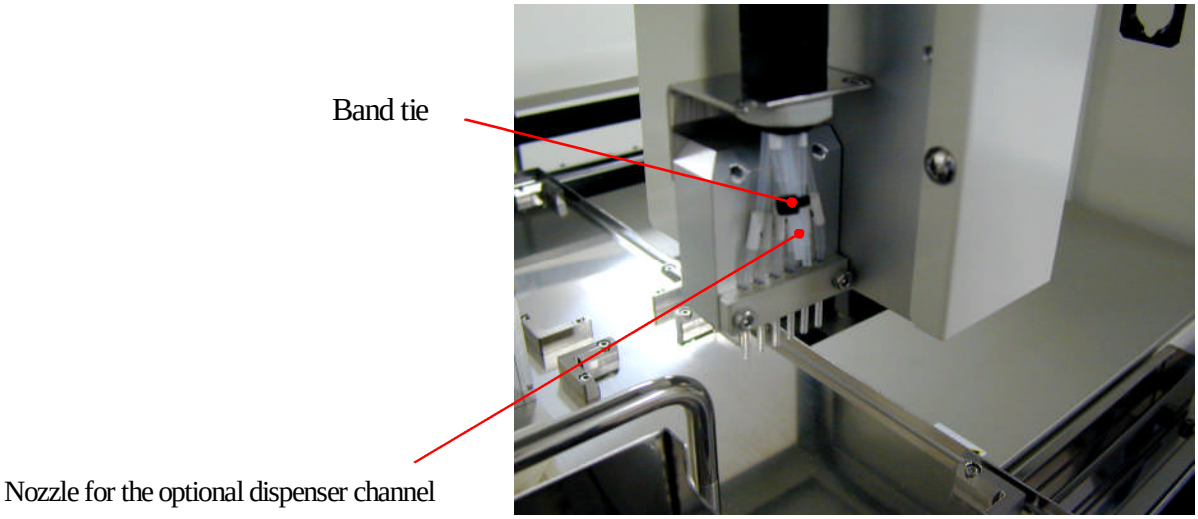



## 3-2-4 Installing the nozzle

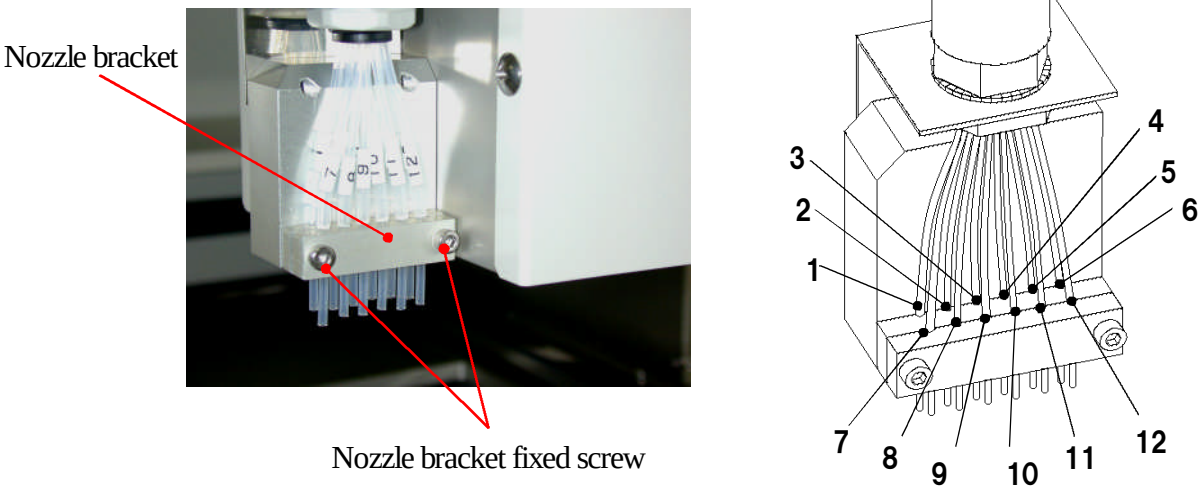
1. Remove the nozzle cover after unscrewing the nozzle cover fixed machine screws.




2. Pull down the nozzle for the optional dispenser channel and remove the band tie.



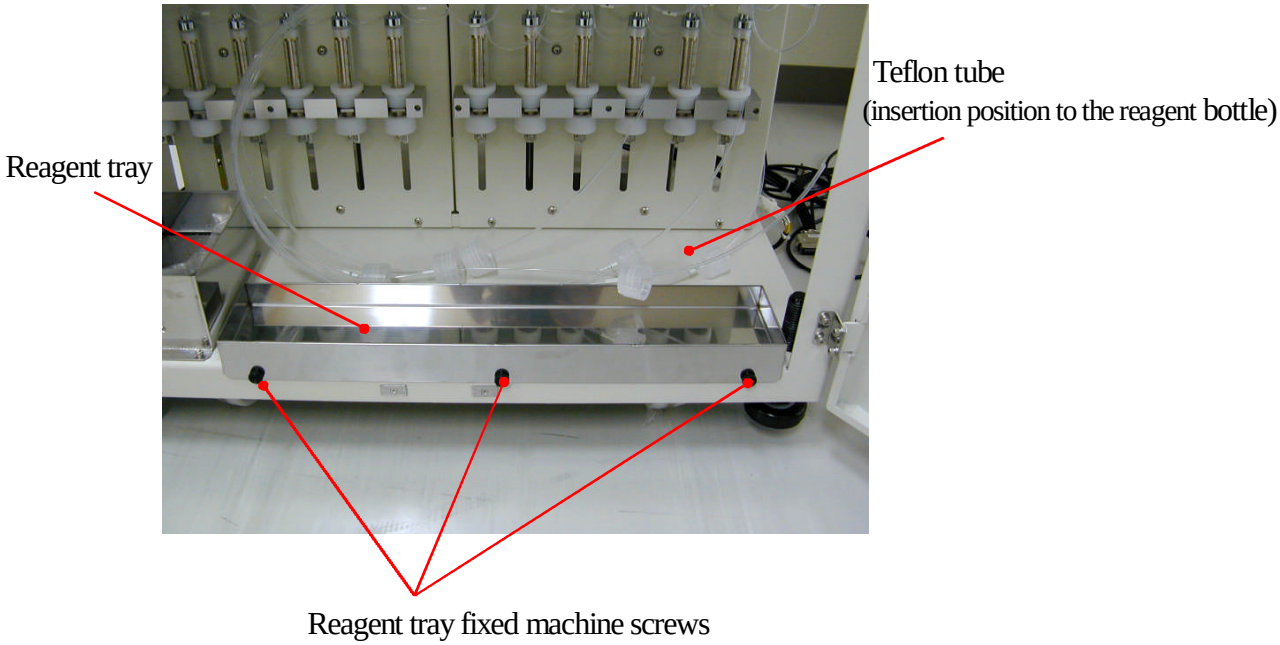
3. Install the optional channel dispenser through the attached nozzle bracket with two nozzle bracket fixed screws. The nozzle No.1 to 6 (standard) are from back left to back right and No.7 to 12 (option) are from front left to front right.




Attach the nozzle cover which is removed in the procedure 1 with the fixed machine screws.

## 3-2-5 Installing the reagent tray and adjusting the length of the dispenser line.

Attach the reagent tray with the attached three reagent tray fixed machine screws and cut the Teflon tubes to a suitable length.

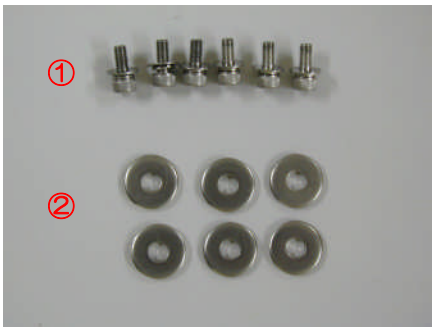


## 3-3 Sample Stacker, the TS-200

### 3-3-1 Composition of the sample stacker, TS-200

The sample stacker, (TS-200) consists of the following parts.


Sample stacker (TS-200)

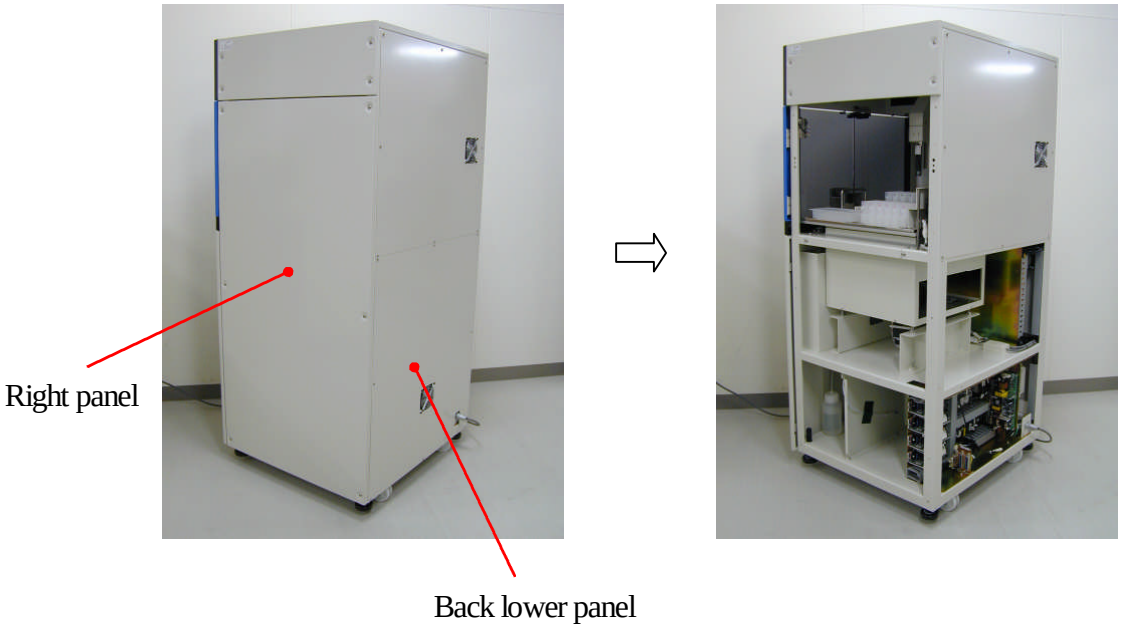



1. Sample stacker fixed machine screws
2. Washer

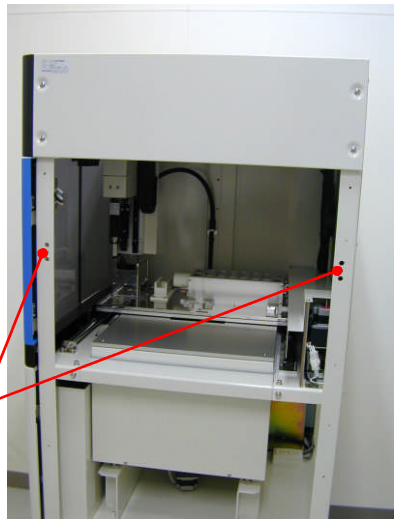

1. Positioning pin fixed machine screw
2. Positining pin

### 3-3-2 Aligning the sample stacker

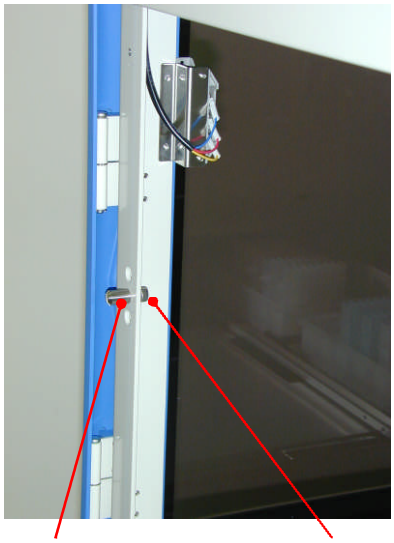
1. Remove the right panel and back pane of the PI-480. As the fan cables are attached to the back below panel,remove the fan cables, too.



2. Screw the two positioning pin fixed machine screws, (5mm hex-head wrench) on the right frame of the PI-480/NA-480 (pointed by the two red arrows) so that the two positioning pins come out .



Position of positioning pin fixed machine screw



Positioning pin

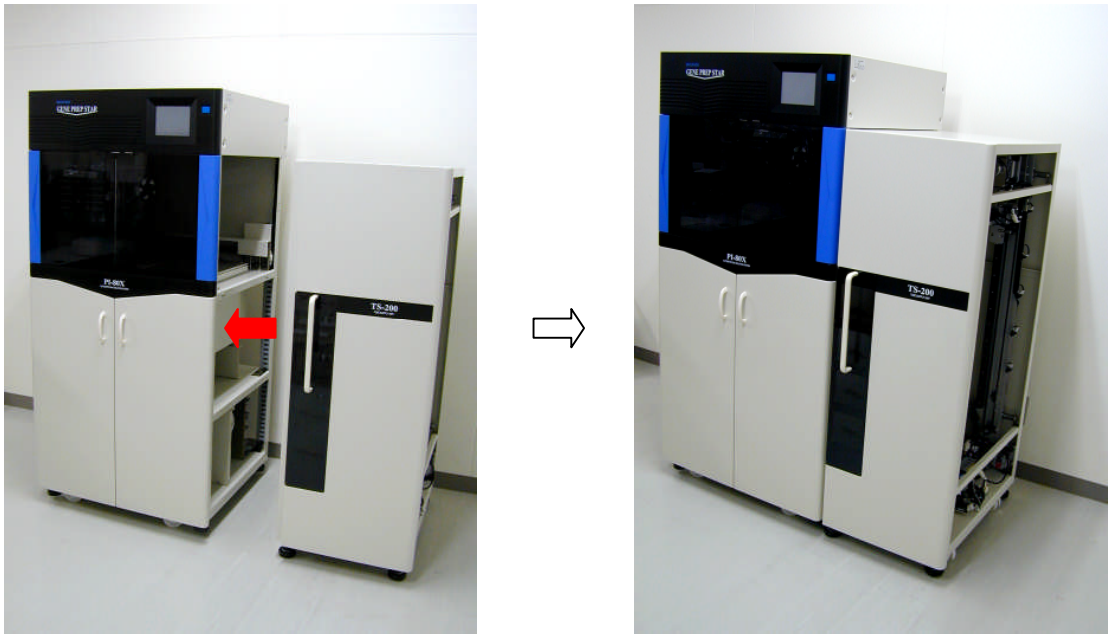
Positioning pin fixed machine screw

3. Unscrew the fixed machine screws and remove the two positioning pins catchers which are attached to the sample stacker. The position of the two positioning pins catchers are pointed by the red arrows

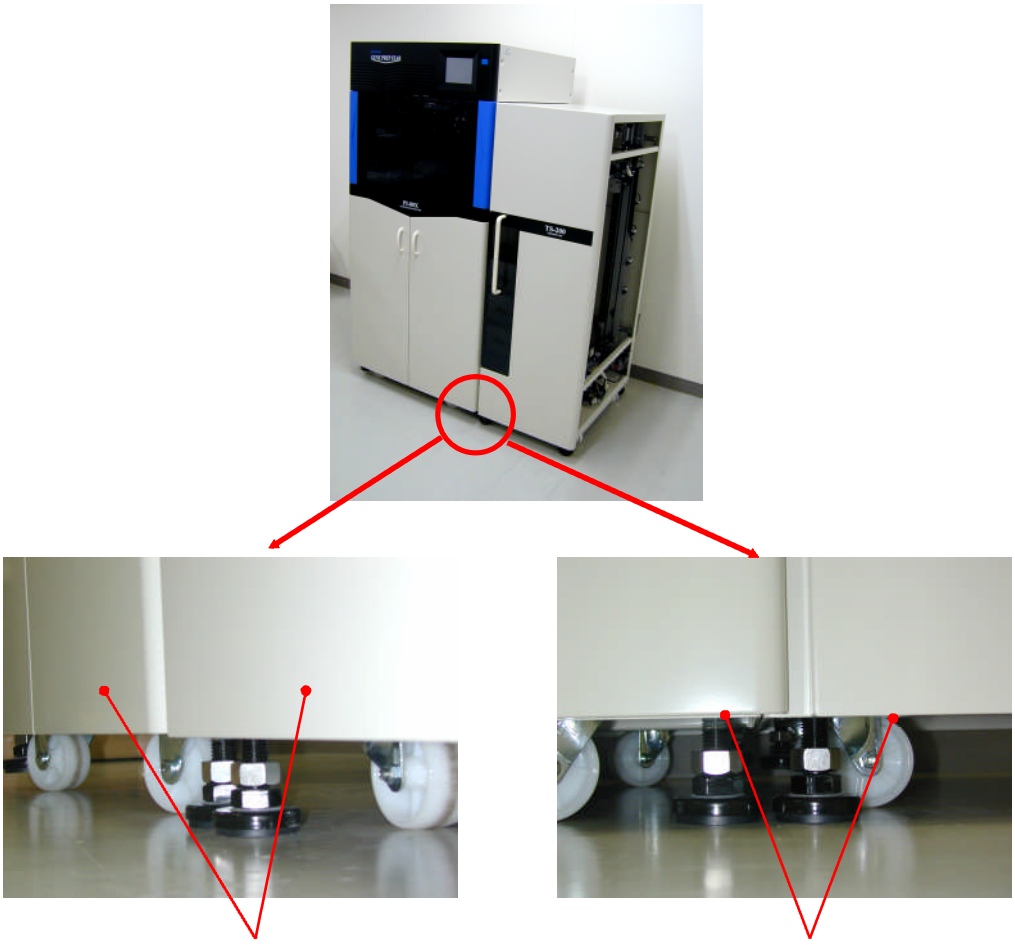
Positioning pin catcher

Fixed machine screws

4. Align the sample stacker with the right side of the PI-480.



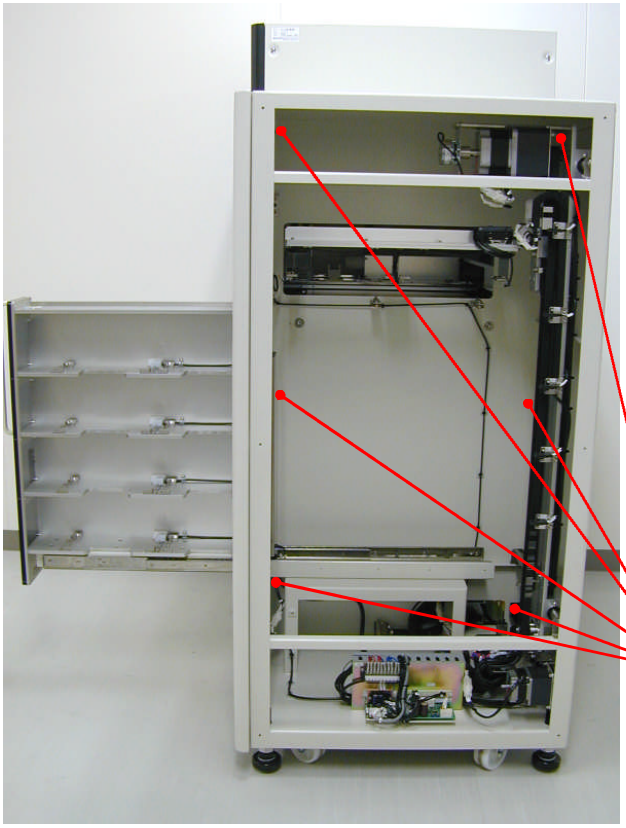
5. Adjust the level of both the PI-480 and the TS-200 using the adjusters so that bottom frame heights are same. Next adjust them so that each front panel becomes the straight line.



Position adjustment Height adjustment

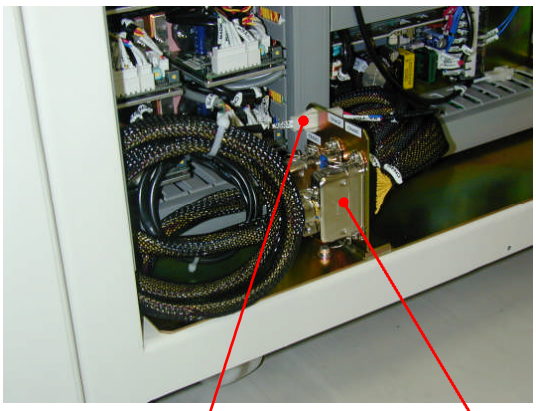
6. Pull the drawer of the TS-200.


7. Screw the six sample stacker fixed machine screws (4 mm hex-head wrench) from right side of the sample stacker to align the PI-480.



8. Pull out the cables (CN46, CN47) from the TS-200 and connect them with the PI-480. Next group them using band ties

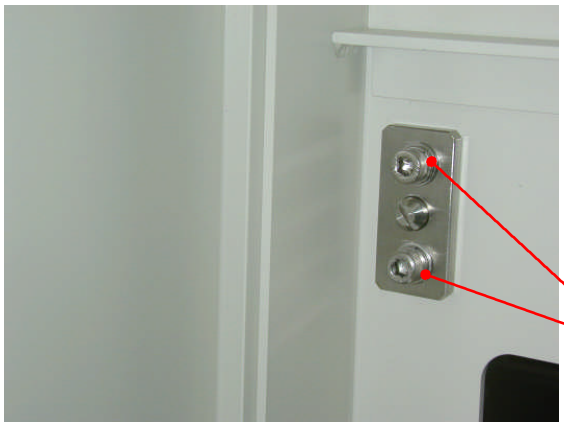
Cables



CN47 CN46

9. Attach the two positioning pin catchers which are removed in the procedure 3 using the two fixed machine screws (5mm hex-wrench)

Position of positioning pin catchers



Positioning pin catcher fixed machine screws

10. Attach the back below panel of the PI-480 which is removed in the procedure 1. As the fan cables is connected to the back below panel, attach the fan cable, too. Next attach the right panel of the PI-480 to the right side of the TS-200.


## 3-3-3 Data (Position Data) change

After completing the attachment, change the peculiar Position Data of the TS-200 must be saved on the Data of the PI-480. The Factory mode is used to change the position data

**Caution**

**The factory mode is used to confirm the position and adjustment. The factory mode is protected by the password which is different from that of the maintenance mode. The important position data of each unit is saved in this mode and it is impossible to change the default. This service manual explains only the basic things for the position and movement confirmation, and adjustment. Obey the following procedures precisely.**

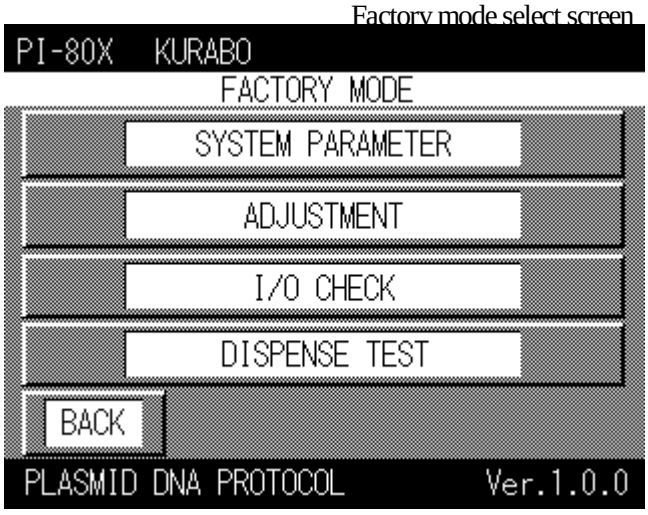
1. Turn on the PI-480 and press the [OTHERS] button.

2. Press the [MAINTENANCE] button.

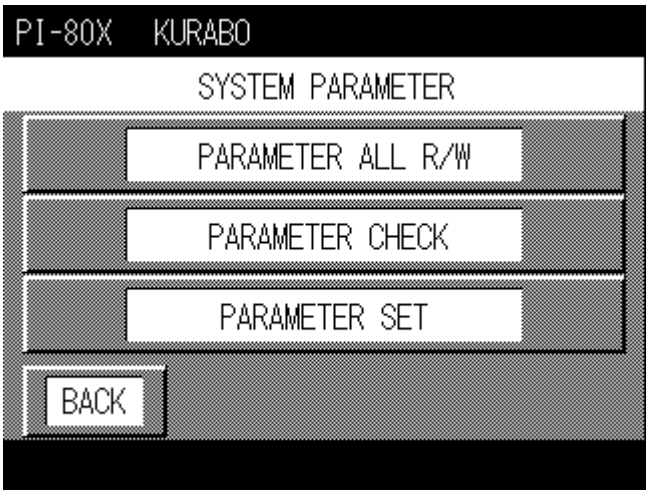

3. Input the password (741895) for factory mode. Press the [ENT] button to display 'the factory mode select screen'. The password of maintenance mode is different from that of the factory mode.


4. Press the [System Parameter] button.

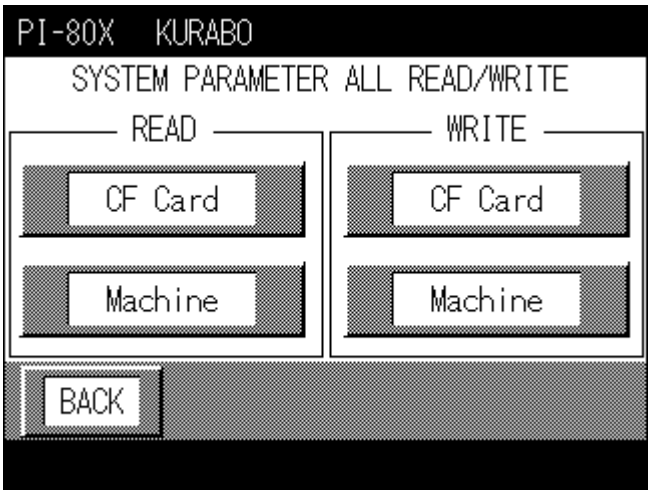
Factory mode select screen

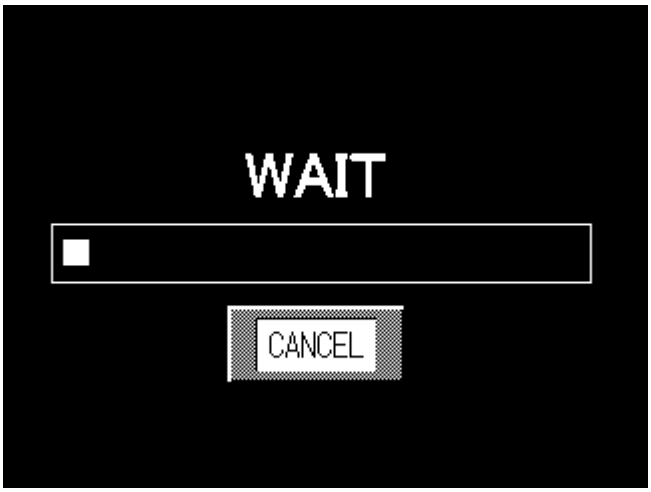


5. Press the [PARAMETER ALL R/W] (position data readout and forwarding) button.

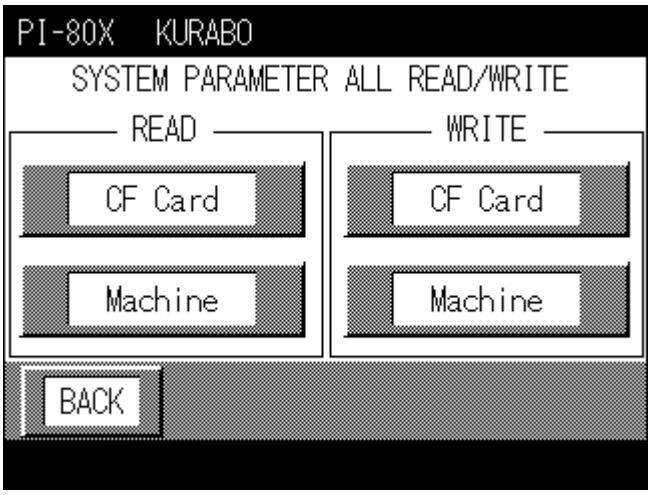



6. Press the left [Machine] button to display the position data of the CPU on the screen
The WAIT screen is displayed while the Data is accessed.

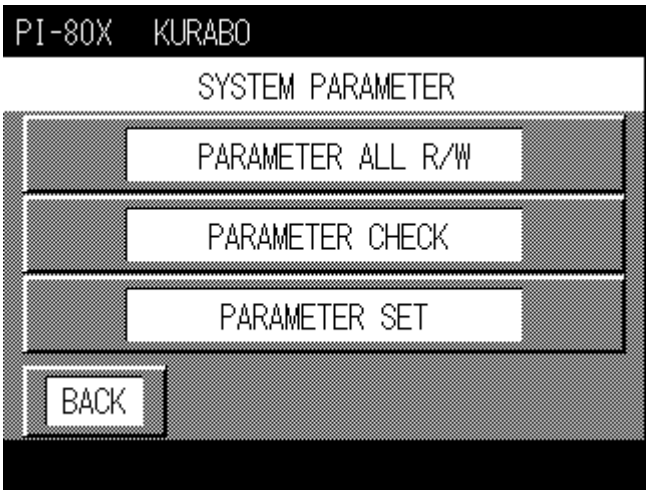


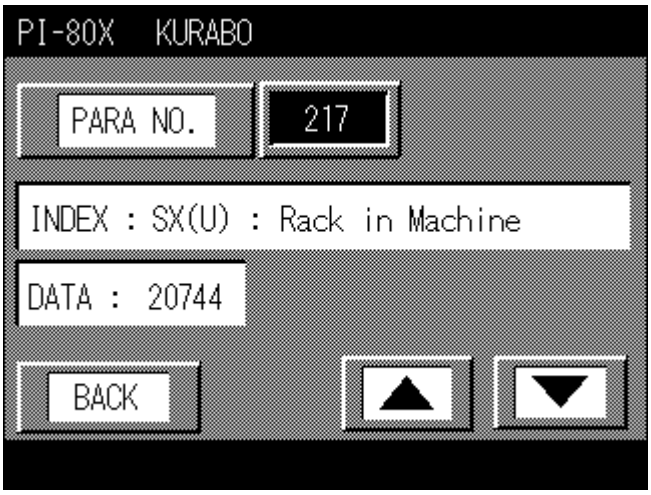
7. Press the [BACK] button after completing the reading transcription, as the screen is returned.

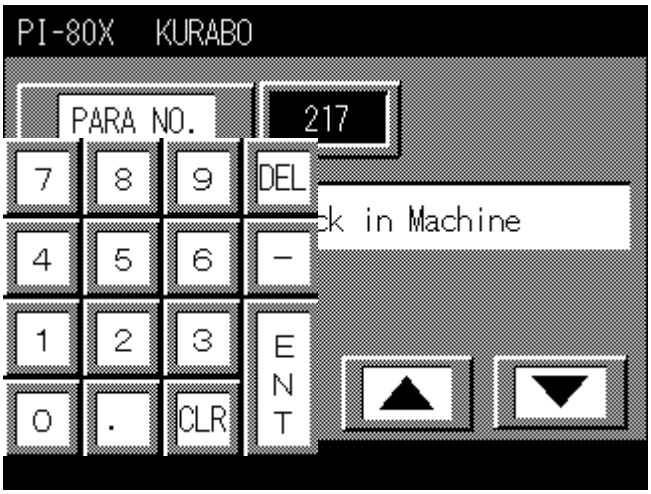



8. Press the [PARAMETER CHECK] button (Position data confirmation button).

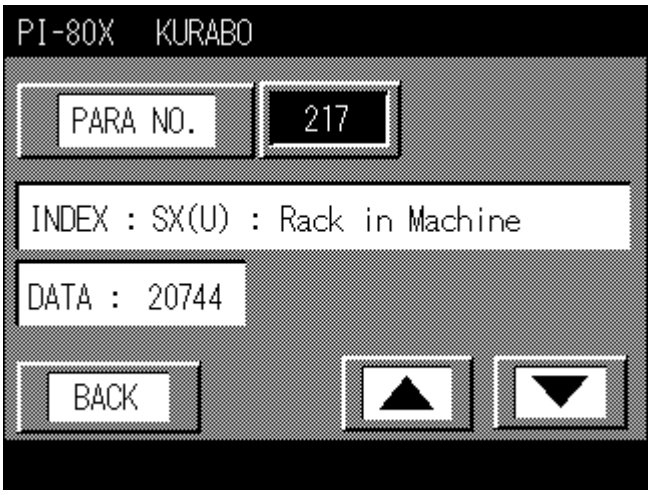



9. Press the [RARA NO.] button to display the numeric key. Input the number using the numeric key and press the [ENT] button to display 'DATA'. Record each number of 'DATA' from RARA No. 200 to 219.



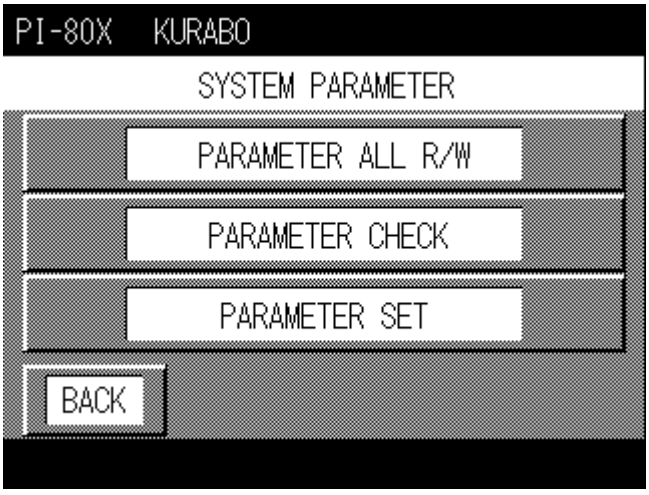



10. After recording the number of 'DATA', press the [BACK] button.

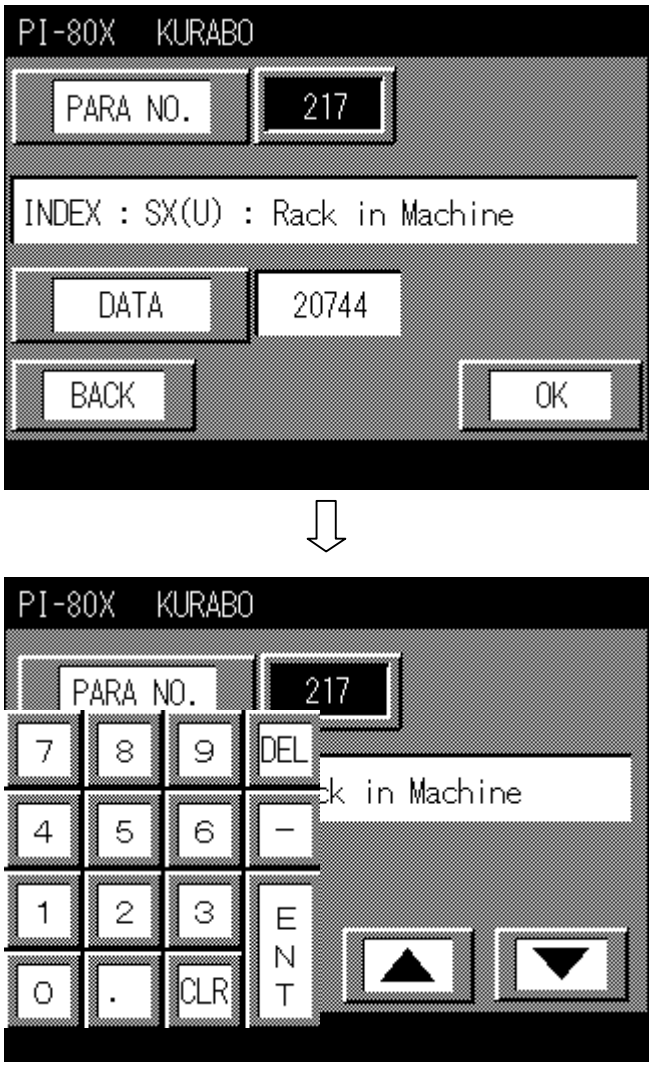



11. Press the [PARAMETER SET] button to change the 'Position Data'

> ⚠ Caution
> **Take caution that the following operations change the Position Data of the instrument.**



12. The numeric keys will open when pressing the [RARA NO.]. Input the number using the numeric keys and press the [ENT] button and the DATA will be changed.
Change each number of the DATA from RARA No. 200 to 219. As each TS-200 has own DATA, refer to the attached 'FACTORY MODE SYSTEM PARAMETER LIST'




FACTORY MODE SYSTEM PARAMETER LIST

※Data is reference values

FACTORY MODE-SYSTEM PAREAMETER

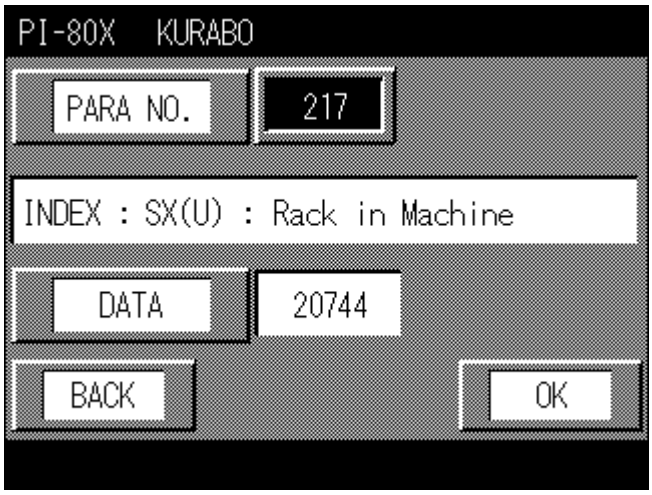
S/N

| PARA No. | INDEX | | DATA |
|---|---|---|---|
| 200 | SZ(Q) | Origin position | |
| 201 | SZ(Q) | Standby position | |
| 202 | SZ(Q) | Upper Rack in Machine | |
| 203 | SZ(Q) | Lower Rack in Machine | |
| 204 | SZ(Q) | Upper Rack1 in Supply | |
| 205 | SZ(Q) | Lower Rack1 in Supply | |
| 206 | SZ(Q) | Upper Rack2 in Supply | |
| 207 | SZ(Q) | Lower Rack2 in Supply | |
| 208 | SZ(Q) | Upper Rack3 in Supply | |
| 209 | SZ(Q) | Lower Rack3 in Supply | |
| 210 | SZ(Q) | Upper Rack4 in Supply | |
| 211 | SZ(Q) | Lower Rack4 in Supply | |
| 212 | blank | | |
| 213 | blank | | |
| 214 | blank | | |
| 215 | SX(U) | Origin position | |
| 216 | SX(U) | Standby position | |
| 217 | SX(U) | Rack in Machine | |
| 218 | SX(U) | Rack in Supply | |
| 219 | SX(U) | Save Rack in Supply | |

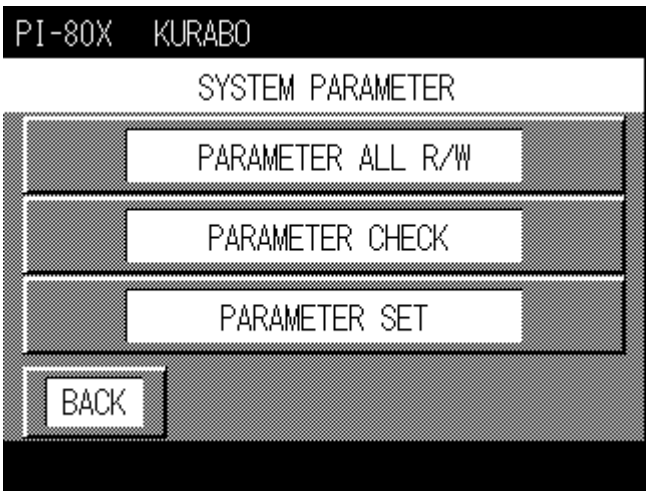
DATA(POSITON DATA)

13. Press the [OK] button after changing each number of DATA from RARA No. 200 to 219.
The changed data is saved. Press the [BACK] button again and the previous screen will be returned. When pushing the [BACK] button without pressing the [OK] button, the changed data is not saved (Default is preserved) and the previous screen will be returned.

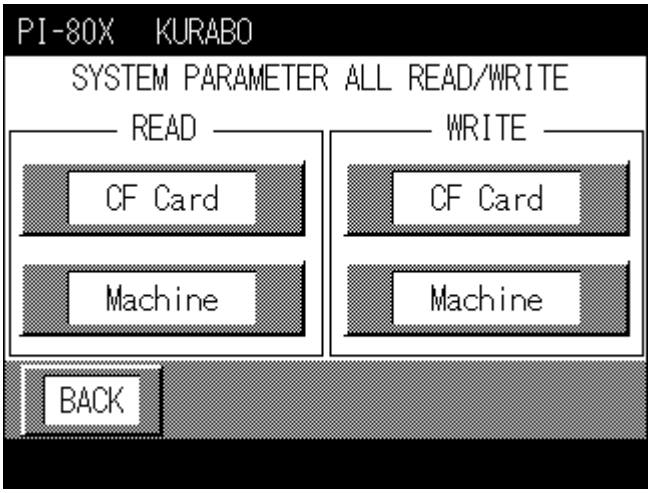
In case when saving the changed DATA, press the [OK] button and then press the [BACK] button.
In case when not saving the changed DATA, press the [BACK] button.

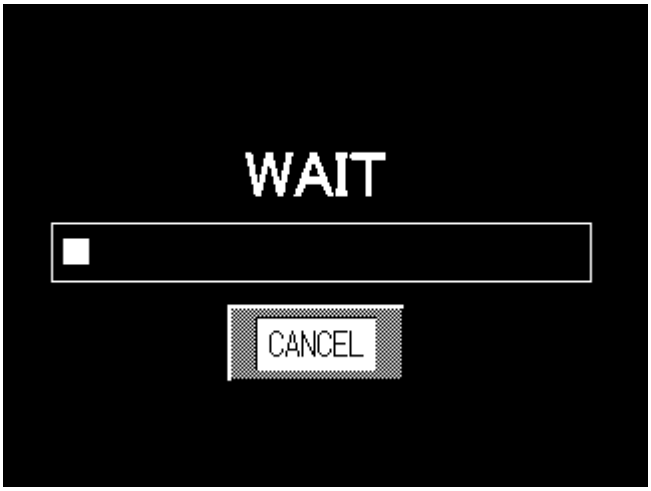



14. Press the [PARAMETER ALL R/W] button to readout and forward the 'Position Data'.

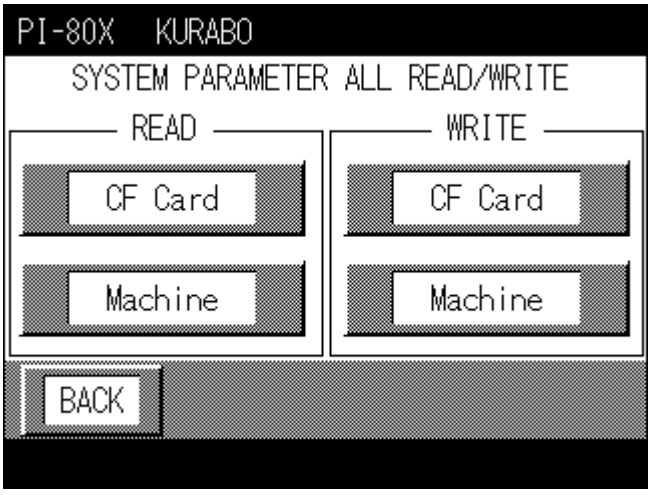


15. Press the right [Machine] button in the [WRITE] section to forward the changed Position Data to the CPU. The WAIT screen is displayed during forwarding.




16. After forwarding the Position Data, press the [BACK] button as the previous screen will be returned.

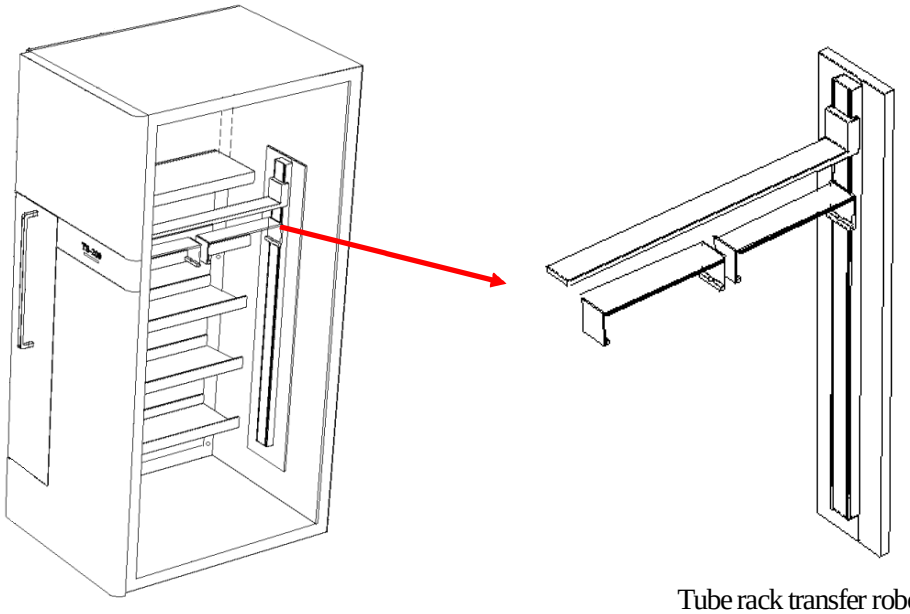


After adjusting, press the [BACK] button until the screen becomes the 'Operation Mode Select Screen'. Then turn off the PI-480.


## 3-3-4 Movement confirmation and adjustment

After aligning the TS-200 and changing the 'Position Data', operate the PI-480 by the Maintenance Mode to confirm the operation. (Refer to 2-3-7 Sample Stacker Mode). If there is any abnormality such as apposition gap while the TS-200 is transferring the tube rack, it is necessary to change the 'DATA' of the tube rack transfer robot. Adjust the tube rack transfer robot after confirming the gap (direction and distance). The confirmation and adjustment modes are factory mode, (default mode) when the GENE PREP is shipped from the factory, and they are used to confirm the position and adjustment. Refer to the next page for the adjustment items

> ⚠ Caution
>
> **The factory mode is used to confirm the position and adjustment. The factory mode is protected by the password which is different from that of the maintenance mode. The important position data of each unit is saved in this mode and it is impossible to change the default. This service manual explains only the basic things for the position and movement confirmation, and adjustment. Obey the following procedures precisely.**



Tube rack transfer robot

| POSITION No. | PARA No. | Axis | INDEX | DATA |
|---|---|---|---|---|
| 0 | 200 | Z | Origin position | Z axis home position of tube rack transfer robot |
| 2 | 202 | Z | Upper Rack in Machine | The step where the tube rack transfers robot transferred the tube rack to the GENE PREP and starts to put it on the table. |
| 3 | 203 | Z | Lower Rack in Machine | The step where the tube rack transfer robot transferred the tube rack to the GENE PREP and put it on the table. |
| 4 | 204 | Z | Upper Rack1 in Supply | The step where the tube rack transfer robot lifted up the tube rack on the first layer of the TS-200. |
| 5 | 205 | Z | Lower Rack1 in Supply | The step where the tube rack transfer robot put the tube rack on the first layer of the TS-200. |
| 6 | 206 | Z | Upper Rack2 in Supply | The step where the tube rack transfer robot lifted up the tube rack on the second layer of the TS-200. |
| 7 | 207 | Z | Lower Rack2 in Supply | The step where the tube rack transfer robot put the tube rack on the second layer of the TS-200. |
| 8 | 208 | Z | Upper Rack3 in Supply | The step where the tube rack transfer robot lifted up the tube rack on the third layer of the TS-200. |
| 9 | 209 | Z | Lower Rack3 in Supply | The step where the tube rack transfer robot put the tube rack on the third layer of the TS-200. |
| 10 | 210 | Z | Upper Rack4 in Supply | The step where the tube rack transfer robot lifted up the tube rack on the fourth layer of the TS-200. |
| 11 | 211 | Z | Lower Rack4 in Supply | The step where the tube rack transfer robot put the tube rack on the fourth layer of the TS-200. |
| 0 | 215 | X | Origin position | X axis home position of tube rack transfer robot |
| 2 | 217 | X | Rack in Machine | The step where the tube rack transfers robot transferred the tube rack to the GENE PREP. |
| 3 | 218 | X | Rack in Supply | The step where the tube rack transfer robot transferred the tube rack to the TS-200 and put it in the storage place. |
| 4 | 219 | X | Save Rack in Supply | The step where the tube rack transfer robot transferred the tube rack to the TS-200 and starts to put it in the storage place. |

Example: In case when adjusting the tube rack transfer robot Z axis of 'Upper Rack in Machine' to below by 1mm

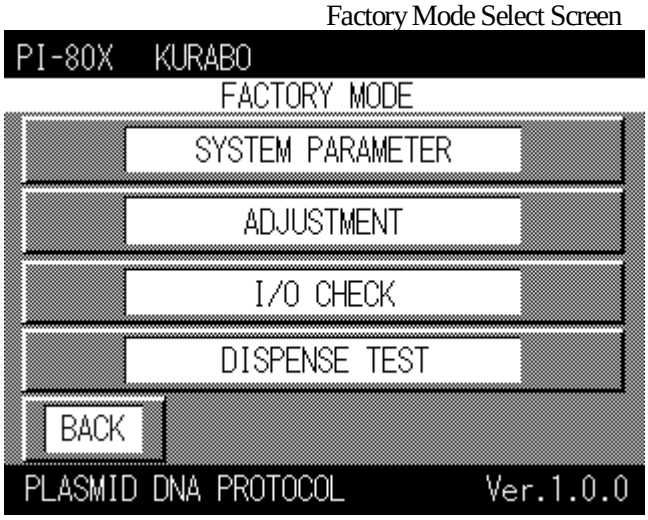
1. Turn on the PI-480 and press the [OTHERS] button.


2. Press the [MAINTENANCE] button.

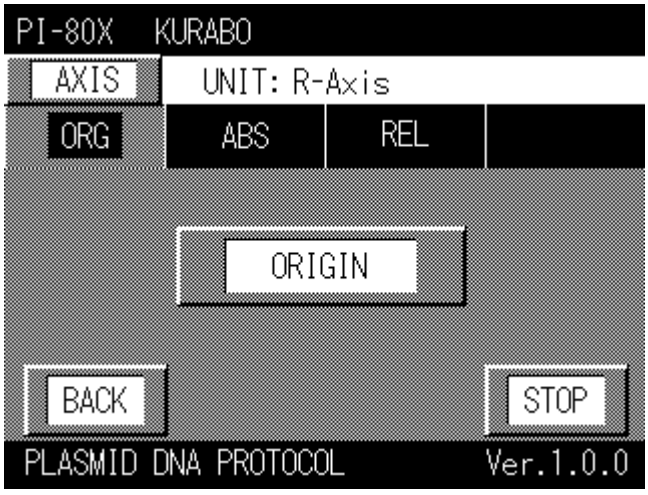

3. Input the password of factory mode (741895) and press the [ENT] button to display 'factory mode select screen'. * The password of factory mode is different from that of maintenance mode.

4. Press the [ADJUSTMENT] button (adjustment mode).

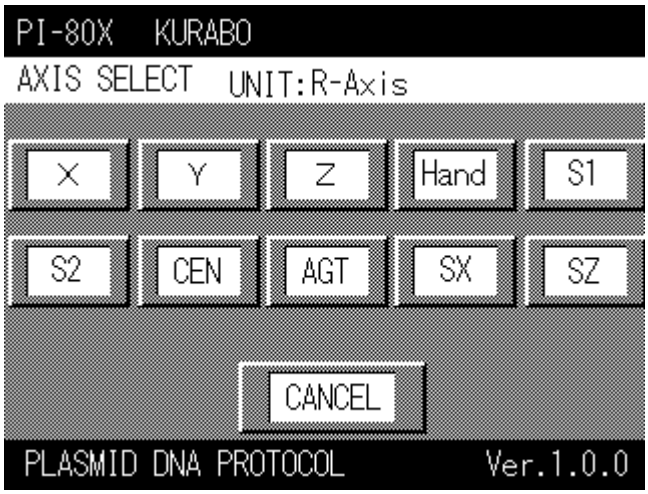
Factory Mode Select Screen



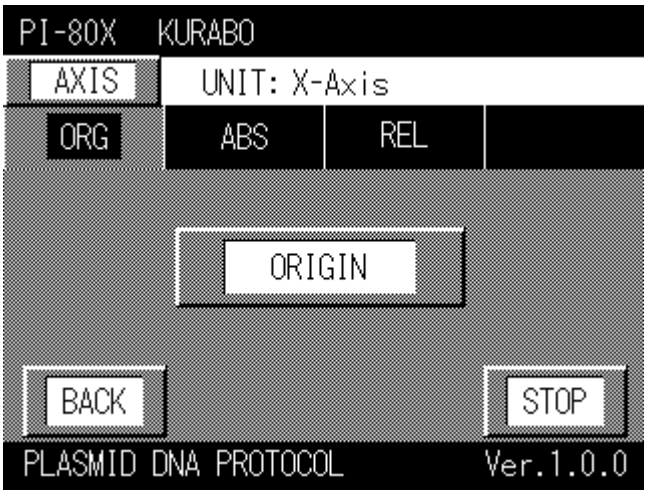

5. Press the [AXIS] button (drive axis select)



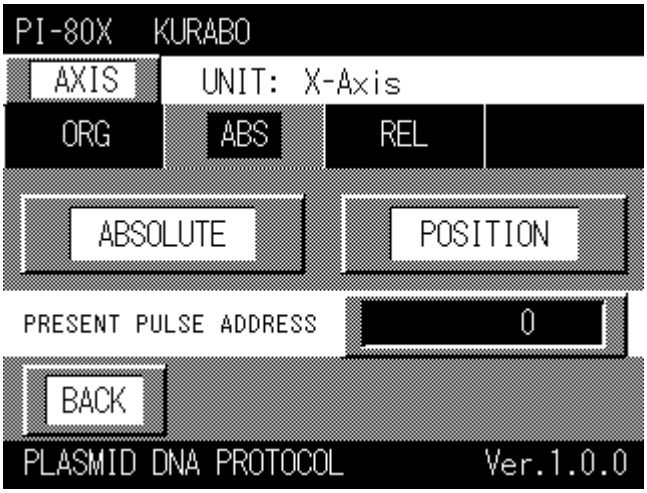

6. Press the [SZ] button to operate the Z axis of the tube rack transfer robot in the TS-200.



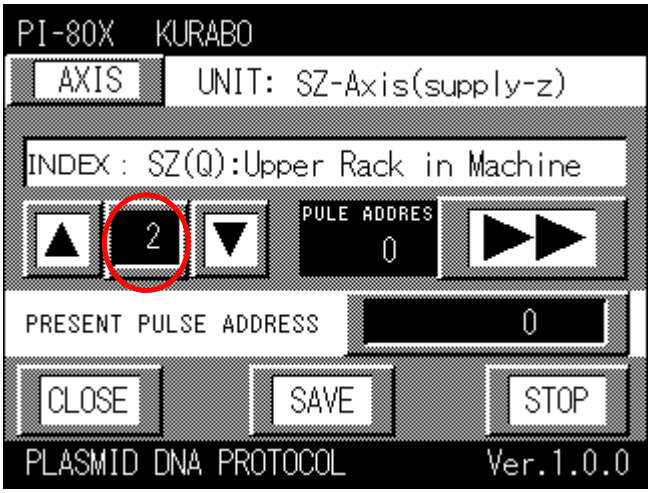
7. Press the [ABS] button (position confirmation and adjustment mode).




8. Press the [POSITION] button (position confirmation).

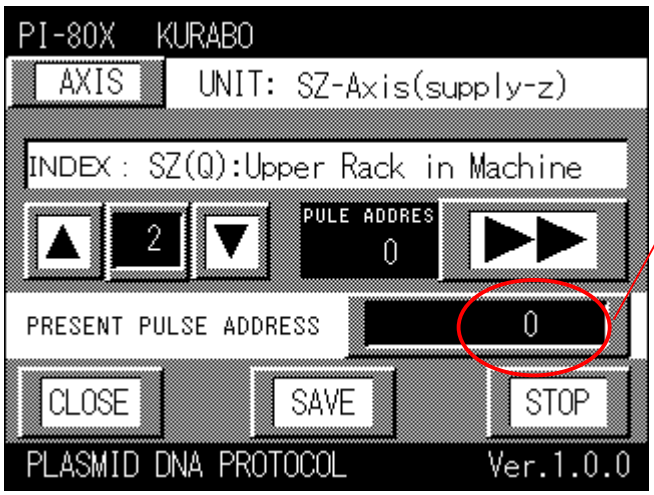



9. Press the ▼ button until the number which is marked by red circle becomes 2




▶▶

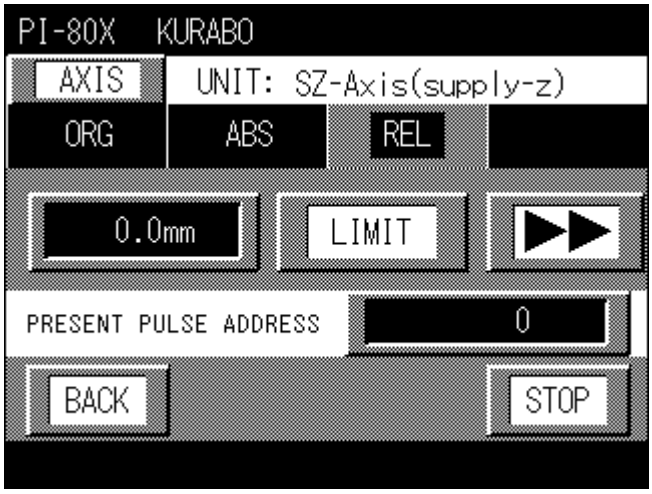
10. Pres the button to move the tube rack transfer robot to the 'Upper Rack in Maintenance' position. Record the value in the 'PRESENT PULSE ADDRESS' field. This value in the 'PRESENT PULSE ADDRESS' field is the 'POSITION DATA' (pulse) of 'Upper Rack in Machine' position. This value is different from that of each instrument. Press the [CLOSE] button after recording the value.



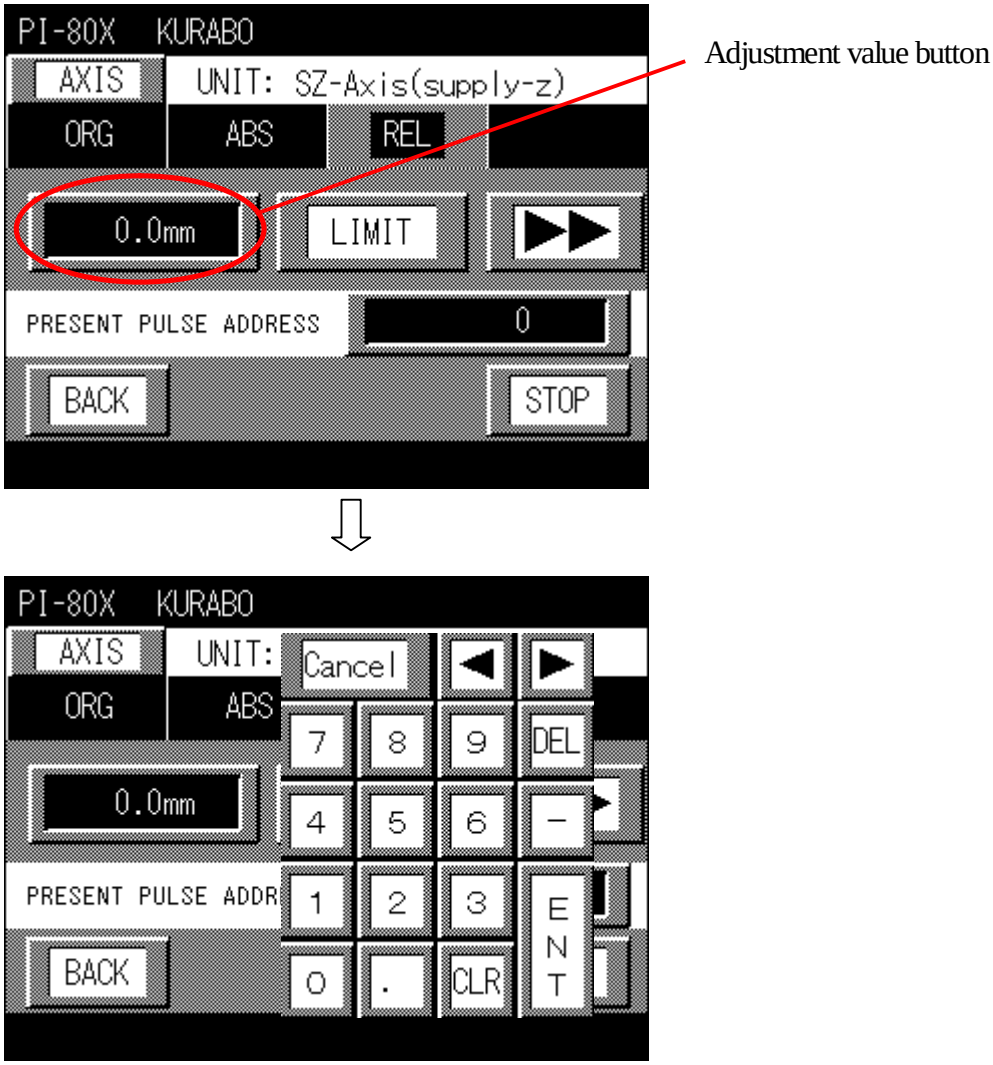

**Caution**

**Record the value in the 'PRESENT PULSE ADDRESS' field accurately.**

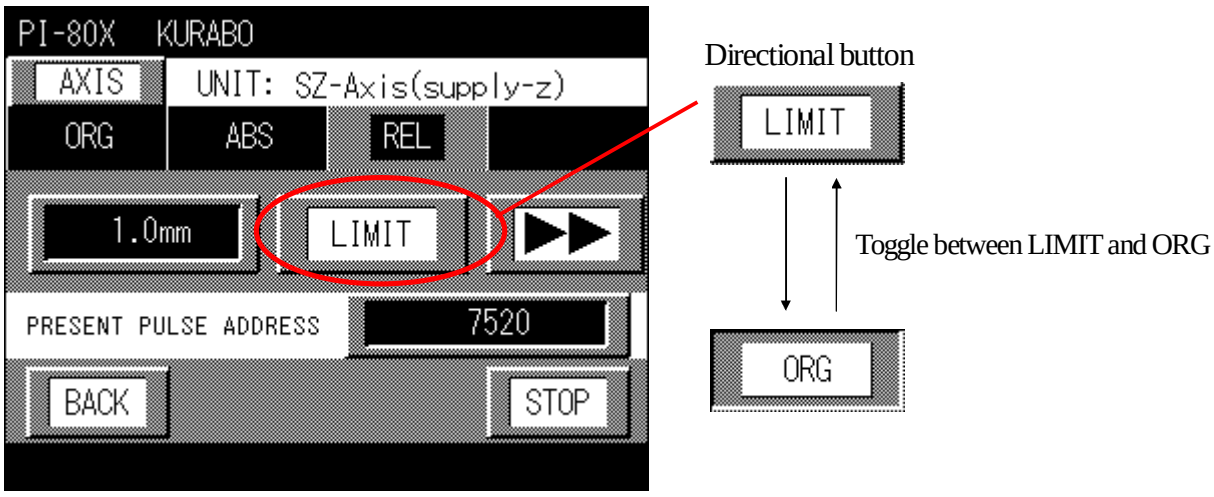
11. Press the [REL] button (position adjustment).



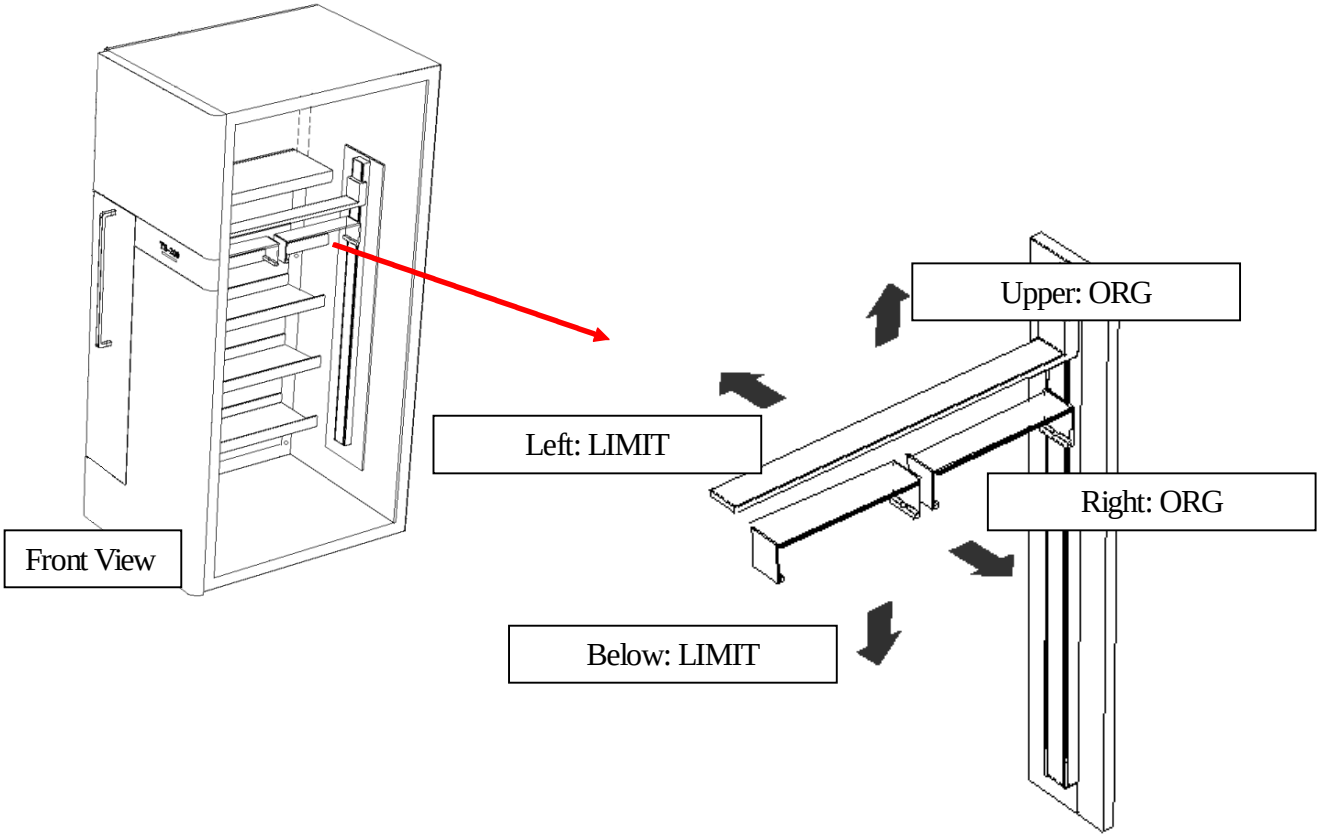
12. Press the adjustment value button which is marker by red circle to open the numeric keys. Press '1' button and then press the [ENT] button to close the numeric keys




13. Decide the adjustment direction by the directional button. The display toggles between LIMIT (below) and ORG (Upper) whenever pressing the directional buttons. Refer to next page for the directions

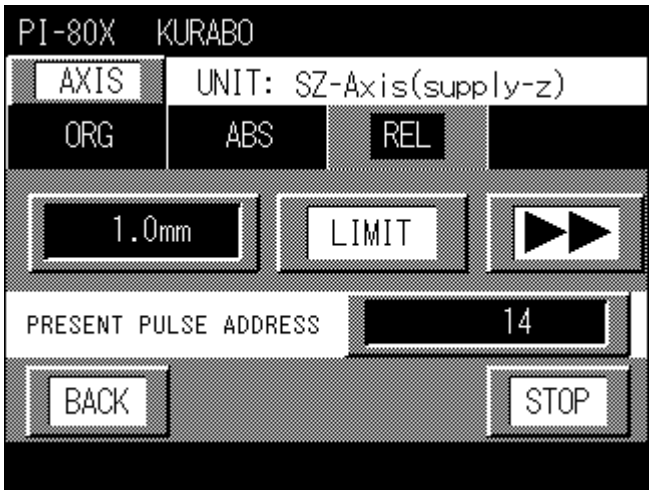


When adjusting the tube rack transfer robot to below, press the [LIMIT] button.
When adjusting the tube rack transfer robot to upper, press the [ORG] button.
When adjusting the tube rack transfer robot to left, press the [LIMIT] button.
When adjusting the tube rack transfer robot to right, press the [ORG] button.

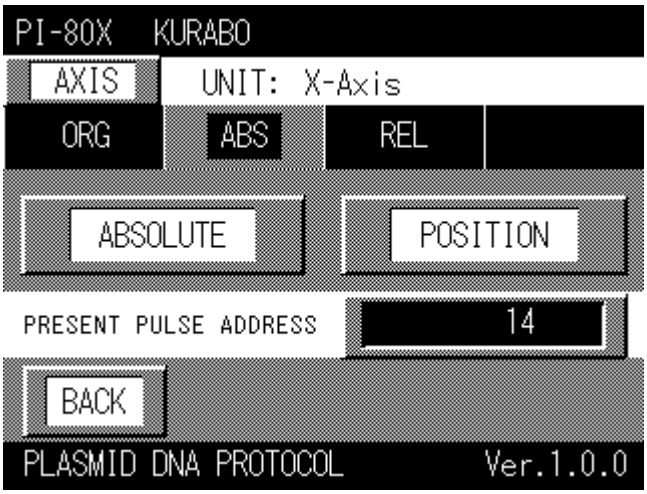



Tube rack transfer robot

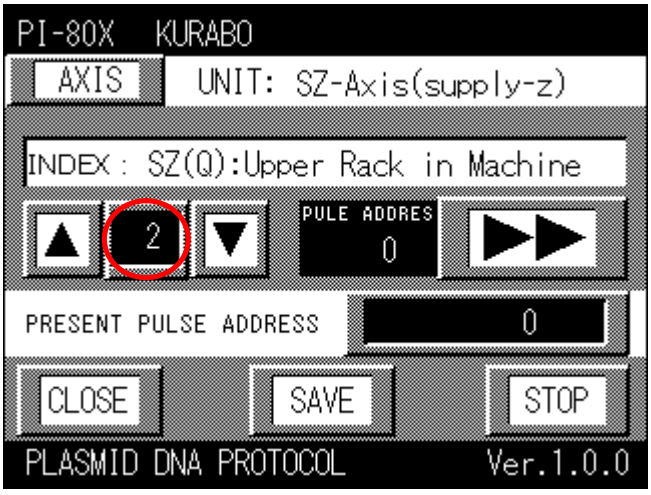
14. Press the [LIMIT] button to adjust the tube rack transfer robot to below and then press the ▶▶ button, and it will move to below by 1.0mmm. Check whether the value in the 'PRESENT PULSE ADDRESS' field was changed.



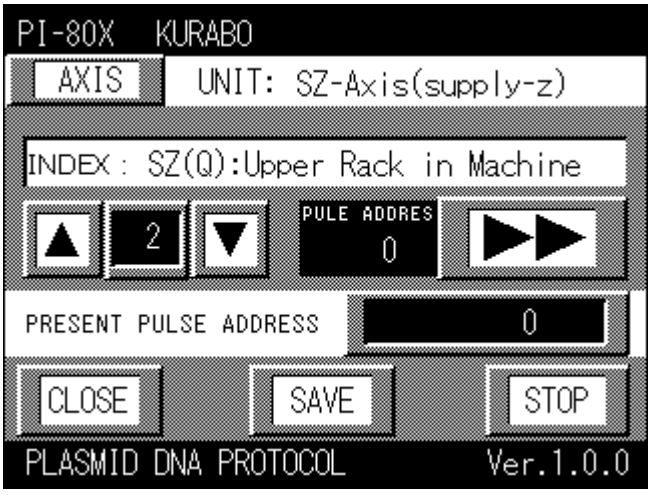
15. Press the [ABS] button after adjusting the position and then press the [POSITION] button.




16. Press the ▼ button until the value which is marked by red circle becomes 2 (Upper Rack in Machine Position).




17. When pressing the [SAVE] button, the 'PRESENT PULSE ADDRESS', (position pulse data) is changed This means that Upper Rack in Machine position of the tube rack transfer robot is adjusted to below by 1mm.

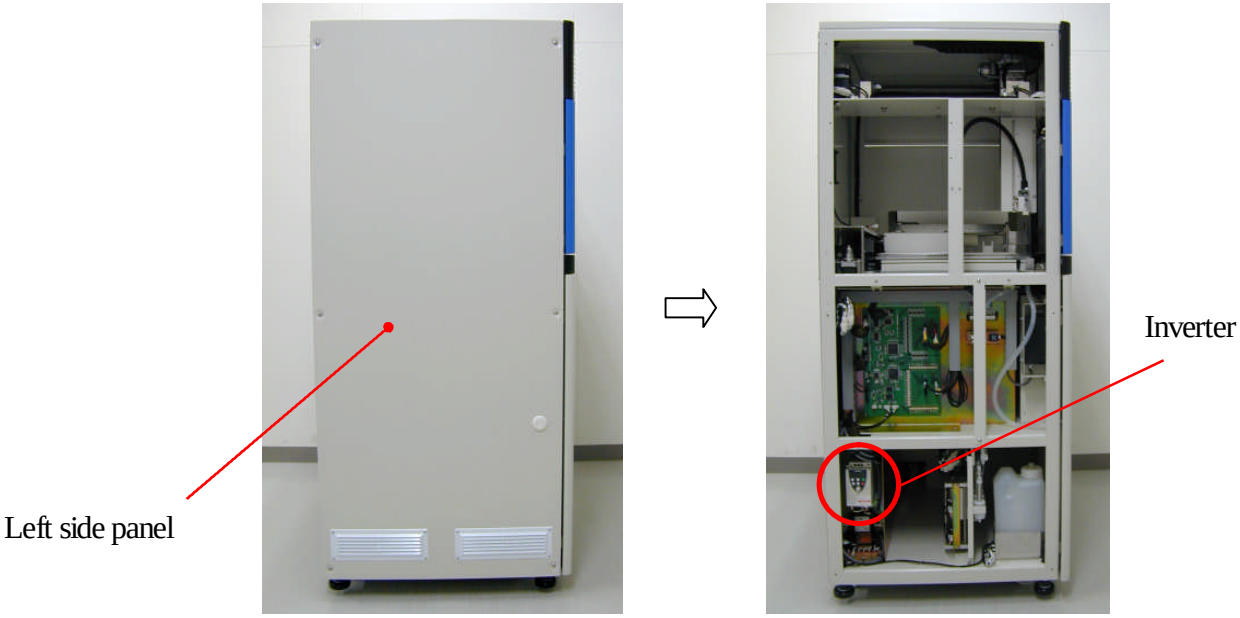


18. Press the [CLOSE] button after completing adjustment to return the previous screen. Press the [BACK] button to return 'operation mode select screen' and then turn off the PI-480.

Operation Select Mode Screen

## 3-4 Inverter (VFNC1S-1004P)

Remove the left panel of the PI-480/NA-480. The position of the inverter is marked by red circle.




### 3-4-1 Each part explanation


**MON Monitor key**
Select run, setting and status monitor mode

**RUN Run Key**
Operate the PI-480/NA-480 while RUN key is lighting.

**Charge light**
Caution
Do not touch the machine, when the charge light is blinking, as high voltage remains in the inverter.

**RPG light**
LED on during the parameter set mode.

**Indicator**

**Up Down Key**

**Run lamp**
Blink during the inverter working.

**ENT Enter key**
Used for the readout and inputting the frequency and parameter

**STOP Stop Key**
Reduce spin speed and stop while the run ramp is blinking.

**Volume for setting frequency**
Set the operation frequency.

## 3-4-2 Inverter adjustment

**Warning**

**Do not touch the touch panel of the PI-480/NA-480 during adjusting the inverter.**

Adjust the set value according to the following table.

Inverter setting table

| Item | display | value |
|---|---|---|
| Set Up Menu | SEt | JP |
| Multi-speed run frequency 1 | Sr1 | 34.6 |
| Multi-speed run frequency 2 | Sr2 | 68.1 |
| Multi-speed run frequency 3 | Sr3 | 101.8 |
| Multi-speed run frequency 4 | Sr4 | 118.8 |
| Multi-speed run frequency 5 | Sr5 | 133.0 |
| Multi-speed run frequency 6 | Sr6 | 0.0 |
| Multi-speed run frequency 7 | Sr7 | 0.8 |
| Accelerate time1 | Acc | 60 |
| reducing time 1 | dEC | 60 |
| Maximum frequency | FH | 140 |
| Minimum frequency | uL | 120 |
| Upper limit frequency | UL | 140 |

| Item | display | value |
|---|---|---|
| Input terminal section 1A(F) | F111 | 2 |
| Input terminal section 1B(F) | F151 | 10 |
| Input terminal section 2A(R) | F112 | 2 |
| Input terminal section 2B(R) | F152 | 12 |
| Input terminal section 3A(S1) | F113 | 2 |
| Input terminal section 3B(S1) | F153 | 14 |
| Input terminal section 4A(S2) | F114 | 0 |
| Input terminal section 4B(S2) | F154 | 0 |
| Output terminal section 1A | F130 | 6 |
| Output terminal section 2 | F132 | 10 |
| Command mode selection | Cnod | 0 |
| Frequency setting mode selection | Fnod | 0 |
| Connected meter selection | Fnsl | 0 |
| Frequency of V1 / 2 point | F204 | 139 |

(Example 1) Set the value of Sr1 (Multi-speed operation frequency 1) at 34.6.

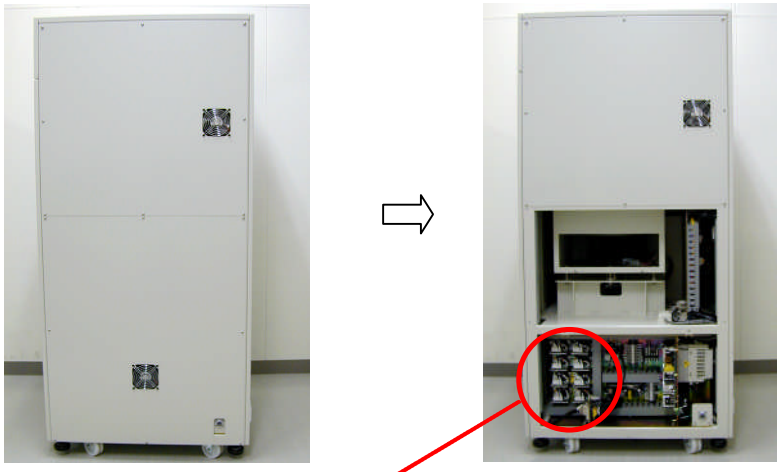
1. Turn on the instrument.
2. Press the [MODE] button one time to display 'AUH'.
3. Press the [▼] button nine times to display the 'Sr1'.
4. Press the [ENT] button one time and the set value will be displayed.
5. Set the value of 'Sr1' at 34.6 using the [▲] or the [▼] button.
6. Press the [ENT] button and the 'Sr1' will be displayed after the value on the indicator blinking.
7. Press the [MODE] button twice to display 0.0 on the indicator.

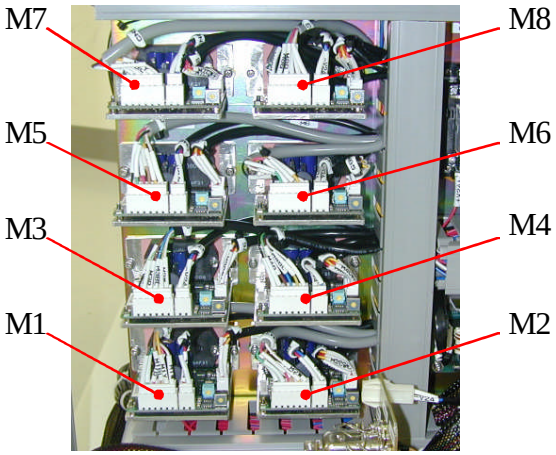
Attach the side panel of the PI-480/NA-480 after adjusting the value.

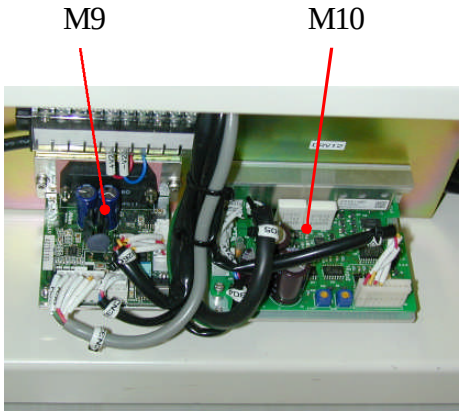
## 3-5 Motor driver (DB-2630/U16, CSD2130p) setting

The maximum eight motor drivers, (DB-2630/16) are installed in the PI-480/NA-480 and a motor driver is also attached in the sample stacker, (TS-200). A motor driver, (CSD2130P) is also installed in the sample stacker. Remove the back below panel of the PI-480/NA-480. As the fan cable is connected with the back below panel, remove the fan cable, too. Remove the right panel of the sample tube stacker. The following illustrations indicate the place where the motor drivers are attached.

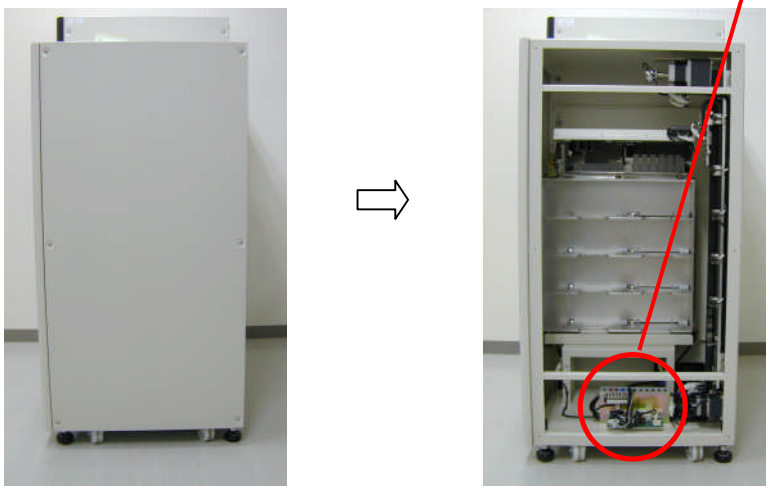
PI-480





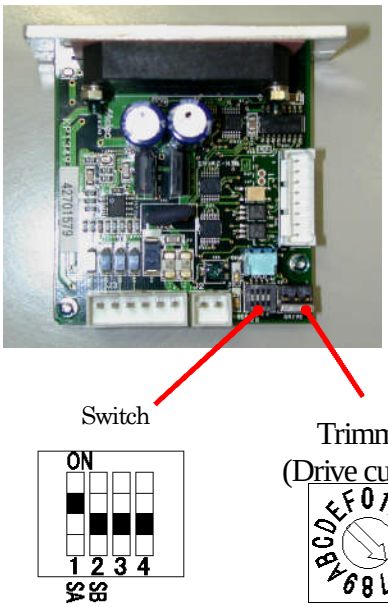




Sample stacker
(TS-200)



Set each motor driver as follows.

DB-2630／U16



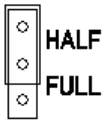
Switch



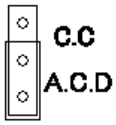

Trimmer
(Drive current)


CSD2130P

Jumper pin
(Step corner)




Jumper pin
(Automated current down)




DB-2630／U16

| | Motor | 1(SA) | 2(SB) | 3 | 4 | Trimmer |
|---|---|---|---|---|---|---|
| M1 (DRV1) | Centrifuge rotor motor | ON | ON | OFF | OFF | 6 |
| M2 (DRV2) | Transferring robot Y axis motor | OFF | ON | OFF | OFF | F |
| M3 (DRV9) | Transferring robot Y axis motor | OFF | ON | OFF | OFF | F |
| M4 (DRV3) | Transferring robot hand Opening and closing motor | ON | ON | OFF | OFF | 6 |
| M5 (DRV4) | Moving table X axis motor | ON | ON | OFF | OFF | F |
| M6 (DRV5) | Agitation unit drive motor | ON | OFF | OFF | OFF | 8 |
| M7 (DRV6) | Channel dispenser 1 syringe Drive motor (standard) | ON | OFF | OFF | OFF | 6 |
| M8 (DRV7) | Channel dispenser 2 syringe Drive motor (option) | ON | OFF | OFF | OFF | 6 |
| M9 (DRV8) | Sample stacker transferring robot X axis motor (standard) | ON | ON | OFF | OFF | F |

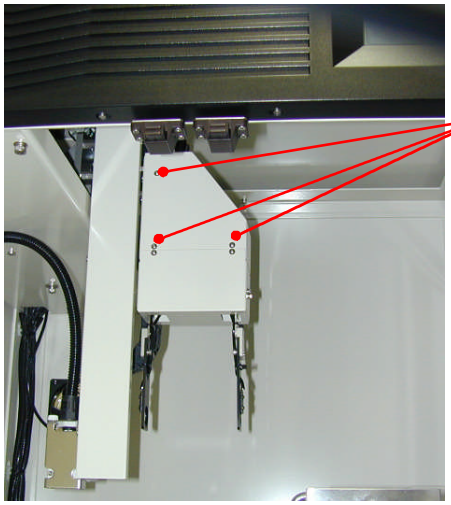
CSD2130P

| | Motor | Automated current down | Step Corner |
|---|---|---|---|
| M10 (DRV12) | Sample stacker transferring robot Z axis motor (standard) | ACD | HALF |

Attach the back below panel to the PI-480/NA-480 (as the fan cable is connected with the back below panel, attach it to the back below panel, too.) and the right panel to the sample stacker.

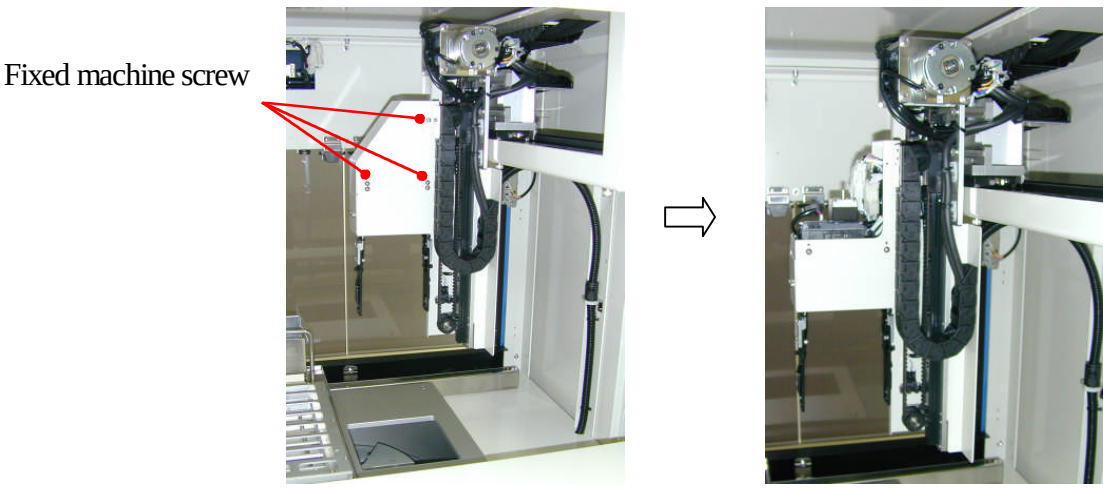
## 3-6 Hand sensor sensitivity adjustment

1. Open the front acrylic door and unscrew the three fixed screws on the front of robot hand cover using a plus driver.

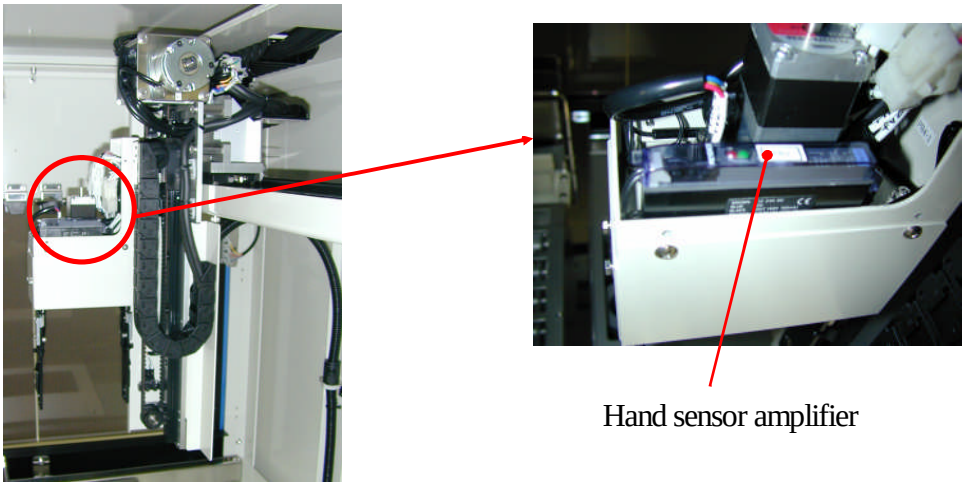



2. Remove the back upper panel of the PI-480. As the fan cable is connected with the back upper panel, disconnect the fan cable, too.

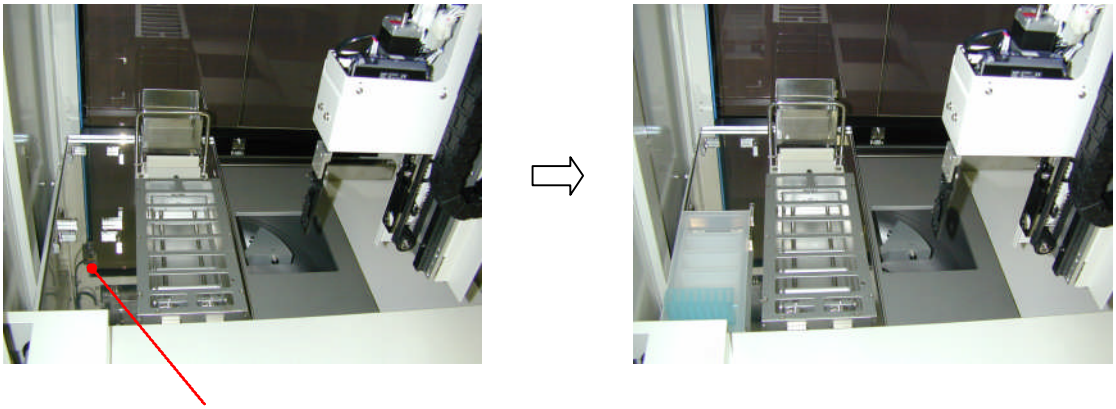
3. Unscrew the three fixed screws on the back of the robot hand cover using a plus driver and remove the robot hand cover



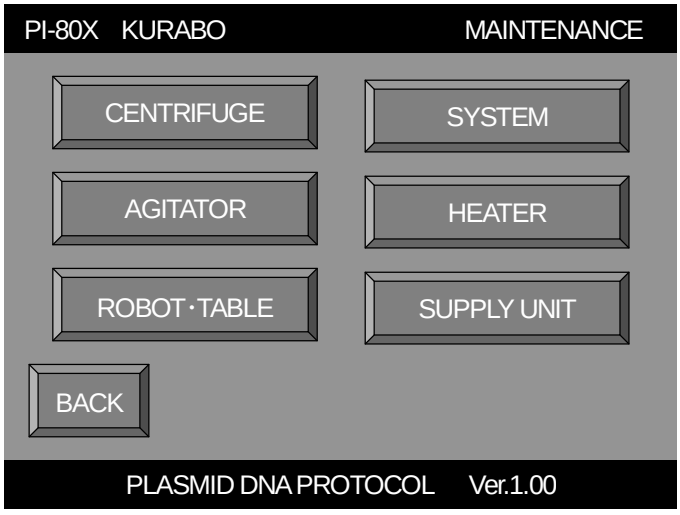
The following illustrations indicate the place where the hand sensors are attached.



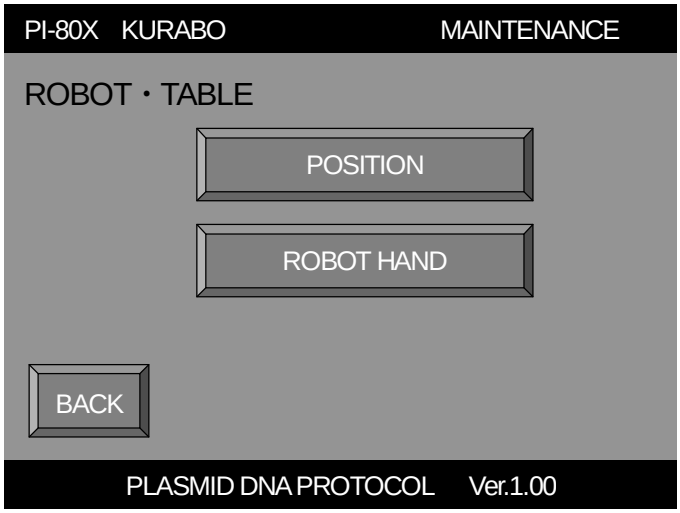

4. Insert the tube rack on the DNA storage rack set position into the back of the PI-480/NA-480 and put the 8 hole tubes unit on the position No.6.



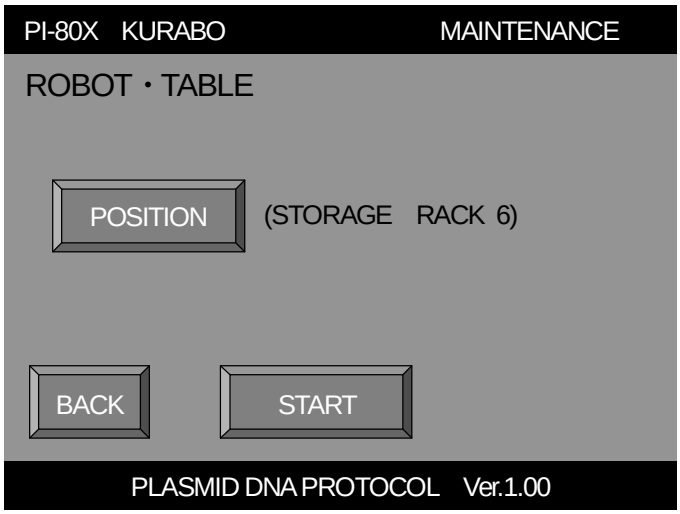

5. Turn on the PI-480/NA-480 and press the [ROBOT･TABLE] button on the Maintenance menu screen. (Refer to 2-2, 'Start of maintenance menu screen'.



6. Press the [POSITION] button.

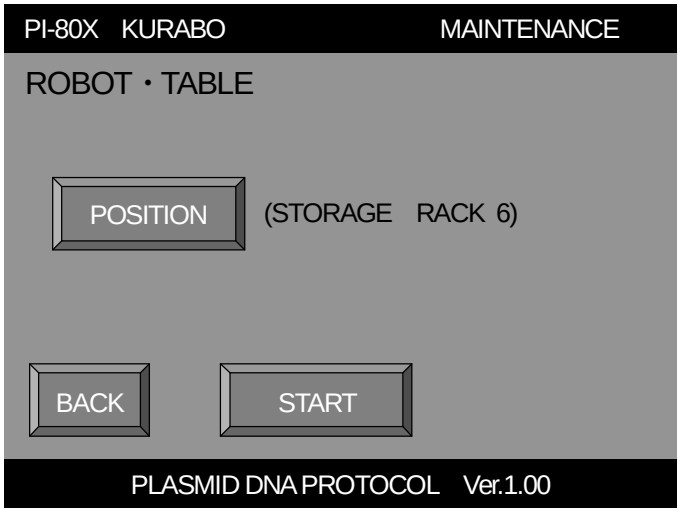



7. Select (STORAGE RACK 6) using the [POSITION] button and press the [STRAT] button.
The tube transferring robot and the moving table move to 'STORAGE RACK 6' (Refer to the following illustration.)

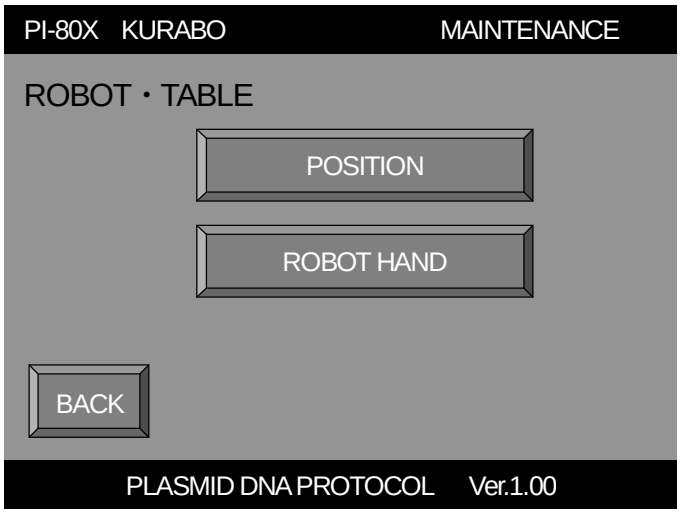



STORAGE RACK 6 Position Back View

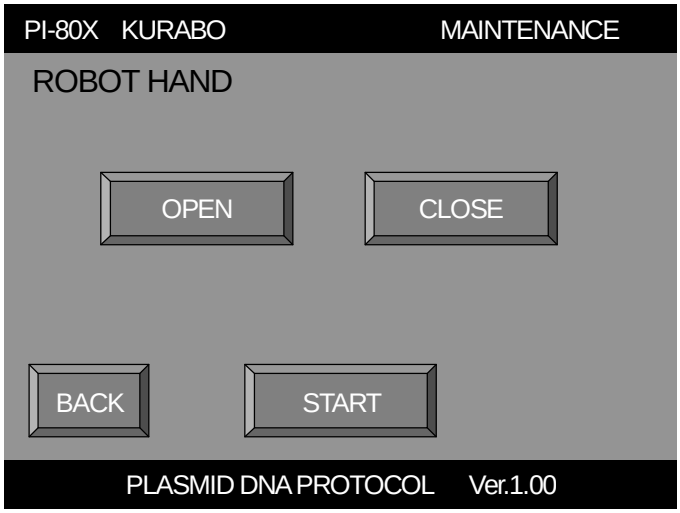
8. Press the [BACK] button.



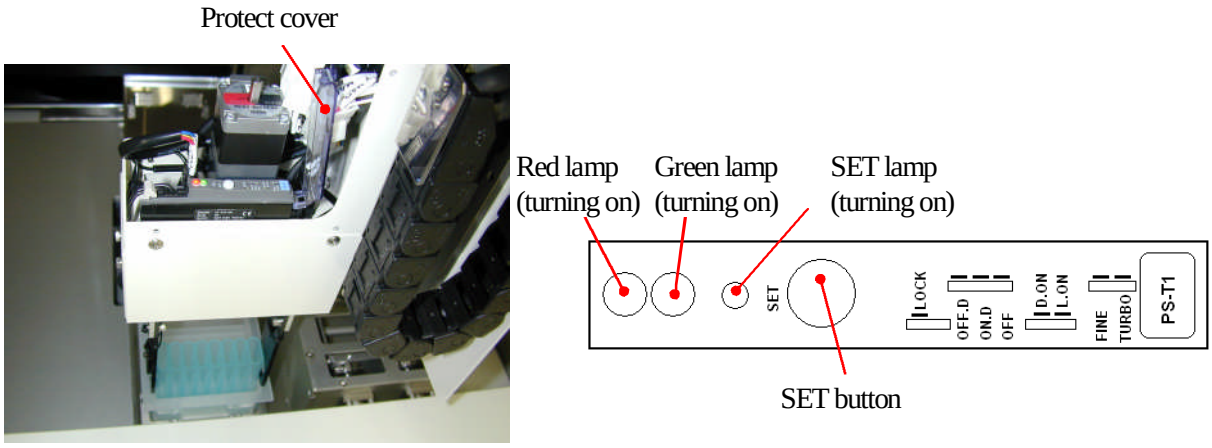

9. Press the [ROBOT HAND] button.



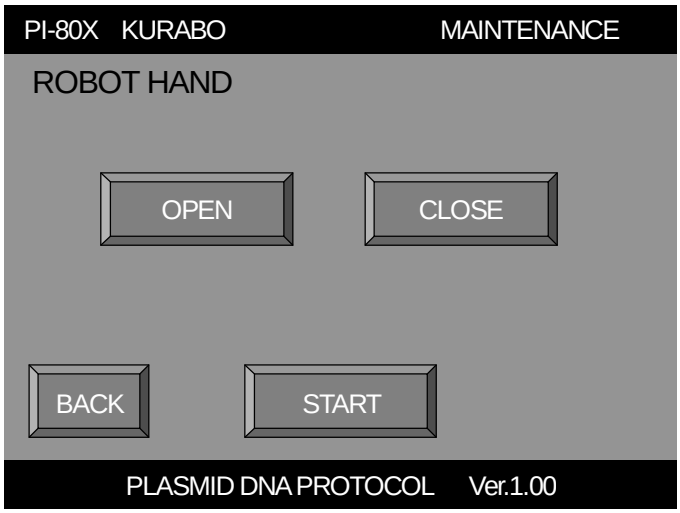

10. Select the [CLOSE] button and then press the [START] button. The robot hand will close.



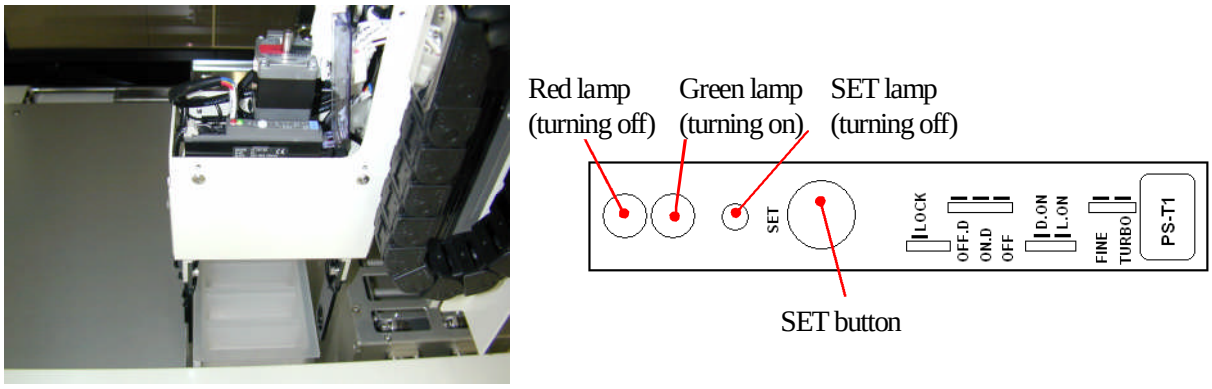
11. Open the protection cover of the hand sensor amplifier and press the SET button. Check whether the red lamp, green lamp and SET lamp light.




12. Select [OPEN] and press the [START] button. The robot hand will open.



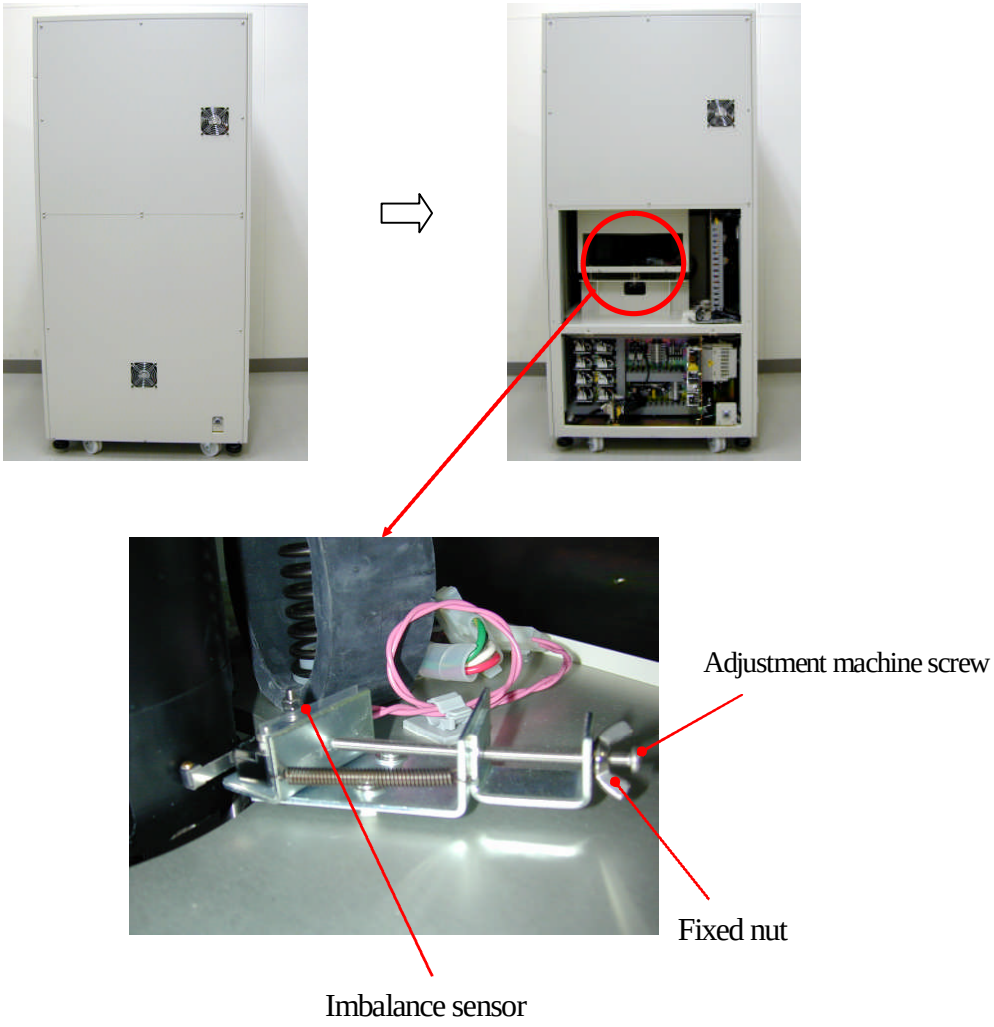

13. Take out the 8 holes tube unit which is set on tube rack and press the SET button one time.
Check whether the green lamp is turned on and the both red lamp and the SET lamp is turned off.



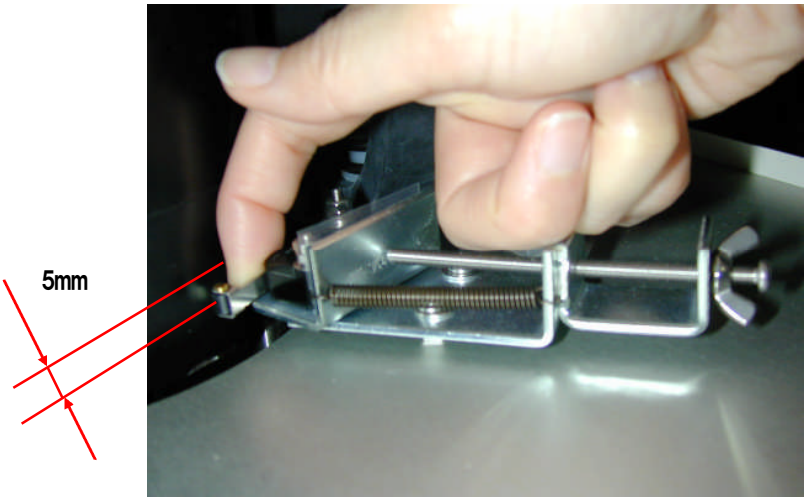

14. Close the protection cover of the hand sensor after adjusting and attach the robot hand cover and the back upper panel of the PI-480/NA-480. (As the fan cable is connected with the back upper panel, connect the fan cable.)

## 3-7 Imbalance sensor adjustment

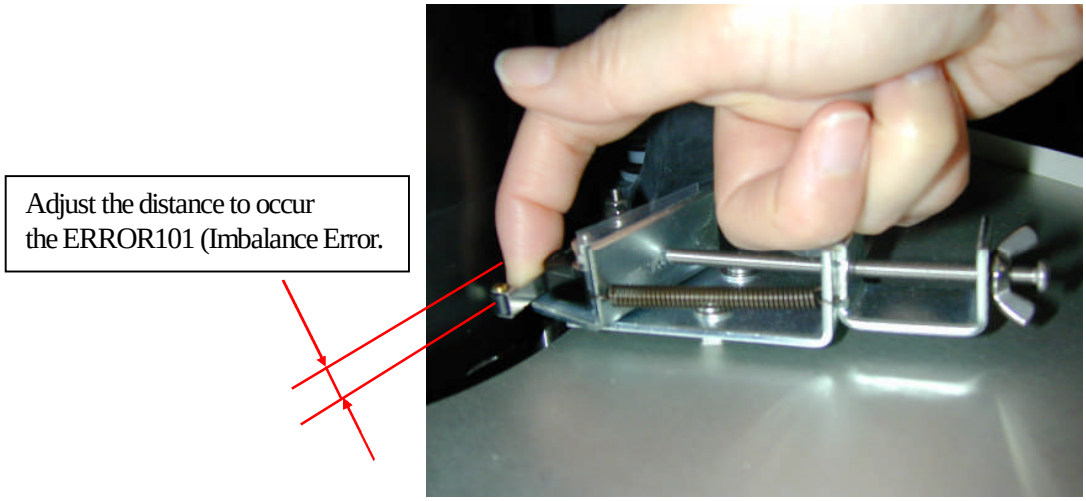
1. Remove the back below panel of the PI-480/NA-480. As the fan cable is connected with the back bottom panel, remove the fan cable, too. The following illustrations indicate the place where the imbalance sensor is installed.



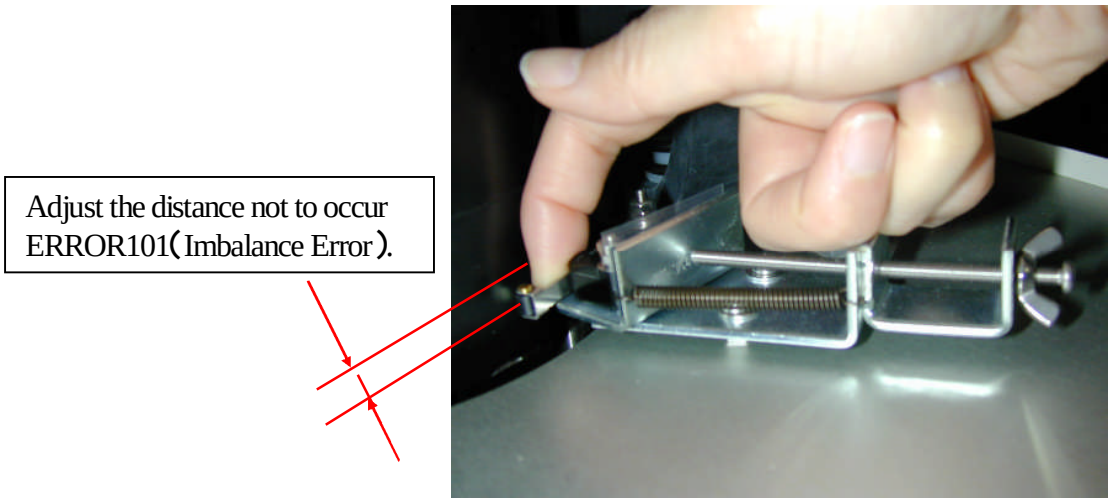

2. First adjust the imbalance sensor roughly. Press the imbalance sensor with your finger and loosen the machine screw so that the distance between the imbalance sensor and the centrifuge motor becomes about 5mm. Next adjust the distance using the adjustment machine screw and fix the imbalance sensor using the fixed nut accurately.



3. After completing the rough adjustment, adjust the imbalance sensor precisely. Put one 20g weight in a centrifuge bucket and centrifuge by 2,000rpm for one minute to occur the 'Imbalance Error',(ERROR 101) and then adjust the distance between the imbalance sensor and the centrifuge motor as in the previous step.



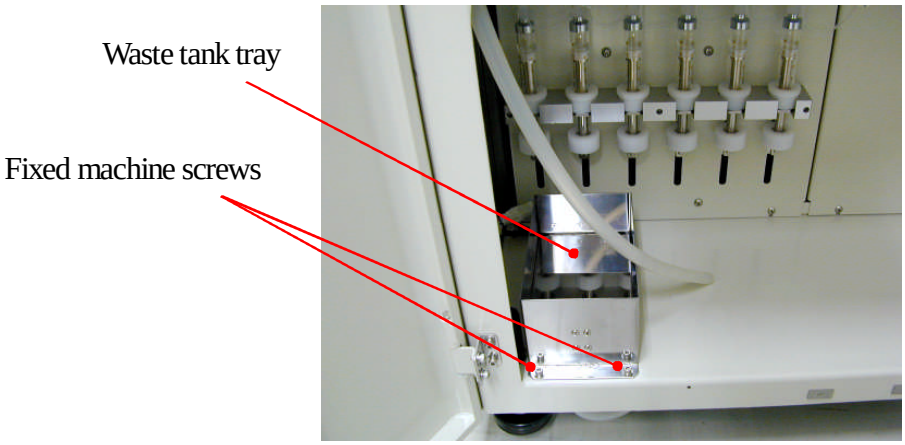

4. Remove the 20g weight from the centrifuge bucket. Next put the 15g weight in a centrifuge bucket and centrifuge by 2,000rpm for one minute not to occur the 'Imbalance Error',(ERROR 101) and then adjust the distance between the imbalance sensor and the centrifuge motor as previous step.



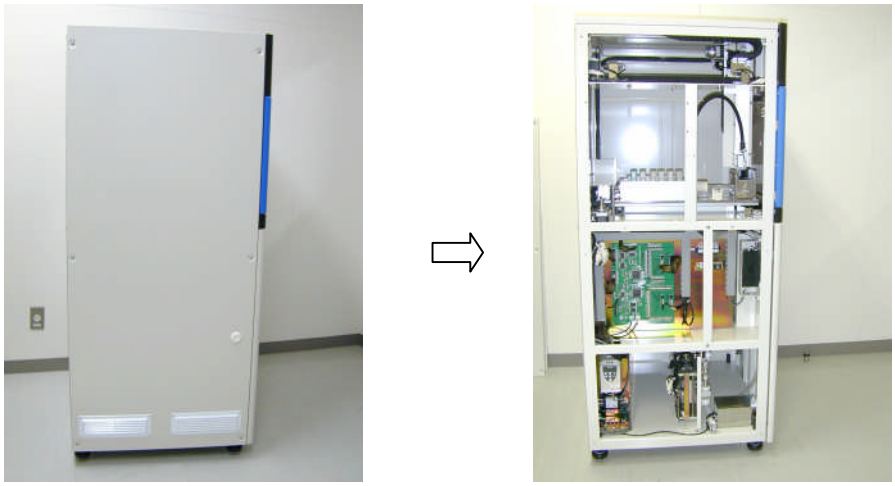

5. Attach the back bottom panel of the PI-480/NA-480 after adjusting. Attach the fan cable, too.

## 3-8 Weight sensor adjustment

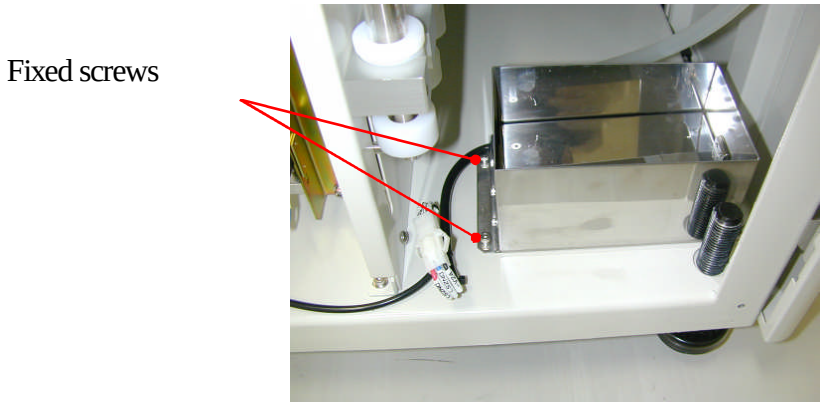
1. The waste fluid tank tray is fixed with the four fixed machine screws (hex-head wrench 2.5mm). Open the front below door and unscrew the front two fixed machine screws.



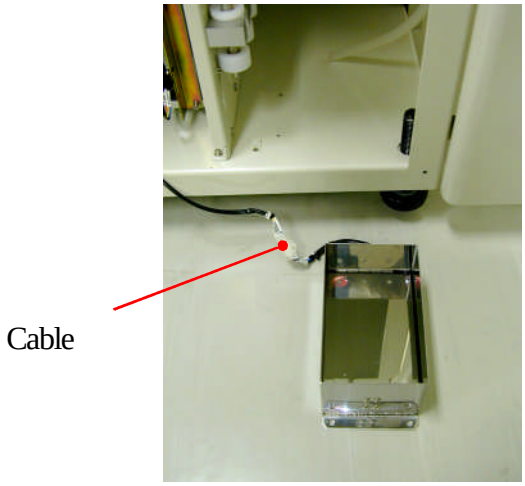

2. Remove the left panel.



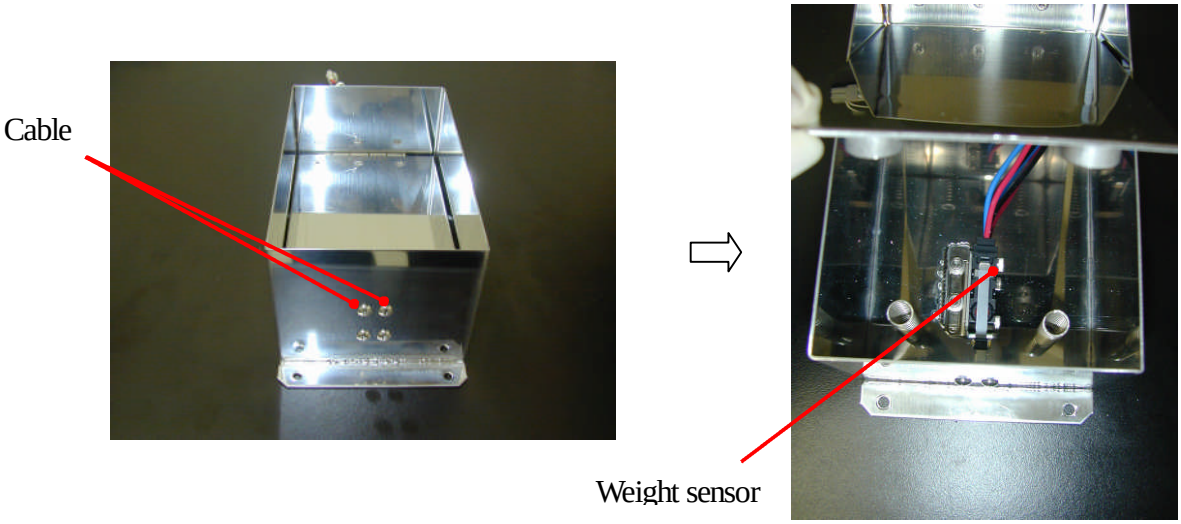
3. Unscrew the two fixed screws at the behind of the waste fluid tray from left.



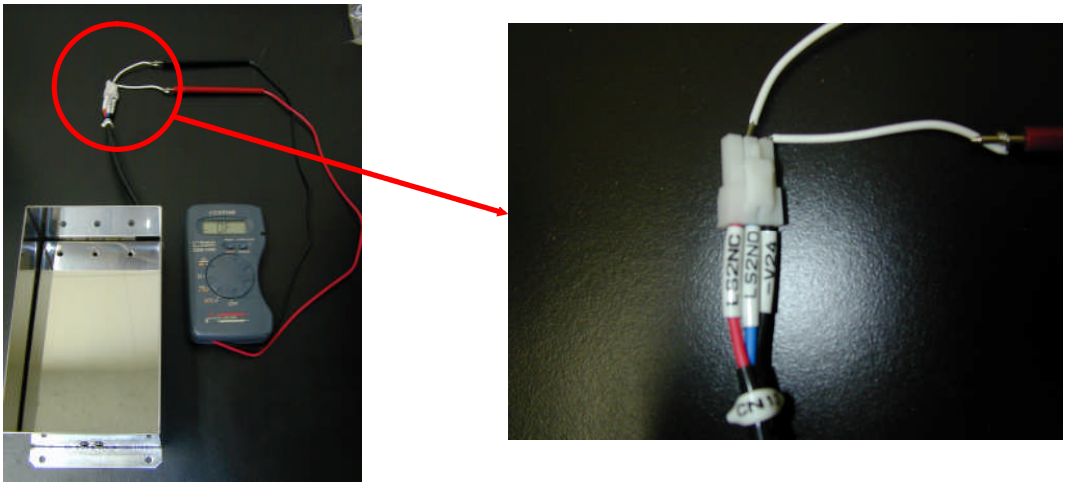
4. Remove the cables (CN13) which are connected to the waste fluid tank tray and the cable ties.



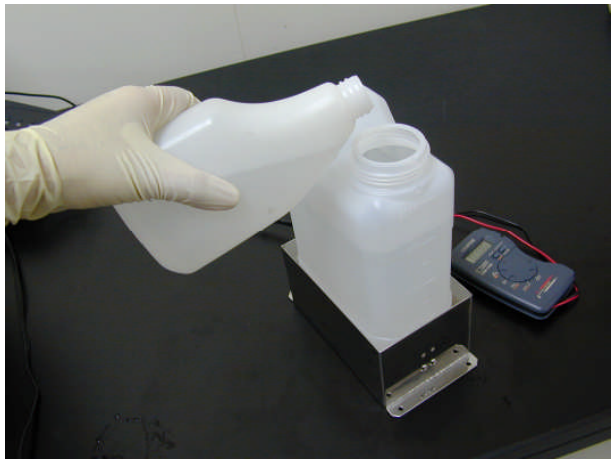

Unscrew the two front fixed machine screws and then remove the stoppers. Raise the waste fluid tank set and you will see the weight sensors which are installed in the interior of the waste fluid tank tray.

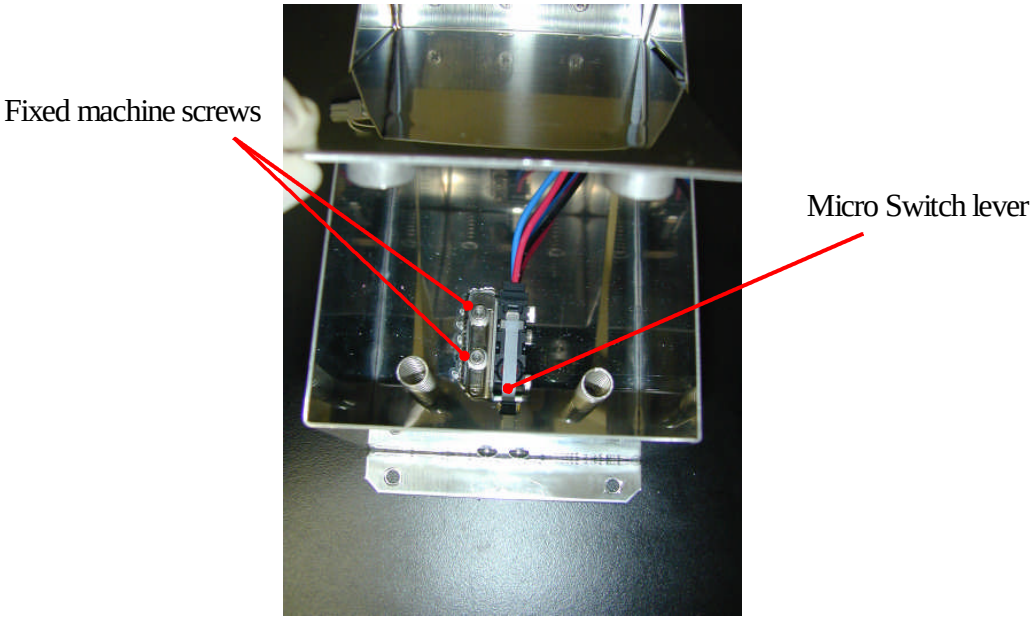



Connect the CN13-24V(Black) and the LS2NO(Blue) to the tester to check the continuity.



7. Set the waste bottle on the waste fluid tray. Next adjust the installation position of the micro switch and the angle of the micro switch lever to turn on the micro switch when approximately 1.5 of water is added



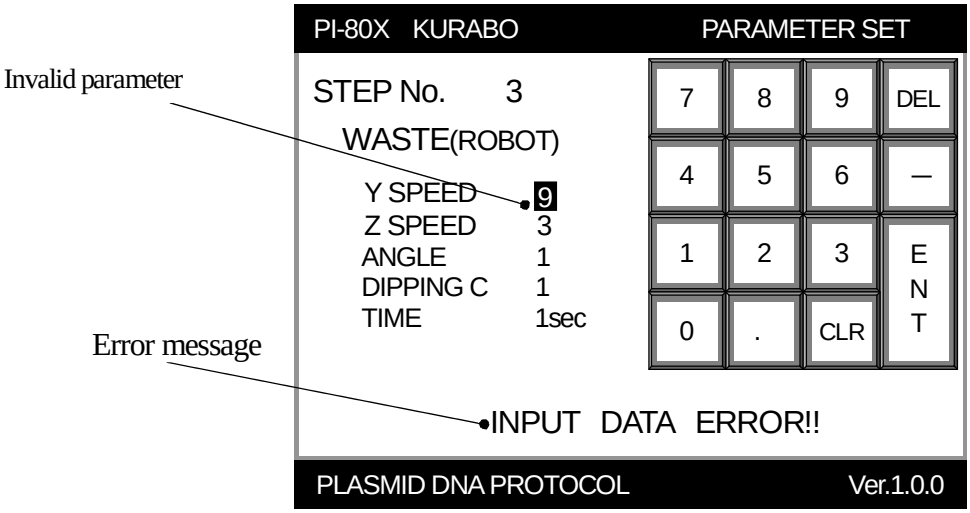


## 4-1Introduction

Turn off the PI-480/NA-480, if it stops due to the electrical or machine troubles. As the error message is displayed on the operation screen, do the corrective action according to the error No. (refer to ").

## 4-2 Input Data Error

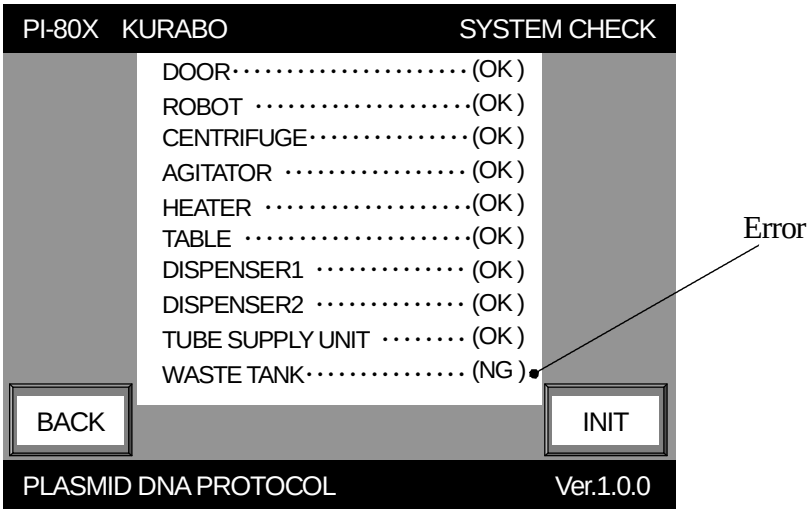
When the invalid sample number is inputted during the parameter set, the instrument will not accept the invalid value. Following screen is an example when inputting the invalid Y-axis speed at Step 3 in the plasmid protocol. It is possible to release the error by inputting the correct number.




Input valid parameter and press the [ENT] button on the key pad for saving the parameter.
Press the [DEL] button on the key pad to erase the current input value.
Press the [CLR] button on the key pad to erase the current input sample number before saving.

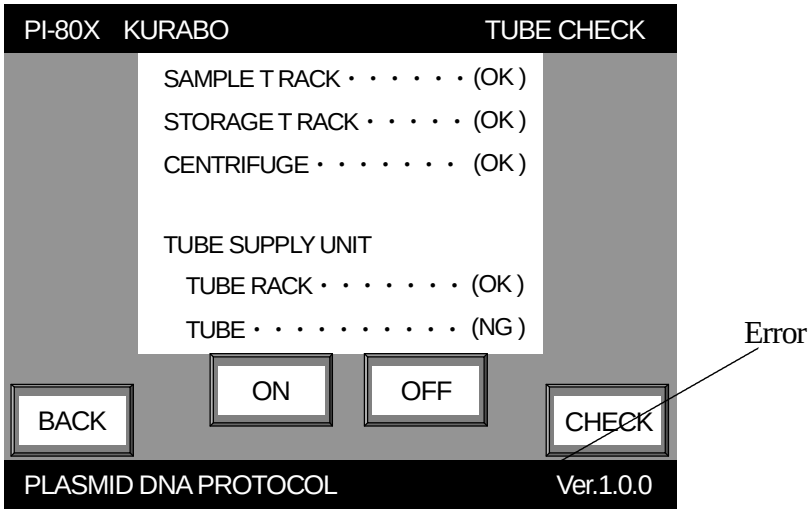
## 4-3 System error

The system error occurs in the system check at restart driving mode (RE-START) of automatic driving mode (AUTOMATED RUN) and reagent waste fluid mode (REAGENT) when trouble is found for each unit. When any trouble is found, 'NG' will displays in the right bracket of the component. Turn off the PI-480/NA-480 and then check.



## 4-4 Tube Set Error

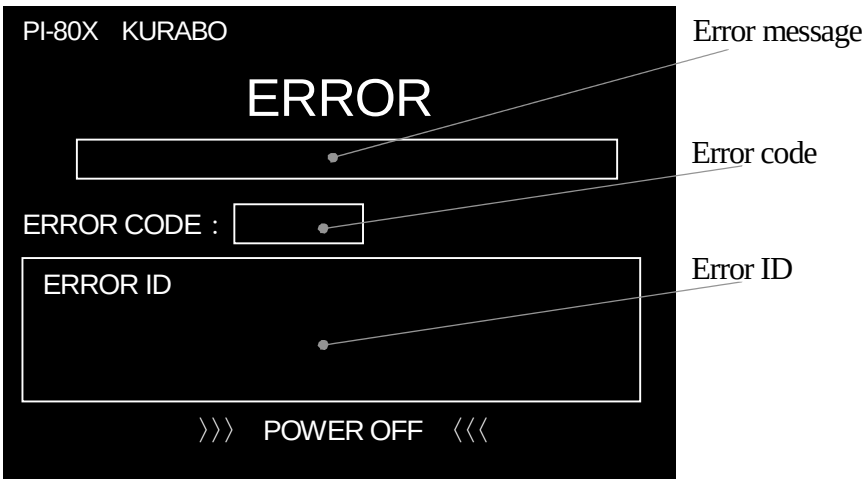
This error message will display during the “Tube Check” of the automated or restart operation. If the number of the tube unit or that of the tube rack does not match the input sample number or improper setting of these items, [NG] displays in right parenthesis of the component.




**Contact AutoGen Inc. if any abnormality is not founded.**

## 4-5 Error screen

If a mechanical or electrical abnormality is found in the internal component during automated or restart operation, following error screen will display on the touch panel. The error screen includes the error message, error code and error ID.




Turn off the PI-480/NA-480 and take corrective action according to the instruction to each error code which is described in the following section.

## 4-6 Corrective Actions for Error Numbers

### System Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 1 | Busy | It is impossible to perform command<br><br>**Typical cause**<br>-Electric noise from outside the instrument<br>-Trouble of PCB | 1. Turn power switch on/off several times.<br>This error will occur at protocol selection screen or system initialization screen. Necessary repeating time of power switch on/off depends on the screen where the instrument gets trouble.<br>2. If the system check is successful, select restart step and continue the operation.<br>3. If the operation ends in failure several times, contact AutoGen. |
| 2 | Time-up Error | It is impossible to receive response within preset time period after transmitting command.<br><br>**Typical cause**<br>-Electric noise from outside the instrument<br>-Trouble of PCB | |
| 3 | Request Error | Receive command which is out of format or definition.<br><br>**Typical cause**<br>-Electric noise from outside the instrument<br>-Trouble of PCB | |
| 4 | NA Door Open Error | Open the front upper door<br>(left:DS1; right: DS2).<br><br>**Typical cause**<br>-defective in the door interlock mechanism | 1. Verify that the door is interlocked when powering on the instrument.<br>2. Trying operation.<br>3. If you find defective in the interlock or operation fails several times, contact AutoGen. |
| 5 | Drain Tank Full Error | Discard waste fluid.<br>When the weight of the fluid is over the preset-value (approximately 1.5l), this error message displays.<br>The weight sensor tracks the weight only at the system initialization. | 1. Open the left lower door.<br>2. Empty waste bottle, return it to the original position and insert the waste hose into the cap of the bottle. |
| 7 | JOB Error | Actuator doesn't work. | 1. Turn power switch off and on several times.<br>2. If the system check is successful, select restart step and continue the operation.<br>3. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 8 | Exception Error | Other defective in the instrument | 1. Turn power switch on/off several times.<br>2. If the system check is successful, select restart step and continue the operation.<br>3. If the operation ends in failure several times, contact AutoGen. |

## Program Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 10 | Internal Parameter Error | Internal parameter is abnormal. | 1. Turn power switch on/off several times.<br>2. If the system check is successful, select restart step and continue the operation.<br>3. If the operation ends in failure several times, contact AutoGen. |
| 11 | Device Error | Internal device is abnormal | |

## Centrifuge Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 101 | CENTRIFUGE Imbalance Error | Imbalance of the centrifuge rotor.<br>**Typical Cause**<br>-Weight of sample tubes at the opposing rotor positions is not equal.<br>-Inadequate set of the buckets.<br>-Electric noise from outside the instrument.<br>-Position of imbalance sensor does not correct.<br>-Trouble of the CPU or centrifuge inverter. | 1. Turn power switch off and slide the table and then open by your hand.<br>2. Remove the tube from the bucket and make sure that the weights of tubes which are set at opposing rotor positions are equal. Maximum imbalance allowance is 15 g.<br>3. If necessary, adjust the weight with sample culture or water.<br>4. Be sure that buckets are set according to their number and move smoothly.<br>If necessary, clean the bucket by immersing them in a soap and water solution. Wipe dry and apply light oil to the grooves on the sides of the buckets before reassemble.<br>5. If you cannot find any above problems and the error still occurs after trying restart several times, contact AutoGen. |
| 102 | CENTRIFUGE Over Speed Error | Spin speed of the centrifuge is over the limit<br>* Display when spin speed is over 300 rpm. from the preset speed.<br>**Typical Cause**<br>Trouble in centrifuge system.<br>Electric noise. | 1. Turn power switch on/off and try to restart.<br>2. If the system check is successful, select restart step and continue the operation<br>3. If the operation ends in failure several times, contact AutoGen. |
| 110 | CENTRIFUGE Set Speed Error | Defect in the centrifuge motor<br>*The spin speed of the centrifuge does not rise at the preset rpm within 120 seconds.<br>**Typical Cause**<br>Trouble in centrifuge system.<br>Electric noise. | |
| 111 | CENTRIFUGE Stop Speed Error | Defect in the centrifuge motor<br>*The centrifuge does not stop within 120 seconds.<br>**Typical Cause**<br>Trouble in centrifuge system.<br>Electric noise. | |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 114 | CENTRIFUGE Home Position Error | The home position cannot be found within the regulation time.<br>(Centrifuge rotor home position error)<br><br>**Typical Cause**<br>-Any object is inside the centrifuge.<br>-Defective in centrifuge system.<br>-Electric noise.<br>-Malfunction of the home position sensor. | 1. Verify that bucket can stop at the proper position, if not contact AutoGen.<br>2. Verify that the robot gripper can pick up tube unit properly. If not, align the robot gripper.<br>3. If there is no abnormality on bucket position or robot gripper, turn power switch off.<br>4. Initialize the instrument by turning the power switch on.<br>5. If the system check is successful, select restart step and continue the operation.<br>6. If the operation ends in failure several times, contact AutoGen. |
| 115 | CENTRIFUGE Door Error | Centrifuge door is open during centrifugation<br>*Display when centrifuge door is open during centrifugation. | 1. Turn power switch on/off and try to restart.<br>2. If the system check is successful, select restart step and continue the operation<br>3. If the operation ends in failure several times, contact AutoGen. |
| 116 | CENTRIFUGE Door Close Error | It is impossible to close the centrifuge door.<br>*Display when the door does not close within 30 seconds. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 117 | CENTRIFUGE Door Open Error | It is impossible to open the centrifuge door.<br>*Display when the door does not open within 30 seconds. | |
| 119 | CENTRIFUGE Centrifuge Error | Other trouble in the centrifuge | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

## Transfer Robot Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 201 | ROBOT<br>Y-axis Home Position Error | Malfunction of the Y-axis robot.<br>*Display when the robot does not return to the home position within 20 seconds after Robot-CPU transmits the return command.<br>**Typical Cause**<br>-Electric noise.<br>-Defect in the moving system of the robot such as motor, belt, driver and sensor. | 1. Turn power switch off.<br>2. Verify that the robot is within the normal position.<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 202 | ROBOT<br>Y-axis Rear Limit Position Error | Over run of the Y-axis(robot)<br>*Display when the Y-axis shutter shuts down the light of the rear limit sensor (CW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of rear sensor.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shut down the light, return robot to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |
| 203 | ROBOT<br>Y-axis Front Limit Position Error | Over run of the Y-axis(robot)<br>*Display when the Y-axis shutter shuts down the light of the front limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of rear sensor.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return robot to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 204 | ROBOT<br>Y-axis Motor Error | De-synchronization of the Y-axis motor<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 209 | ROBOT<br>Y-axis Error | Trouble in Y-axis<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 211 | ROBOT<br>Z-axis Home Position Error | Malfunction of the Z-axis robot.<br>*Display when the robot does not return to the home position within 20 seconds after Robot-CPU transmits the return command.<br>**Typical Cause**<br>-Electric noise.<br>-Defect in the moving system of the robot such as motor, belt, driver and sensor. | 1. Turn power switch off.<br>2. Verify that the robot is within the normal position.<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 212 | ROBOT<br>Z-axis Upper Limit Position Error | Over run of the Z-axis(robot)<br>*Display when the Z-axis shutter shuts down the light of the upper limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of rear sensor.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return robot to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 213 | ROBOT<br>Z-axis Lower Limit Position Error | Over run of the Z-axis(robot)<br>*Display when the Z-axis shutter shuts down the light of the lower limit sensor (CW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of rear sensor.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shut down the light, return robot to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |
| 214 | ROBOT<br>Z-axis Motor Error | De-synchronization of the Z-axis motor<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 219 | ROBOT<br>Z-axis Error | Trouble in Z-axis<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 221 | ROBOT<br>Hand Home Position Error | It is impossible to find the home position at open direction of the gripper (CW).<br>* Display when the gripper open does not complete within 3 seconds, after CPU transmits the command.<br>**Typical Cause**<br>-Defective in the gripper system such as motor or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 222 | ROBOT<br>Hand Close Limit Position Error | Over run of the gripper<br>*Display when the gripper shutter shuts down the light of the closed position sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of closed position sensor.<br>-Defective in the moving system of the gripper such as motor or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shut down the light, return robot to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |
| 229 | ROBOT<br>Hand Error | Trouble in the gripper | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

## Moving Table Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 301 | TABLE<br>X-axis Home Position Error | Malfunction of the table.<br>*Display when the table does not return to the home position within 20 seconds after Robot-CPU transmits the return command.<br>**Typical Cause**<br>-Electric noise.<br>-Defect in the moving system of the table such as motor, belt, driver and sensor. | 1. Turn power switch off.<br>2. Verify that the table is within the normal position.<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 302 | TABLE<br>X-axis Left Limit Position Error | Over run of the table<br>*Display when the table shutter shuts down the light of the left limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of left sensor.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return table to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |
| 303 | TABLE<br>X-axis Right Limit Position Error | Over run of the table<br>*Display when the table shutter shuts down the light of the right limit sensor (CW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of right sensor.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return robot to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 304 | TABLE<br>X-axis Motor Error | De-synchronization of the table motor<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 309 | TABLE<br>X-axis Error | Trouble in the table<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

## Agitation Unit Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 401 | Agitator<br>Home Position Error | Malfunction of the agitator.<br>*Display when home position of the agitator does not find within 20 seconds after Robot-CPU transmits the return command.<br>**Typical Cause**<br>-Electric noise.<br>-Defect in the moving system of the agitator such as motor, driver and sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 409 | AGITATOR<br>Error | Trouble in the agitator<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the agitator such as motor, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

## Standard Dispenser Unit Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 501 | DISPENSER 1 Plunger Home Position Error | It is impossible to find the home position of the plunger (CW).<br>* Display when the plunger does not return to the home position within 20 seconds after the CPU transmits the command.<br>**Typical Cause**<br>-Electric noise.<br>-Plunger stuck to the barrel of the syringe.<br>-Malfunction of dispenser. | 1. Turn power switch off.<br>2. Record step number and the position of the plunger.<br>3. If you find any object in the syringe, remove the syringe from the instrument and wash it with hot water.<br>4. After reassembling the syringe, initialize the instrument by turning the power switch on.<br>5. If the system check is successful, select restart step and continue the operation.<br>6. If the operation ends in failure several times, contact AutoGen. |
| 502 | DISPENSER 1 Plunger Limit Position Error | Over run of the plunger<br>*Display when the plunger shutter shuts down the light of the limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Plunger stuck to the barrel of the syringe.<br>-Malfunction of dispenser. | 1. Turn power switch off.<br>2. Record step number and the position of the plunger.<br>3. If you find any object in the syringe, remove the syringe from the instrument and wash it with hot water.<br>4. After reassembling the syringe, initialize the instrument by turning the power switch on.<br>5. If the system check is successful, select restart step and continue the operation.<br>6. If the operation ends in failure several times, contact AutoGen. |
| 509 | DISPENSER 1 Plunger Error | Other trouble in the plunger | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

* The trouble in the optional dispenser displays as Error number 60X(where X are any 1,2 and 9 in the above table)

## Optional Dispenser Unit Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 601 | DISPENSER 2 Plunger Home Position Error | It is impossible to find the home position of the plunger (CW).<br>* Display when the plunger does not return to the home position within 20 seconds after the CPU transmits the command.<br>**Typical Cause**<br>-Electric noise.<br>-Plunger stuck to the barrel of the syringe.<br>-Malfunction of dispenser. | 1. Turn power switch off.<br>2. Record step number and the position of the plunger.<br>3. If you find any object in the syringe, remove the syringe from the instrument and wash it with hot water.<br>4. After reassembling the syringe, initialize the instrument by turning the power switch on.<br>5. If the system check is successful, select restart step and continue the operation.<br>6. If the operation ends in failure several times, contact AutoGen. |
| 602 | DISPENSER 2 Plunger Limit Position Error | Over run of the plunger<br>*Display when the plunger shutter shuts down the light of the limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Plunger stuck to the barrel of the syringe.<br>-Malfunction of dispenser. | 1. Turn power switch off.<br>2. Record step number and the position of the plunger.<br>3. If you find any object in the syringe, remove the syringe from the instrument and wash it with hot water.<br>4. After reassembling the syringe, initialize the instrument by turning the power switch on.<br>5. If the system check is successful, select restart step and continue the operation.<br>6. If the operation ends in failure several times, contact AutoGen. |
| 609 | DISPENSER 2 Plunger Error | Other trouble in the plunger | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

* The trouble in the optional dispenser displays as Error number 60X(where X are any 1,2 and 9 in the above table)

## Heater Unit Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 701 | HEATER: Z-axis Upper Position Error | The heater cover does not return to the upper position<br>* Display when the cover does not return to the upper position within 20 seconds after the CPU transmits the command.<br>**Typical Cause**<br>-Electric noise.<br>-Any object obstructs movement of the cover.<br>-Defective in the moving system of the cover such as motor, driver or sensor. | 1. Turn power switch off.<br>2. If you find any object around the cover, remove it<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 702 | HEATER: Z-axis Lower Position Error | The heater cover does not return to the lower position<br>* Display when the cover does not return to the lower position within 20 seconds after the CPU transmits the command.<br>**Typical Cause**<br>-Electric noise.<br>-Any object obstructs movement of the cover.<br>-Defective in the moving system of the cover such as motor, driver or sensor. | |
| 703 | HEATER Temperature Alarm 1 | The GENE PREPmonitors the status of the heater only the steps using it.<br><br>This error displays when temperature controller transmits Alarm 1 to CPU of the GENE PREP | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 704 | HEATER Temperature Alarm 2 | The GENE PREP monitors the status of the heater only the steps using it.<br><br>This error displays when temperature controller transmits Alarm 2 to CPU of the PI-80X | |
| 709 | HEATER Error | Other trouble in the heater | |

Heater unit is an optional unit, and basic unit does not have these error codes.

## Sample Stacker Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 801 | TUBE SUPPLY UNIT<br>X-axis Home Position Error | Malfunction of the stacker<br>*Display when the table does not return to the X-axis home position within 20 seconds after Robot-CPU transmits the return command.<br>**Typical Cause**<br>-Electric noise.<br>-Defect in the moving system of the stacker such as motor, belt, driver and sensor. | 1. Turn power switch off.<br>2. Verify that the table is within the normal position.<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 802 | TUBE SUPPLY UNIT<br>X-axis right Limit Position Error | Over run of the table<br>*Display when the table shutter shuts down the light of the right limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of right sensor.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return table to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |

Stacker is an optional unit, and basic unit does not have these error codes.

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 803 | TUBE SUPPLY UNIT<br>X-axis left Limit Position Error | Over run of the table<br>*Display when the table shutter shuts down the light of the left limit sensor (CW).<br><br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of left sensor.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return table to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |
| 804 | TUBE SUPPLY UNIT<br>X-axis Motor Error | De-synchronization of the X-axis motor<br><br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 809 | TUBE SUPPLY UNIT<br>X-axis Error | Other trouble in X-axis of the stacker<br><br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 811 | TUBE SUPPLY UNIT<br>Z-axis Home Position Error | Malfunction of the stacker<br>*Display when the table does not return to the Z-axis home position within 20 seconds after Robot-CPU transmits the return command.<br><br>**Typical Cause**<br>-Electric noise.<br>-Defect in the moving system of the stacker such as motor, belt, driver and sensor. | 1. Turn power switch off.<br>2. Verify that the table is within the normal position.<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 812 | TUBE SUPPLY UNIT<br>Z-axis Lower Limit Position Error | Over run of the table<br>*Display when the table shutter shuts down the light of the lower limit sensor (CCW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of lower sensor.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return table to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 813 | TUBE SUPPLY UNIT Z-axis Upper Limit Position Error | Over run of the table<br>*Display when the table shutter shuts down the light of the upper limit sensor (CW).<br>**Typical Cause**<br>-Electric noise.<br>-Any object shuts down the light of upper sensor.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Check if an object, including the shutter shuts down the sensor light.<br>3. If the shutter shuts down the light, return table to the normal position.<br>4.If any object shuts down the light, remove it<br>5. Initialize the instrument by turning the power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the operation ends in failure several times, contact AutoGen. |
| 814 | TUBE SUPPLY UNIT Z-axis Motor Error | De-synchronization of the Z-axis motor<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the table such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |
| 819 | TUBE SUPPLY UNIT Z-axis Error | Other trouble in Z-axis of the stacker<br>**Typical Cause**<br>-Electric noise.<br>-Defective in the moving system of the robot such as motor, belt, driver or sensor. | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 821 | TUBE SUPPLY UNIT Cabinet Set Error | Improper setting of the cabinet | 1. Turn power switch off.<br>2. Verify that the cabinet is set to the proper position. If necessary, set again the cabinet.<br>3. Initialize the instrument by turning the power switch on.<br>4. If the system check is successful, select restart step and continue the operation.<br>5. If the operation ends in failure several times, contact AutoGen. |
| 829 | TUBE SUPPLY UNIT Error | Other trouble in the stacker | 1. Turn power switch off.<br>2. Initialize the instrument by turning the power switch on.<br>3. If the system check is successful, select restart step and continue the operation.<br>4. If the operation ends in failure several times, contact AutoGen. |

## Tube unit Error

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 901 | Tube Chucking Error | Gripping error<br>Robot gripper sensors can not recognize the presence of the tube in the centrifuge.<br>**Typical Cause**<br>-Physical position of the robot gripper is not correct.<br>-Position of the robot gripper sensors is not correct.<br>-Malfunction of centrifuge (rotation)<br>-Electric noise. | 1. Turn power switch off.<br>Check whether the tube is picked up normally by the robot gripper. Also, if you do not find the tube between the grippers, check and record whether the tube is still in the centrifuge bucket.<br>2. If you find that there is no tube between the gripper or in the bucket, contact AutoGen.<br>3. If the tube is present between the grippers, check the tube for any defect. If you find a defect, replace the tube.<br>4. If the error is displayed even though the tube is normal and the gripper picked-up it, the position of the gripper sensor might be incorrect. Adjust its location according to the instruction in page 6-8<br>5. Check the position of robot gripper according to the instruction in page 6-8.<br>6. After corrective actions, initialize the instrument by turning power switch on.<br>7. If the system check is successful, select restart step and continue the operation.<br>8. If the system check ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 902 | Tube Chucking Error | Gripping error<br>Robot grips a tube unit.<br>**Typical Cause**<br>-Malfunction of the gripper.<br>-Position of the robot gripper sensors is not correct.<br>-Electric noise. | 1. Turn power switch off.<br>Check whether the tube is absent at the robot gripper.<br>2. If the tube is present between the grippers, remove it according to the instruction in page 6-8.<br>3. Power on the instrument and start system initialization.<br>4. If you again get the error, the position of the gripper sensor or sensitivity of the sensor might be incorrect. Take corrective actions according to the instruction in page 6-8<br>5. After corrective actions, initialize the instrument by turning power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the system check ends in failure several times, contact AutoGen. |
| 903 | Tube Set Error of Sample Tube Rack | The number of tube unit on the sample tube rack counted by the gripper sensor does not match the number of sample tube unit input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set to the sample rack<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set to the sample rack.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |
| 904 | Tube Set Error of Storage Tube Rack | The number of tube unit on the Storage (DNA) tube rack counted by the gripper sensor does not match the number of DNA tube unit input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set to the storage rack<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set to the storage rack.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 905 | Tube Set Error of Centrifuge | The number of tube unit in the centrifuge does not match the number of input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set in the centrifuge.<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set in the centrifuge.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |
| 906 | Tube Set Error of Agitator | The number of tube unit in the agitation unit does not match the number of input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set on the agitation unit.<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set on the agitation unit.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |
| 907 | Tube Set Error of Decant Stage | The number of tube unit on the decantation stage does not match the number of input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set in the centrifuge.<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set on the decantation.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |

## Tube Rack Error

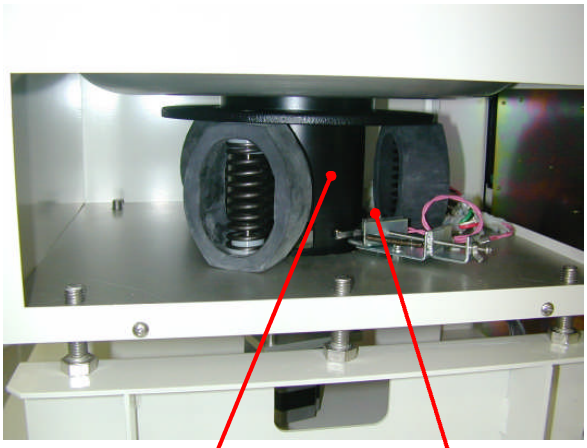
| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 951 | Sample Tube Rack Chucking Error | Gripping error<br>Robot gripper sensors can not recognize the presence of the tube rack.<br>**Typical Cause**<br>-Physical position of the robot gripper is not correct.<br>-Position of the robot gripper sensors is not correct.<br>-Malfunction of centrifuge (rotation)<br>-Electric noise. | 1. Turn power switch off.<br>Check whether the tube rack is picked up normally by the tube rack transfer robot. Also, if you do not find the tube rack between the robot grippers, check and record whether the tube is still in the centrifuge bucket.<br>2. If you find that there is no tube between the gripper or in the bucket, contact AutoGen.<br>3. If the tube rack is present between the robot grippers, check the tube rack for any defect. If you find a defect, replace the tube rack.<br>4. If the error is displayed even though the tube rack is normal and the gripper picked-up it, the position of the gripper sensor might be incorrect. Adjust its location according to the instruction in page 6-8<br>5. Check the position of robot gripper according to the instruction in page 6-8.<br>6. After corrective actions, initialize the instrument by turning power switch on.<br>7. If the system check is successful, select restart step and continue the operation.<br>8. If the system check ends in failure several times, contact AutoGen. |
| 952 | Sample Tube Rack Chucking Error | Gripping error<br>Robot grips a tube unit.<br>**Typical Cause**<br>-Malfunction of the gripper.<br>-Position of the robot gripper sensors is not correct.<br>-Electric noise. | 1. Turn power switch off.<br>Check whether the tube is absent at the robot gripper.<br>2. If the tube is present between the grippers, remove it according to the instruction in page 6-8.<br>3. Power on the instrument and start system initialization.<br>4. If you again get the error, the position of the gripper sensor or sensitivity of the sensor might be incorrect. Take corrective actions according to the instruction in page 6-8<br>5. After corrective actions, initialize the instrument by turning power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the system check ends in failure several times, contact AutoGen. |

| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 953 | Storage Tube Rack Chucking Error | Gripping error<br>Robot gripper sensors can not recognize the presence of the tube in the centrifuge..<br>**Typical Cause**<br>-Physical position of the robot gripper is not correct.<br>-Position of the robot gripper sensors is not correct.<br>-Malfunction of centrifuge (rotation)<br>-Electric noise. | 1. Turn power switch off.<br>Check whether the tube is picked up normally by the robot gripper. Also, if you do not find the tube between the grippers, check and record whether the tube is still in the centrifuge bucket.<br>2. If you find that there is no tube between the gripper or in the bucket, contact AutoGen.<br>3. If the tube is present between the grippers, check the tube for any defect. If you find a defect, replace the tube.<br>4. If the error is displayed even though the tube is normal and the gripper picked-up it, the position of the gripper sensor might be incorrect. Adjust its location according to the instruction in page 6-8<br>5. Check the position of robot gripper according to the instruction in page 6-8.<br>6. After corrective actions, initialize the instrument by turning power switch on.<br>7. If the system check is successful, select restart step and continue the operation.<br>8. If the system check ends in failure several times, contact AutoGen. |
| 954 | Storage Tube Rack Chucking Error | Gripping error<br>Robot grips a tube unit.<br>**Typical Cause**<br>-Malfunction of the gripper.<br>-Position of the robot gripper sensors is not correct.<br>-Electric noise. | 1. Turn power switch off.<br>Check whether the tube is absent at the robot gripper.<br>2. If the tube is present between the grippers, remove it according to the instruction in page 6-8.<br>3. Power on the instrument and start system initialization.<br>4. If you again get the error, the position of the gripper sensor or sensitivity of the sensor might be incorrect. Take corrective actions according to the instruction in page 6-8<br>5. After corrective actions, initialize the instrument by turning power switch on.<br>6. If the system check is successful, select restart step and continue the operation.<br>7. If the system check ends in failure several times, contact AutoGen. |

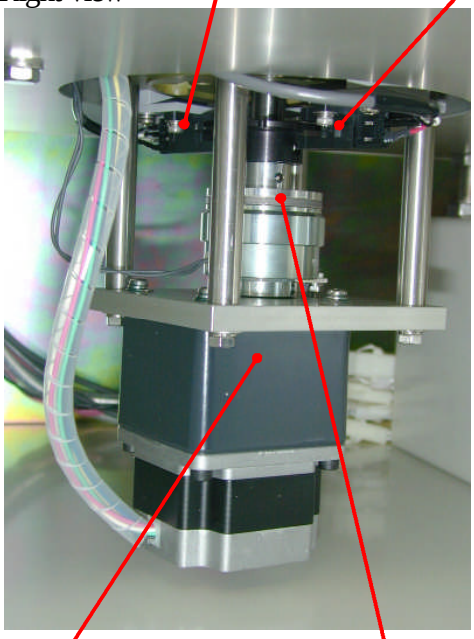
| Error code | Error message | Description | Corrective action |
|---|---|---|---|
| 956 | Sample Tube Rack Set Error of Tube Supply Unit | The number of tube unit on the Sample tube rack sensor does not match the number of sample tube unit input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set to the sample rack<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set to the sample rack.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |
| 957 | Storage Tube Rack Set Error of Tube Supply Unit | The number of tube unit on the Storage (DNA) tube rack sensor does not match the number of DNA tube unit input sample number.<br><br>**Typical Cause**<br>- Necessary number of the tube unit is not set to the storage rack<br>-Malfunction of the gripper sensor. | 1. Turn power switch off. Verify that necessary number of the tube unit is normally set to the storage rack.<br>2. After corrective actions, initialize the instrument by turning power switch on.<br>3. If the system and tube check is successful, select restart step and continue the operation.<br>4. If the system or tube check ends in failure several times, contact AutoGen. |

# 5-1 Centrifuge

Back view

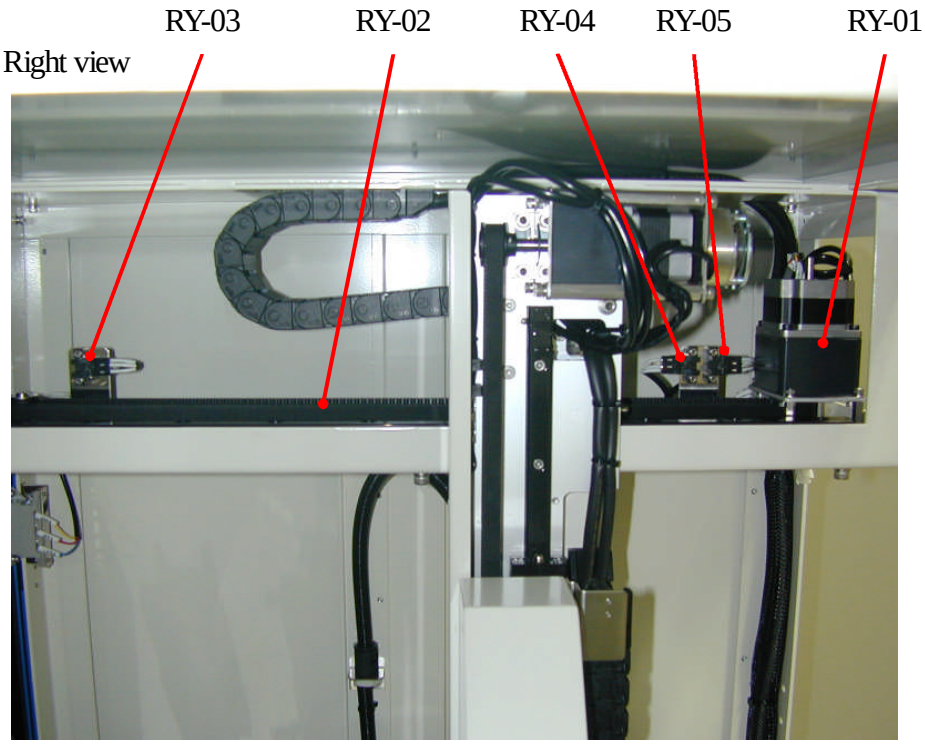



Right view




| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| CE-01 | | Centrifuge Motor | 1 | |
| CE-02 | | Imbalance sensor | 1 | |
| CE-03 | | Stepping Motor | 1 | |
| CE-04 | | Clutch | 1 | |
| CE-05 | | Rotor homo position sensor | 1 | |
| CE-06 | | Rotor position sensor | 1 | |

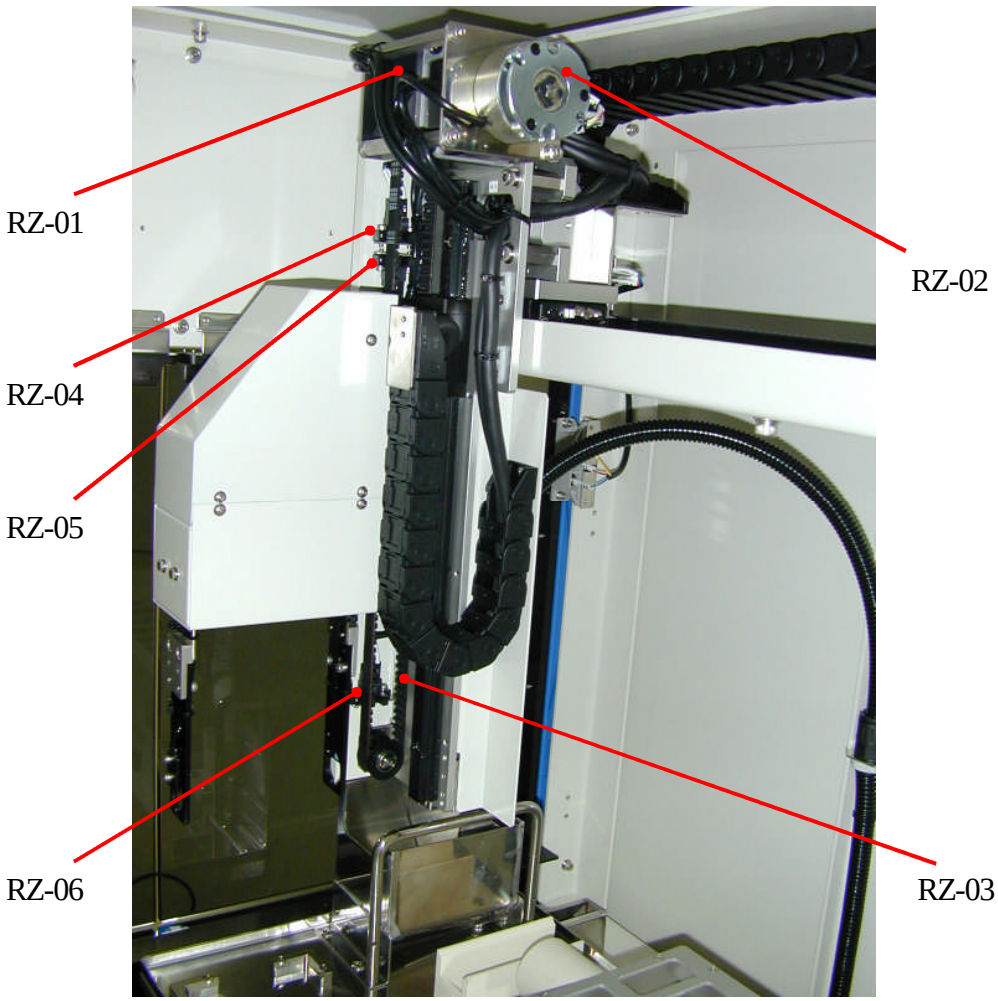
## 5-2 Transfer Robot (Y-axis)




| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| RY-01 | | Stepping Motor | 1 | PK264B2-SG10 |
| RY -02 | | Timing Belt | 1 | 150S5M1195 |
| RY -03 | | Front Limit Sensor | 1 | EE-SX671A |
| RY -04 | | Home Position Sensor | 1 | EE-SX671A |
| RY -05 | | Rear Limit Sensor | 1 | EE-SX671A |

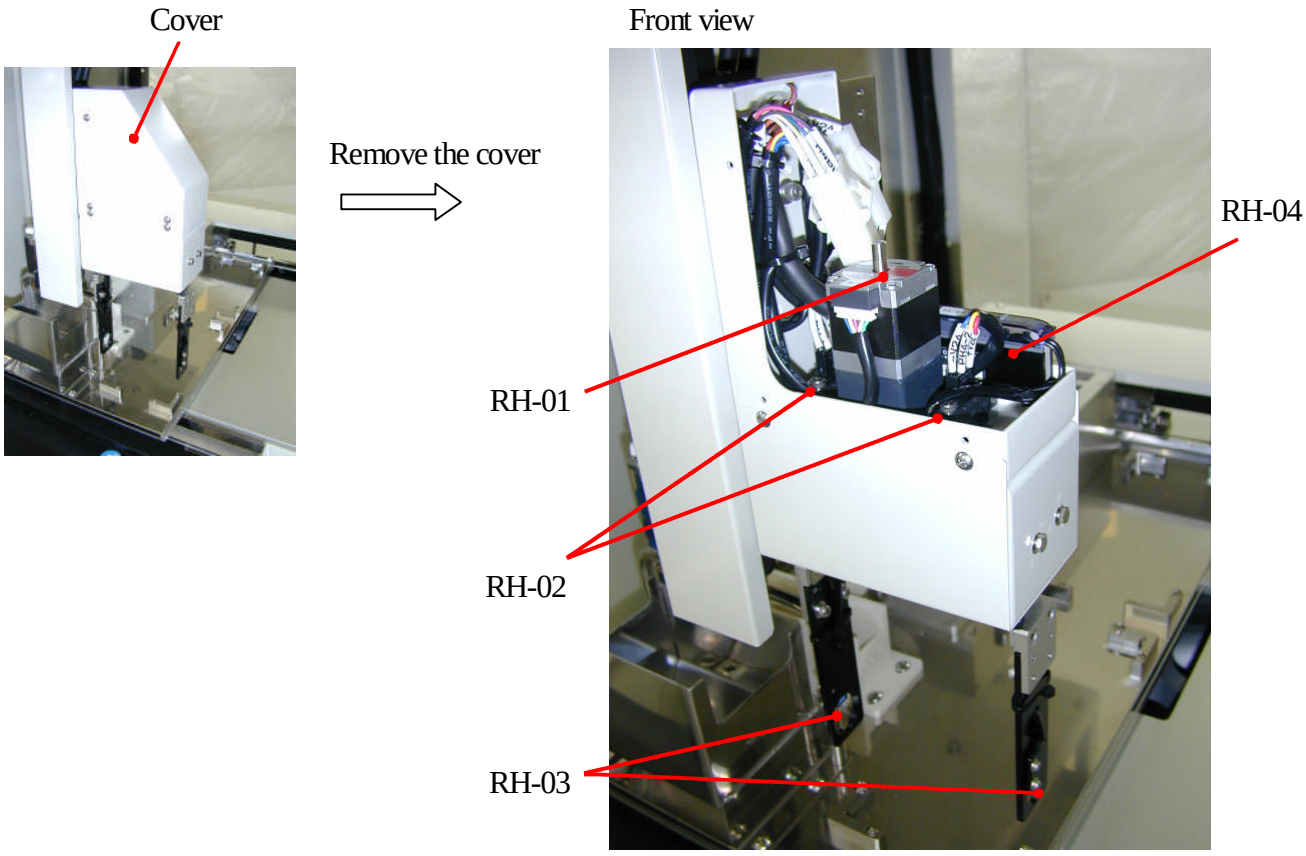
## 5-3 Transfer Robot (Z-axis)

Back view




| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| RZ-01 | | Stepping motor | 1 | PK264B2-SG10 |
| RZ-02 | | Not-excitation Brake | 1 | BXW-02-10H24V-7 |
| RZ-03 | | Timing Belt | 1 | 100S5M845 |
| RZ-04 | | Front Limit Sensor | 1 | EE-SX671A |
| RZ-05 | | Home Position Sensor | 1 | EE-SX671A |
| RZ-06 | | Rear Limit Sensor | 1 | EE-SX671A |

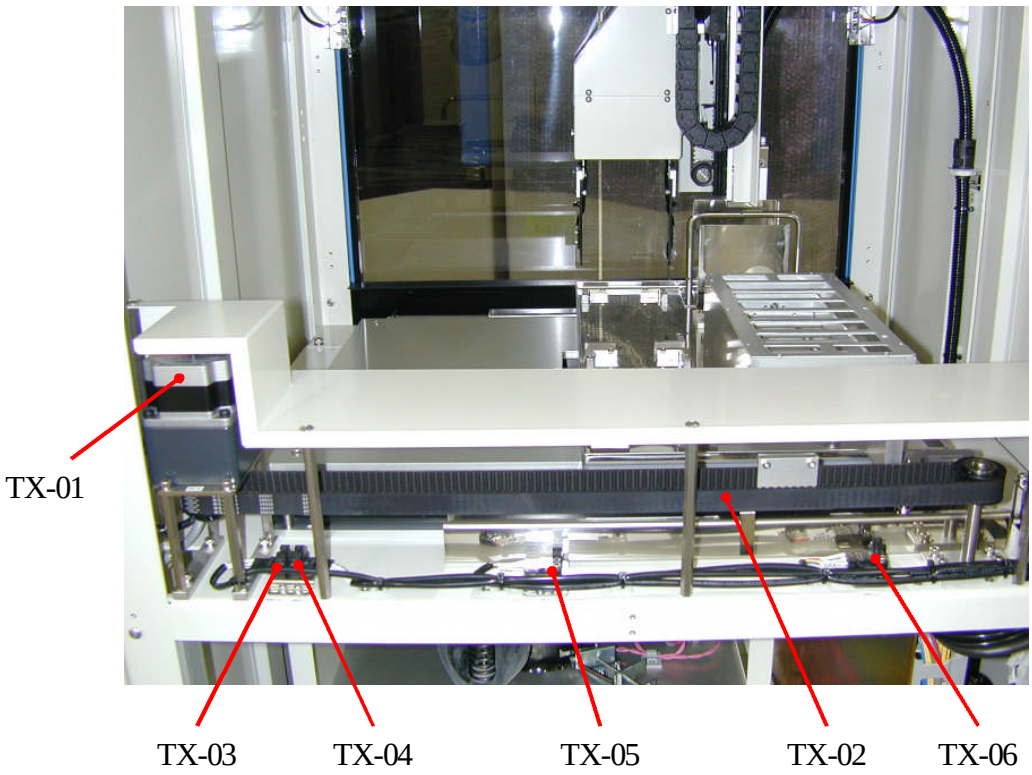
## 5-4 Transfer Robot (Hand)




| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| RH-01 | | Stepping Motor | 1 | PK223PB-SG36 |
| RH-02 | | Home Position Sensor | 2 | EE-SX670A |
| RH-03 | | Hand Grip Sensor | 2 | PS-56 |
| RH-04 | | Sensor amplifier | 1 | PS-T1 |

## 5-5 Table (X axis, Back View)

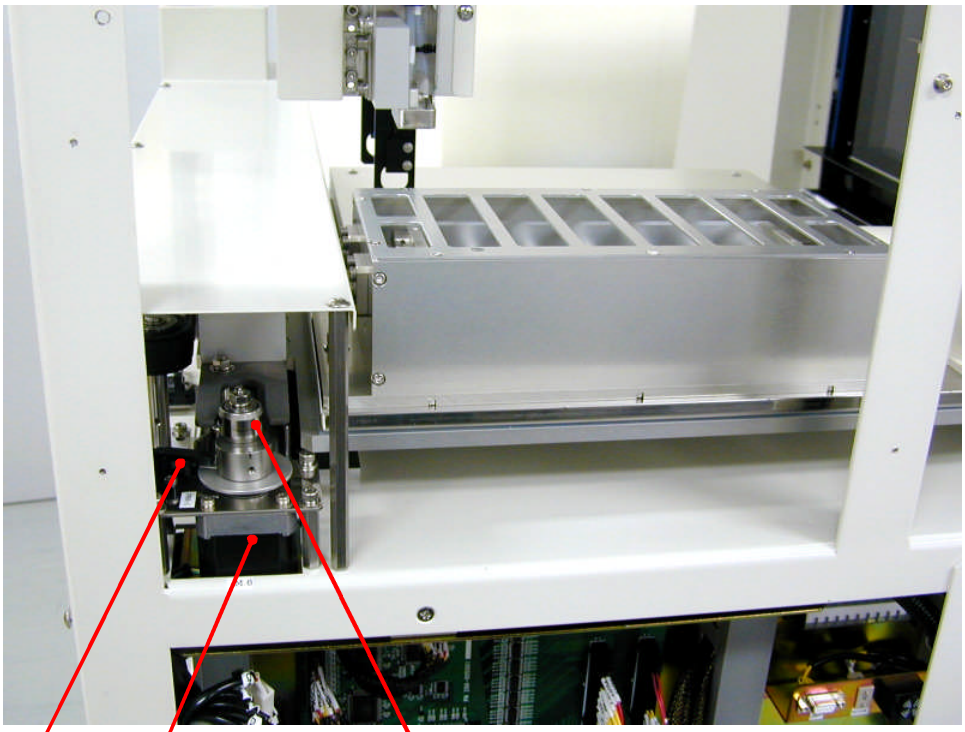
Back view




| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| TX-01 | | Stepping Motor | 1 | PK264B2-SG10 |
| TX-02 | | Timing Belt | 1 | 150S5M1125 |
| TX-03 | | Right Limit Sensor | 1 | EE-SX671A |
| TX-04 | | Home Position Sensor | 1 | EE-SX671A |
| TX-05 | | Centrifuge Close Sensor | 1 | EE-SX671A |
| TX-06 | | Left Limit Sensor | 1 | EE-SX671A |

## 5-6 Table (X axis, Left View)

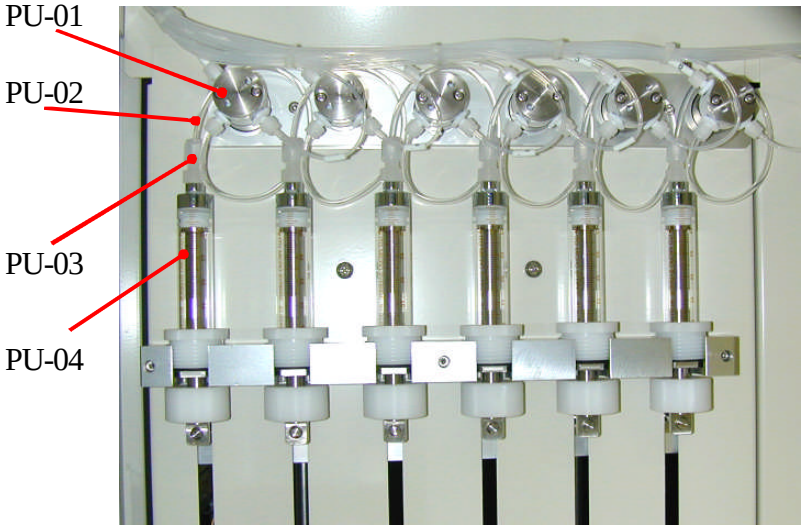
Left view



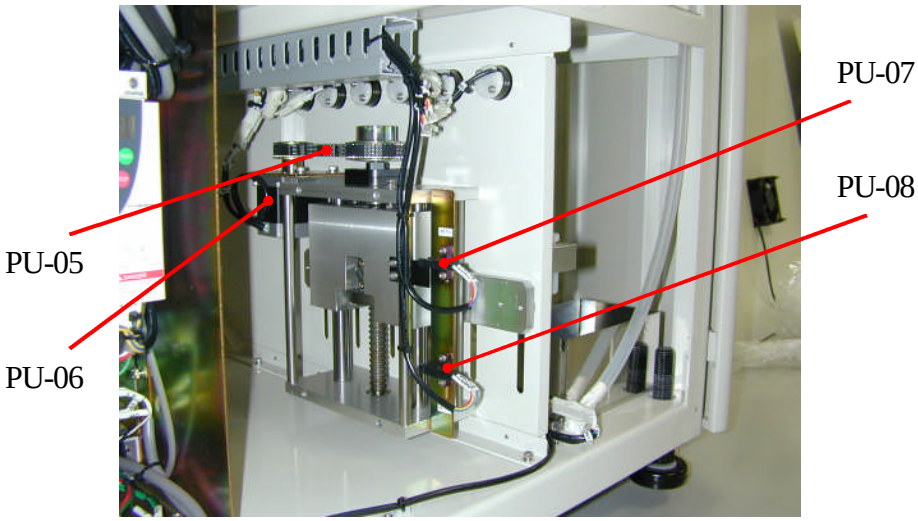

| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| AG-01 | | Stepping Motor | 1 | PK245-01B |
| AG-02 | | Bearing | 1 | DDL-1360ZZ |
| AG-03 | | Home Position Sensor | 1 | EE-SX672 |

## 5-7 Dispenser Channel

Front View



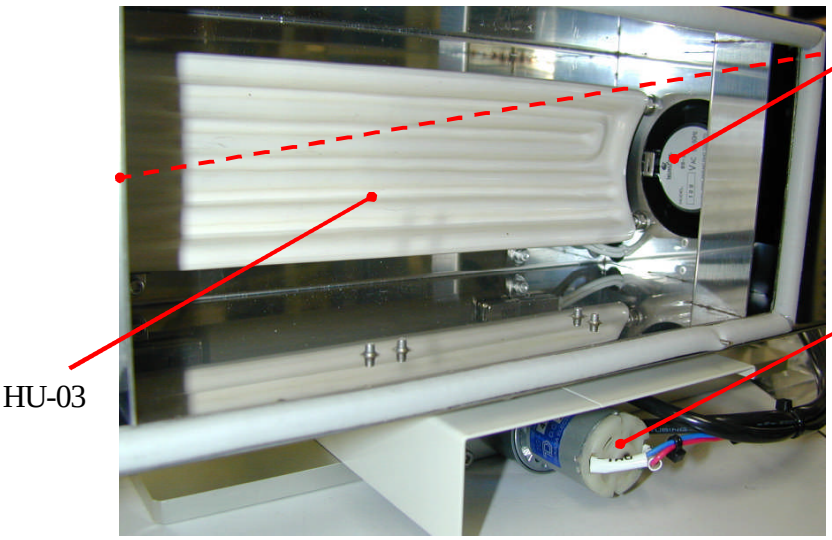

Left view



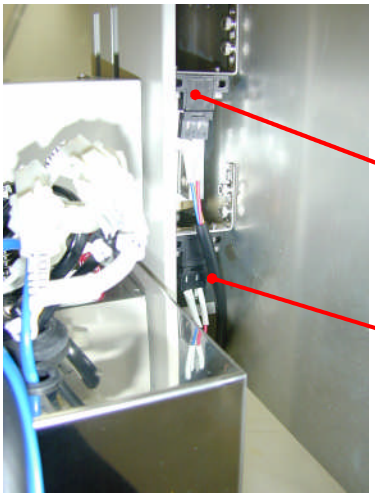

| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| PU-01 | | Three directions electromagnetic valve | 6 | AV-2312-11D |
| PU-02 | | Valve Joint | 18 | 44630 |
| PU-03 | | Lure Connector | 6 | SRB-3 |
| PU-04 | | Syringe | 6 | MS-GLLX00DH |
| PU-05 | | Timing Belt | 1 | B100S5M350 |
| PU-06 | | Stepping Motor | 1 | PK266-01B |
| PU-07 | | Home Position Sensor | 1 | EE-SX672A |
| PU-08 | | Lower Limit Sensor | 1 | EE-SX672A |

## 5-8 Heater Unit

Inside Heater Chamber




Back view

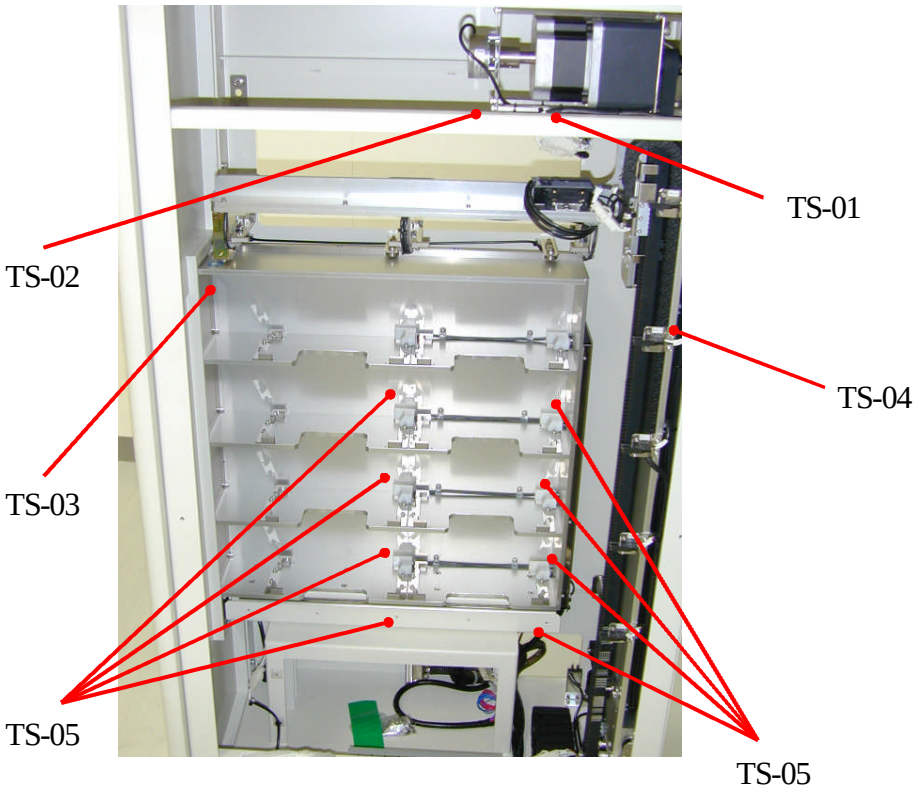



Front view

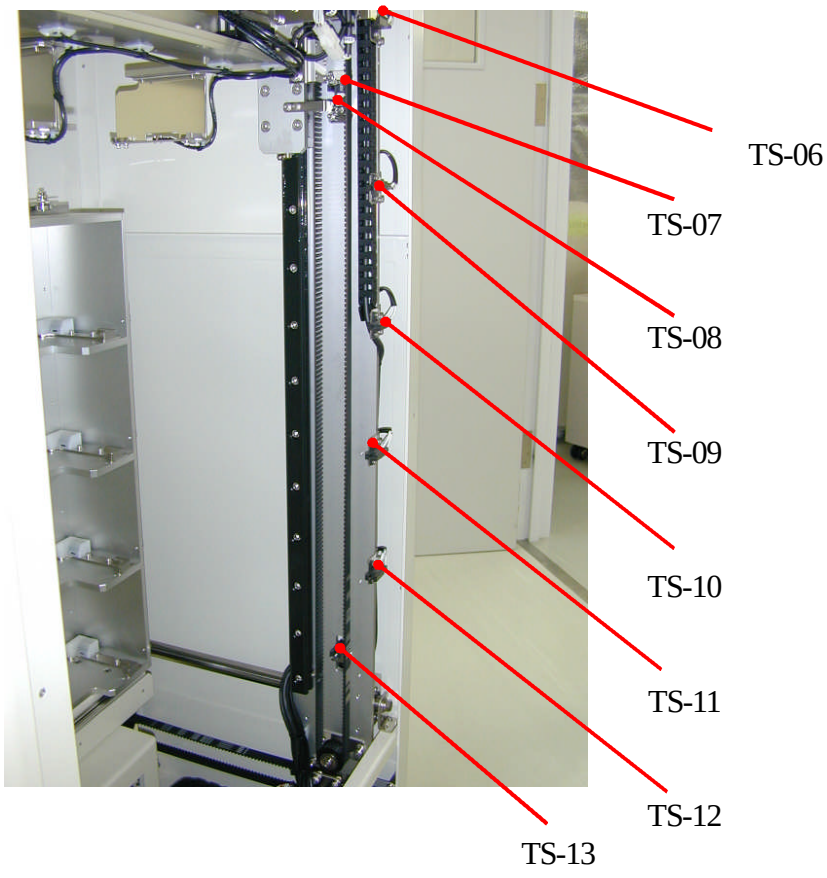

| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| HU-01 | | Heat-resistant Fan | 2 | 60-2 |
| HU-02 | | DC Motor | 1 | TG-47C-SG 1/25 24V |
| HU-03 | | Far-infrared radiation ceramic Heater | 1 | S-I type 100V 400W |
| HU-04 | | Upper position sensor | 1 | EE-SX671A |
| HU-05 | | Low position sensor | 1 | EE-SX671A |
| HU-06 | | Thermal regulator | 1 | E5CN-Q2HBTC |

## 5-9 Sample Stacker, (the TS-200)

Right view

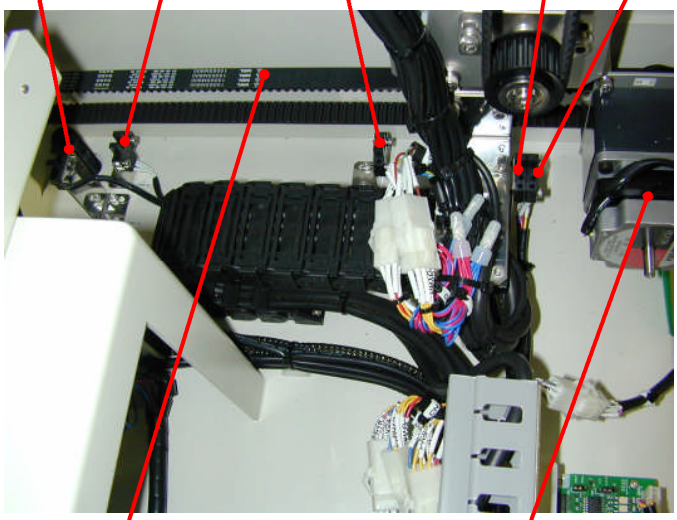



Right



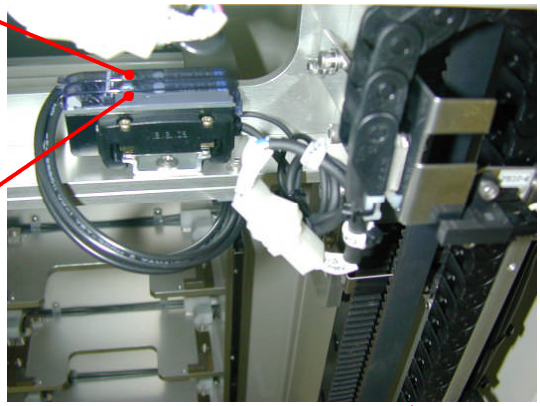
Right View

TS-16 TS-17 TS-18 TS-19 TS-20



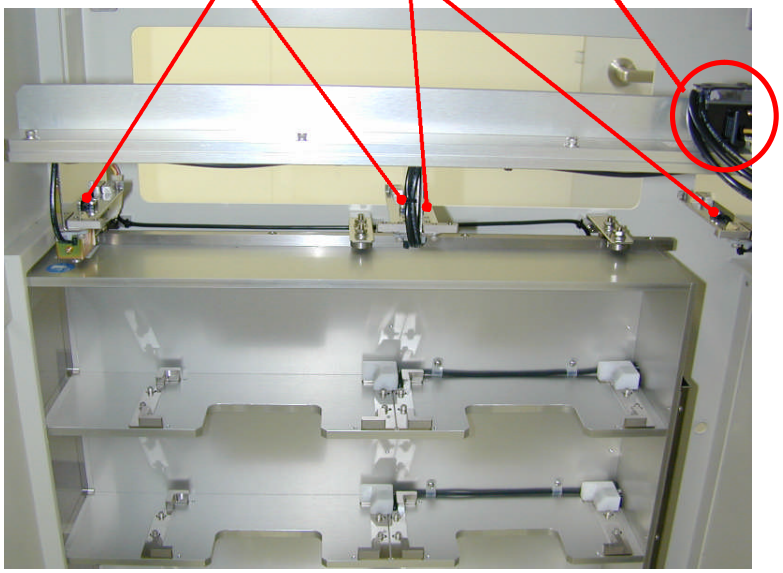
TS-22 TS-15 TS-14

TS-21



TS-23 TS-24

Right View



## 5-10 Composition of Sample Stacker

| No. | Code | Item | Number | Standard |
|---|---|---|---|---|
| TS-01 | | Stepping Motor (Z) | 1 | CSK296BP-SG7.2 |
| TS-02 | | Not-excitation Brake | 1 | BXW-02-10H24V-7 |
| TS-03 | | Solenoid Rock | 1 | LE-33-12 |
| TS-04 | | Timing belt (Z) | 1 | 150S5M2000 |
| TS-05 | | Tube Rack Set Sensor | 1 | EE-SPY802 |
| TS-06 | | Supply Position Sensor | 1 | EE-SX672A |
| TS-07 | | Upper Limit Sensor | 1 | EE-SX673A |
| TS-08 | | Home Position Sensor | 1 | EE-SX673A |
| TS-09 | | First Position Sensor | 1 | EE-SX672A |
| TS-10 | | Second Position Sensor | 1 | EE-SX672A |
| TS-11 | | Third Position Sensor | 1 | EE-SX672A |
| TS-12 | | Fourth Position Sensor | 1 | EE-SX672A |
| TS-13 | | Lower Limit Sensor | 1 | EE-SX673A |
| TS-14 | | Stepping Motor (X) | 1 | PK264B2-SG36 |
| TS-15 | | Timing belt (X) | 1 | 150S5M900 |
| TS-16 | | Left Limit Sensor | 1 | EE-SX670A |
| TS-17 | | Tube Rack Supply Position Sensor | 1 | EE-SX670A |
| TS-18 | | Tube Rack Catch Position Sensor | 1 | EE-SX670A |
| TS-19 | | Home Position Sensor | 1 | EE-SX670A |
| TS-20 | | Right Limit Sensor | 1 | EE-SX670A |
| TS-21 | | Sample tube rack capture Sensor Amplifier | 1 | PS-T1 |
| TS-22 | | DNA tube rack capture Sensor Amplifier | 1 | PS-T2 |
| TS-23 | | Sample tube rack capture Sensor Amplifier | 1 | PS-52 |
| TS-24 | | DNA tube rack capture Sensor Amplifier | 1 | PS-52 |