World's Best Dental Imaging Company

PaX-Primo

Service Manual

for the expert

Caring Insight

VATECH

Table of Contents

SYMBOLS USED IN THIS MANUAL

In order to effectively relay information and emphasize significant descriptions, the following symbols are used in this manual:

This sign provides useful information or matters to be aware of with regards to the instructions supplied in the manual.

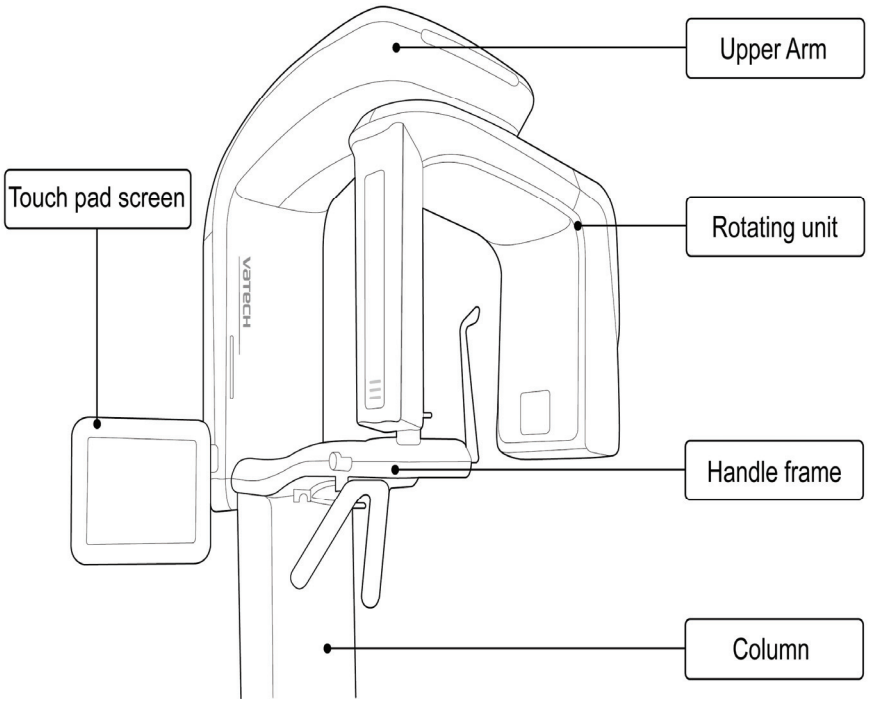
This contains safety related instructions for the use of the product. Ignoring such instructions may cause faulty operation and fatal damage to the product.

This contains important instructions for the use of the product. Ignoring such instructions may cause serious injuries to the equipment user or to the patients.

When this symbol is indicated, it means that an extreme precautionary measure is required. Otherwise, serious damages may be caused to the system.

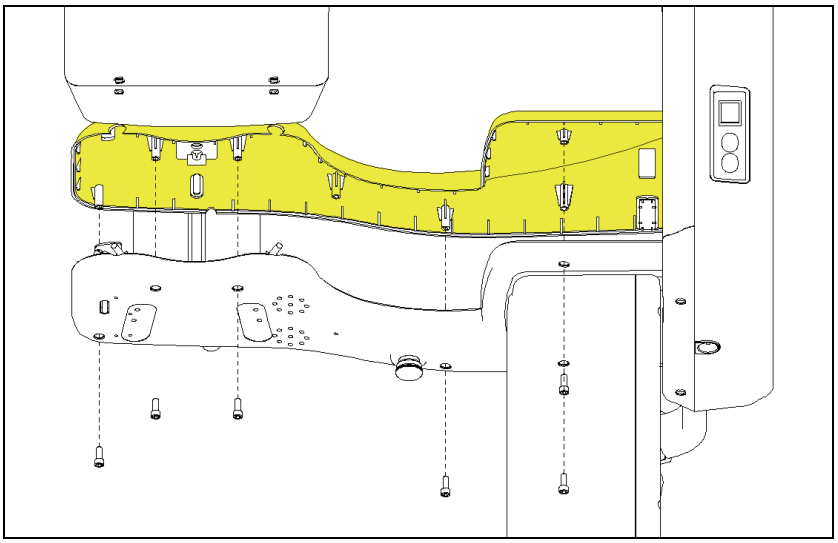
Chapter 1 Equipment Disassembly and Reassembly

1.1 Fundamental Equipment Parts

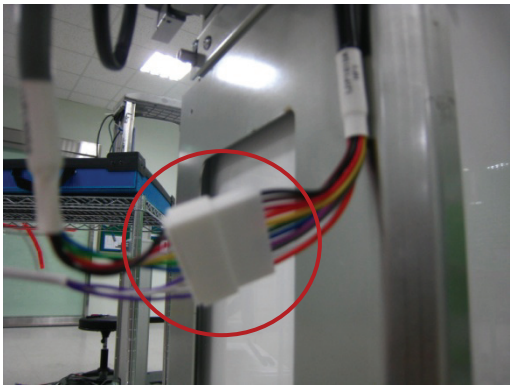


1.2 Disassembly of the Handle Frame

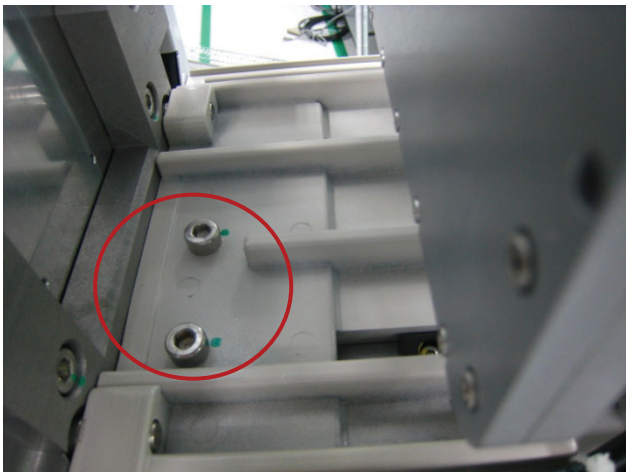
1. Take the 6 rubber caps off, and then remove the 6 Truss Bolts from the handle frame. Then detach the upper cover of the handle frame, as shown in the figure.



2. Disconnect the Connector P1010A and the connection cable P1008A for emergency switch.




3. Loosen up 2 bolts, as shown in the figure, then disassemble the Handle frame.

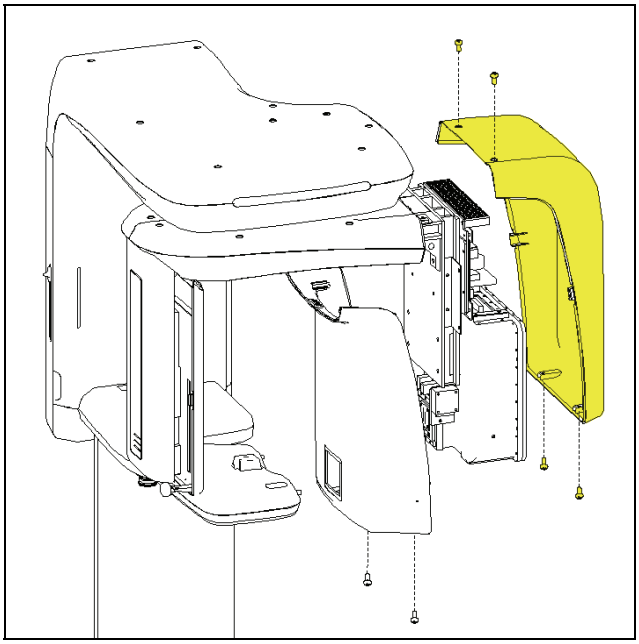


1.3 Disassembly of the Rotating unit

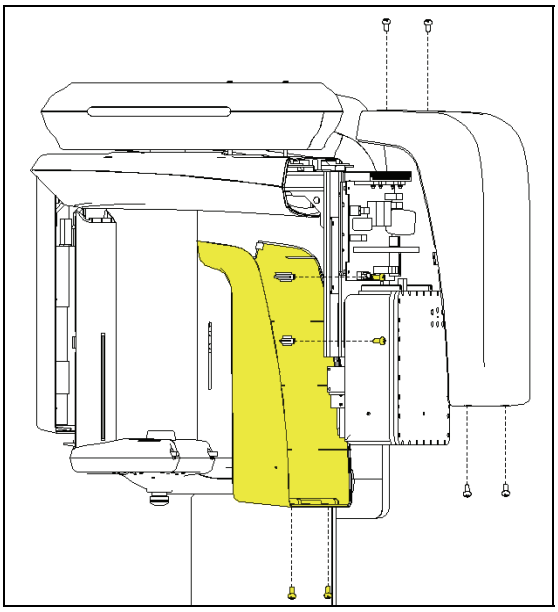
1.3.1 Disassembly of the device

1. Remove the side panel, as shown below.

2. Detach the outer cover of the rotating unit. The outer case can be disassembled by removing 4 Truss bolts from the top and bottom of the casing, as illustrated below.



3. Take the 2 Truss bolts off the bottom of the inner case of the rotating unit; then detach the case by removing 4 more bolts from inside the case.



4. Take the 6 rubber caps off, and then remove the 6 Truss Bolts. Then loosen the screws and detach the upper cover of the Rotating Unit, as shown in the figure.

1.3.2 Dismantlement of the Circuit Board inside the Unit

NOTE

The disassembly of circuit boards inside the Rotating Unit for replacement purposes needs to be done only after disconnecting the external parts of the rotating unit. The following procedure only provides descriptions of the circuit board part. On the other hand, always make sure to avoid bending the Pin when you connect or disconnect the cables. When you reassemble the circuit board after a replacement, check the cable markings upon disconnection or fastening of cables from and to the board in order to make sure that no mistake is made.

1. Inverter Board

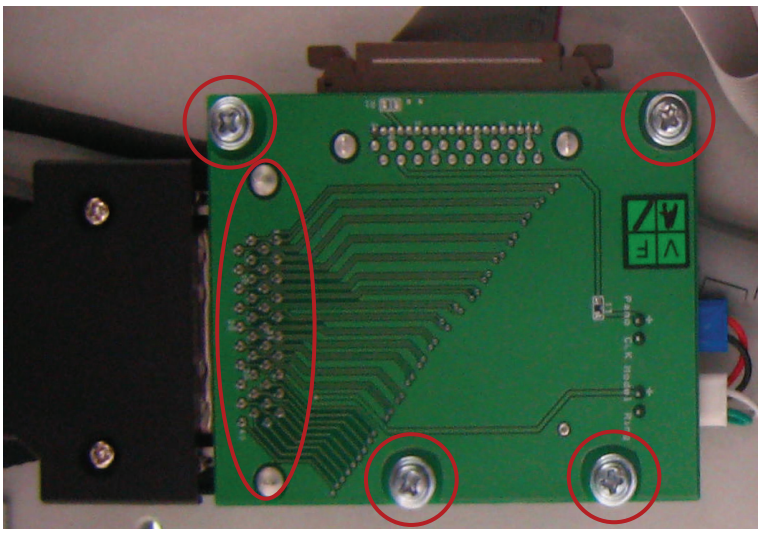
For replacement of Inverter board, please refer to the *Tube head replacement* section of *Major Parts Replacement.*

IMPORTANT

Tube and inverter board should be replaced together as 1 set. So when you replace the inverter, you also have to replace the tube. This is because, upon manufacturing, various parameters were set for optimal condition of each part. So if only one of the two parts is changed, recalibration will be required.

2. Sensor Board

① First, remove the 3 screws, which are located at the Pano cable (black: 40pin) connector holder. (See the following figure.)



② Detach the data cable (40 pin), which is connected from the board to the sensor module.

③ Then disconnect Cable P1036A and P1036A.

④ Remove the 4 screws.

3. Power Board Disassembly and Assembly

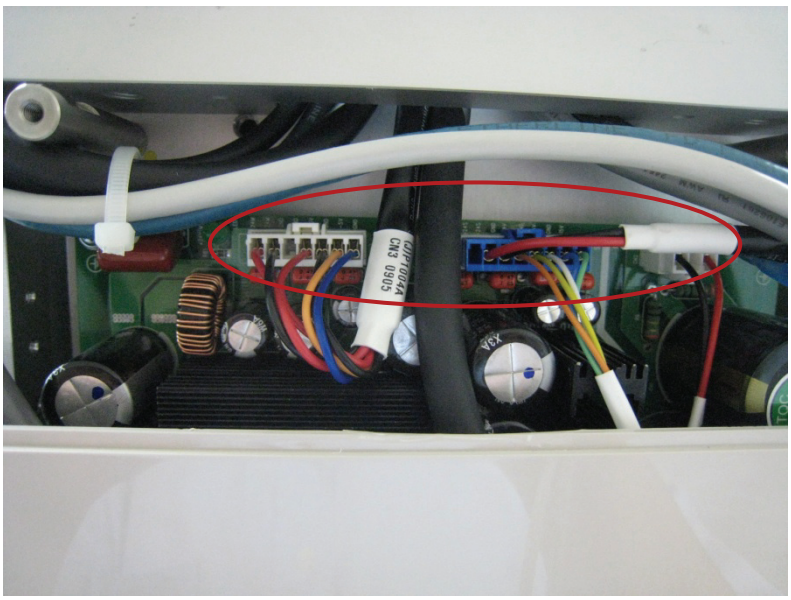
IMPORTANT

By way of caution, the following should be heeded and applied with when replacing the Power board.

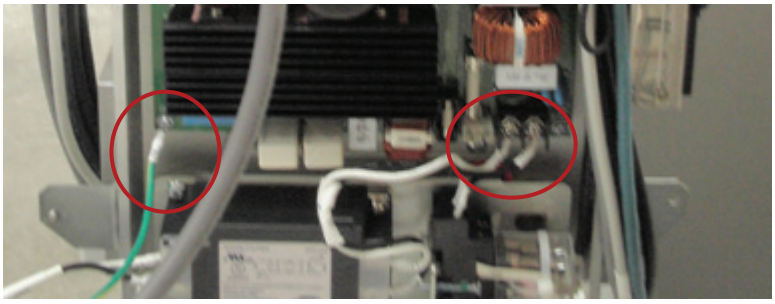
- **While work is being carried out, the power supply cable should be shut off.**
- **Even after the power supply is shut off, there may still be some residual electric charge in each of the Capacitors of the Board for some time, which can still cause electric shock. Therefore, start working on the replacement only after a certain time has passed. (After completely discharging the residual electricity.)**
- **After replacing the board, the grounding cable should be tightly fastened with screws.**

Once the power board is disassembled, replace it in the following sequence.

① Carefully disconnect 3 cables, as shown in the figure.



② Disconnect the cables located at the lower part of the board.

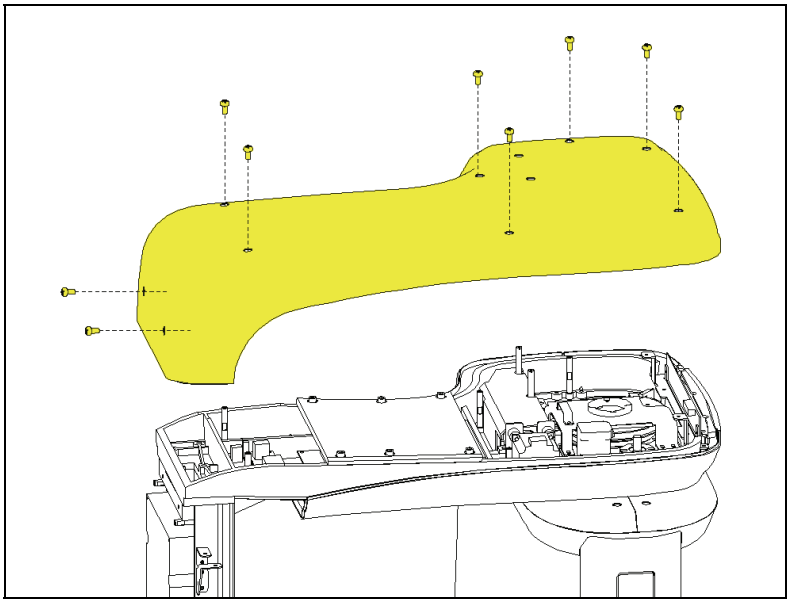


③ Undo 6 screws that fasten the board, then, replace the board with a new one. Reassemble new Power Board in reverse sequence with opposite methods accordingly.

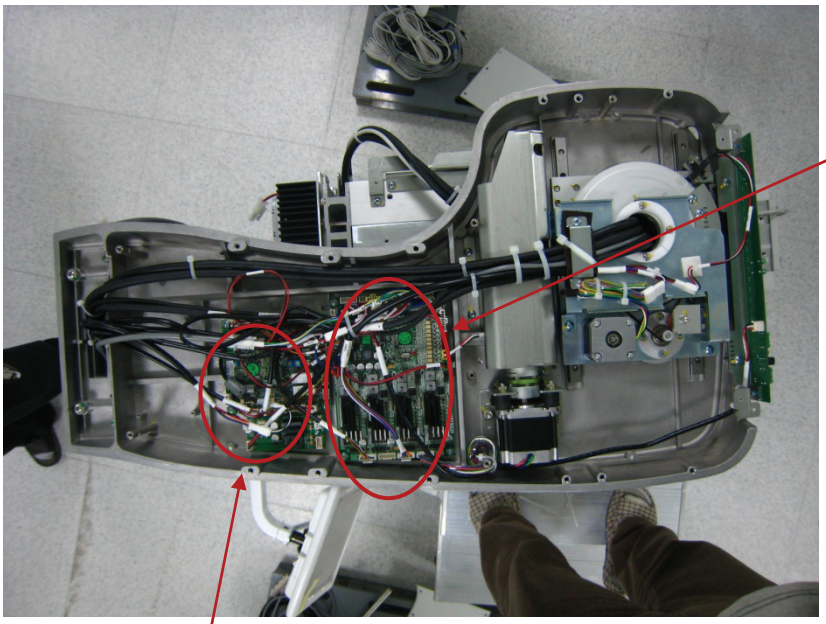
1.4 Disassembly of the Upper Arm

1.4.1 Disassembly of the Device

1. Remove 9 pieces of Truss bolts from the top casing of the arm, as shown in the figure, then detach the upper casing.



2. After which, the circuit board connection will be exposed.
   The circuit board consists of 2 MCU Boards, which are the 4AXIS MCU and the Column MCU.



1.4.2 Removal of the Boards

1. 4AXIS MCU Board

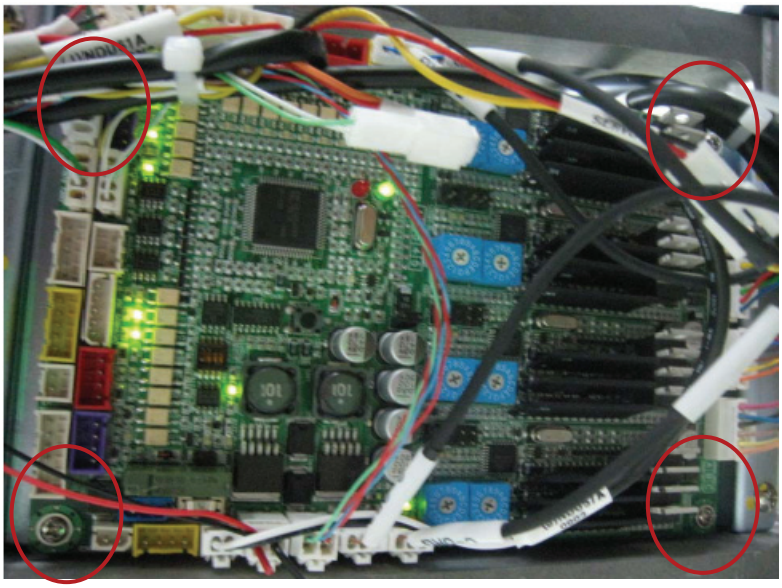
IMPORTANT

Depending on the cable type, there could be a number of pins, from 2 to 8, which could be difficult to separate as well as to make recombination. Therefore, do not use excessive force when you try to disconnect or insert the pins.

① Remove the Upper arm cover, as shown in figure 1.4.1.

② Remove all cables that are connected to the board.

③ Undo 4 screws located at the corners.

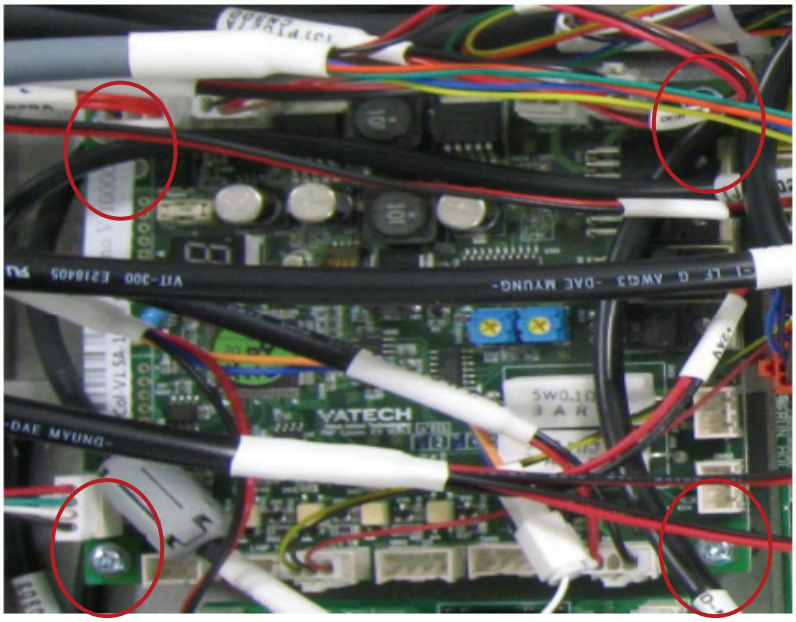


2. Column MCU Board

① Remove the Upper Arm cover, as shown in figure 1.4.1.

② Remove all cables that are connected to the board.

③ Undo 4 screws located at the corners.



Chapter 2 Detailed Connection Diagram of the Board

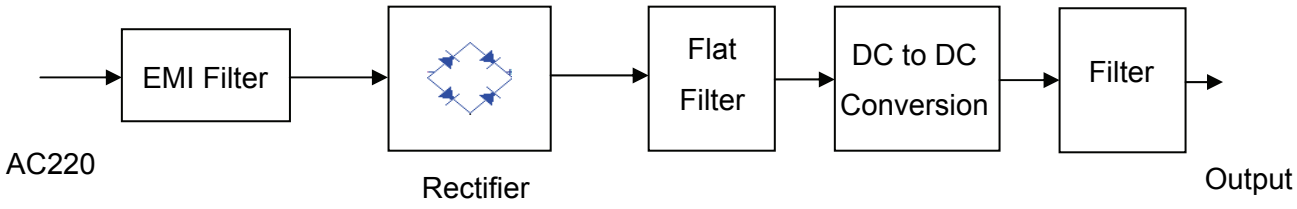
2.1 Power supply

The role of this power supply board is very important as it provides various power supply capabilities, which are required for the PaX-Primo Equipment.

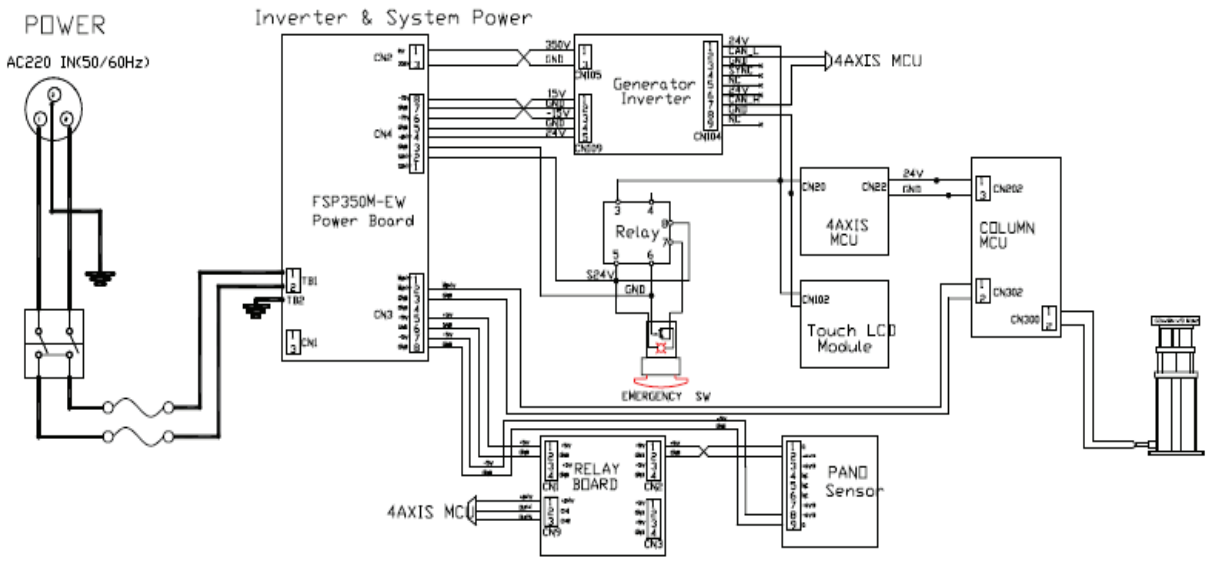
Its operation logic is the SMPS (switching mode power supply) type, which has the following advantages:

- Small-sized, lightweight but with large output.
- Reduced size of condenser for the filter.
- Relatively easy Voltage/Current Regulation.

Therefore, SMPS is widely used for many electromagnetic devices. The Block diagram below illustrates how to acquire the output:



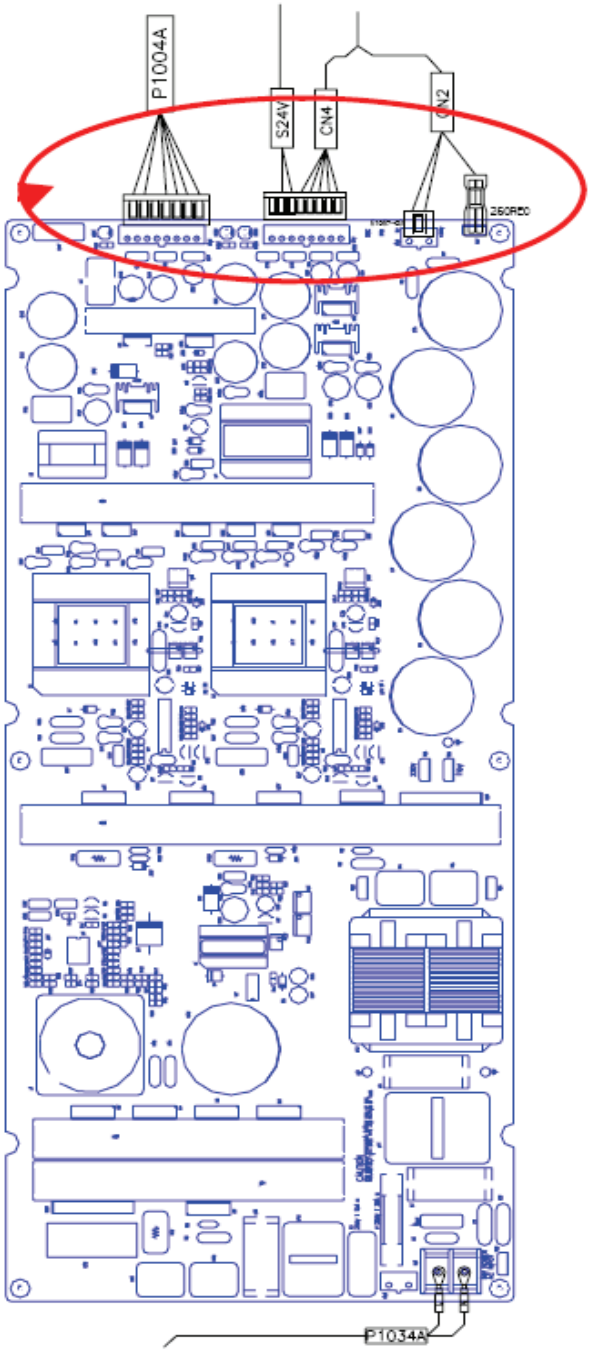
- **Circuit diagram**



- **Output Voltage by Connector**

Connector	Voltage	Supply Board
CN2(2 pins)	350V	Tube power
CN3(7 pins)	24 V	column
CN4(8 pins)	24 V	System board

- **Exterior of Board and Connector Names**

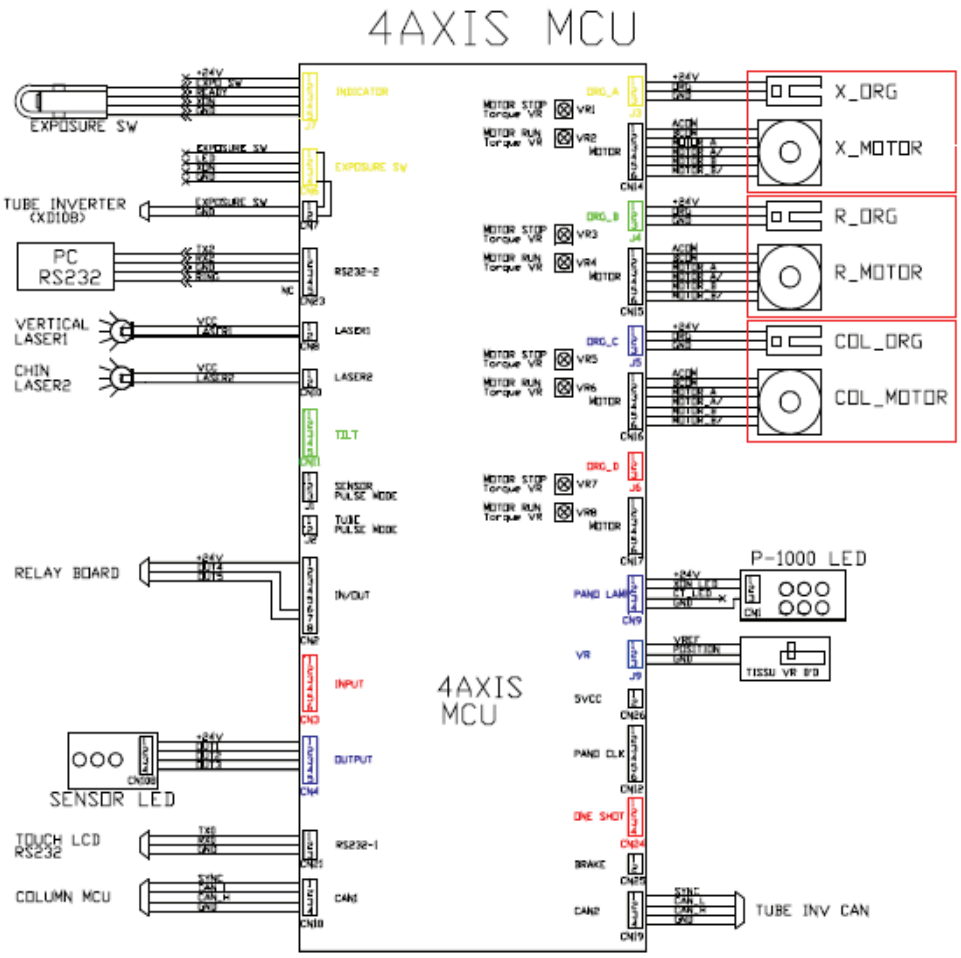


2.2 4AXIS MCU Board

1. Role of the Board

- Starts up the Motor of the Rotating unit.
- Detects the ON/OFF Limit Switch for the Rotating unit.
- Controls the Motor for Collimator Control.
- Controls the laser beam for vertical and horizontal alignment.
- For Rotator ORG and collimator ORG.
- For Pano sensor power control

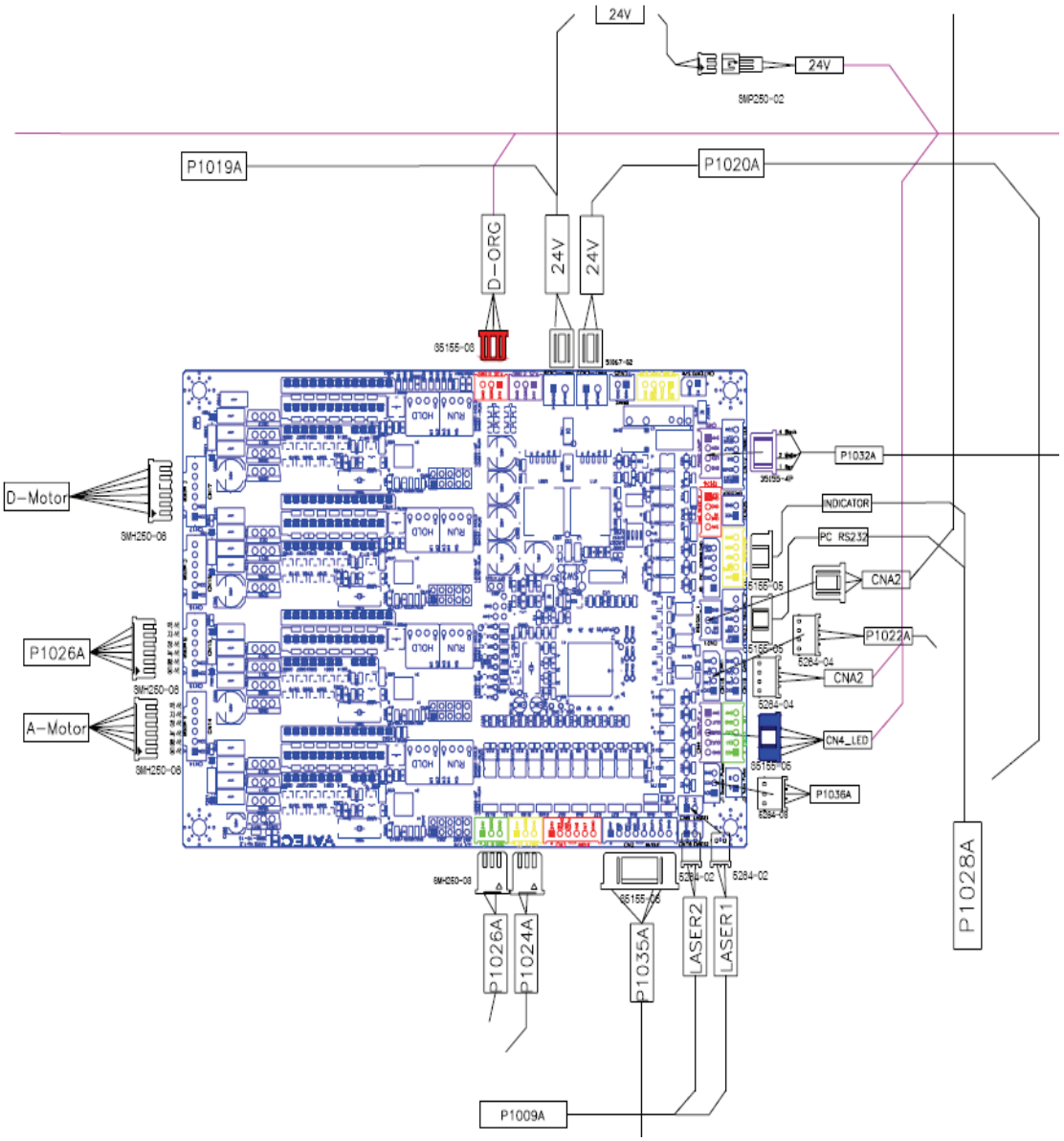
2. Circuit Diagram



3. Connector Names and Functional Descriptions

Connector Name	Number of Pins	Functional Description
J3	3	
CN14	6	X_MOTOR
J4	3	
CN15	6	R_MOTOR
J5	3	
CN16	6	COLUMN MOTOR
J6	3	
CN17	6	
CN9	4	PANO LAMP
J9	3	VR
CN19	4	CAN2:TUBE INVERTER
CN18	4	CAN1:COLUMN MCU
CN21	3	RS232-1:TOUCH LCD
CN4	5	SENSOR LED
CN2	8	RELAY BOARD
CN10	2	HORIZONTAL LASER
CN8	2	VERTICAL LASER
CN23	5	RS232-2: PC
CN7	2	INVERTER BOARD
CN6	4	EXPOSURE SWITCH

4. Exterior of the Board

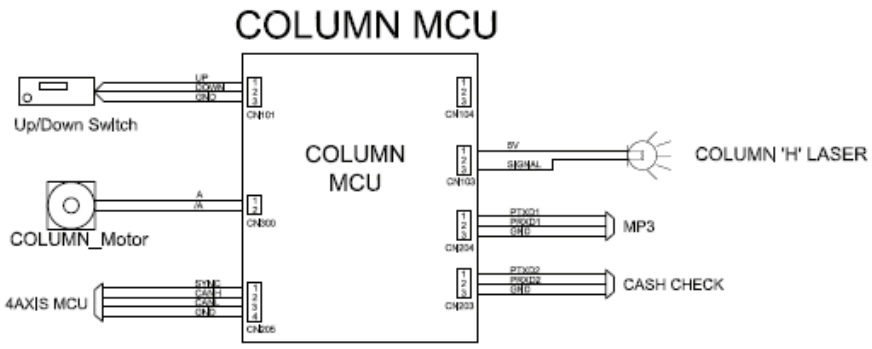


2.3 Column MCU Board

1. Role of the Board

- For Up/Down switching.
- For Column motor operation.
- For generating Vertical laser beam.

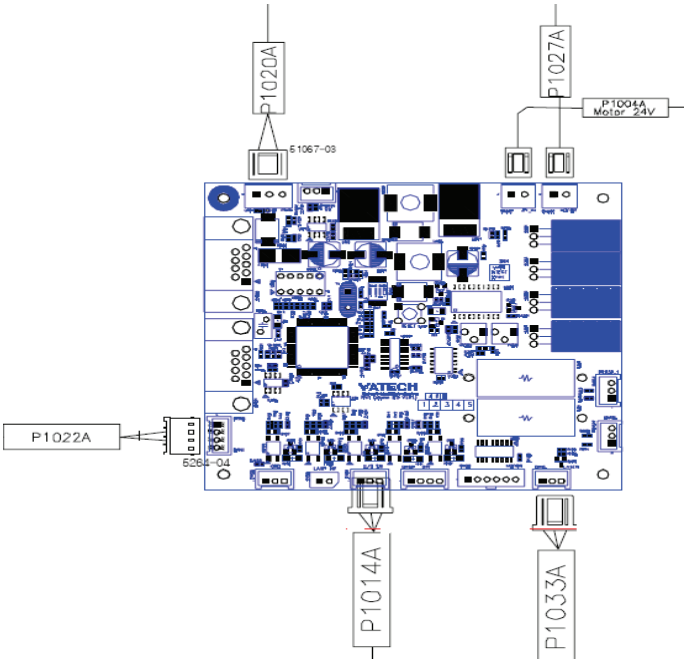
2. Circuit diagram



3. Connector Names and Functional Descriptions

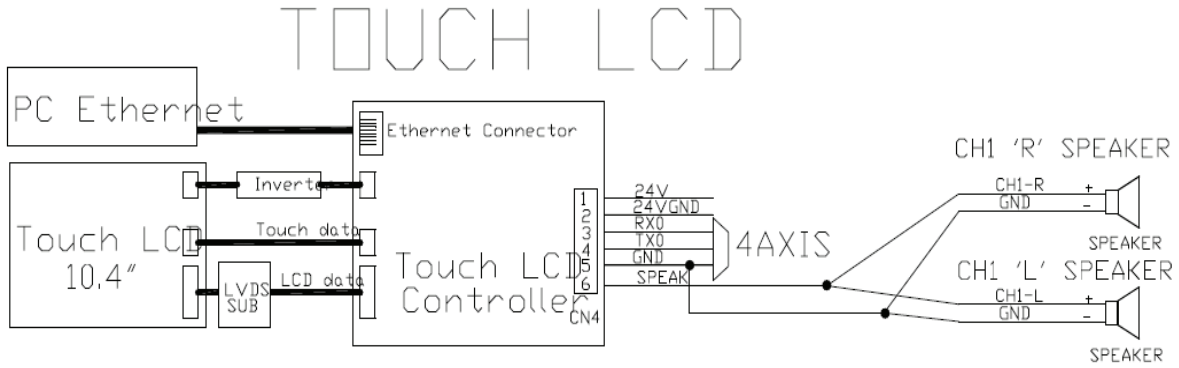
Connector Name	Number of Pins	Functional Description
CN101	3	UP/DPWN SWITCH
CN300	2	COLUMN_MOTOR
CN205	4	4AXIS MCU
CM103	2	COLUMN LASER
CN204	3	MP3 board
CN203	3	CASH CHECK

4. Exterior of the Board



2.4 Touchpad screen LCD

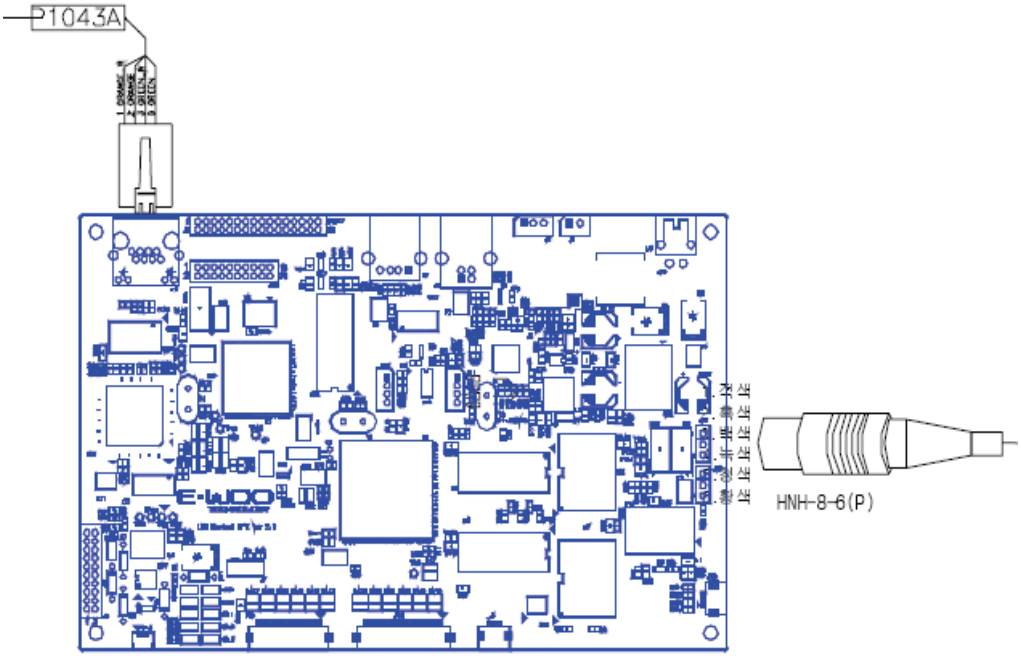
1. Circuit diagram



2. Pin connector names and functions

Connector	Number of Pins	Functional Description
CN4	6	4AXIS AND EXTERNAL SPEAKERS
Ethernet Connector		PC ETHERNET CONTROLL CARD

3. Exterior of the Board



2.5 Inverter board

Because this board operates with very high voltage applied to some parts, extreme caution is required when checking the field. Carelessness can lead to severe shock causing serious injury.

1. Role of the Board

- This board is a device for generating high voltage power that is applied between the Anode and the Cathode of the tubes.

2. Circuit diagram

3. Connector Names and Functional Descriptions

- **CN104**

  Connector for CAN Communication

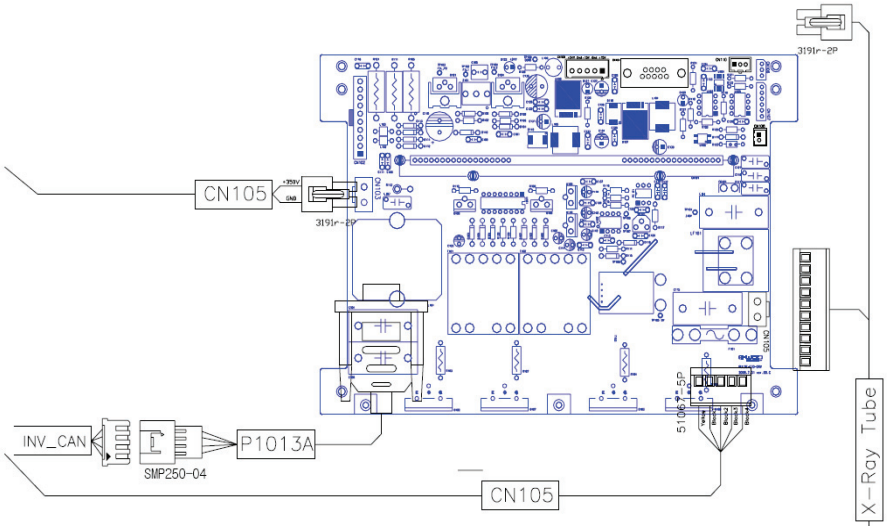
- **CN105**

Pin number	Pin name	Pin color
1	Inverter power	Red
2	NC	NC
3	Ground	Black

- **CN109**

Pin number	Pin name	Pin color
1	Power	orange
2	Ground	yellow
3	Power	green
4	Ground	Black
5	Pano sensor	white

4. Exterior of the Board

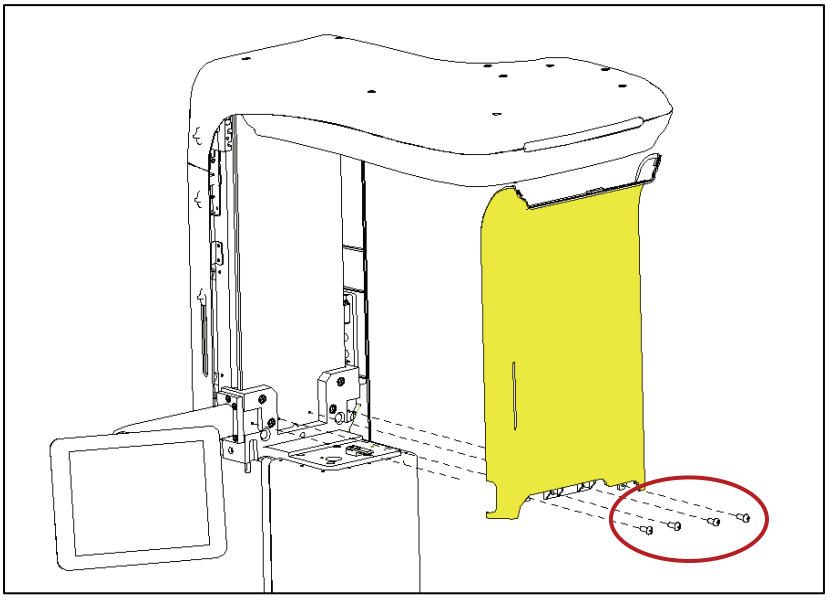


Chapter 3 Replacements of Major Parts

3.1 Sensor module replacement

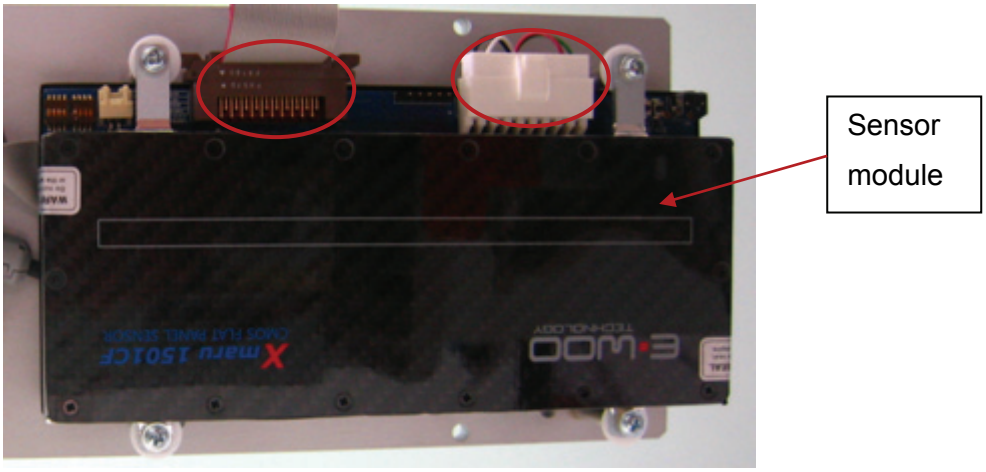
Follow the following procedures when replacing the sensor module:

1. Remove the cover of the Rotating Unit, where the sensor module is attached.

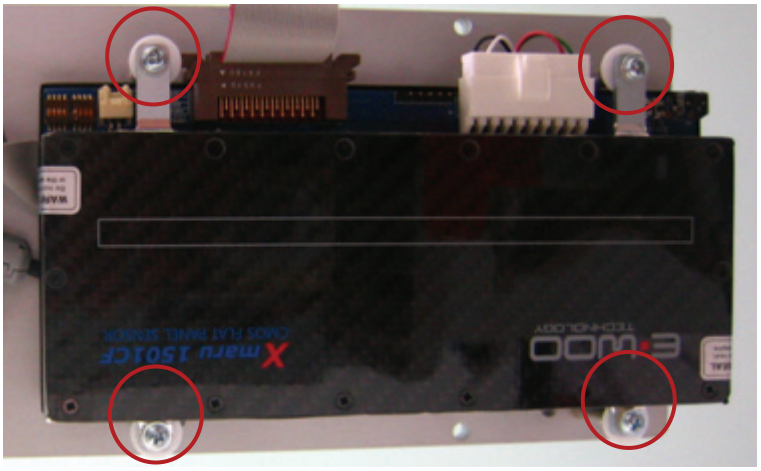


2. Check the location of the sensor module, as shown in the figure.

3. Disconnect Cable P1005A and Pano gender cable(40 Pin) from the module.



4. Loosen and remove the 4 screws, then detach and replace the module.



5. Once replacement has been completed, reassemble the whole part in the same manner as its original state.

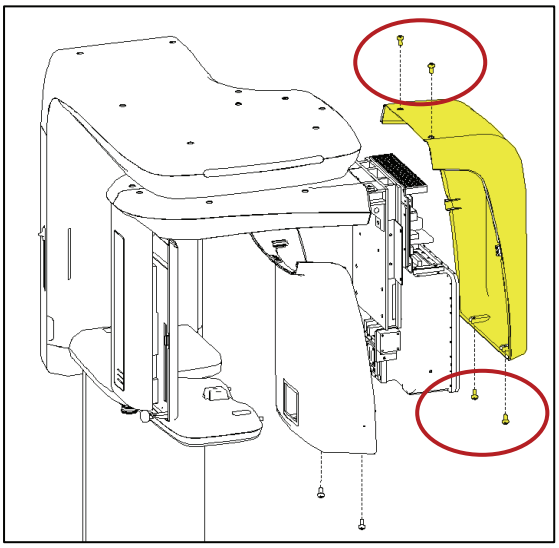
3.2 Tube head replacement

IMPORTANT

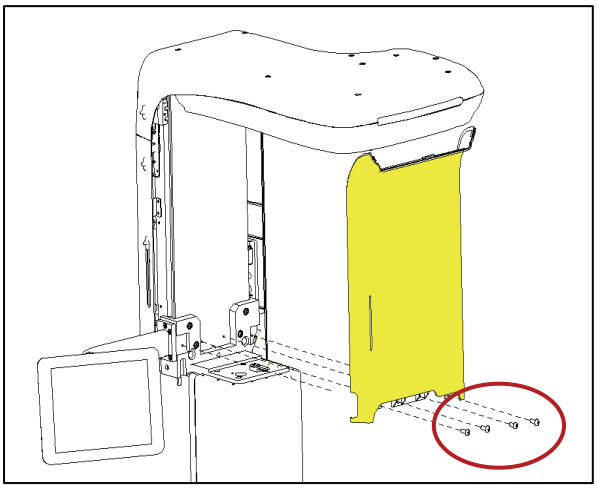
If you replace the Tube head, the Inverter board should also be replaced at the same time. This is because the connection parameters between the tube and the inverter were already set at their optimal conditions upon manufacturing.

1. First, remove the 4 rubber caps from the cover.

2. Detach the outer cover of the Tube head of the Rotating unit.

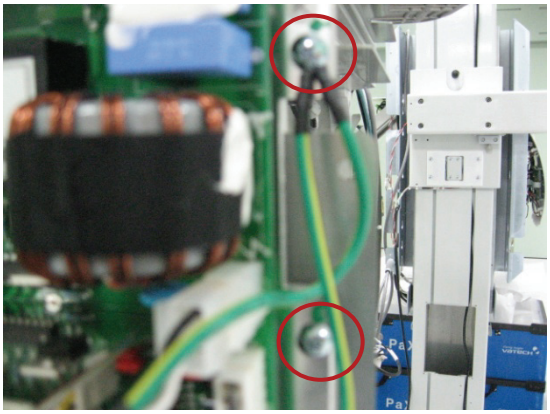


3. Detach the inner cover of the Tube head of the Rotating unit.



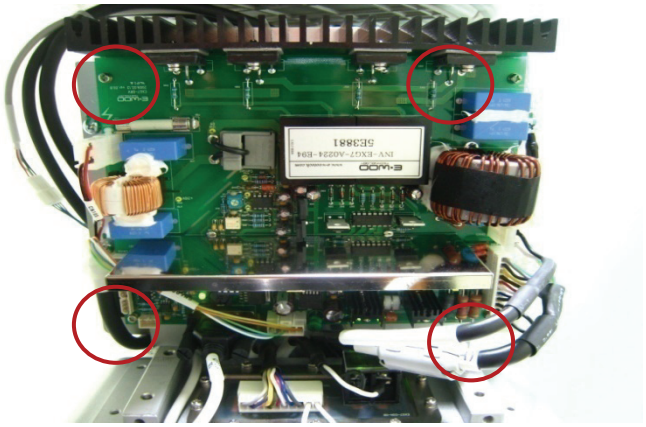
4. Then, you will be able to see the Inverter board under the tube, as shown in the figure. *Since any replacement to be done with any of the two parts would require replacement as well of the other part, it is essential that the replacement method will be that for both parts, as provided in this manual.*

5. Disconnect the board first. Then undo 4 screws for grounding, which are located at both sides of the board.

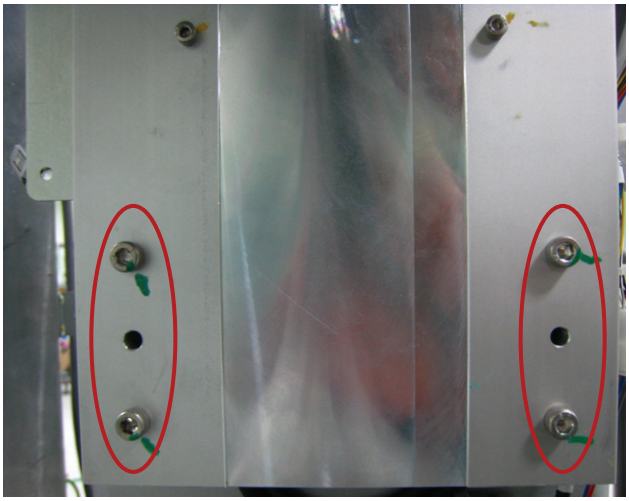


6. Disconnect cables CN105x2EA and P1013A, and the cable from the X-ray tube.

7. Remove 4 screws that support the board.



8. Then disconnect the tube.
   Remove 4 screws located inside the Rotating unit.



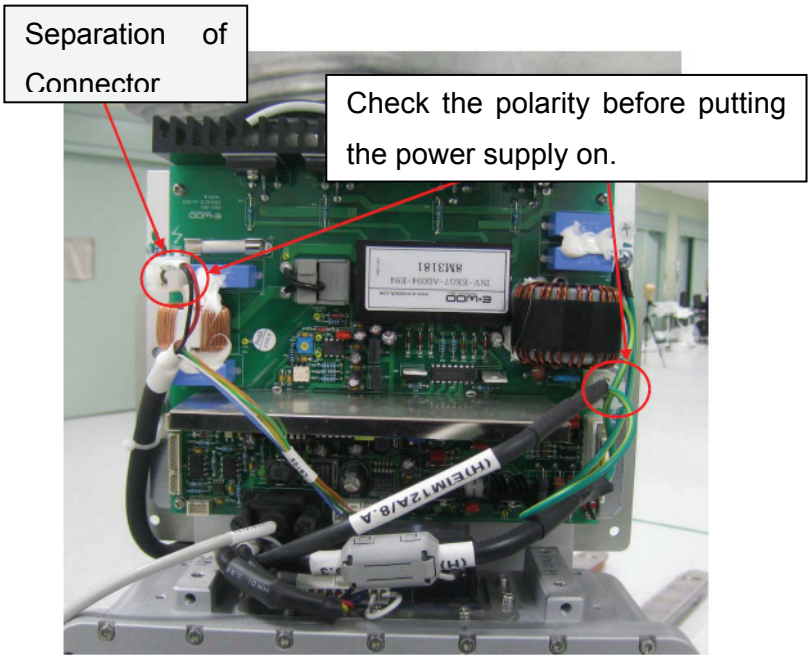
Then, both of the tube and the inverter board will be disconnected.

Reassembly

Reassemble the parts in reverse method and sequence to that of the dissembling procedure.

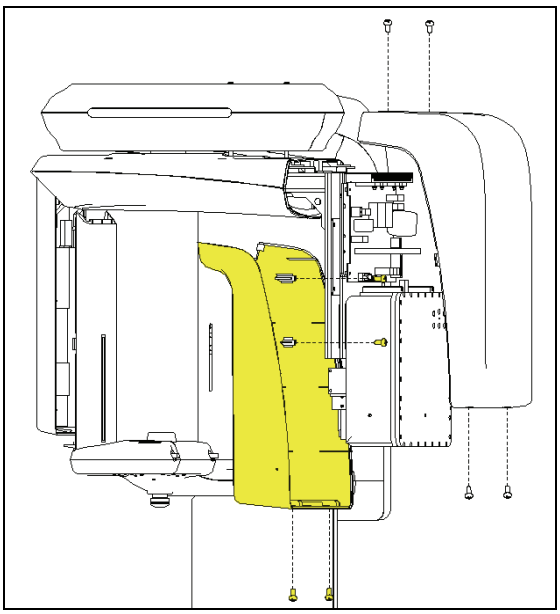
CAUTION

- **When you reassemble the parts after the replacement, make sure that there is no interference between the wires of the device and that the pins are not bent.**
- **When you do tests after reassembling the parts, make sure that there is no X-ray irradiation by separating the following connectors.**
- **The grounding line, which was disconnected at step 5, should be fastened back to its fixed location.**



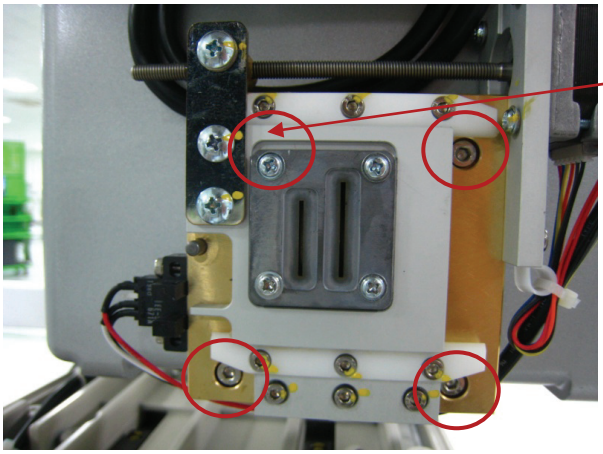
3.3 Collimator replacement

1. Remove the inner cover of the Collimator of the Rotating unit.

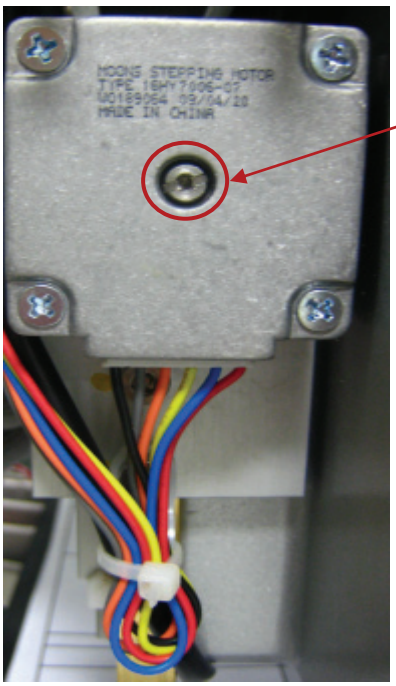


2. Disconnect the Cable (6 pins) for collimator step motor and P1025A (3 pins).

3. Then, remove 4 screws from the front side of the collimator.
   At this point, 1 of the screws will not be visible from the front view.



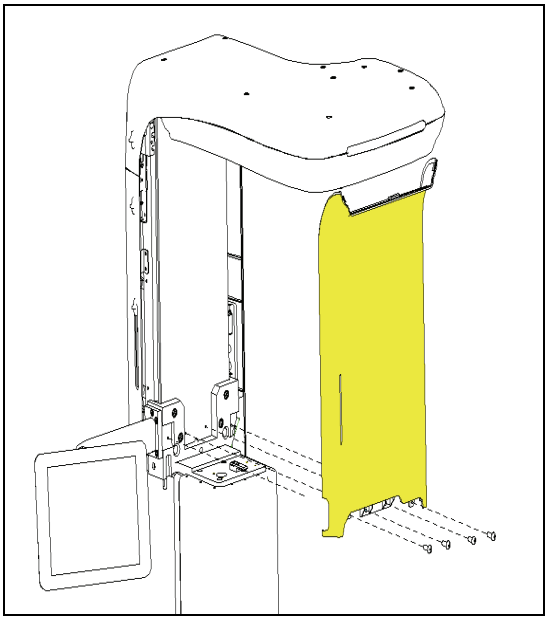
4. In order to remove the hidden screw at the upper left side, follow the procedure below:
   Use a flat head screw driver to turn the front side of the Collimator, which will move from side to side.
   Turn the Collimator until you see the screw from the front. Then, remove the screw.



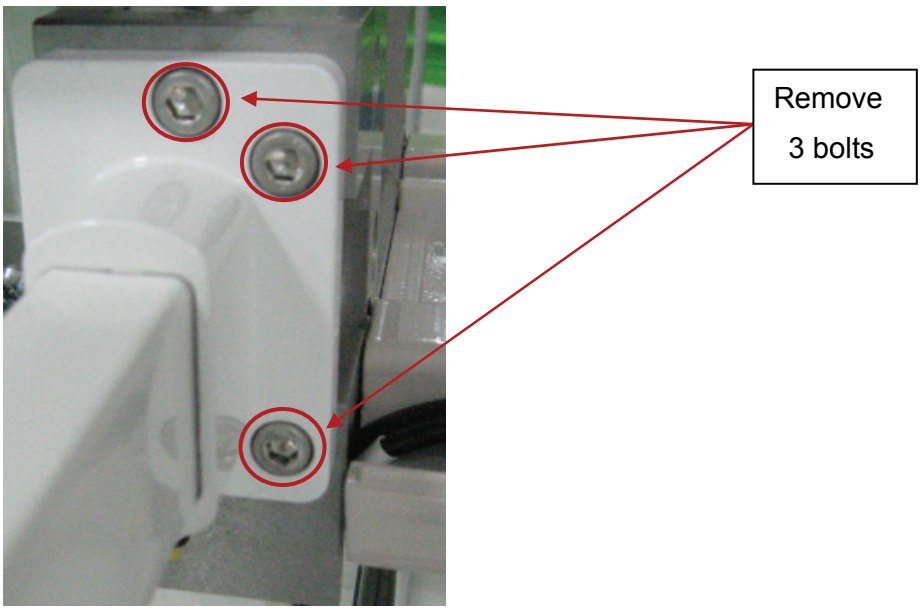
Reassemble the parts in reverse method and sequence to that of the removal procedure. You must align the collimator after reassembly.

3.4 Touchpad screen (LCD) replacement

1. Detach the covers of the Rotating unit.



2. Expose the connecting area of the Touch pad screen.
   From this point, the LCD Panel can be removed by unscrewing 3 bolts.



3. As a final step, take out the cable connected to the LCD.

Chapter 4 Voltage Measurement and Measured Voltage of the Board

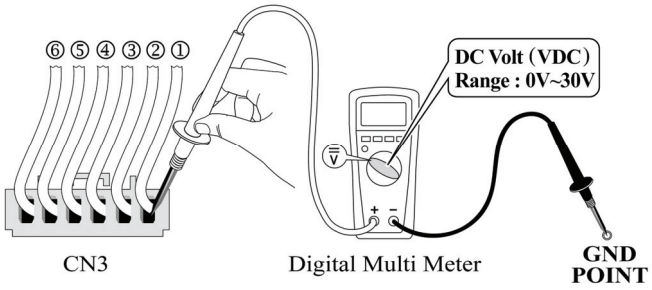
1. Important Notices:

- Doing voltage measurements require utmost caution to ensure that there is no concurrent contact between the pin to be measured and its neighboring pins.
- Before doing measurements, you must discharge all accumulated static electrical charges in your body because there are parts attached on the circuit board which are very sensitive to static electricity. Wearing a discharge pad on your arms is one of the methods of draining away the static electricity.
- Make sure that the equipment is well grounded.
- Avoid rough handling when separating the cables from the connectors.
- If necessary, request for assistance.

2. Required tools and Measurement devices :

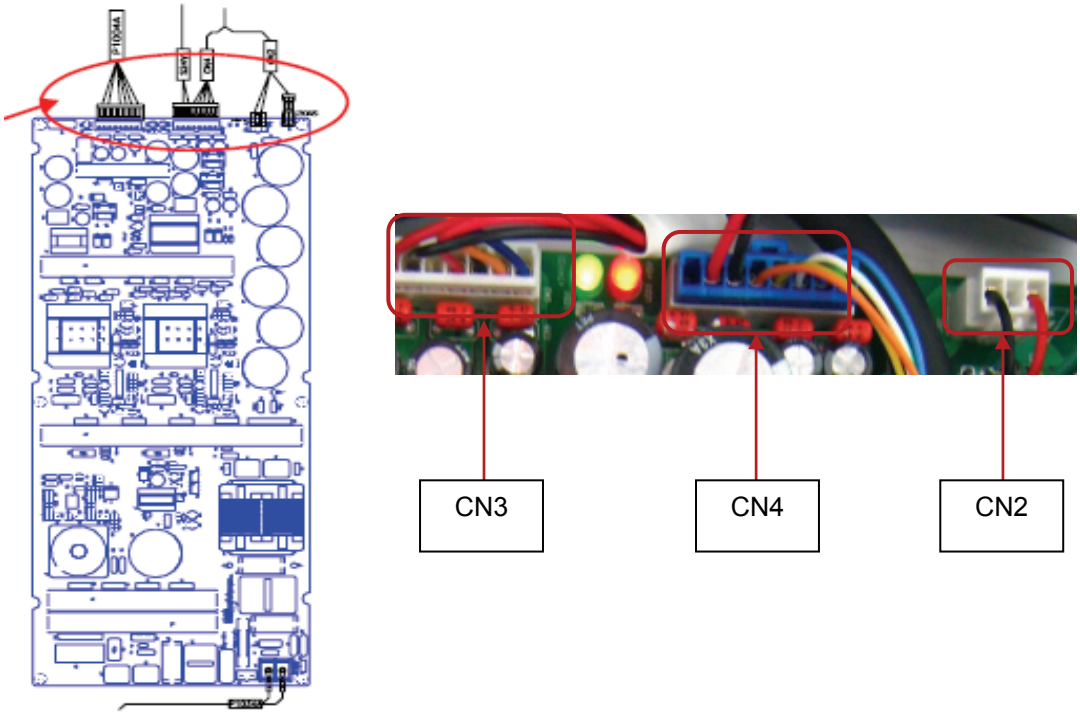
Item	Description
Multimeter (up to 1500VDC measurable capacity)	
Alligator clips	
Crosshead screw driver	
Flathead driver	

3. **General example of how to connect the DMM.**



4.1 SMPS Power Supply Board

1. **Location of the Board connector**



2. **Voltage measurement by connectors and measurement method**

CAUTION

Doing Connector board voltage measurements require extra cautions. Exposure to electrical shocks is highly likely due to the existence of residual very high voltage current in some parts on the board.

- **CN2:**

  Role: Connection part for the power supply (350V. DC) to the Tube Inverter Board.

  Measurement Method

  ① Set the multimeter to voltage measurement mode.

  ② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 600VDC.

  ③ Use the positive (+) (Red) Probe of the Multi-meter to touch the red line and the negative (–) (black) Probe to touch the black line of the connector, and then read the measured value. The reading value should be about +350VDC.

  ④ If the measurement is lower than 340V, it will be regarded as a board defect and therefore needs to be replaced.

In order to help you to work effectively and safely, make a ground connection by using the alligator clip. Plug it to the Multimeter, and then put it off to a suitable ground connection point.

Pin number	Pin name	Pin color	Normal Value
1	Ground	Black	0
2	NC	NC	
3	Inverter power	Red	+350VDC

- **CN4:**

  Role: Connection part for the power supply to the System Control Board, LCD touch screen, and the Inverter Board.

  Measurement Method

  ① Set the multi-meter to voltage measurement mode.

  ② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

  ③ Measure Pin 2. This pin supplies 24V power to various system boards through the Relay board. Therefore, the measured value should also be 24V.

  ④ Measure Pin 4. This pin supplies 24V power to the Inverter Board.

  ⑤ Measure Pin 6. This pin supplies 15V power to the Inverter/Generator Board.

  ⑥ Measure Pin 8. This pin supplies -15V power to the Inverter/Generator Board.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Normal Value
1	Not used		
2	System and Various Boards	Red	+24 VDC
3	Ground	Black	0
4	Inverter Board	Orange	+24VDC
5	Ground	Black	0
6	Inverter/generator	Yellow	+15VDC
7	Ground	White	0
8	Inverter/generator	Blue	-15VDC

- **CN3:**

Role: Connection part for the power supply to the Relay Board, PANO sensor Board, and Column MCD Board.

Measurement Method

① Set the multi-meter to voltage measurement mode.

② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

③ Measure Pin 1. This pin supplies 24V power to the Column MCU Board. Therefore, the measured value should also be 24V.

④ Measure Pin 4. This pin supplies +5V power to the Relay Board.

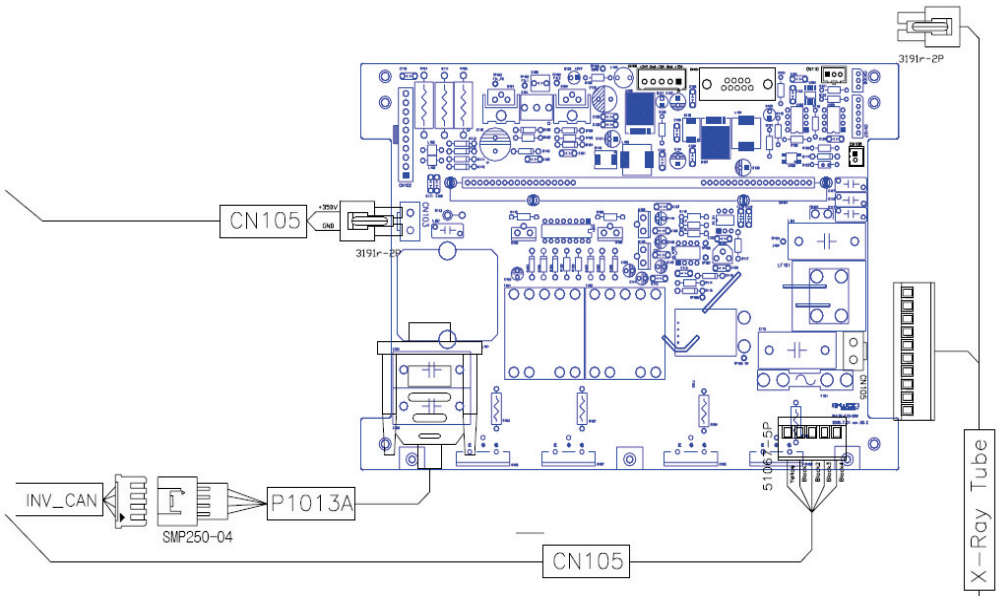
⑤ Measure Pin 6. This pin supplies -5V power to the Pano Sensor Board.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Normal Value
1	Column MCU Board	Red	+24 VDC
2	Ground	Black	0
3	NC		
4.	Relay Board	Red	+5VDC
5	Ground	Black	0
6	Pano sensor	orange	-5VDC
7	Ground	White	0

4.2 Inverter board

1. Location of the Board connector



2. Voltage measurement by connectors and measurement method

WARNING

Because this board operates with very high voltage applied to some parts, extreme caution is required when checking the field. Carelessness can lead to severe shock causing serious injury.

Generally, the normal measurement value of each pin should be as follows:

- **CN104**

  Connector for CAN Communication

- **CN105**

Pin number	Pin name	Pin color	Normal Value
1	Inverter power	Red	+350VDC
2	NC	NC	
3	Ground	Black	0

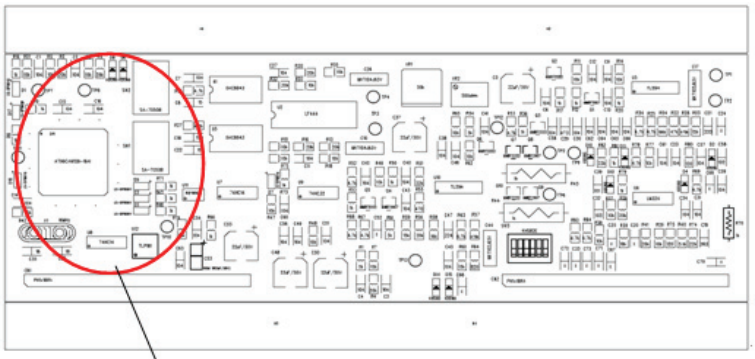
- **CN109**

Pin number	Pin name	Pin color	Normal Value
1	Power	orange	+15 VDC
2	Ground	yellow	0
3	Power	green	-15VDC
4	Ground	Black	0
5	Pano sensor	white	24VDC

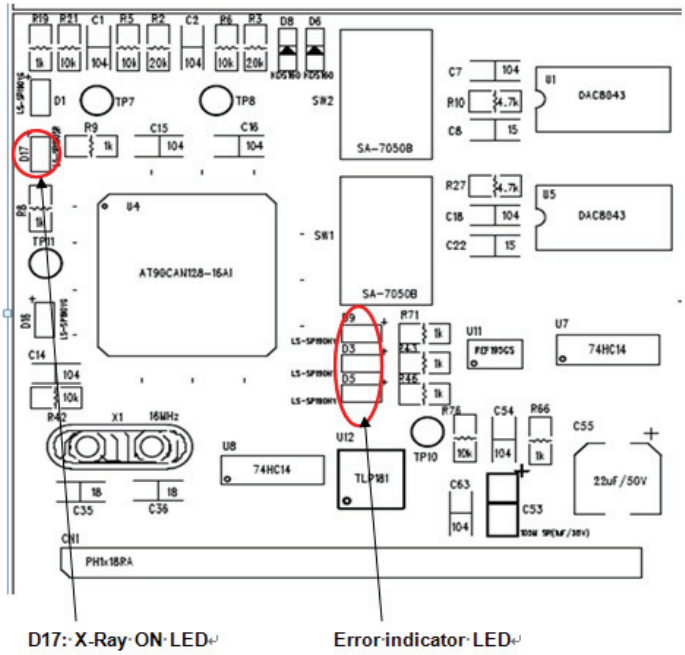
3. Identification of the causes of Error Messages

- **Inverter LED and TP Point**

  The following figure shows the Daughter board, which is installed at the Inverter Board.



Enlarged Figure



- **X-Ray On LED**

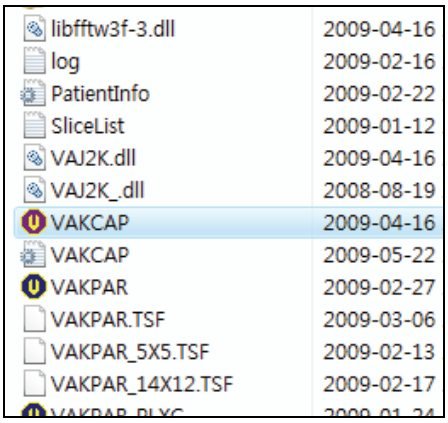
No.	LED	Color	Operation	Description
1	D17	YELLOW	LED illuminates upon X-Ray irradiation.	LED confirms X-Ray irradiation process.

- **Error LED Signals and Causes**

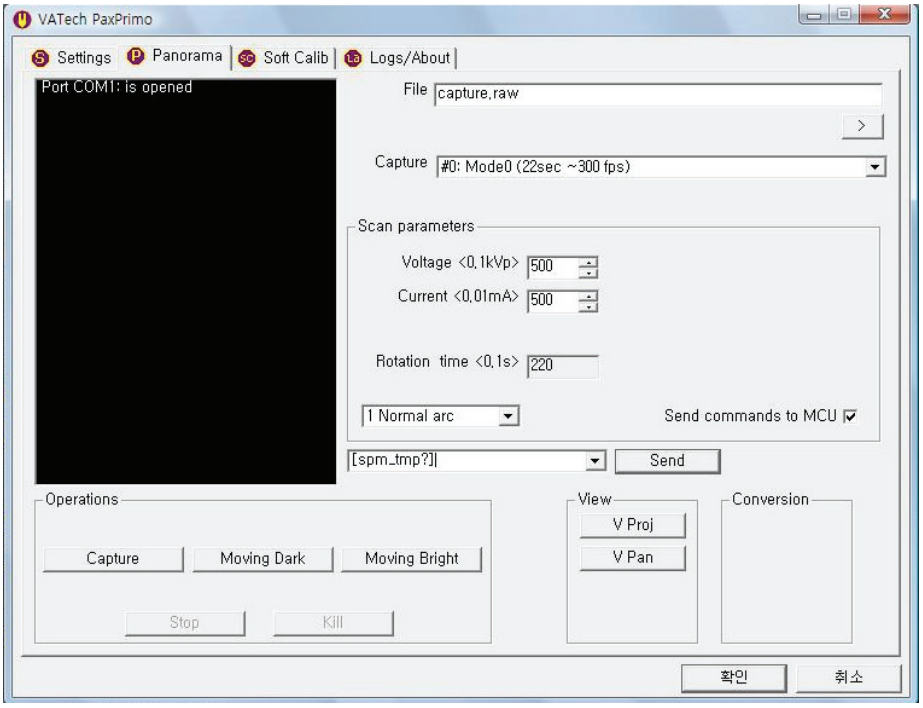
Error LED Status			Error List	Description
A	B	C		
Illuminating	-	-	Inter Lock	Connector [CN102] with Single Wire Cable, Cable is not connected.
-	Illuminating	-	OCP	Higher current at the 1st side of the Mono-Tank than its tolerable value.
Blinking	-	-	kV Ref.	When kV Ref. value shows a difference of ±10kV
-	**Blinking**	-	mA Ref.	When mA Ref. value shows a difference of ±0.5 mA
Blinking	**Blinking**	-	kV Feedback	When kV Feedback value shows a difference of ±20kV
-	-	**Blinking**	mA Feedback	When the Tube current is higher or lower than the set value
Illuminating	Illuminating	-	Temp. Error	When the temperature of the Mono-Tank is higher than its tolerable value
-	-	Illuminating	Current Error	When the current value at the 1st side of the Mono-Tank is +1A higher than the reference value
Illuminating	-	Illuminating	X-Ray On Error	X-Ray Switch is On but no X-Ray On command from the System
-	Illuminating	Illuminating	X-Ray Off Error	X-Ray Switch is Off but no X-Ray Off command from the System

4. How to confirm whether the communication between the Inverter Board and the CAN is working?

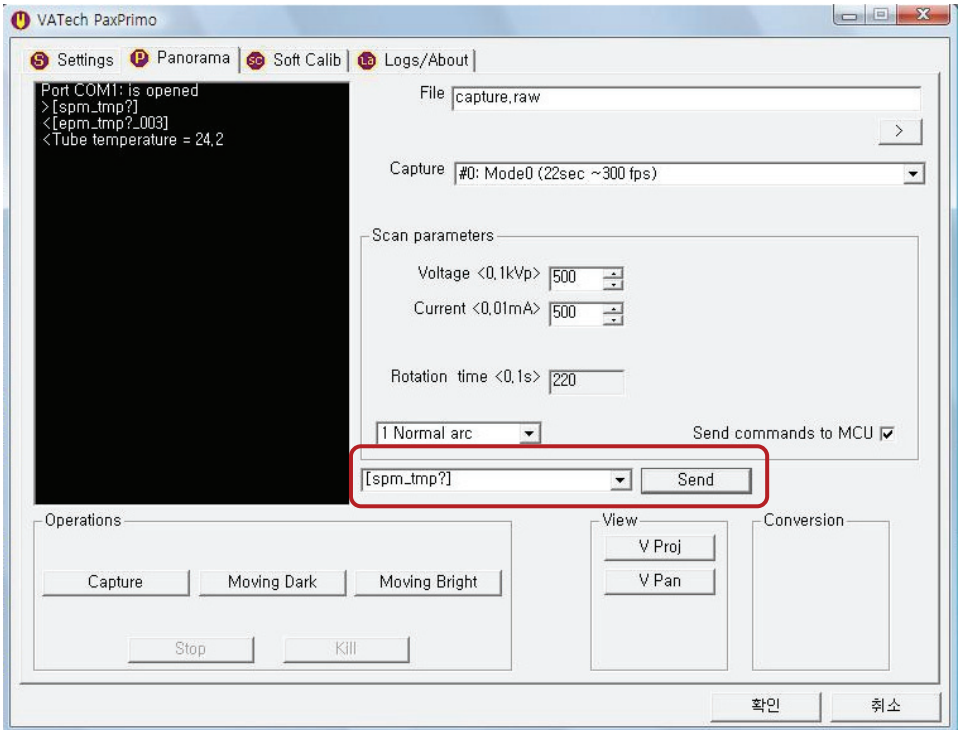
① Execute the **VAKCAP** exe. File from C:\>PaXPrimo>pano of My Computer.
(You may also execute it through the Hyper-terminal.)



② The VAKCAP Window will pop up, as follows.

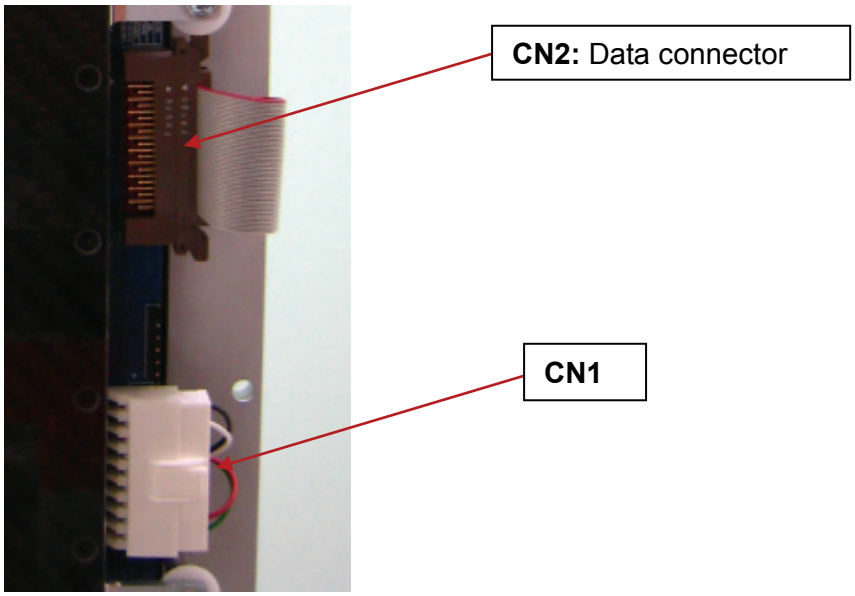


③ Input **“[SPM_TMP?]” on the command input window** then click **“Send”.**
Then the following window will come up, showing the current internal temperature of the Tube. And it should show a normal CAN communication with the Inverter Board. But if there is no response, it indicates that the CAN communication is not working.



4.3 Sensor board

1. Location of the Connector



2. Measurement Method and Measured Values

- **CN1:**

  Connection part for the power supply to the Role Sensor

  Measurement Method

  ① Set the multimeter to voltage measurement mode.

  ② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

  ③ Measure Pin 2. This pin supplies +5V power to the Sensor Board. Therefore, the measured value should also be +5V.

  ④ Measure Pin 8. This pin supplies -5V power to the Sensor Board. Therefore, the measured value should also be -5V.

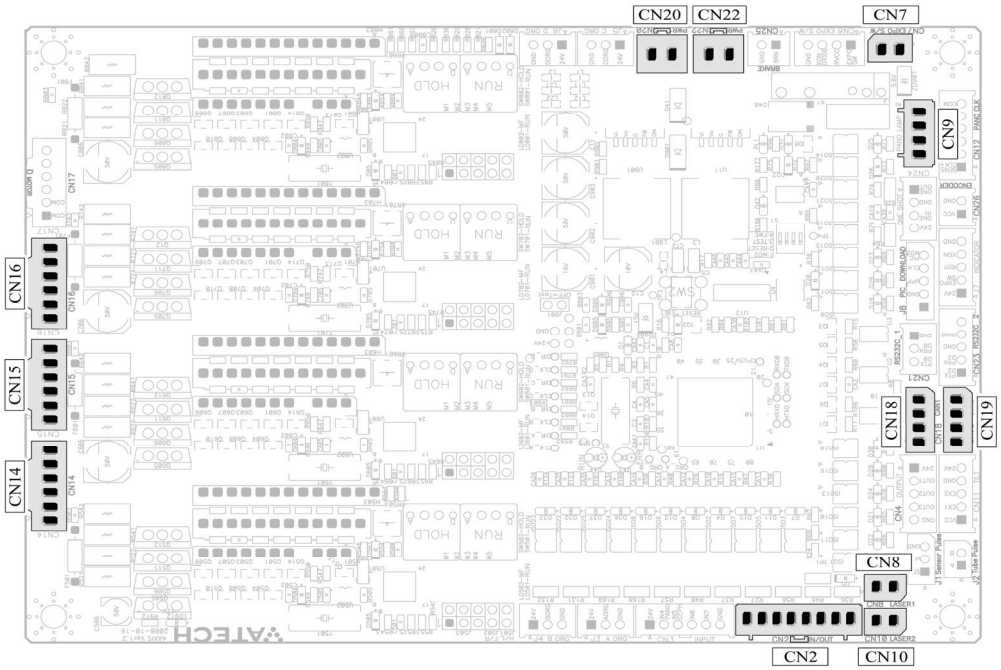
In order to help you to work effectively and safely, make a ground connection by using the alligator clip. Plug it to the Multimeter, and then put it off to a suitable ground connection point.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Normal Value
1	Ground	Black	0
2	Sensor	White	+5VDC
3	NC		
4.	NC		
5	NC		
6	NC		
7	NC		
8	Sensor	Red	-5VDC
9	Ground	Green	0

4.4 4AXIS MCU Board

1. Names and Locations of the Connectors



2. Measurement Method and Measured Values

- **CN2**

  Role:

  Connecter of the X-ray exposure switch, that is to be externally attached. (When irradiating, the LED will illuminate in orange.)

  Measurement Method

  ① Execute the Control Panel from the Scanning Program. (See the Appendix)

  ② Send the command **"[XOF]"** to switch off X-ray irradiation.

  ③ Send the command **"[KVP]"**.

  ④ Press the irradiation switch, and make the (-) lead bar of DMM (Digital Multimeter) be in contact with the ground. Then measure Number ① and ③ pins of the CN2 Connecter. The measurement values should be less than 2V.

PIN NUMBER	PIN NAME	COLOR	Exposure S/w Off	Exposure S/W ON
①	EXPO_SW	Red	More than 20V	Less than 2V
②	VCC 24V	Orange	More than 20V	More than 20V
③	XON	Green	More than 20V	Less than 2V
④	GND	White	0V	0V

- **CN7**

Role: Connecter to check on Exposure. SW Signal at the Tube Inverter B'D.

Measurement Method:

① Open the utility program on the upper right corner on the image capture program or the HyperTerminal.

② Send command**"[XOF]"**.

③ Make the (-) lead of the DMM (Digital Multi Meter) is in contact with the ground. Then connect the (+) lead to ① pin of CN7.

④ Press the exposure switch, and measure the voltage of the current operation.

Shown in the table are the normal measurement values:

PIN NUMBER	PIN NAME	Pin COLOR	At state of Stop	At the State of Operation
①	EXPO_SW	Brown	More than 20V	Less than 2V
②	GND	White	0V	0V

- **CN8**

Role: Connection part for the power supply to drive the vertical laser beam.

Measurement Method:

NOTE **See the Appendix and use the method to send the command to the equipment.**

① Input the command **"[SPM_PANO]"** then click **"send"**.

② Input the command **"[SPM_LON_]"**, then the vertical and horizontal lasers of the equipment will be switched ON.

③ Now measure Pin 3. The measured voltage of this pin should be less than 1VDC.

④ Then, send the command **"[SPM_LOF_]"**, and the Lasers would be switched off. When you measure Pin ③ at this point, the value would become 4.5V. Pin 1 should always have a measurement of 5V.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Beam Off	Beam On
1	Vcc	Orange	+5V	+5V
2	Laser Signal	Black	More than 4.5V	less than 1V

- **CN9**

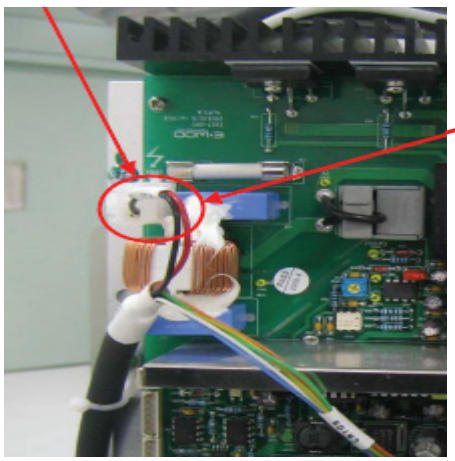
Role: Connection part for the power supply to drive the Pano lamp.

Measurement Method:

① Set the multimeter to voltage measurement mode.

② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

③ Disconnect the cable from the Inverter board as shown in the figure. This step is to keep X-ray from being exposed when the exposure switch is pressed.



④ Measure Pin 1 (Red Cable) and make sure that the value is +24VDC.

⑤ Pin 2 is a signal line of which value changes by turning the exposure switch On or Off.
Therefore, it is about 24V when the switch is Off. And it should be less than 1V when On.

Pin number	Pin name	Pin color	Exposure s/w Off	Exp s/w On
1	Power	Red	+24VDC	+24VDC
2	XON_LED		+24V	less than 1V
3	NC			
4	Ground	Black	0	0

- **CN10**

Role: Connection part for the power supply to drive the canine laser beam.
Measurement Method:

NOTE **See the Appendix and use the method to send the command to the equipment.**

① Input the command **"[SPM_PANO]"** then click **"send"**.

② Input the command **"[SPM_LON_]"**, then the vertical and horizontal lasers of the equipment will be switched ON.

③ Now measure Pin 3. The measured voltage of this pin should be less than 1VDC.

④ Then, send the command **"[SPM_LOF_]"**, and the Lasers would be switched off. When you measure Pin ③ at this point, the value would become 4.5V. Pin 1 should always have a measurement value of 5V.

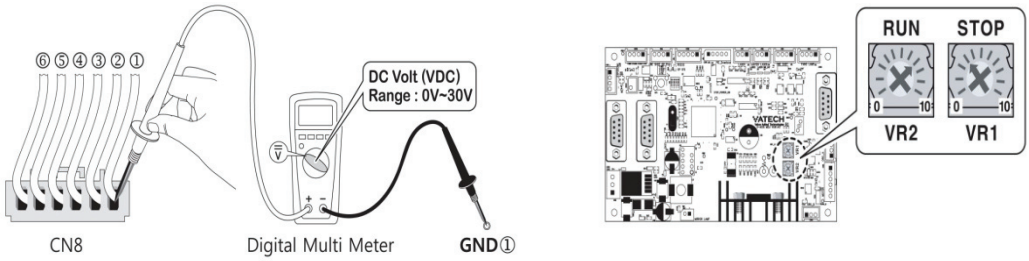
Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Beam Off	Beam On
1	Vcc	Orange	+5V	+5V
2	Laser Signal	Black	More than 4.5V	less than 1V

- **CN14**

  Role: STEP MOTOR Connecter that drives the X axis.

  Measurement Method:



① When the power is ON, Pin ①, Pin ② of CN14 Connector should be measured and both values should always be at 23V.

② VR2(RUN) functions by adjusting the Running Current of the X axis motor (Strength of Motor Rotation)

③ Set the arrow mark to “7”, as shown in the figure above.

④ VR1 (STOP) functions by adjusting the STOP Current of the X axis motor (Strength of Motor when it is idle.)

⑤ Set the arrow mark to “3”, as shown in the figure above.

PIN	PIN NAME	At state of Stop	At the State of Operation
①	VCC24	More than about 23V	More than 23V
②	VCC24	More than about 23V	More than 23V
③	A_MOTOR_A	More than about 20V (Frequency)	More than 18V(Frequency)
④	A_MOTOR_A/	More than about 20V (Frequency)	More than 18V(Frequency)
⑤	A_MOTOR_B	More than about 20V (Frequency)	More than 18V(Frequency)
⑥	A_MOTOR_B/	More than about 20V (Frequency)	More than 18V(Frequency)

- **CN15**

Role: STEP MOTOR Connector that drives the Rotating unit.

Measurement Method:

① When the power is ON, Pin ①, Pin ② of CN15 Connector should be measured and both values should always be at 23V.

VR4 (RUN) functions by adjusting the Running Current of the Rotating unit (Strength of Motor Rotation)

② Set the arrow mark to “7”, as shown in the figure above.

③ VR3(STOP) functions by adjusting the STOP Current of the X axis motor (Strength of Motor when it is idle.)

PIN #	PIN NAME	At state of Stop	At the State of Operation
①	VCC24	More than about 23V	More than 23V
②	VCC24	More than about 23V	More than 23V
③	A_MOTOR_A	More than about 20V	More than 18V (Frequency)
④	A_MOTOR_A/	More than about 20V (Frequency)	More than 18V (Frequency)
⑤	A_MOTOR_B	More than about 20V (Frequency)	More than 18V (Frequency)
⑥	A_MOTOR_B/	More than about 20V (Frequency)	More than 18V (Frequency)

④ Set the arrow mark to “3”, as shown in the figure above.

- **CN16**

Role: STEP MOTOR Connecter that drives the Column Motor

Measurement Method:

① When the power is ON, Pin ①, Pin ② of CN16 Connector should be measured and both values should always be at 23V.

② VR6(RUN) functions by adjusting the Running Current of the Column motor (Strength of Motor Rotation)

PIN #	PIN NAME	At state of Stop	At the State of Operation
①	VCC24	More than about 23V	More than 23V
②	VCC24	More than about 23V	More than 23V
③	A_MOTOR_A	More than about 20V (Frequency)	More than 18V (Frequency)
④	A_MOTOR_A/	More than about 20V (Frequency)	More than 18V (Frequency)
⑤	A_MOTOR_B	More than about 20V (Frequency)	More than 18V (Frequency)
⑥	A_MOTOR_B/	More than about 20V (Frequency)	More than 18V (Frequency)

③ Set the arrow mark to “7” as shown in above figure.

④ VR5 (STOP) functions to adjust the STOP Current of Column motor (Strength of Motor when it is idle.)

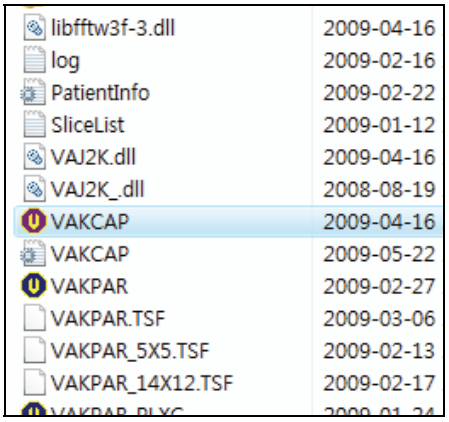
⑤ Set the arrow mark to “3”, as shown in the figure above.

- **CN18**

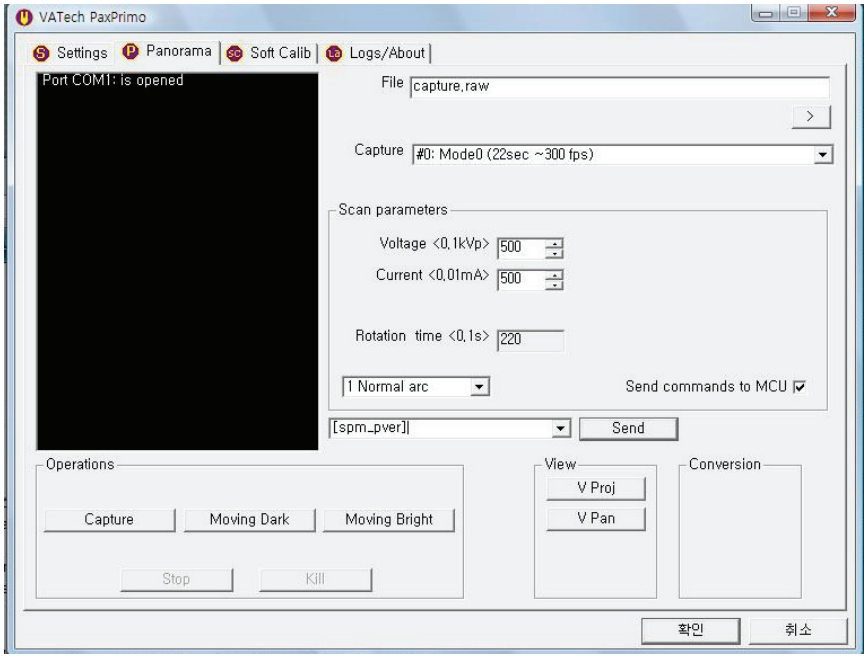
Role: Connecter for CAN Communication between the Column MCU Board and the 4AXIS Board.

Measurement Method:

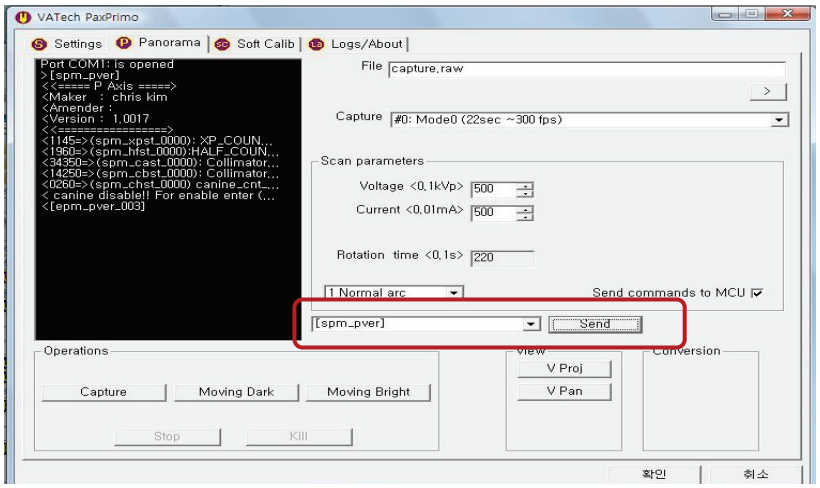
① Execute the **VAKCAP** exe. File from C:\>PaXPrimo>pano of My Computer (You may also execute it using the Hyper-terminal.)



② The VAKCAP Window will pop up, as follows.



③ Input **“[SPM_PVER]” on the command input window** then click **“Send”**.
Then following window will come up, showing the currently set Firmware contents. And it will show the normal CAN communication with the 4AXIS board. But if there is no response, it indicates that CAN communication is not working.



- **CN19**

  Role: Connector for CAN Communication with the Tube inverter.

  Measurement Method:

  ① Observe the response to the command "[SPM_TMP?]" and check whether communication is existing or not.

  ② The process is same as that of CN18.

- **CN20**

  Role: Connection part for power supply to drive the Relay Board.

  Measurement Method:

  ① Set the multimeter to voltage measurement mode.

  ② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

  ③ Measure Pin 1 (Red Cable) and make sure that the value is at +24VDC.

  ④ Pin 2 (Black Line) is the grounding line.

Pin number	Pin name	Pin color	Normal Value
1	Power	Red	+24VDC
2	Ground	Black	0

- **CN22**

  Role: Connection part for power supply from the 4AXIS MCU Board to the Column MCU Board.

  Measurement Method:

  ① Set the multimeter to voltage measurement mode.

  ② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

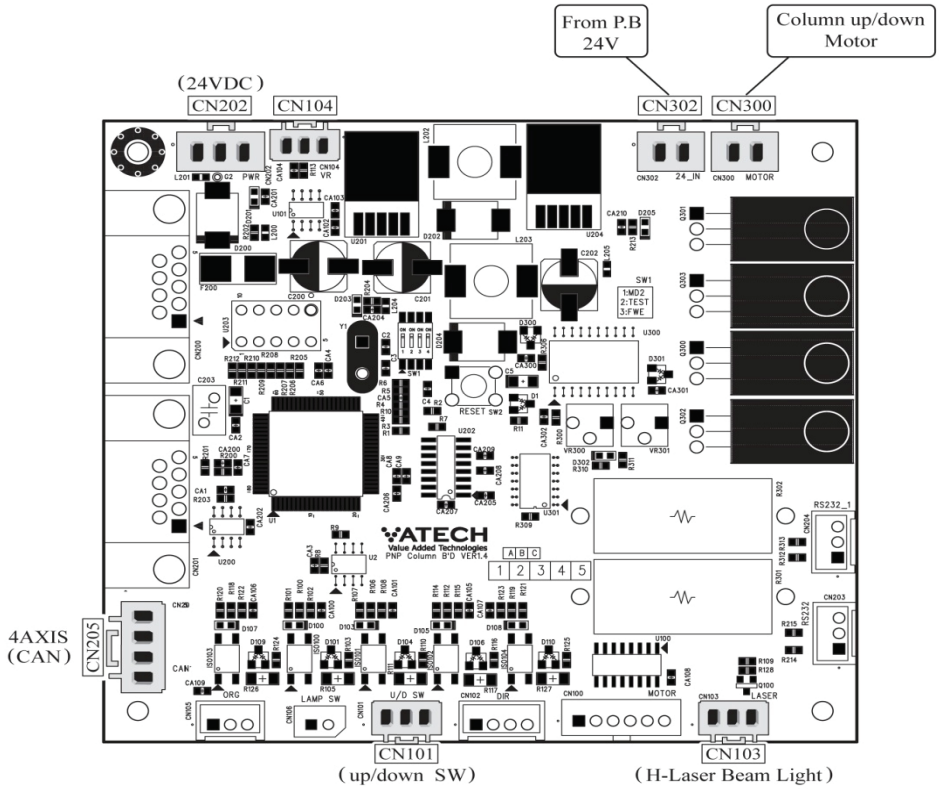
  ③ Measure Pin 1 (Red Cable) and make sure that the value is at +24VDC.

  ④ Pin 2 (Black Line) is the grounding line.

Pin number	Pin name	Pin color	Normal Value
1	Power	Red	+24VDC
2	Ground	Black	0

4.5 PNP Column MCU Board

1. Location of the Connector



2. Measurement Method and Measured Values

- **CN101**

  Role: Switches the Column movement up or down.

  Measurement Method:

  ① Set the multimeter to voltage measurement mode.

  ② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

  ③ Measure Pin 1. If you turn the switch off, the normal voltage of this pin should be +24VDC. But if you turn the switch on, the measurement should be less than 2V. And the column will go up.

  ④ Measure Pin 2. If you turn the switch off, the normal voltage of this pin should be +20VDC. But if you turn the switch on, the measurement should be less than 2V. And the column will go down.

In order to help you to work effectively safe and easily, make a ground connection by using the alligator clip. Plug it to the Multimeter, and then put it off to a suitable ground connection point.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	When not pressed	When pressed
1	Up Switch	yellow	More than 20V	Less than 2V
2	Down Switch	Red	More than 20V	Less than 2V
3	Ground	Black	0	0

- **CN103**

Role: Power supply to generate horizontal laser beam light for the patient positioning alignment.

Measurement Method:

See the Appendix and use the method to send the command to the equipment.

Measurement is to be made in the following sequence, while sending the commands from the imaging program:

① Input the command **"[SPM_PANO]"** then click **"send"**.

② Input the command **"[SPM_LON_]"**, then the vertical and horizontal lasers of the equipment will be turned ON.

③ Now measure Pin 3. The measured voltage of this pin should be less than 1VDC.

④ Then, when you send the command **"[SPM_LOF_]"**, the Lasers would be switched off. When measuring Pin ③ at this point, the value would become 4.5V. The pin 1 should always have a value of 5V.

In order to help you to work effectively safe and easily, make a ground connection by using the alligator clip. Plug it to the Multimeter, and then put it off to a suitable ground connection point.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Beam Off	Beam On
1	Vcc	Orange	+5V	+5V
2	NC			
3	Laser Signal	Black	More than 4.5V	Less than 1V

- **CN202**

Role: Connection part for power supply to the 4AXIS Board.

Measurement Method:

① Set the multimeter to voltage measurement mode.

② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

③ Measure Pin 1. The normal value is at +24VDC.

④ Pin 2 (Black Line) is the grounding line.

In order to help you to work effectively safe and easily, make a ground connection by using the alligator clip. Plug it to the Multimeter, and then put it off to a suitable ground connection point.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Normal Value
1	Power	Red	+24VDC
2	NC		
3	Ground	Black	0

- **CN205**

Role: Connector for CAN Communication with the 4axis and the Column MCU Board.

- **CN300**

Role: Connector to link the power supply required for the DC Motor of the Up/Down Column of the equipment.

Measurement Method: Motor Specifications (24V, 5A)

If you press and hold the Up button of the Up/Down switch, the green LED of D2 (UP SWITCH INPUT LED) will illuminate and you should get a voltage measurement of less than 2V for the CN1 Connector Pin 1; and if you release the Up button switch from being pressed, the D2 LED light will also go off, and you will then be able to get a voltage measurement of more than 20V.

① Press the Up button of the UP/DOWN Switch.

② Connect the positive (+) part of the Multitester (DMM) to the CN1 Connector Pin 1 and the negative (–) part to the ground (GND), then you should be able to get voltage measurement of less than 2V.

③ At this time, if the equipment moves upward, the switch is considered to be working normally.

PIN NUMBER	PIN NAME	Pin color	Idle state	Operational
①	UP SW	Green	More than 20V	Less than 2V
②	DW SW	White	More than 20V	Less than 2V
③	GND	Brown		

- **CN302**

Role: Connection part for power supply from the SMPS Board to the Column MCU Board.

Measurement Method:

① Set the multitester to voltage measurement mode.

② Set the measurement range just as it is for automatic; but if it is manual, set it at a range of 30VDC.

③ Pin 1 should be measured and should always have a value of +24VDC, while Pin 2 should be set for the grounding line.

Shown in the table are the normal measurement values:

Pin number	Pin name	Pin color	Normal Value
1	Power	Red	+24VDC
2	Ground	Black	0

Chapter 5 Firmware upgrade

5.1 Touchpad screen (LCD) Maintenance

5.1.1 Touchpad Screen Calibration

Reason: If the Touch pad Screen is not functioning correctly.

Procedure:

1. Turn off the power supply of the equipment.
2. Connect the ordinary USB mouse to the USB Connector located at the lower part of the LCD.
3. Take out the SD card from the hole located at the right side of the LCD.
4. Switch the power on and the usual Windows CE booting screen will be seen.
5. Using the mouse, execute [Stylus] in the [Control Panel] of [My Device].
6. Press [Re-correction] from the [Correction] tab of the Stylus properties.
7. Follow the program instructions for the correction/calibration process.
8. After completing the correction process, press the Enter Key to exit.
   - ① Turn off the power supply of the equipment.
   - ② Put the SD card back into the hole located at the right side of the LCD.
   - ③ Switch on the power supply and check that the Touch Input on the LCD is working normally.

5.1.2 IP Setting

Reason: If it is required to change the IP of the Touch pad LCD due to various reasons.

Procedure:

1. Turn off the power supply of the equipment.
2. Connect the ordinary USB Key Board to the USB Connector located at the lower part of the LCD.
3. Take the SD card out of the hole located at the right side of the LCD.
4. Switch the power on and the usual Windows CE booting screen will be seen.
5. Using the touch pad, execute [Network and Dial Up Access] in the [Control Panel] of [My Device].
6. Using the touch pad, double click [DM9CE1].

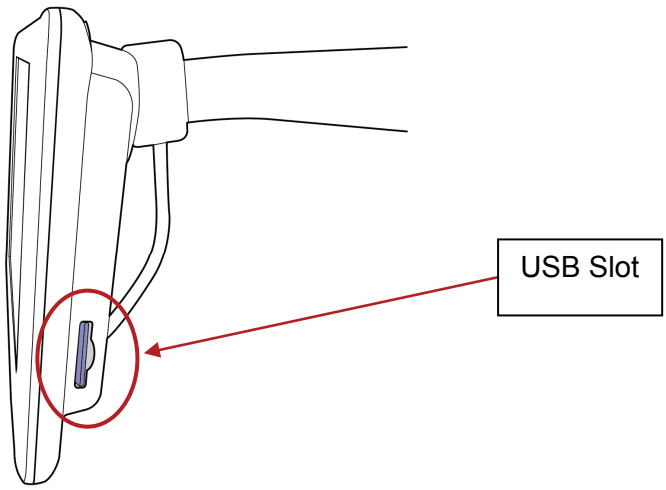
7. Click **IP Address** by using the touch pad, then input the desired value using the Key Board.
8. Press the [OK] button on the upper right corner of the corresponding dialogue screen and turn off the power supply.
9. Put SD card back into the hole located at the right side of the LCD.
10. Switch on the power supply, and check that the Network function is working normally.

5.2 Touch pad screen(LCD) upgrade

The LCD Firmware upgrade of this equipment is to be processed in a very easy and convenient method, which is completely different from the other existing methods.

1. **The USB Card where the file to be upgraded will be saved.**

2. **Location on the LCD.**



3. Sequence of actions for the upgrade

① Confirm and record the current version following the initial process of switching the equipment on.

② Turn off the power supply of the equipment.

③ Insert the USB Card which has the upgraded file to the USB slot located at the right side of the LCD.

④ As the card is inserted, switch the equipment on.

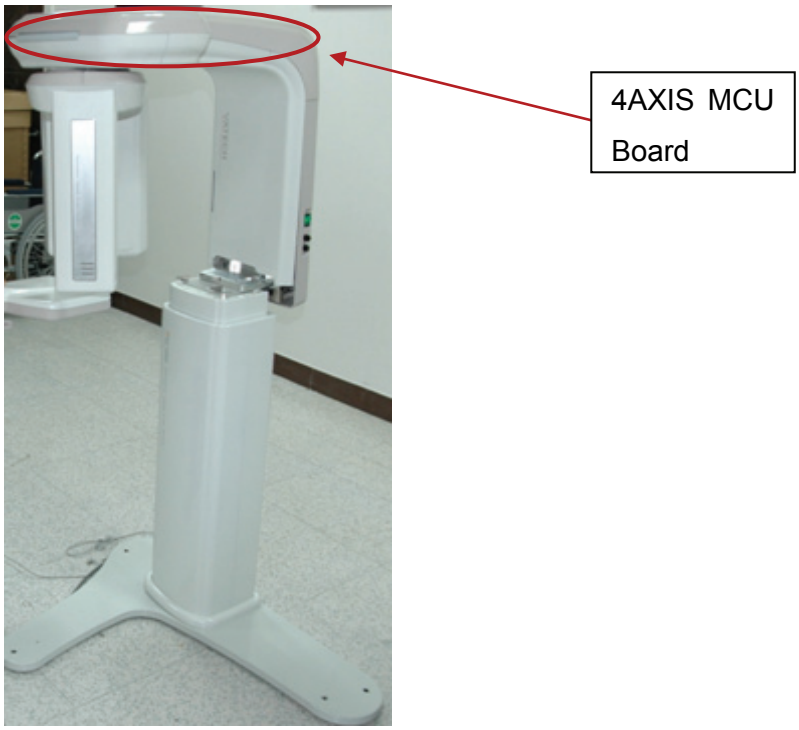
⑤ Check whether the newest version has been installed in comparison to that of the first recorded version.

5.3 Installation of Firmwares for the Boards

The boards that require firmware upgrade in this equipment are only the 4AXIS MCU and the column MCU.

5.3.1 4AXIS MCU Board Upgrade

In order to upgrade the 4AXIS MCU Board, there should be FDT tools installed, which is described in the Appendix A-1. (See Appendix A-1.)



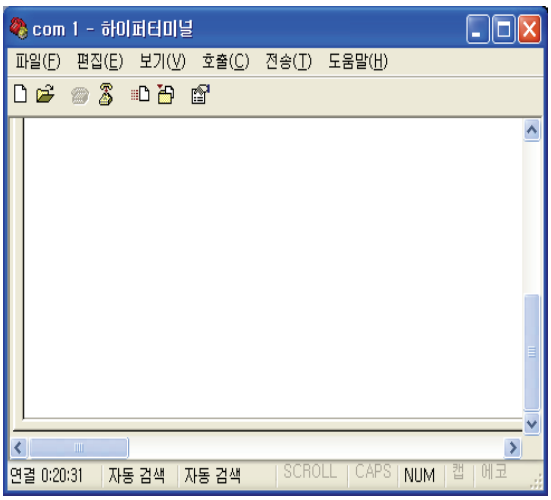
- 4 axes MCU PCB upgrade requires prior installation of FDT in the PC because it only uses Flash Development Toolkit (=FDT).
- Use the Hyper-terminal to compare the versions before and after working on it for correct upgrade. (See “Use of Hyper-terminal” in the Appendix)
- 4 axes MCU PCB upgrade requires that the upper casing of the vertical frame should be removed.

NOTE

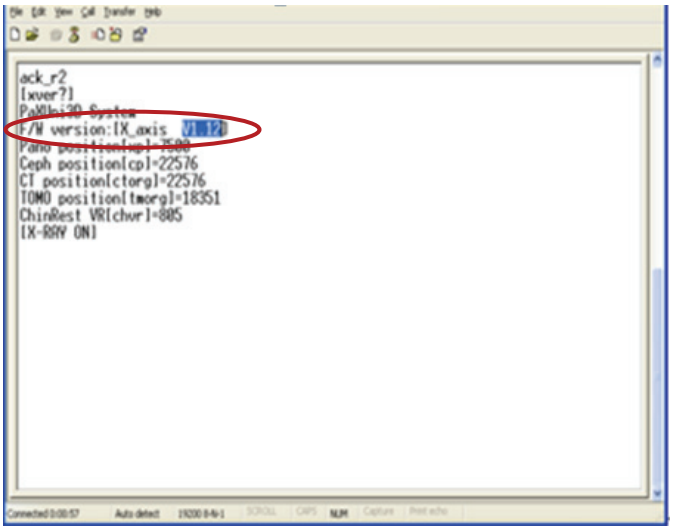
You must download the new version of the Firmware.

Upgrading Procedure:

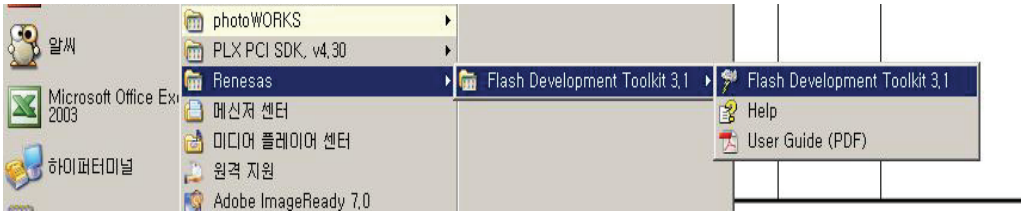
1. Execute the Hyper-terminal.



2. On the Hyper-terminal screen, input **"[spm_pver] "**to check the currently installed X axis firmware version, which should be recorded before you exit from the Hyper-terminal. The objective of this process is to check whether the preferred firmware has been correctly installed. As shown in the sample illustration below, the installed current version is V1.12. (Note: Though the sample illustration shows that of a PaX-Uni3D system, the command for firmware confirmation is same with all other equipments of VATECH.)

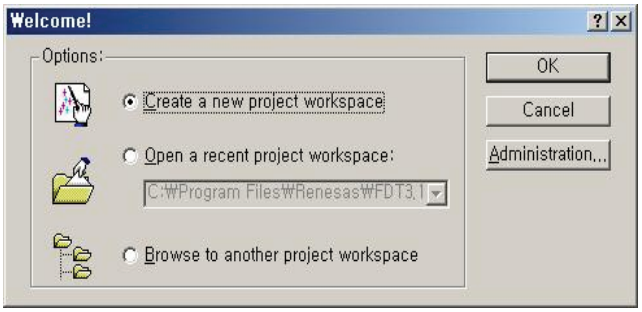


3. Execute the **Renesas Flash Development Tool Kit**.

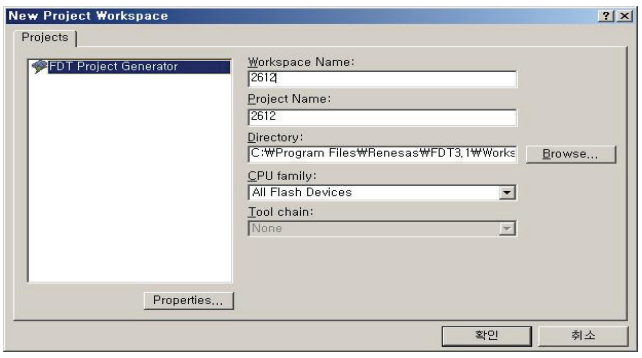


4. When following screen appears, click **"O.K"**.

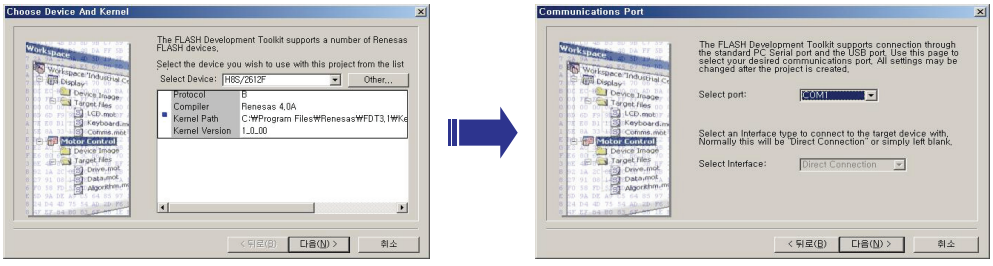
5. Create a New Project.

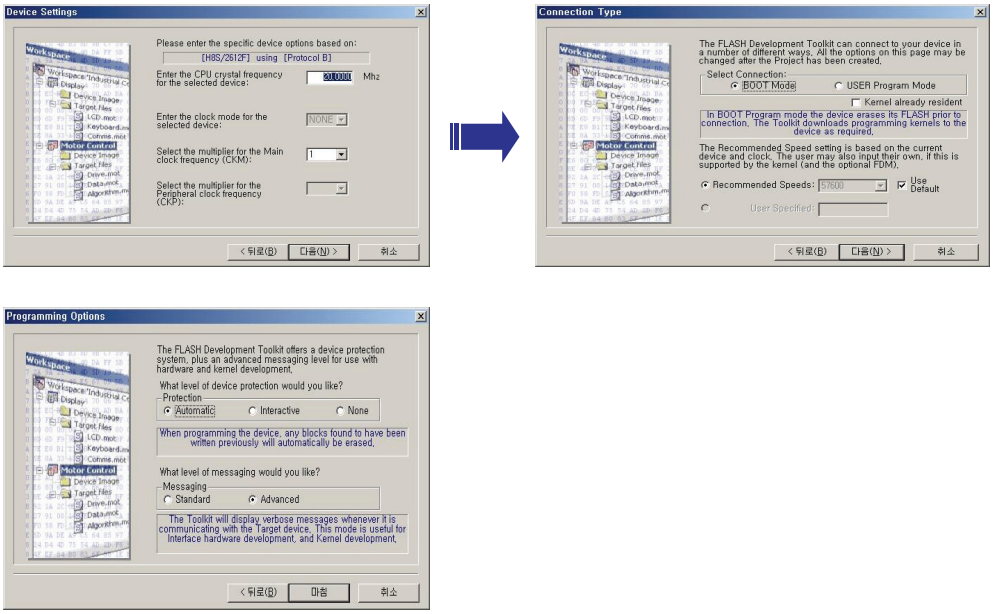


6. Input "2612" in the **Workspace Name** input box and press confirm.

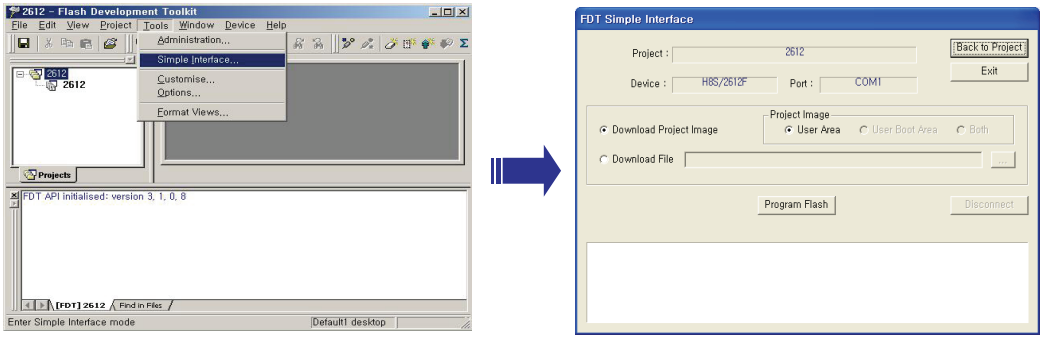


7. Click "Next" to continue.

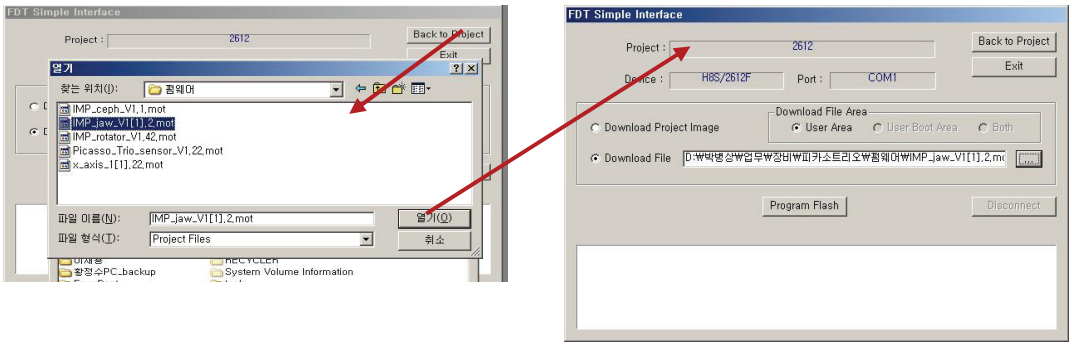




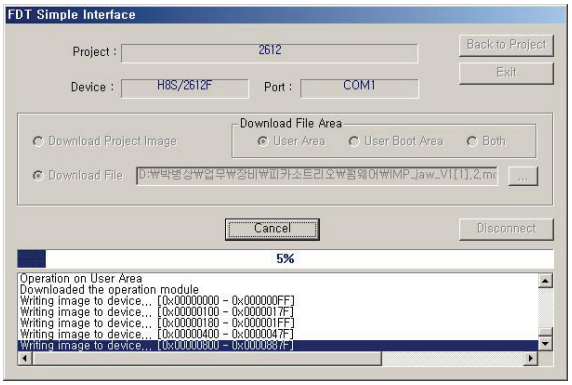
8. Click **Tools → Simple Interface** from the menu, then the **"FDT Simple Interface"** window will appear.



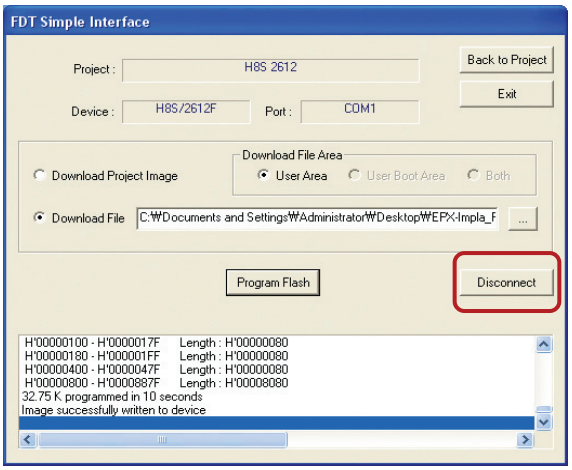
9. Select Download File, then press **'…'** button on the right side. Afterward, search the route and select Firmware, then click "Open".



10. Tap the **'Program Flash'**, which is marked, and it will execute Firmware Uploading as shown in following illustration:



11. Once it is completely uploaded, click "Disconnect" to end the process.



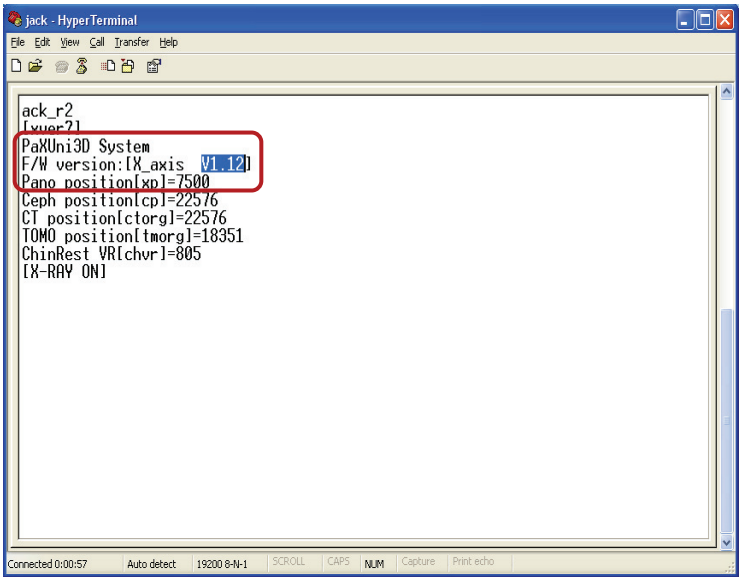
12. Reset the equipment in order to apply the set values.

NOTE

Reset the power supply of the system (PaX-Primo) in order for the new firmware to be applied.

In order to confirm whether the 4 axes MCU firmware upgrade has been done correctly, input **"[spm_pver]"** on the Hyper-terminal window using the Key Board. Also confirm whether the new application is reflected as compared with the pre-upgrade application. Then, close the Hyper-terminal window.

(* This process should be performed at about 10 seconds after resetting the power supply of the system.)



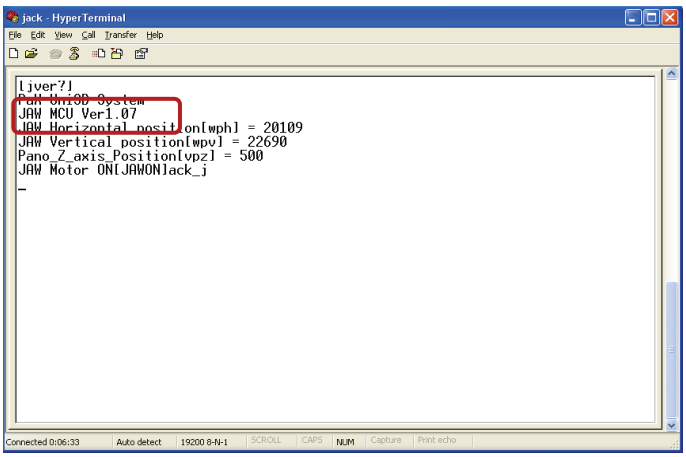
5.3.2 Column MCU board F/W Upgrade

- For this board, upgrade the firmware using the **EzCAN** upgrade tools.
- For more details, see the Appendix A-2.

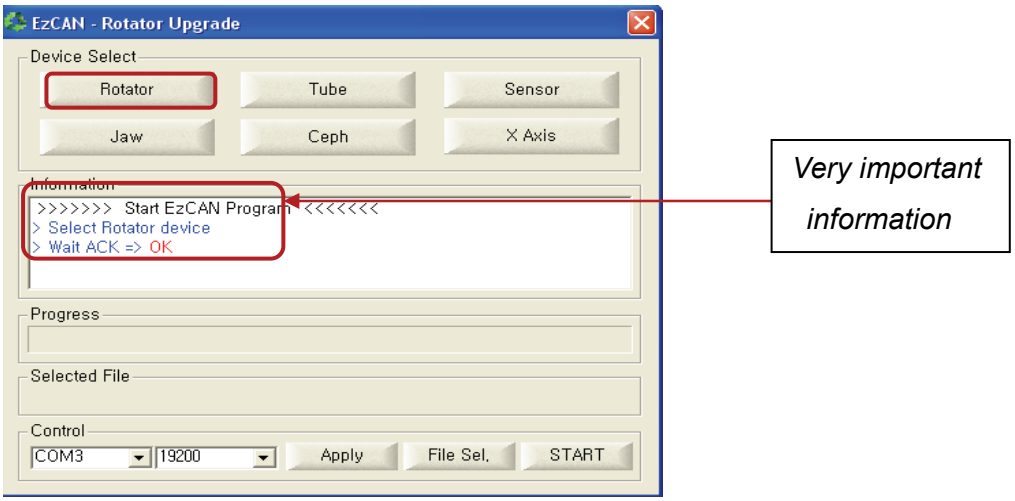
Upgrading procedure:

1. Check the currently installed firmware prior to upgrading, as reference later on for confirmation on the correct upgrade installation. Send the following command to confirm the version. Then, record the current version.

[spm_jver]	Confirm Command for MCU Board Firmware Version



2. Execute **EzCAN1004.exe.**
   Click the "**JAW**" button. After a few seconds, an "**OK**" response will be displayed on the window.



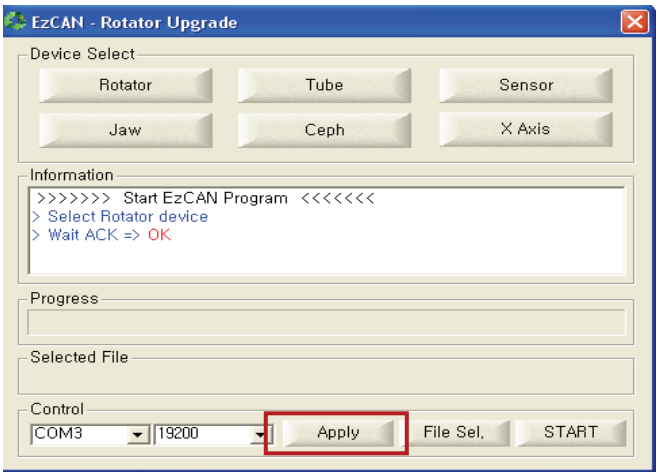
IMPORTANT

After clicking Jaw, there should be an "OK" response. Otherwise is an indication of a communication failure. So, Troubleshooting must be done before moving on to the next step.

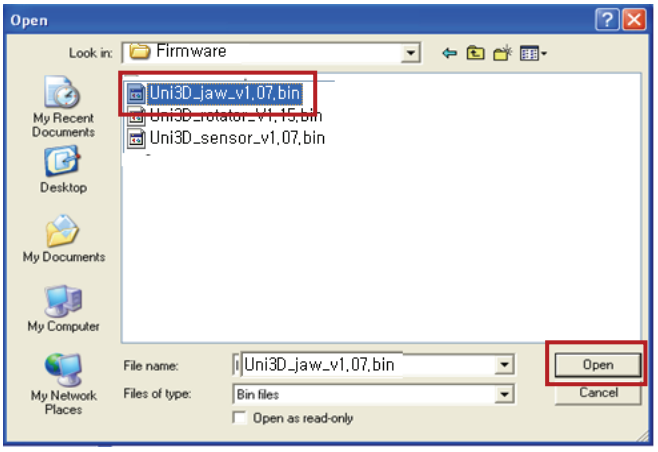
3. Set the Com Port.
4. Input the value **"19200"** to the communication speed window.
5. Click "**Apply**" to save the parameter inputs.

NOTE

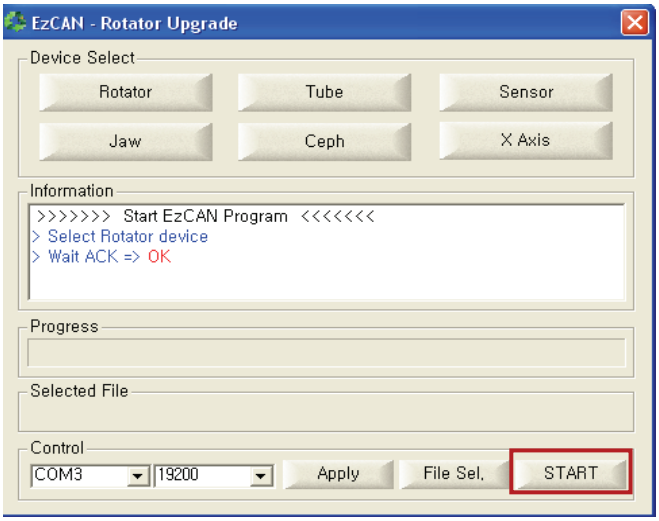
No response after clicking "Apply" is normal.



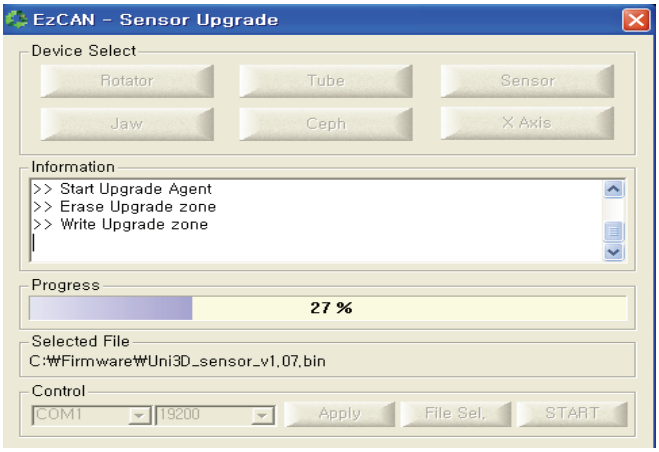
6. Click **[File Sel]** to select **Uni3D_jaw_V1.07.bin** then click **"open"**.



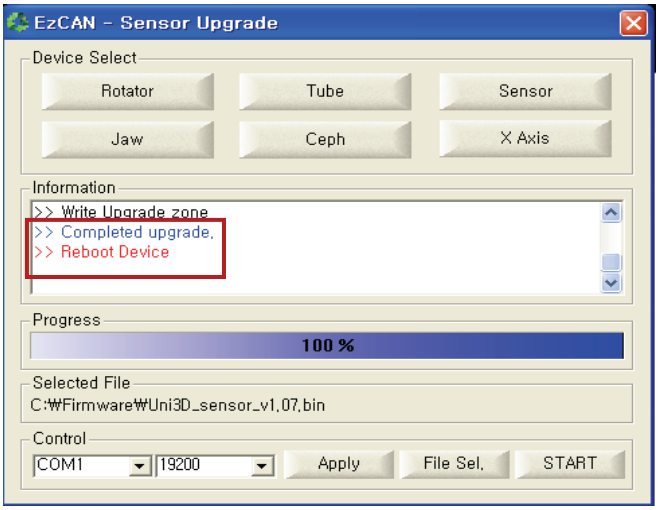
7. Press **[START]** button, then the upgrade begins.



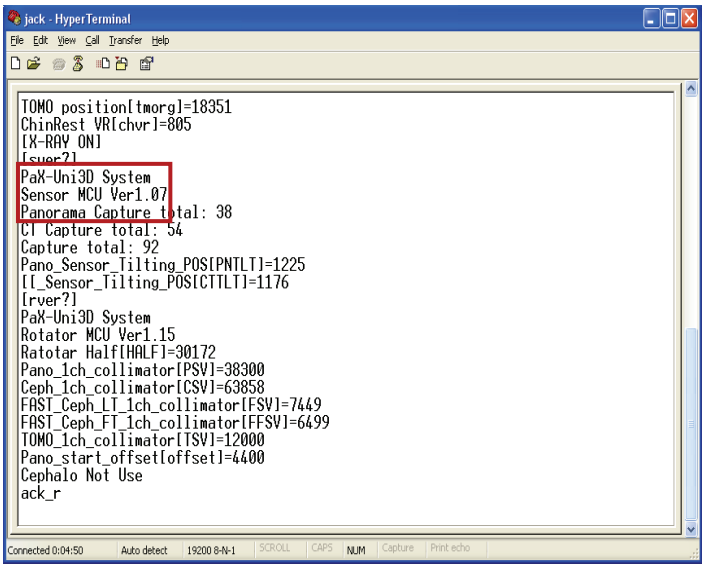
The following shows the progress status.



8. Once upgrading is completed, reset the system to apply the upgrade.

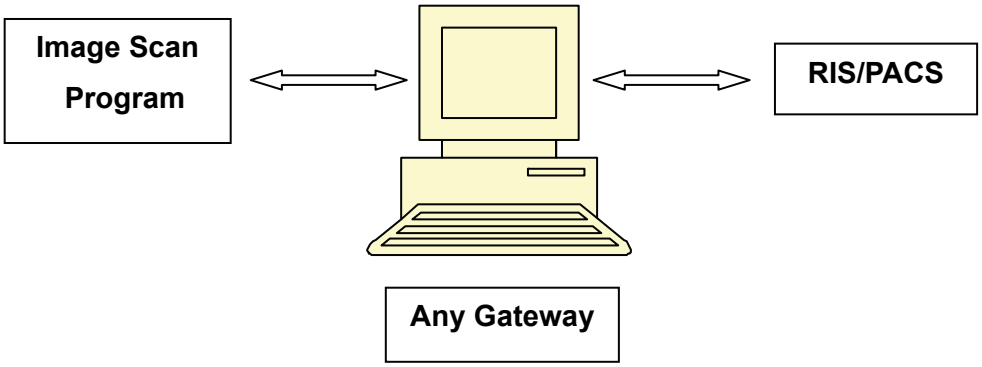


9. Again, confirm the new version using the Hyper-terminal.
It will show that the new version is successfully downloaded to the Board.
Close the Hyper-terminal and move on to the next step.



Chapter 6 Software Linkage

Basically, the image scan program is supposed to operate with EasyDent and Ez3D2009. However, in order to link the image scan program with the other application programs, the environment should be established, as illustration below:



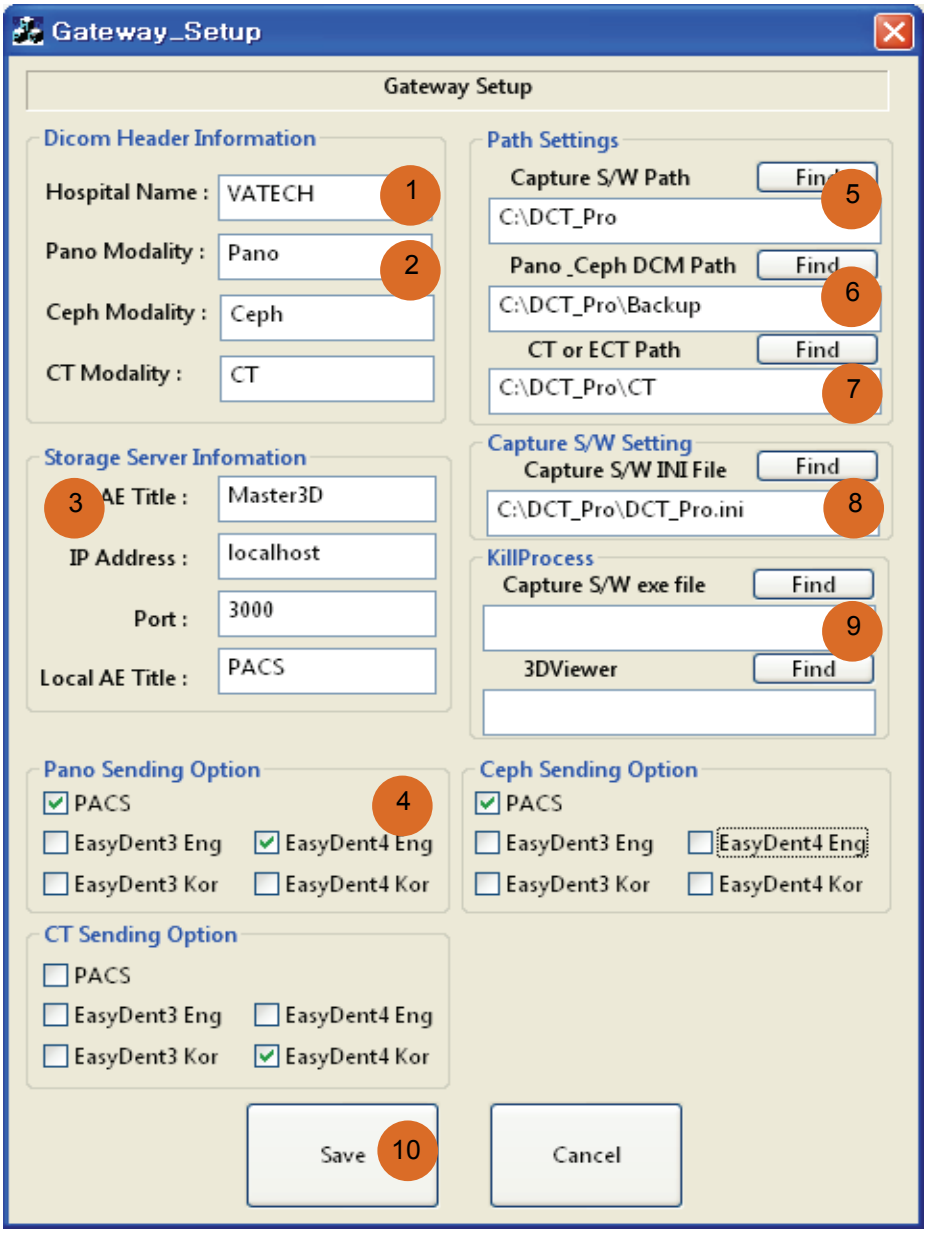
6.1 Gateway Program Installation

1. Download the supplied compression program from its appropriate directory.

2. Click **"Setup.exe"** to start the installation.
3. After some steps, the installation will be completed.
4. When the installation is successfully completed, 2 subdirectories will be created inside **C:\Pacs_Utils** such as the following:

6.1.1 Setting the parameters after Gateway Installation

Click **C:\Pacs_Utils\Gateway\Gateway_Setup.exe,** then the following window will be displayed.



① **Hospital name:** Designate the hospital name to be saved in Dicom.

② **Dicom header information:** Select Modality (equipment type) of either Pano, Ceph, or CT.

③ **Storage server information:** Record the server's information, where the image will be transmitted.

④ **Pano sending option:** Select the program, where the Gateway will transmit. (Possible Selection Duplication).
You can designate the program, which is to be transmitted, through classifying by Modality.

⑤ **Capture s/w path:** ROOT folder where the scan program is installed.

⑥ **Pano DCM path:** Folder where the acquired pano image is designated.

⑦ **CT or ECT path:** Vakpar.exe CT(ECT) folder designation.

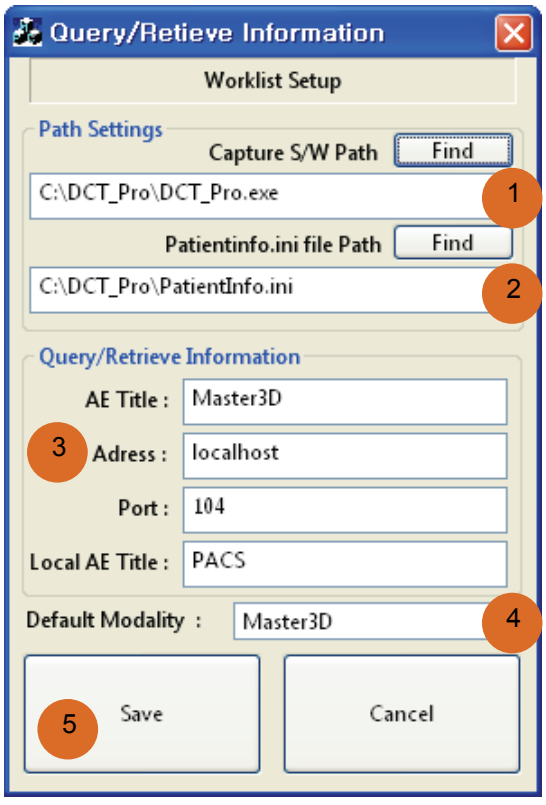
⑧ **Capture software setting:** Scan software environment set up file.

⑨ **Kill Process:** End the process of sending S/W scans and Previews. (In ordinary situation, there is no need for set up.)

⑩ **Save:** Save all the set values.

6.1.2 Work list Parameter Setting

Click **C:\PACS_Utils\Worklist\worklist_Setup.exe,** then the following window will be displayed.



① **Path setting:** Designate the Scanning S/W execution file.

② **Patientinfo.ini file path:** Designate the patient record file of the Scanning S/W.

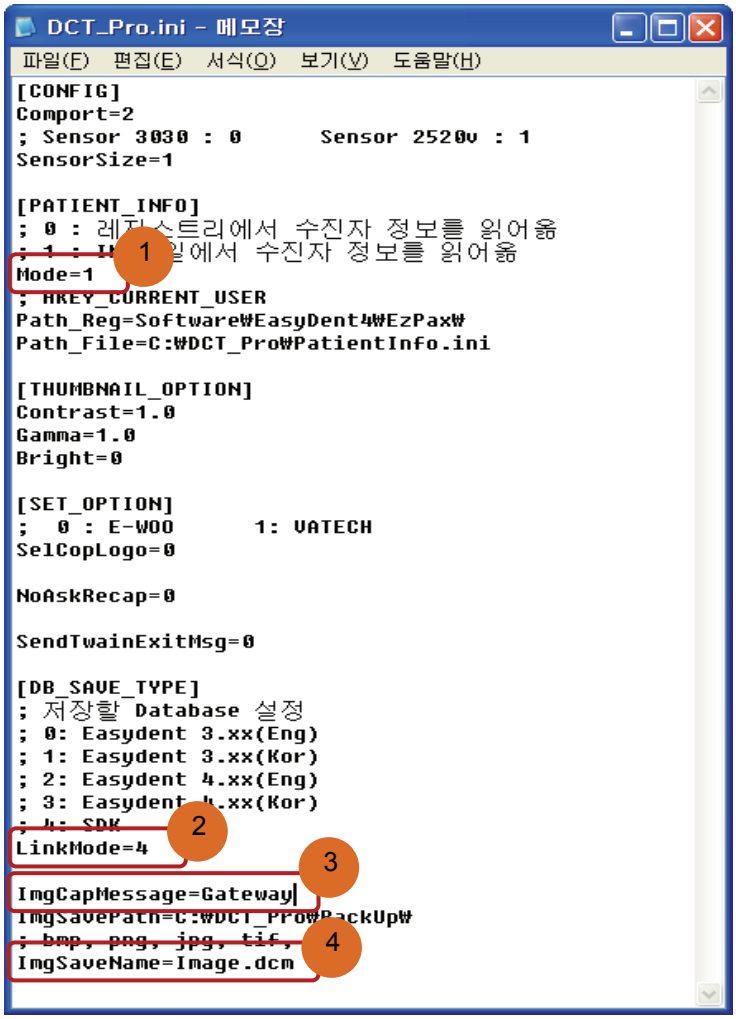
③ **Query/Retrieve information:** Set the Work list server that will get the Order information.

④ **Default Modality:** Select the Default Modality of the Work list. (Initial Modality upon execution of the Work list)

6.1.3 Scanning phase Environment Setup (Environment Setup ini. inclusion in the Scanning S/W)

The following illustration is an example of an .ini file of a DCT_Pro equipment, which has the same set up as the other equipments of VATECH.

Therefore, the set up can be applied just as it is for PaX-Primo.



① **Mode=1:** Set to 1 in order to bring up the patient information from the .INI file.

② **Link Mode=4:** Set to 4 in order to use SDK.

③ **ImageCapMessage=Gateway:** Sets the message which will be sent with the Gateway upon SDK call from the Scanning S/W.

④ **ImgSaveName=Image.dcm:** Change image.bmp to image.dcm in order to create DICOM files for Pano and Ceph images.

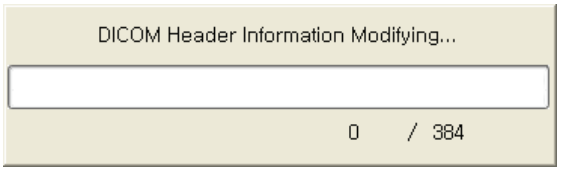
Scanning Software (S/W) Checklist:

1. The Scanning S/W version must support SDK mode.
   (Confirm it by checking whether there is the ImgCapMessage item in the set file (INI).)
2. The Scanning S/W version should be able to support the creation of DICOM files for Pano and Ceph images.
   (Confirm it by checking whether there is the ImgSaveName item in the set file (INI).)
3. The Scanning S/W should still be able to run even without the patient's name information (FNAME, LNAME) at the SDK patient information file (Patientinfo.ini).
4. SliceList.txt and MarList.txt files should be integrated into SliceList.txt.

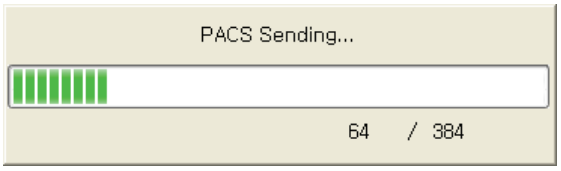
6.2 How to use

6.2.1 Gateway

- The Gateway does not require the user's manipulation because it executes and operates as a window background, if necessary.
- Select the save button after scanning from the Scanning S/W, then the following progression bar will be displayed at the Gateway:



This is a process of recording the patient information selected from the Work list into the created DICOM file.

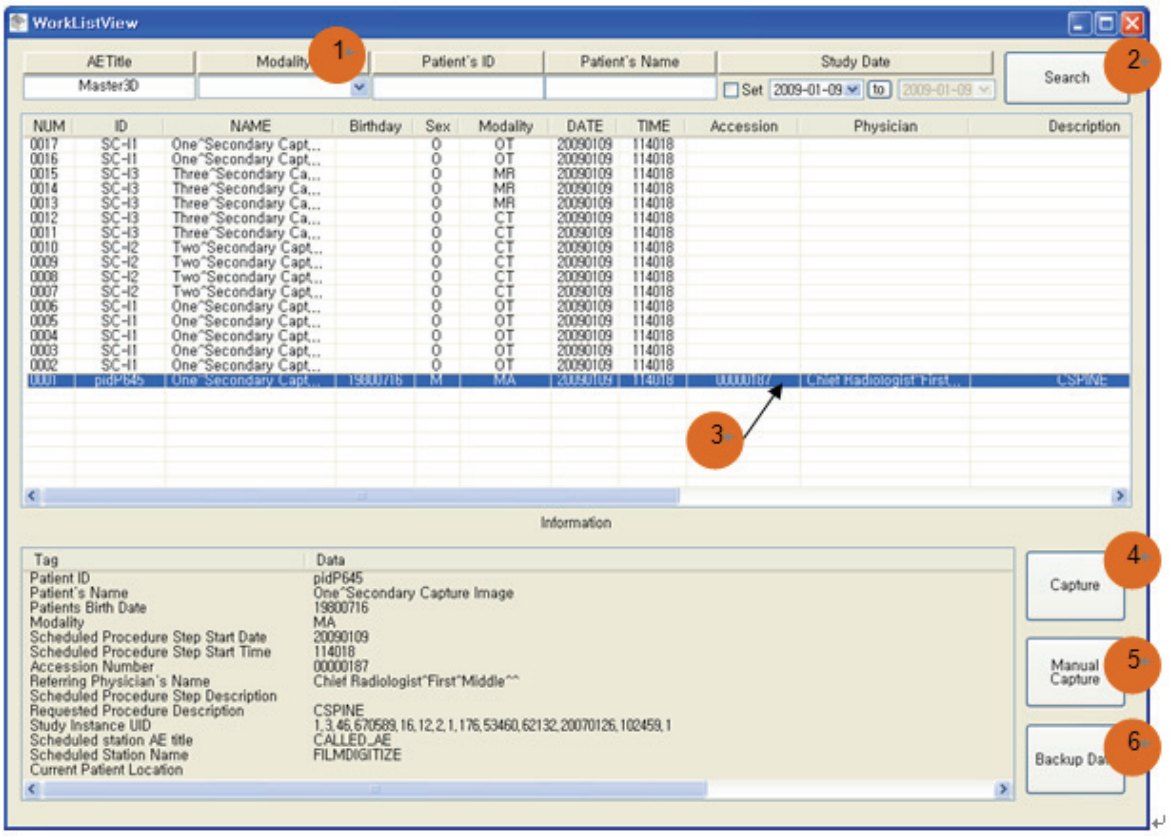


This is a process of transmitting the image to the PACS file server.

The time required for CT transmission can vary depending on the entire volume of the image being transmitted, the internal network environment of the hospital (Transmission speed, Network traffic management method like QOS), and the Receiving speed of the PACS Storage server.

6.2.2 Work list

1. Order Search



① **Modality:** The Default Modality (selected from the environment setup of the Work list) will be displayed upon Work list execution.

② **Search:** Click Search button to search Orders.

③ **Order selection:** Click the Order to be scanned from the list using the mouse.

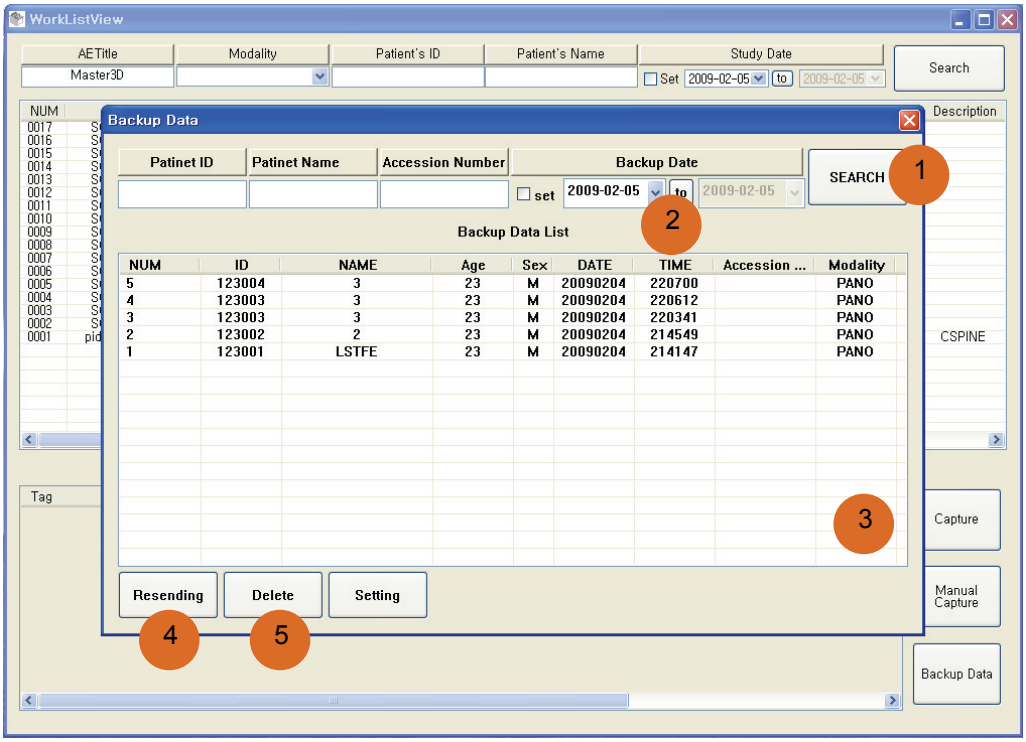
④ **Capture:** Start scanning the selected Order.

⑤ **Manual capture:** This is used for scanning through direct manual input of patient information and not through searching and selecting an Order from the list.

⑥ **Backup data:** Manages the backup data of scanned images.

2. Backup Data Management

- Backup the scanned images after scanning into C:\PACS_Utils\Backup directory prior to Sending.
- The backup information can be confirmed at the Backup data List of the Work list and can also be re-transmitted.



① **SEARCH: Backup:** Search a back up data.

② **Backup Date:** Select the storage period of the backup data.

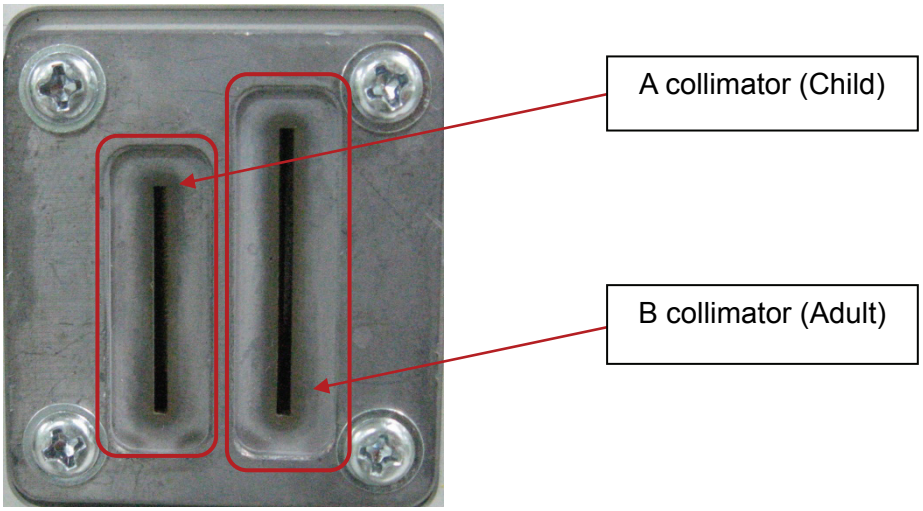
③ **Backup data list:** Shows a list of backup data.

④ **Resending:** Resending of a selected backup data to the PACS Storage server. Sending the data to the location set for transmitting to Geteway_setup.ini.

⑤ **Delete**: Delete the selected backup data.

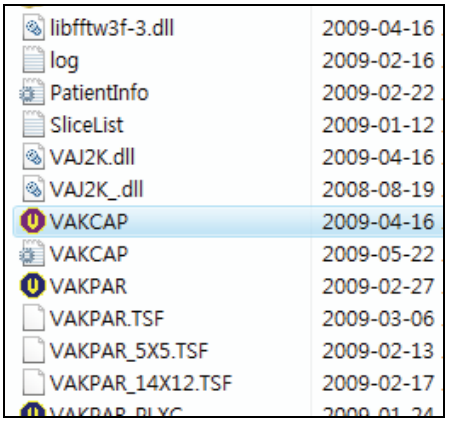
Chapter 7 Collimator Alignment Method

This chapter describes the alignment process that must be performed when the exact layout of the device has been changed due to replacements of parts such as collimator or tube of the equipment.

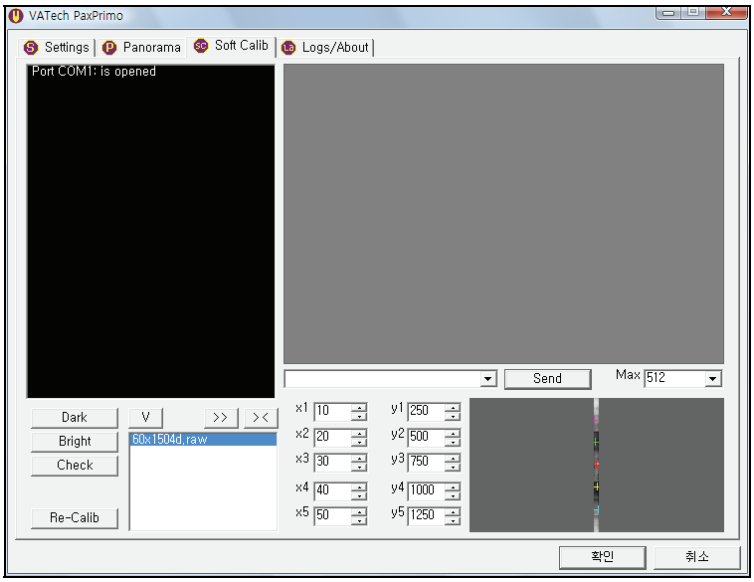


7.1 B Collimator (Adult) Alignment Confirmation

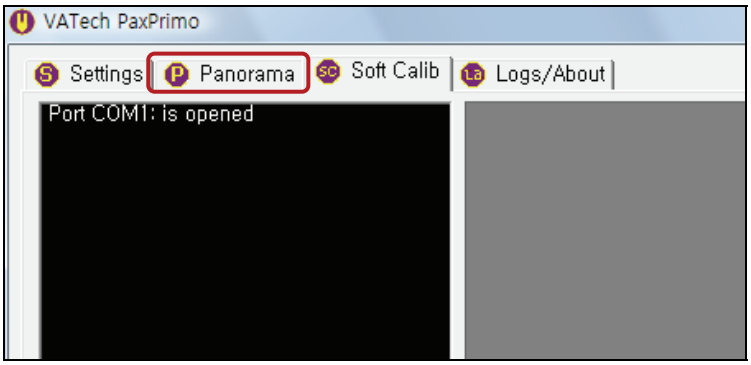
1. Execute the **VAKCAP** file from C:\>PaXPrimo>pano of My Computer.



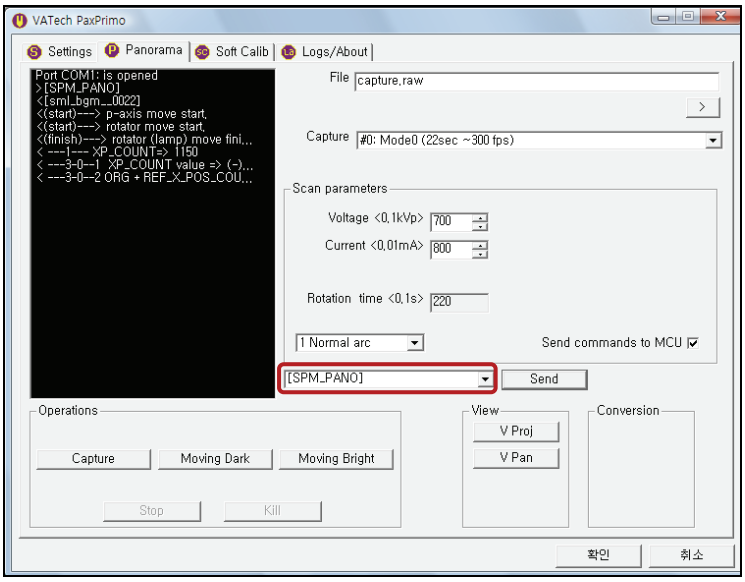
2. The VAKCAP window will pop up as follows.



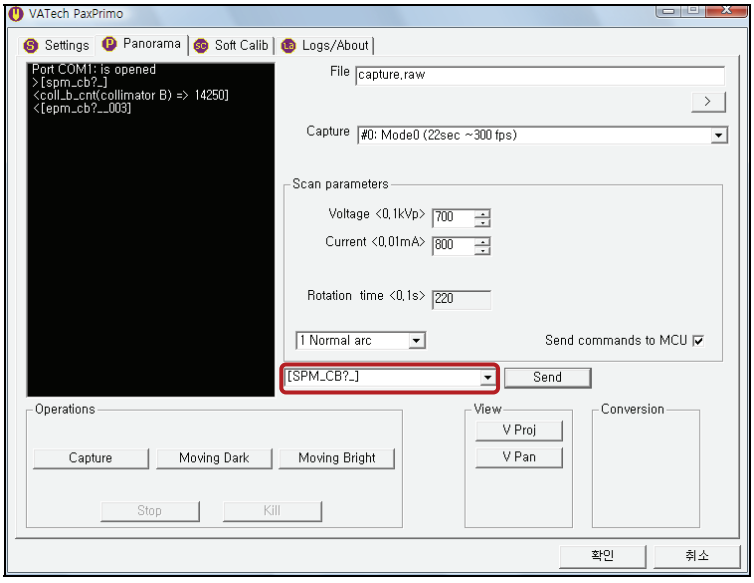
3. Click the **Panorama** Tab.



4. Input **"[spm_pano]"** to the command input window, then click **Send**.
   The command **[spm_pano]** is a command to convert the Scan mode to Panorama mode.

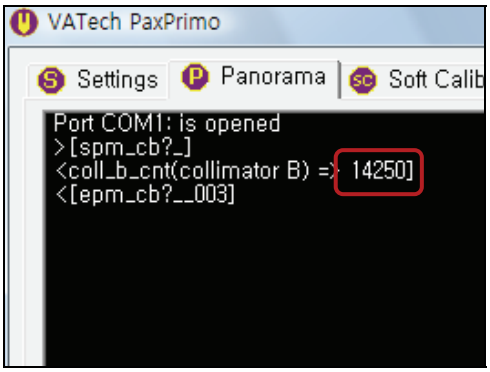


5. Input **[spm_cb_?]** and click send in order to identify the current value of the Adult collimator setting.

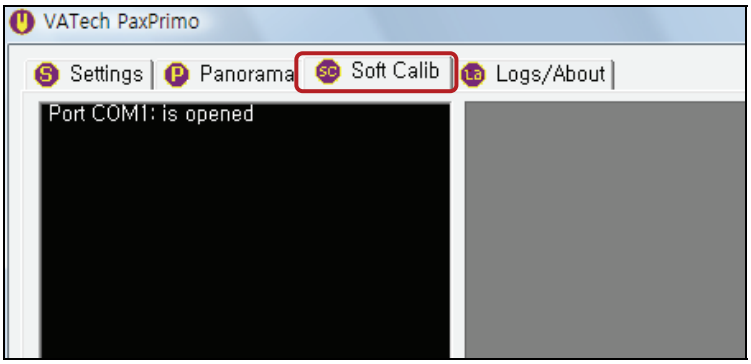


6. Check the CB value.

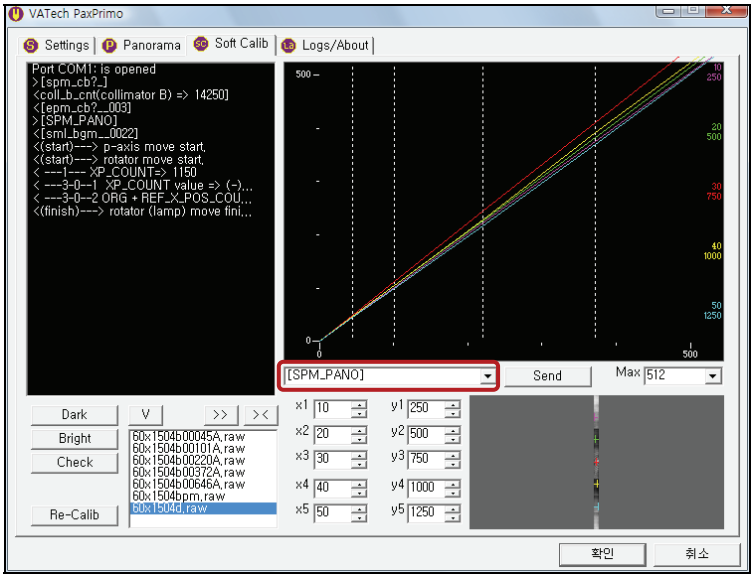
   Collimator B (Adult) Standard value: 14000, Collimator A (Child) Standard value: 34000



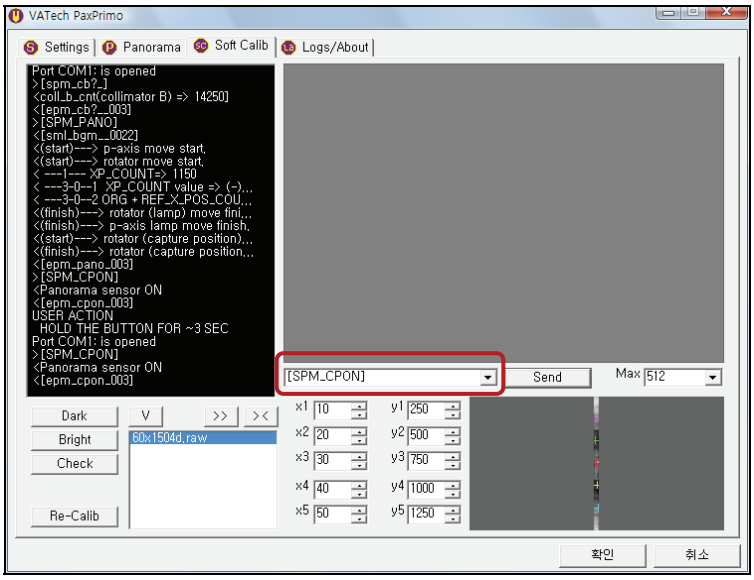
7. Press the **'Soft Calib'** tab.



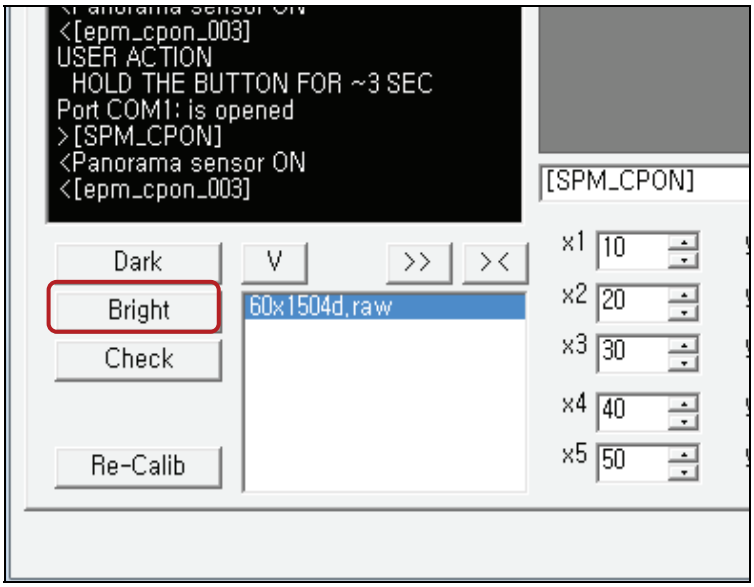
8. Input **"[spm_pano]"** to the command input window, then click **Send**.



9. Input **"[spm_cpon]"** to the command input window, then click **Send**.

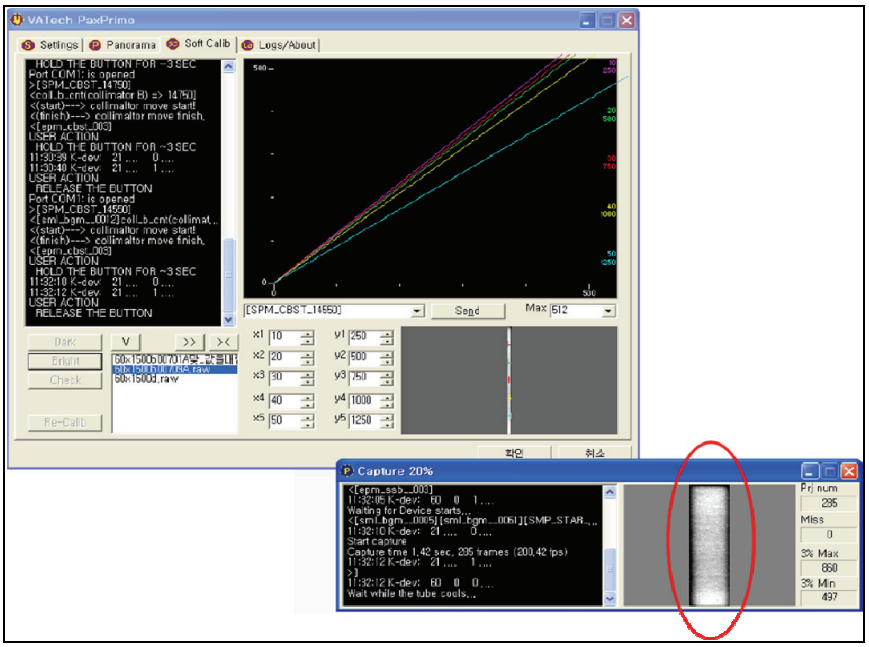


10. Click **Bright** to irradiate X-ray *without the copper plate* in front of the X-ray irradiation window.

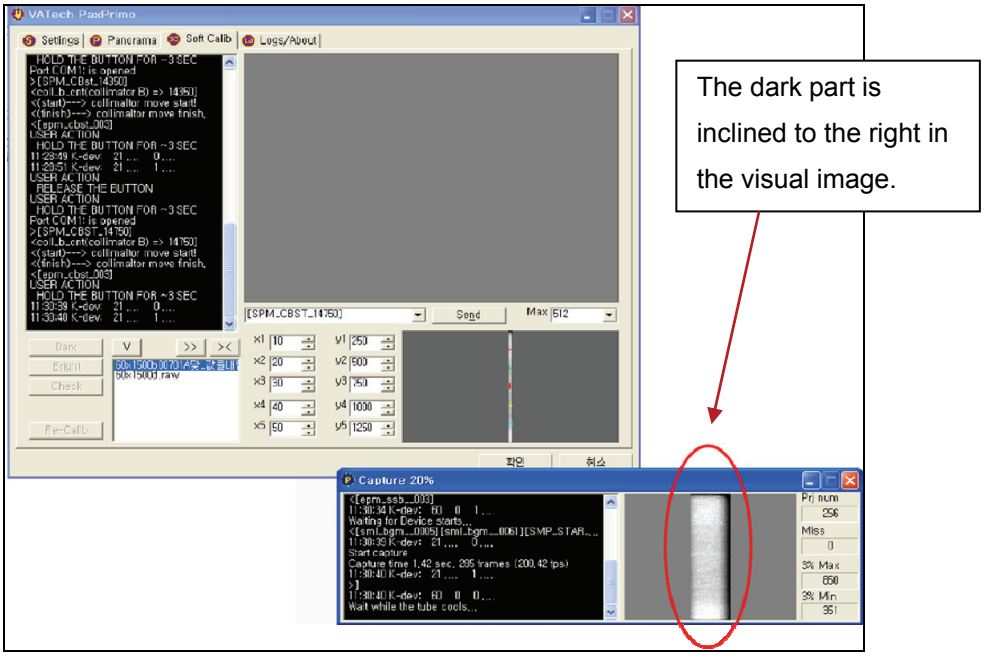


11. X-ray will be exposed and an image will be acquired.

- **The illustration below shows a normally acquired image:**



- **The illustration below shows an abnormally acquired image:**



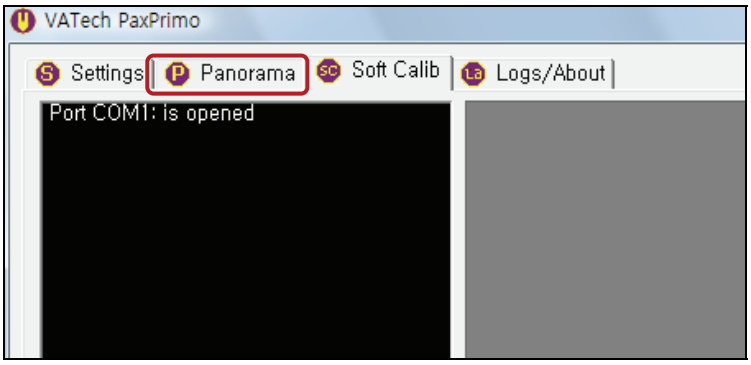
7.2 How to manage

As shown in above sample illustrations, if the dark area is inclined to the right in the image, it is an indication that the Collimator is biased to the left. Therefore, adjust the value down by 100~300. In opposite case, when the dark area is inclined to the left signifying that the Collimator is biased to the right, adjust the value up by 100~300 as well.

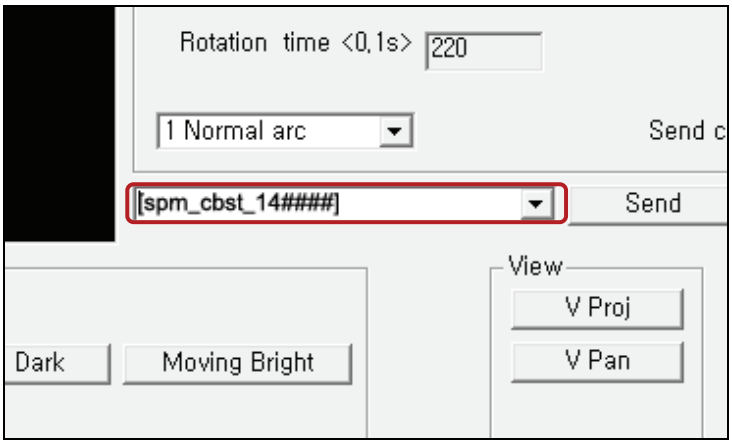
The following shows the process of Collimator correction:

1. Confirmation of B Collimator (For Adult) Alignment

① Press the 'Panorama' tab.



② Input **[spm_cbst_14###]** with the addition of a corrected value to the command input window, then click **Send**.
(### is the corrected value): e.g. because the standard value for adult is 14,000, the corrected value will be =14,000-200=13,800(Left) and 14200(Right).
Meaning, input **[spm_cbst_14200],** based on the example, then click **>Send.**



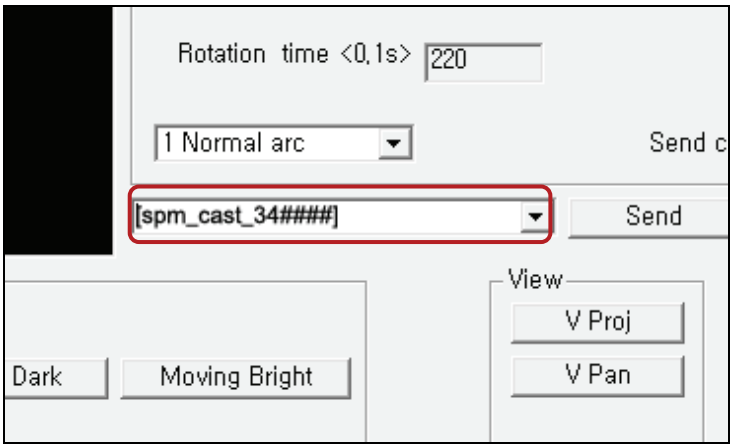
③ Repeat procedures 10 and 11 of the collimator alignment; check if you could acquire a normal image based on the newly aligned Collimator.

④ If the acquired image is different from the normal image shown in the illustration at procedure 11, make adjustments to the Collimator inclination by inputting the appropriate CB value based on the values stated in the Collimator correction method above, and then repeat procedures 10 and 11 of Collimator alignment in order to check if it will now acquire a normal image.

2. Confirmation on A Collimator (For Child) Alignment

After completing the B Collimator alignment setting process, add 20000 to *the CB value of Collimator B*. Then, input the resulting value as a command such as [spm_cast_34###] to the input window, and click **Send**.

(### is the corrected value): e.g. CB value of B collimator is 14,200, the new CB for child is =14,200+20,000 =34,200. Therefore, input **[spm_cast_34,200]** and click “send”.

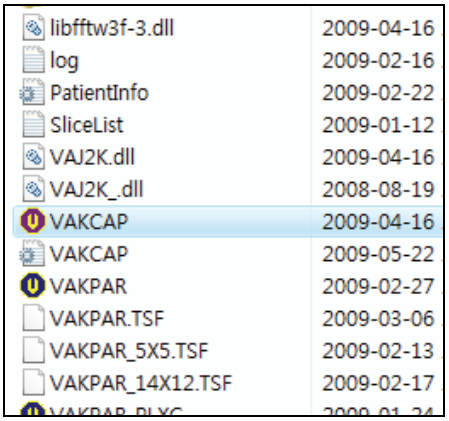


Chapter 8 Half Value Setting and Saving

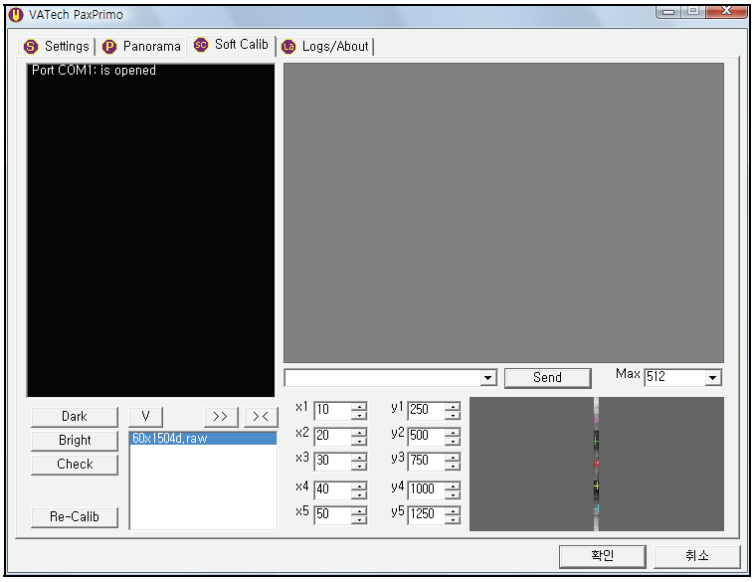
Objective: When you look at the Rotating Unit from the side of the equipment, the X-ray tube and the sensor should be parallel to each other. Any deviation should be adjusted by visually aligning them with the vertical frame.

Procedure:

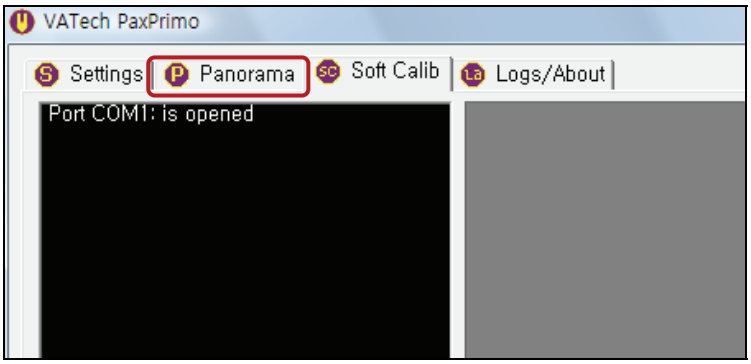
1. Switch on the equipment.
2. Manually turn the Rotator to LAMP position.
3. Execute the **VAKCAP** file from **C:\>PaXPrimo>pano** of My Computer.



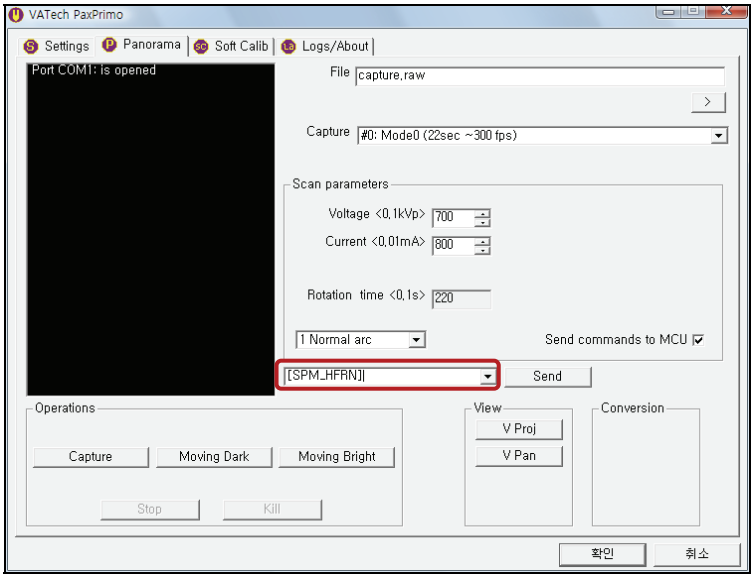
The main window will be displayed as follows.



4. Select Panorama Tab.

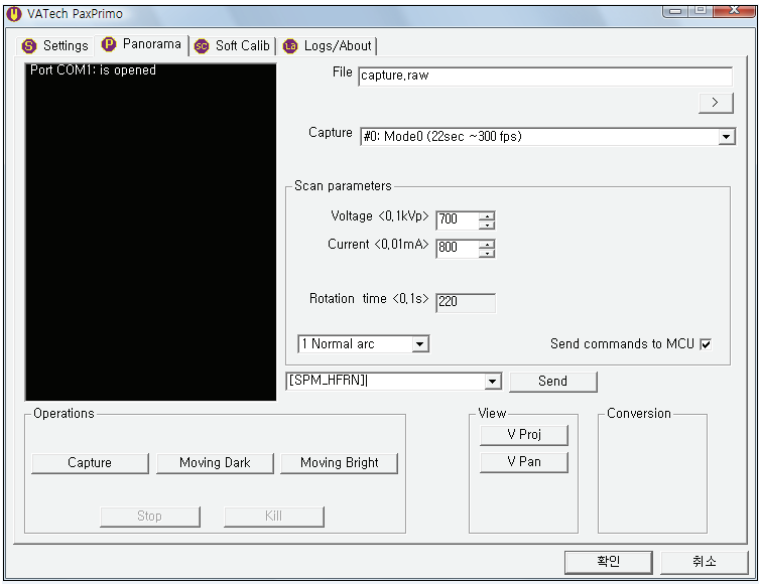


The following window will be displayed.

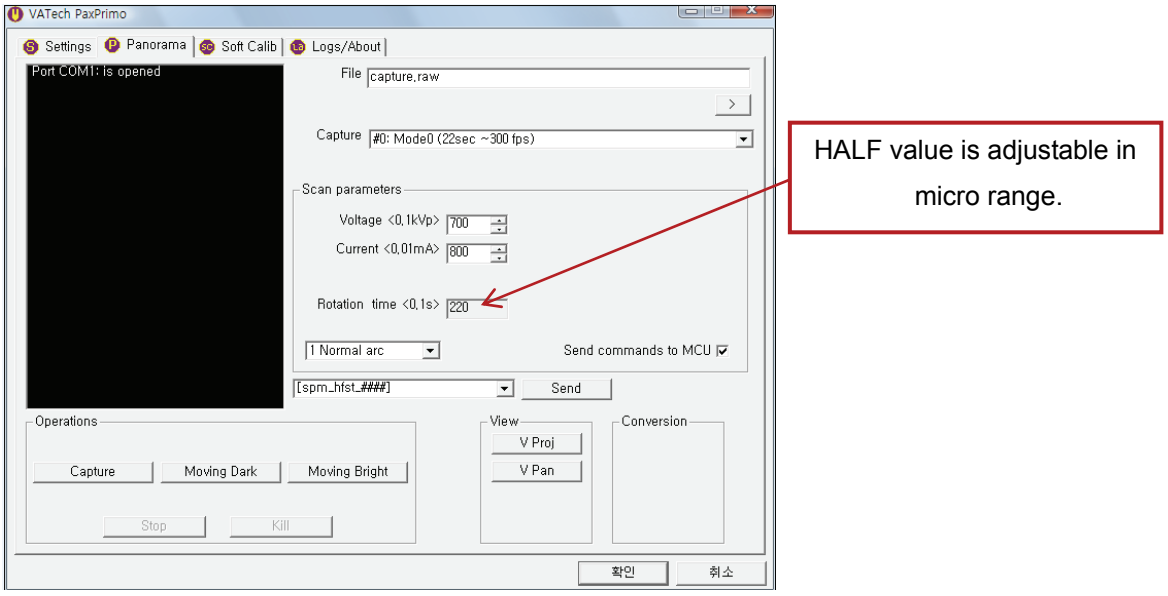


5. Input **[spm_hfrn]** in the command input field, then the unit will automatically move to the Half value position stored in its memory.

6. Reset the equipment to confirm that the Rotator is in Half position.



7. If you want to manually make micro adjustments to the HALF position, set the desired value using the command **[SPM_HFST_0000]**. When moving the Central area to the right, raise the hfst value; and when moving to the left, adjust the value down.



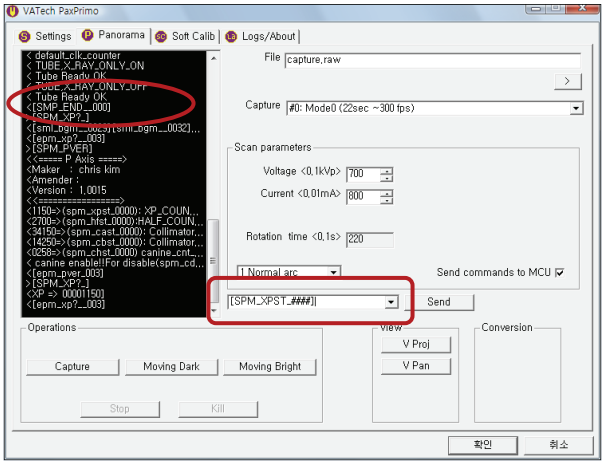
Chapter 9 Panorama P Axis (XP Value) Reference Value Setting

Objective: Although the left and right side enlargement ratios are same, the size of an original image can still actually be different in many cases from the size of an acquired image.

Therefore, this chapter provides details about the adjustment process in order to make the acquired image be same with its original size.

- Provided below is the process to confirm the center ball size, which should be about 50~52pixel (standard value: 1200), using View16 and the Ball phantoms.

1. Send the command [spm_xpst_1200] at the VAKPAR window and set it as the standard value.

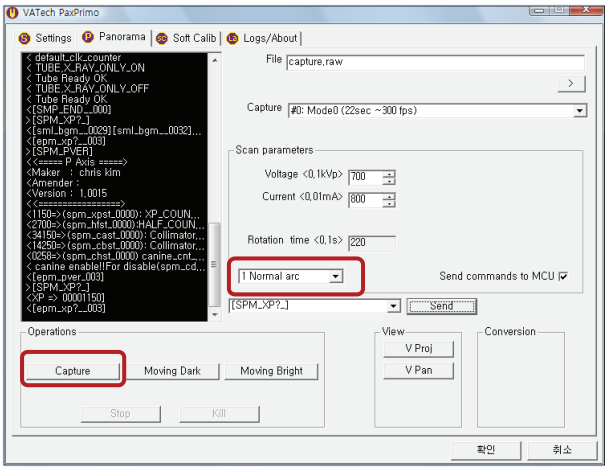


2. Install the Ball phantoms.
3. When the Ball phantoms installation is completed, execute the scan program and perform NORMAL scanning.
   In order to do so, send the commands at the command window in the following order:

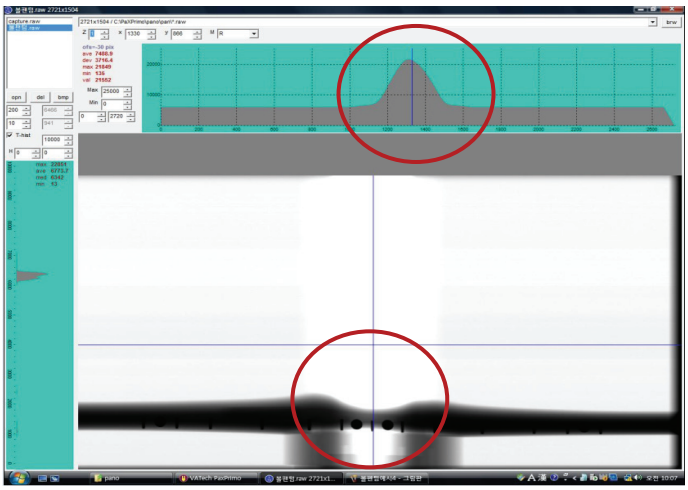
   ([spm_pano] → [spm_cpon] → [spm_snd_] → [spm_stan] → [spm_ret_]

   → [spm_erdy] →capture)

Click **"Send"** for each command being sent.

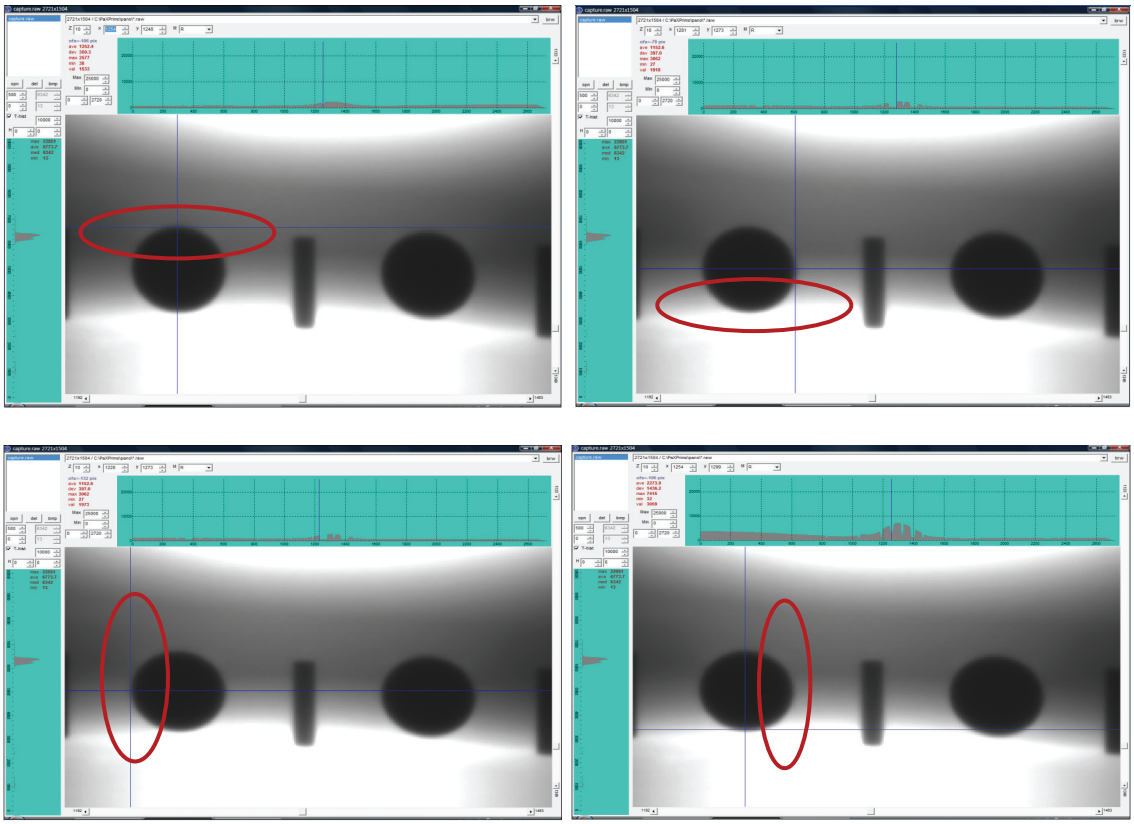


4. Click **V Proj** at the VAKPAR window of the scanned phantom image to make confirmation.



5. Open the PaX-Primo\Pano\Pan\capture.raw.
6. Set the measurement position to the center of the vertical length of the ball.
7. Visually confirm the size of the ball part at the center of the image, which should be at 50~52pixel in round form.
8. Use **[SPM_XP?_]** to confirm the current XP value.

9. Each measurement result of the 4 balls' horizontal length is not in the value range of 50~52pixel. So, subtract the acquired value from step 8 and repeat the process by sending new [XP] value by using the **[spm_xpst_####]** command.



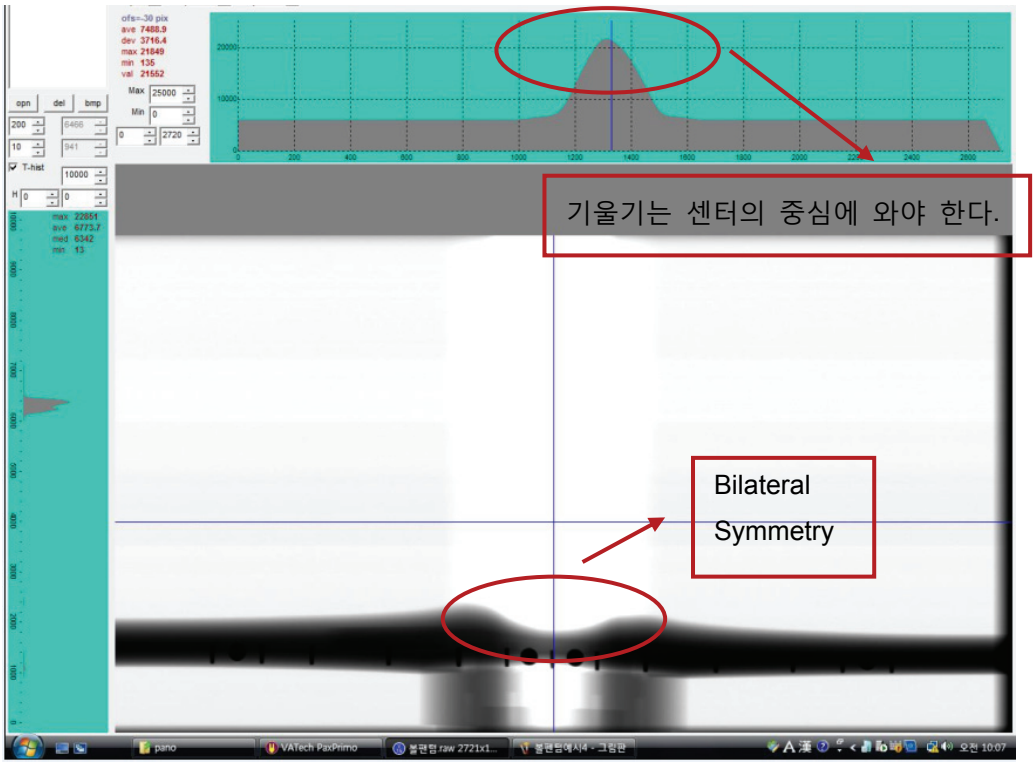
① If the size of the ball is >50~52pixel, the [XP] value reduces if the ball is enlarged.

② If the size of the ball is <50~52pixel, the [XP] value increases if the ball is reduced

Chapter 10 Confirmation of X-Ray Scanned Image

10.1 Confirmation of the center of an X-ray scanned image

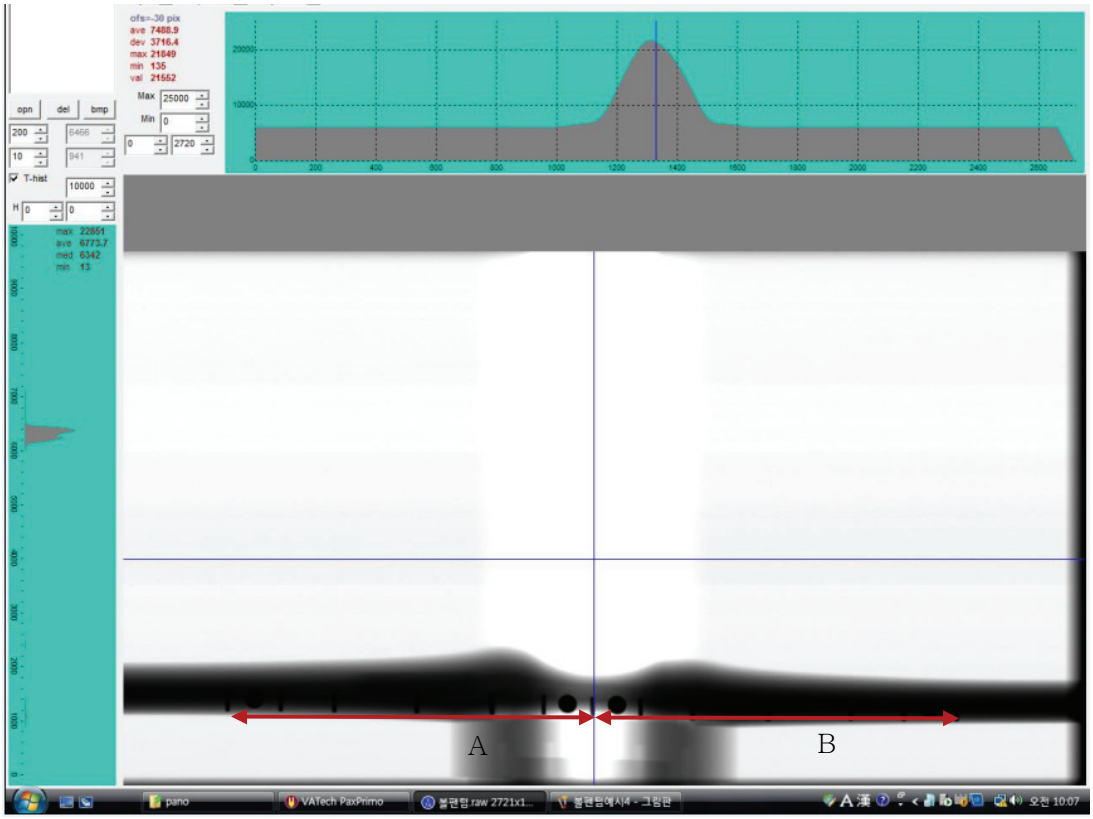
1. Using the Ball phantoms, check the center line of the image.
2. Implement this under the assumption that [Half] value setting is correctly set upon the initial equipment setting.
3. Check the canine, vertical, and horizontal lasers, as well as the horizontal line of the Ball phantom; then scan the Ball phantoms using the scanning column (normal mode).
4. Check the scanned Ball phantom image by clicking **V Proj** at the VAKPAR window.
5. If the center is not fit correctly, adjust the Half value using the command **[spm_hfst_####]**.
6. Open the PaX-Primo\Pano\Pan\capture.raw.



10.2 Confirmation of the Bilateral Symmetry of an X-ray scanned image

1. Using the center pin based Ball phantom image, measure the distance of the right and the left side of the pin.
2. The bilateral distance should be the same at within the error range of 10 pixel.
3. When a pixel error occurs at a range higher than the acceptable one, manually adjust the clamping screws of the chin rest in order to correct the bilateral distance values.

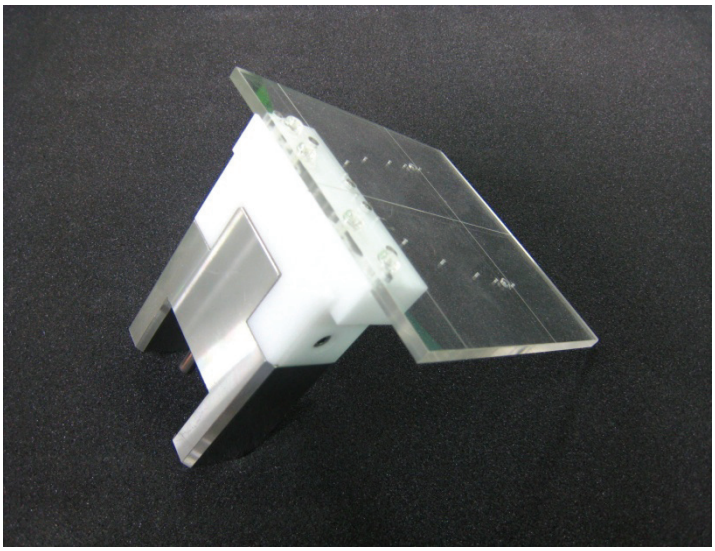
The following figure shows a measurement sample.
In the measurement results, the A value should be equal to the B value, as shown in the figure.



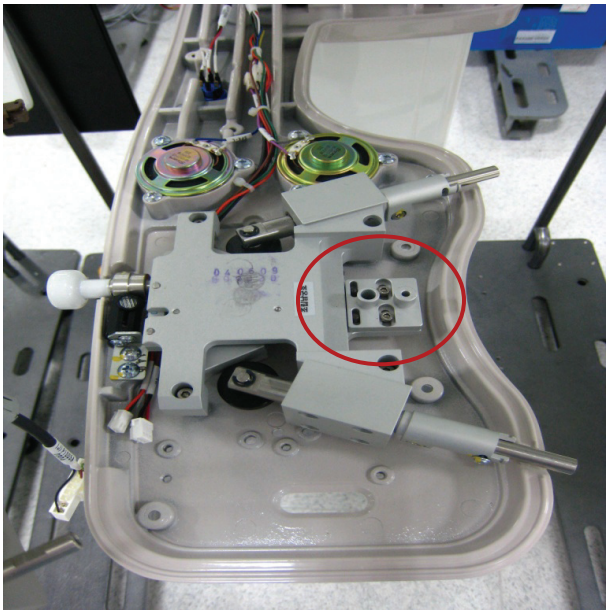
Chapter 11 Magnification Ratio Measurement and Chinrest Central Axis Distance Revision

11.1 Measurement of the Enlargement Ratio

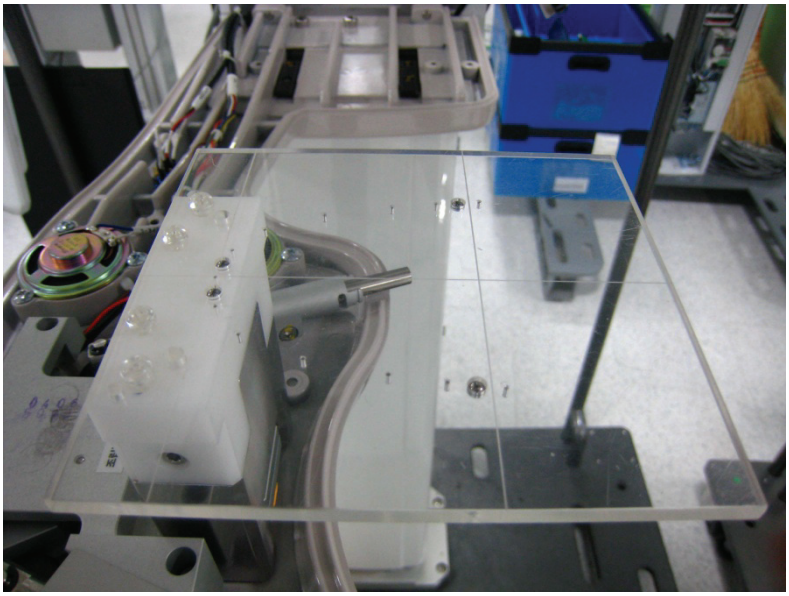
1. For magnification measurement, prepare the PaX-Primo equipment for the exclusive use of ball phantom.



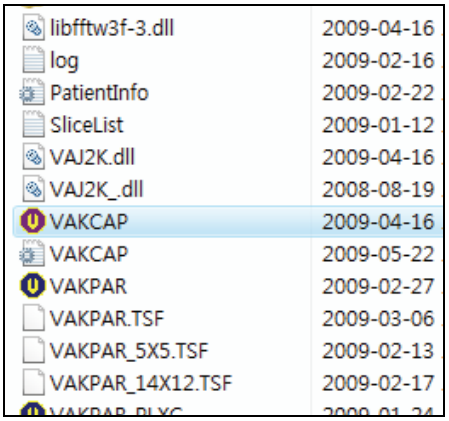
2. Place the Ball phantom on the chin rest of PaX-Primo (shown in red circle).



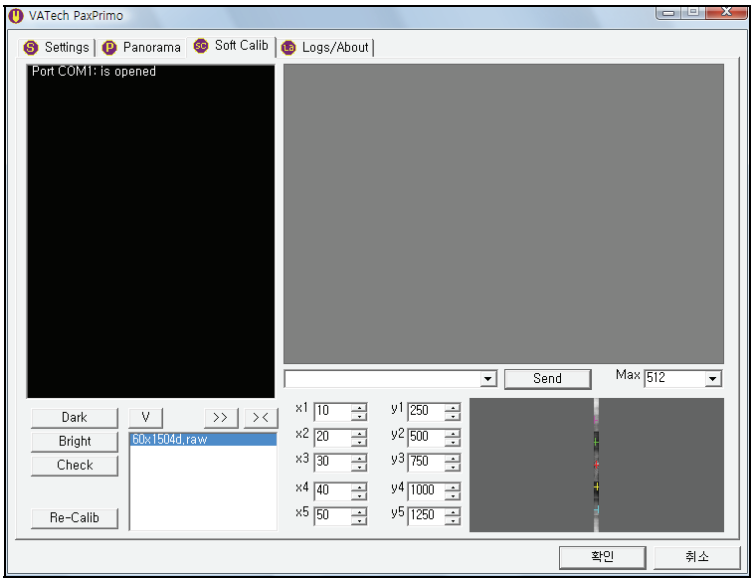
3. The figure below shows how it looks like once the ball phantom is placed.



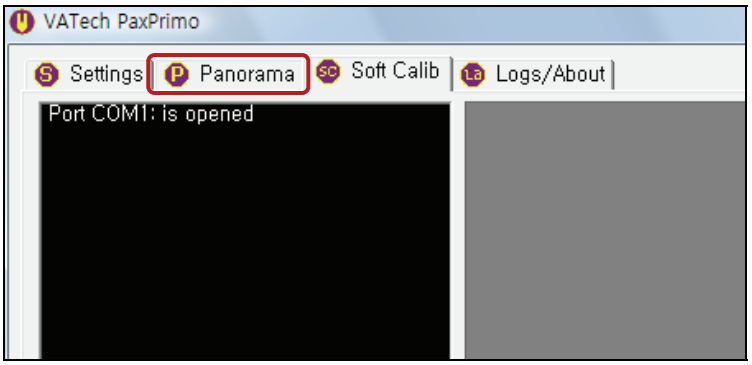
4. Execute **VAKCAP from C:\>PaXPrimo>pano** in My Computer.



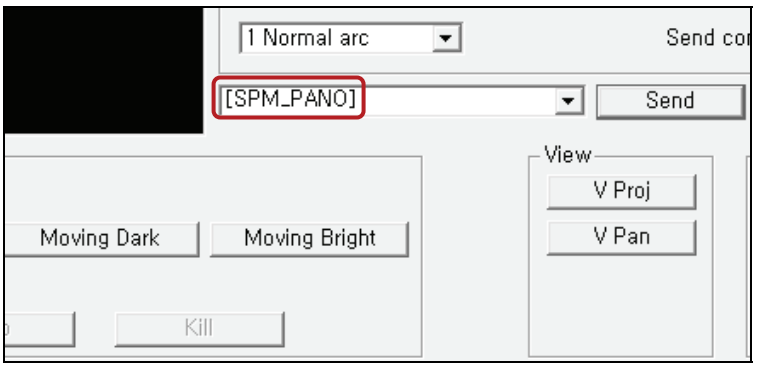
5. Then, the VAKCAP window will be displayed, as shown below.



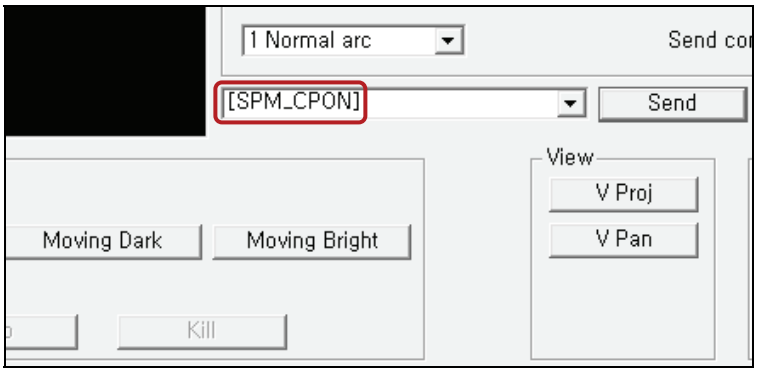
6. Select **Panorama** Tab.



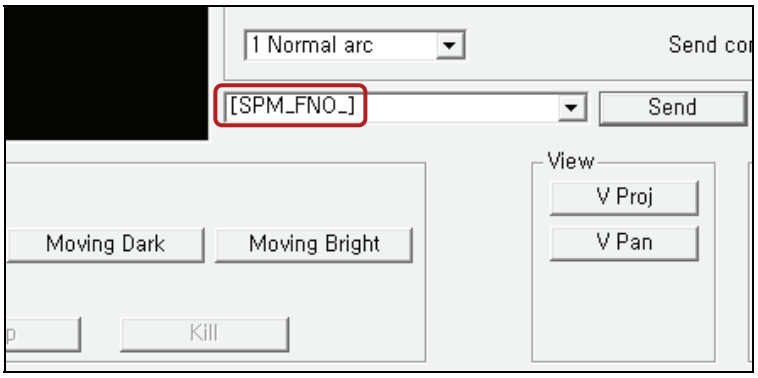
7. Input the command **"[spm_pano]"** to the command input window, then click **Send**.



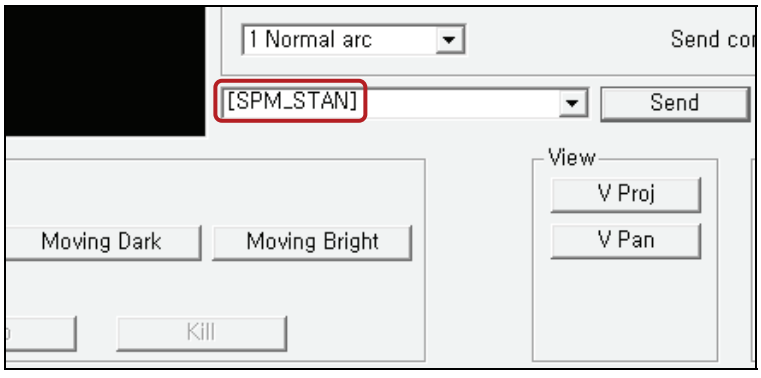
8. Input **"[spm_cpon]"**, then click **Send**.



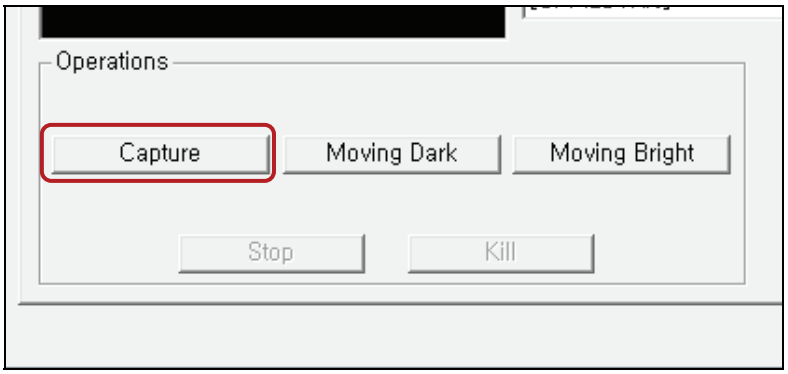
9. Input **"[spm_fno_]"**, then click **Send**.



10. Input **"[spm_stan]"**, then click **Send**.

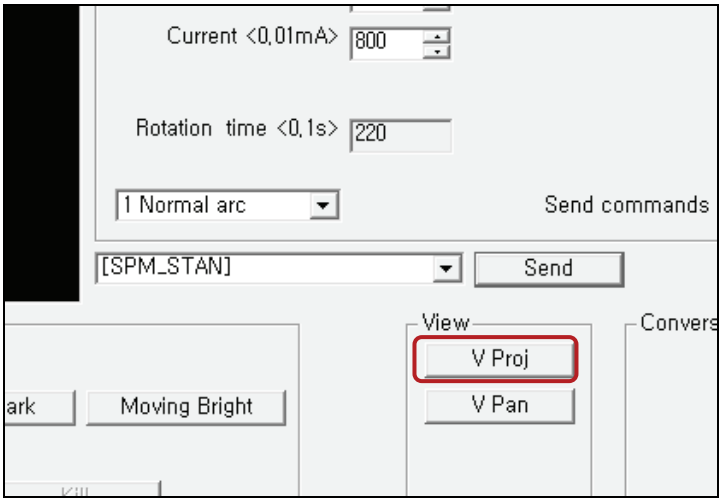


11. Click the Capture button, then the X-ray will irradiate and the image of the Ball phantom will be acquired.

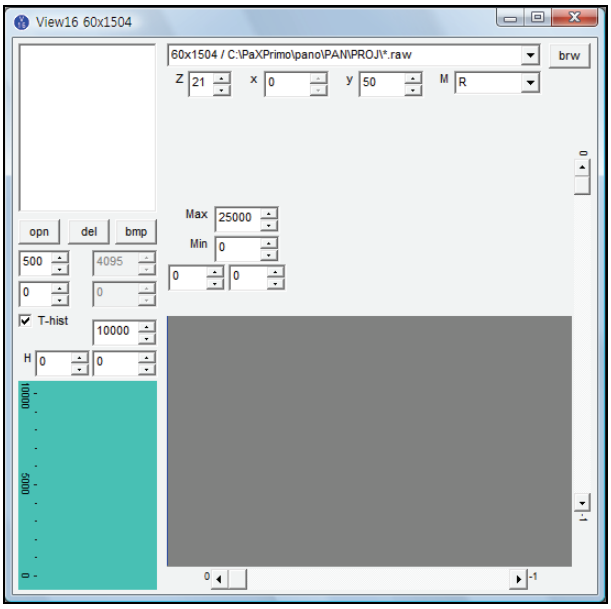


12. The acquired image will be saved at C:\>PaXPrimo>Pano>Pan>**Capture. RAW**.

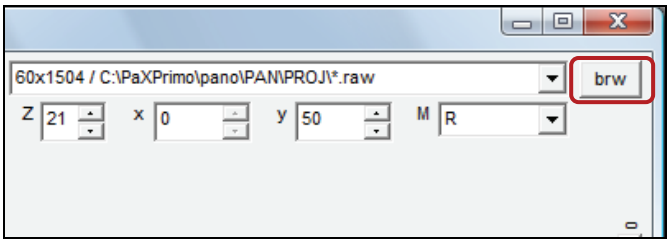
13. Press **V Proj.** at the Viewer box of VAKCAP.

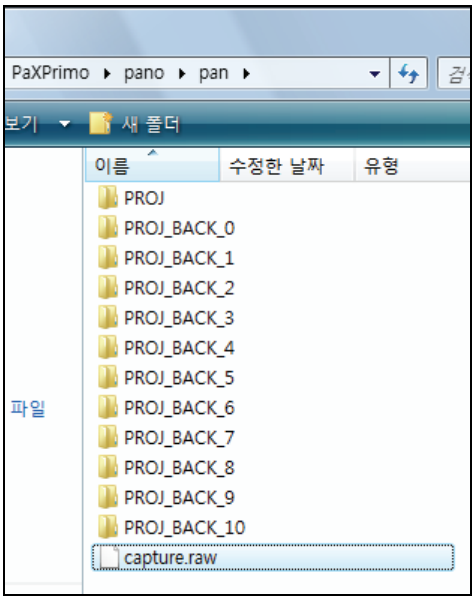


14. Then, the View window will be displayed as shown below.

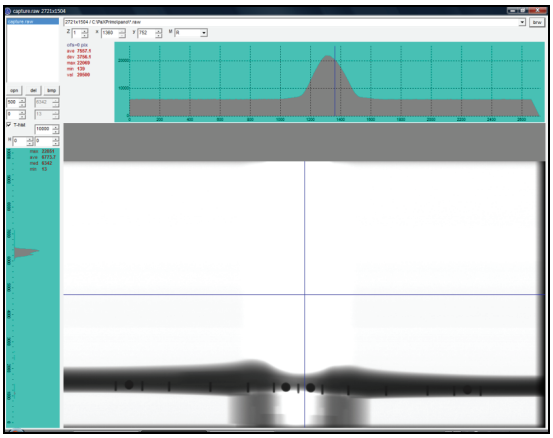


15. Click **Brw** and select C:\>PaXPrimo>Pano>Pan>Capture.raw to open the file.

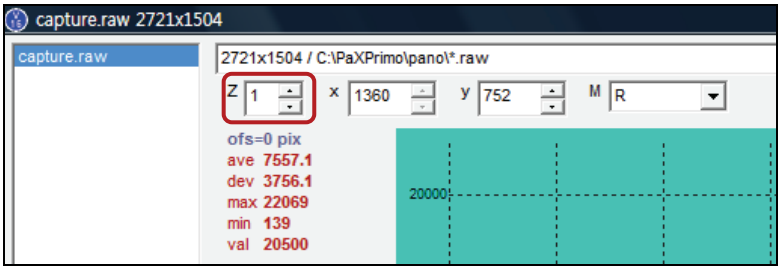




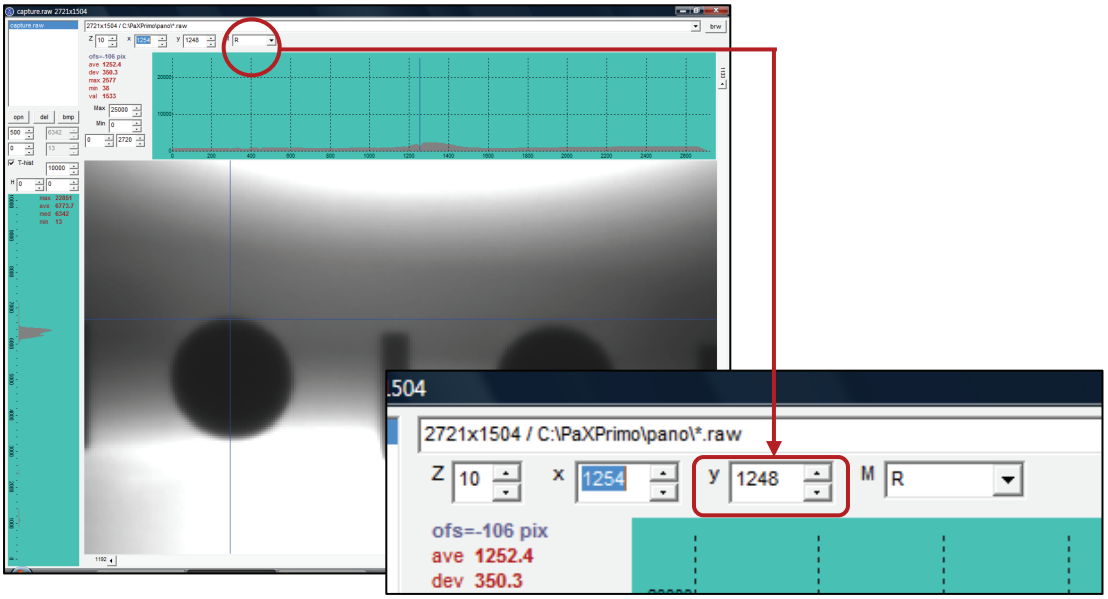
16. You can open the file, as follows.



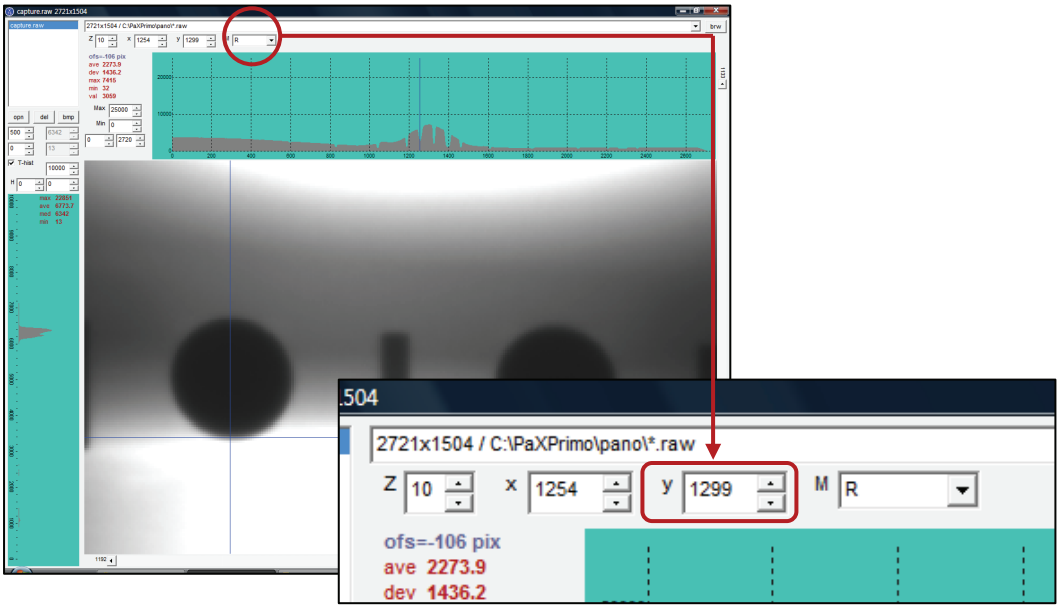
17. Enlarge the image, if necessary, by increasing the Z value.



18. As shown in the illustration, click the top mid area of the left ball phantom image to record its Y value.

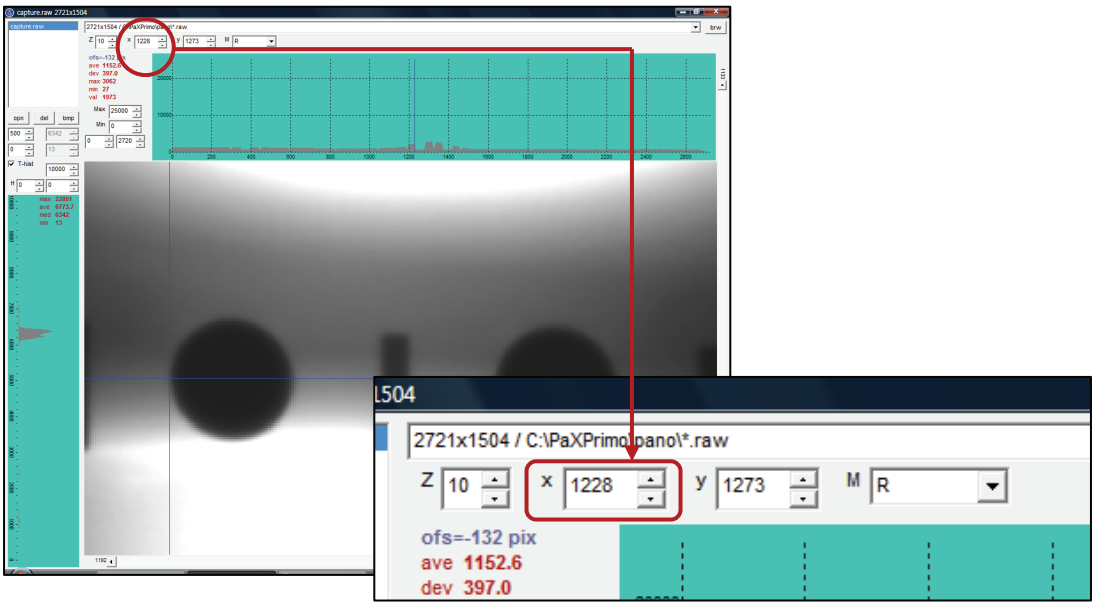


19. Click the bottom mid area of the left ball phantom image to record its Y value.

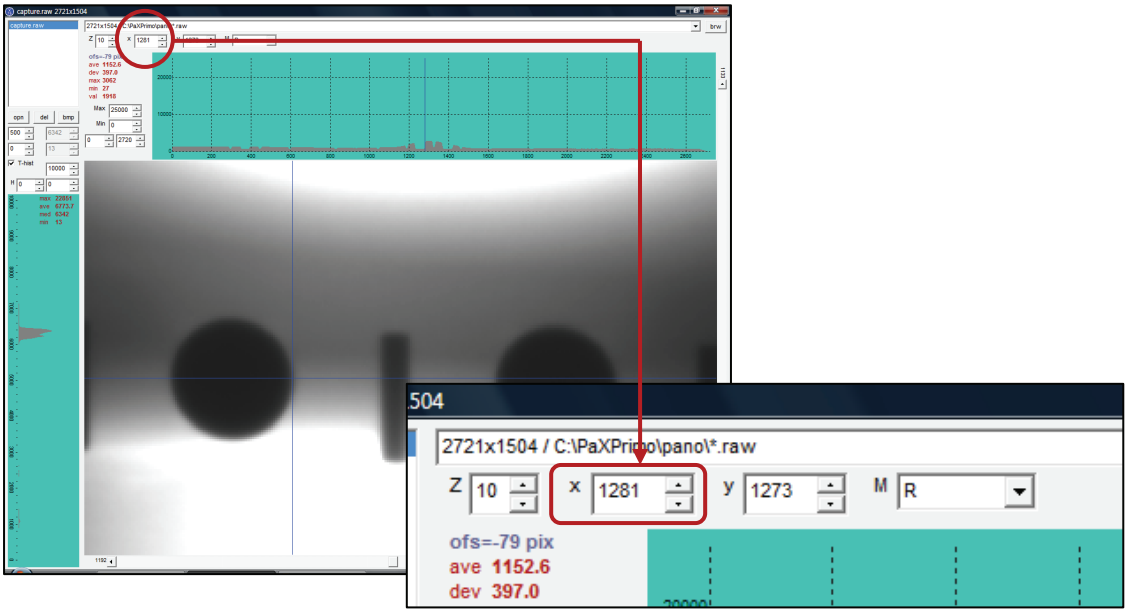


20. Subtract the top mid area value from the bottom mid area value.
    The bilateral size of the Ball phantom should meet the standard value range of 50~52 pixels (Example) 1299-1248 = 51 (Normal)
    The value calculated here is the Reference Value. Record the Reference Value.

21. Click the left mid area of the left Ball phantom image, as shown in the figure; then record its X value.



22. Click the right mid area of the left Ball phantom image, as shown in the figure; then record its X value.



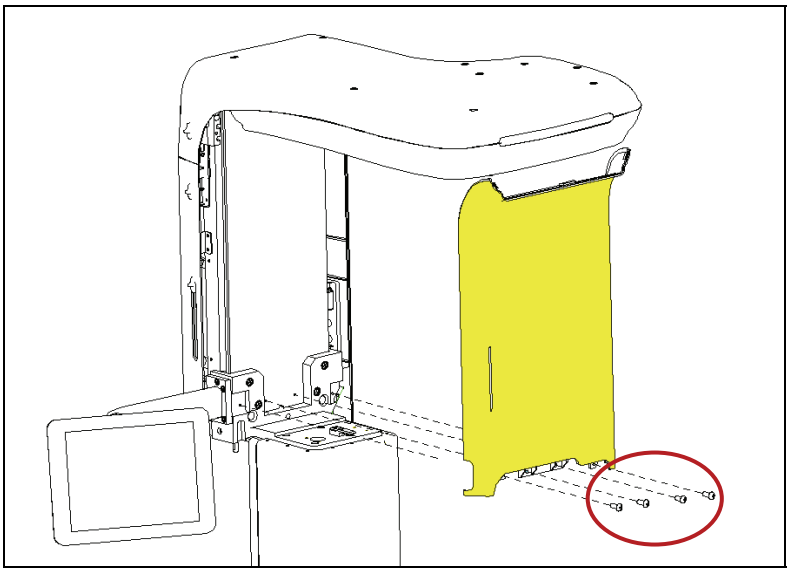
23. Subtract the value of the left side from the value of the right side.
    (Example) 1281-1228 = 53
    ±2pixel is the tolerable error range due to the common difference in comparison with the value recorded in step 19.

24. Repeat steps **21 - 23** for the bilateral distance of the right Ball phantom image and calculation of the size of the left and right mid areas of the ball phantom.

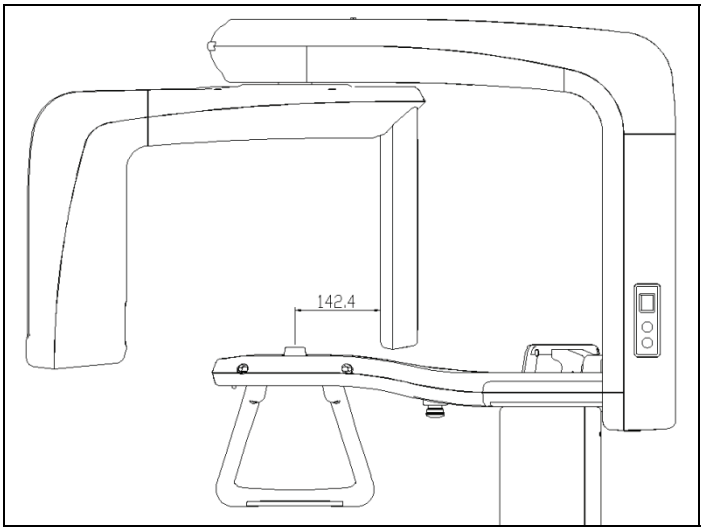
25. Compare the bilateral width of the ball phantoms and if the difference is less than 10pixel, it is within the tolerable error range, which is normal. But if it is more than 10pixel, the magnification ratio between the left and the right sides differ.
    This happens because the bilateral distance between the central axis of the Ball phantom and the sensor differs. This can be solved by troubleshooting, as follows:

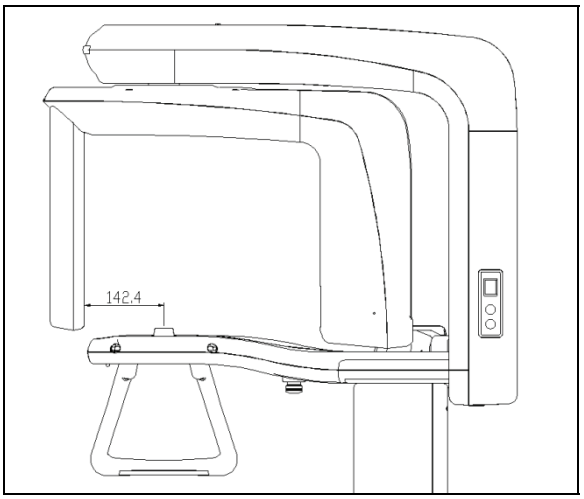
11.2 Correction of Bilateral Distance from the Chin support center axis

1. Disassemble *the cover of the sensor*, as shown in the figure.

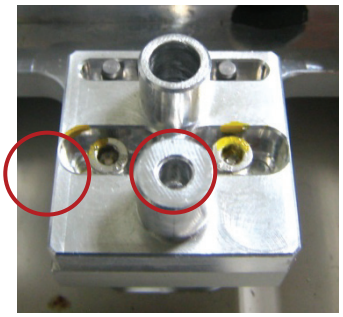


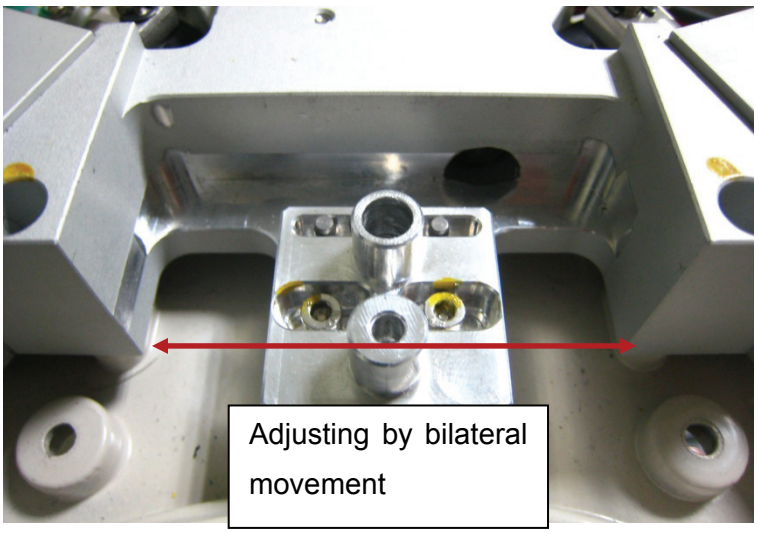
2. The bilateral distances between the chin rest block and the sensor should be same at 142.4mm, as shown in the figure.
   Using a ruler, measure the left and right distances of the chin rest block and the sensor.





3. Loosen the fixation wrench bolts of the chin rest block. Then, taking into account the measured distances, adjust the bilateral distances at 15.4cm.





4. Using a wrench, tighten the loosened chin rest block.
   Repeat correction procedure 11.1. After which, if the resulting value is within the error range, finish the adjustment of bilateral distance values of the chin rest block.

Chapter 12 Guidelines for Spare Parts

1. In principle, the delivery of parts for after-sales service should only be undertaken after the receipt of the defective parts by the warehouse; but certain exceptions are allowed.

2. Exceptions are allowed despite the rule that the agent or branch must receive the defective parts prior to the delivery of new parts by the company. But if the defective parts are not returned within 30 days from the delivery date of the new parts, the accumulated cost of the parts will be summed up and will be charged to the client on the last day of the corresponding month, where the 30-day period passed. (Cables or any other part with a value of less than USD 50 is excluded.)

3. The warranty period of spare parts is within 12 months from the delivery date or within 6 months from the installation date.

4. When a spare part is used for the equipment of which warranty is over, that spare part could still get guarantee for free service within its own warranty period.

5. In principle, a branch or agency should have basic spare parts in its possession if it has already accumulated installations of a particular equipment exceeding 10 sets.

6. If a spare part is to be lent to the branch or agency, a proposal should be made first by the head of overseas business division, which in turn must be approved by the division director. Then, it should be forwarded to the head of the Customer service department for processing.

7. In accordance with the management regulation of the company, a prepayment deposit is necessary for the spare parts sales of less than USD 5,000. But if it is more than USD 5,000, the credit limit of that client as described in the Sales Contract (amount and period) can be applied.

8. The price of spare parts is set based on the Appendix C. Price of spare parts.

12.1 Principle of Delivery Cost Payments

1. All parts with warranted after-sales service should be delivered by a designated carrier (EMS) with the forwarding fee to be paid by the seller. But in special cases, the buyer may choose a specific carrier and the forwarding COST AND FREIGHT should be paid by the buyer.

2. The estimation of payable after-sales service and forwarding payment of the spare parts should be done on the principle of EX-WORKS.

12.2 Replacements and Refunds of Spare parts

1. If the purchased spare part has a storage period that already lapsed 12 months, it can be replaced with any other spare part under the same spare parts list within the limit of the purchase amount of the part. Such request for replacement must be accepted unless there is a valid reason not to.

2. In a situation where the sales contract between the company and the agent or branch has expired or has been terminated, the spare parts held by the agent or the branch, that do not have any quality problem, can be refunded upon request based on the amount paid upon purchase. Such request must be accepted unless there is a valid reason not to.

12.3 Transaction process for Spare parts

The following is the process of purchasing spare parts.

- The buyer of spare parts must choose the parts to be purchased and make an order at the Issue Tracking System (ITS)) website.

- The processing of the ordered parts through ITS is to be carried out by the head of the Customer Service Department, Purchasing Team of the Procurement Department, and the in-charge of the Overseas Business Department, as well as the branch.

- The buyer can check the status of the purchased spare parts through the ITS website.

Appendix

A. Installation Method of Firmware Upgrade Tools

A.1 FDT Installation

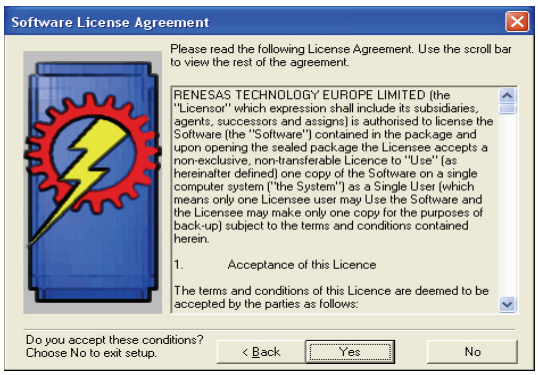
1. Preparation of the new firmware version

Installation should be done only after confirming the new version of the firmware.

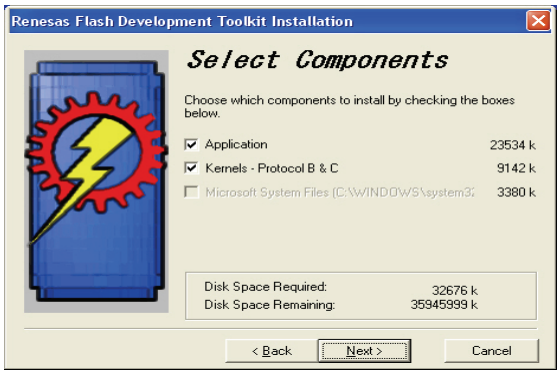
2. Firmware Download Tools (Flash Development Toolkit) Installation

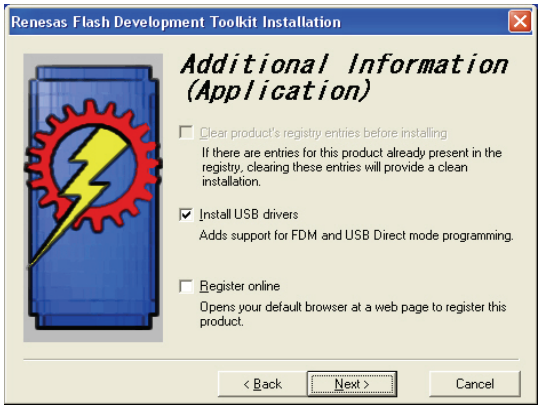
① After unzipping the downloaded file, execute the file "**fdt3_1.exe**", and then the "Welcome" message window will be displayed.
Select **"Next"** button.

② Click **"Yes"**.



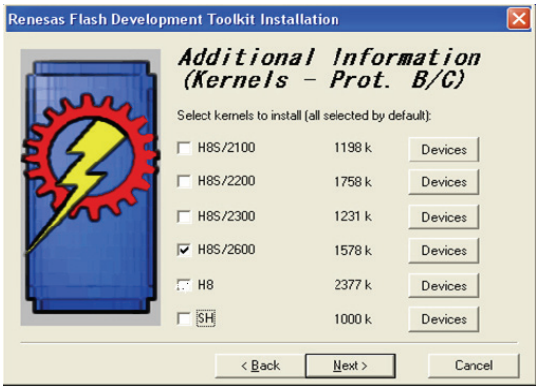
③ The "Select components" window appears, then click "Next" button.





④ If there is any additional installation components, check the applicable button then click “Next”.

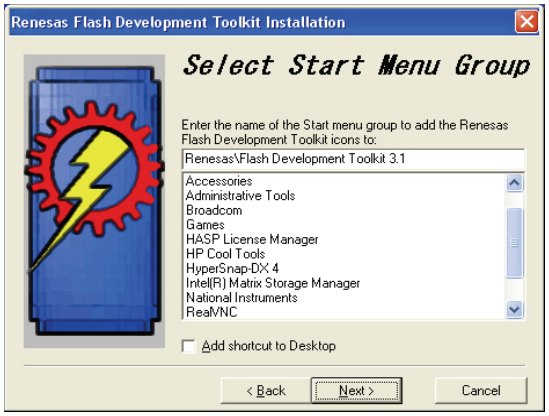
⑤ Uncheck all items in the checkboxes except H8S/2600, then click “Next” button.



⑥ Select the folder to be installed and click “Next”.
At this point, the folder location can be changed.

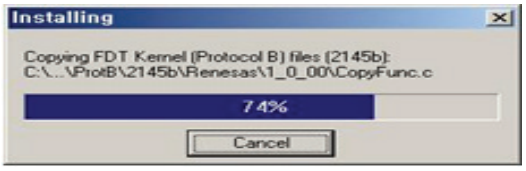
⑦ Select Backup Folder and then click “Next”.

⑧ Select Start Menu Group window will appear. Click “Next” button.



⑨ Click “Install” button.

⑩ The installation progress will be shown.



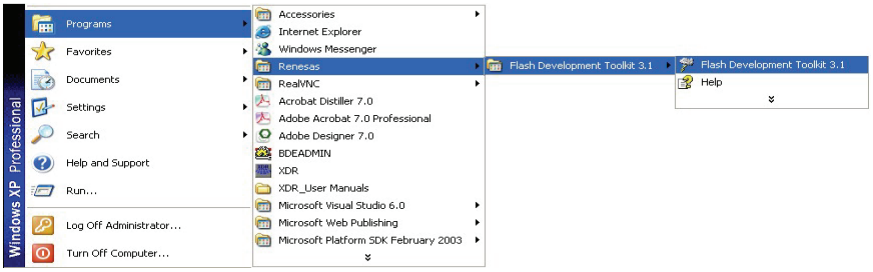
⑪ When the installation is complete, the “Installation completed” window will appear. Click “Finish” button.

3. Work Environment Setup for Firmware Download Tools (Flash Development Toolkit)

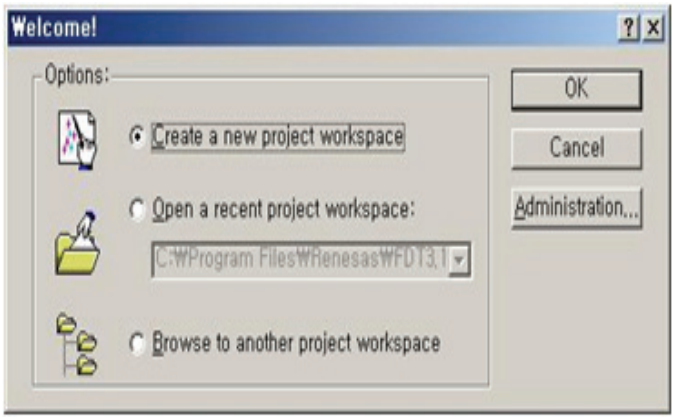
- When FDT is being performed for the first time, the work environment of the new project should be set up.

Procedure:

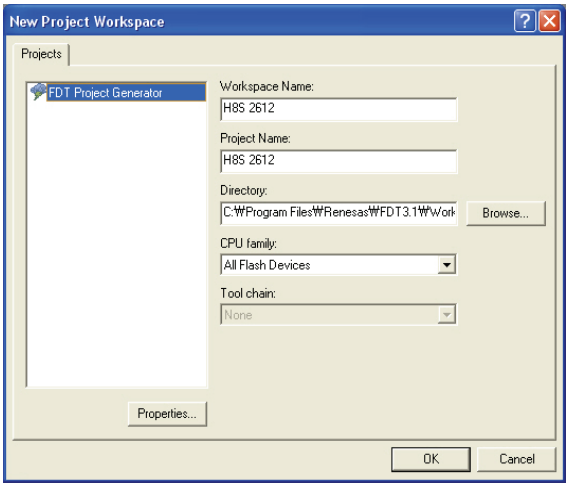
1. Start > Program > **Renesas > Flash Development Toolkit3.1** >
   Select and execute **"Flash Development Toolkit 3.1"**.



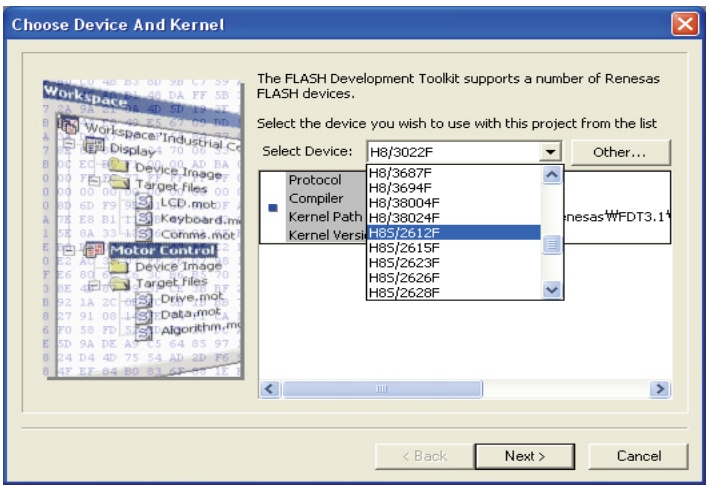
2. The following window will be displayed, then select **"Create a new project workspace"** in order to create the work environment for the new project. Then click "OK" button.



3. Input **'H8S2616'** to the Workspace Name and the Project Name input boxes using the keyboard Board. Then click "OK" button.



4. Select **'H8S/2612F'** device and click "Next" button.

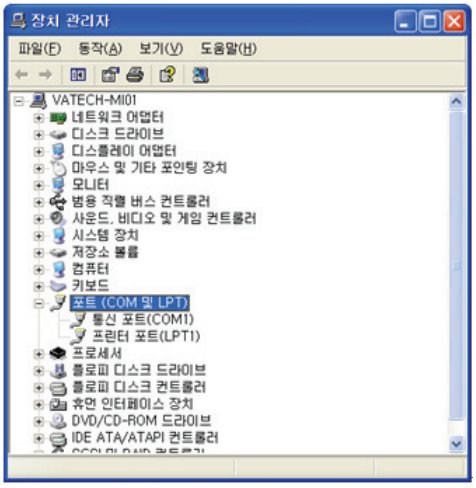


The communication between PaX-Primo and the computer should be checked using the communication port, which is an added attachment to the computer.

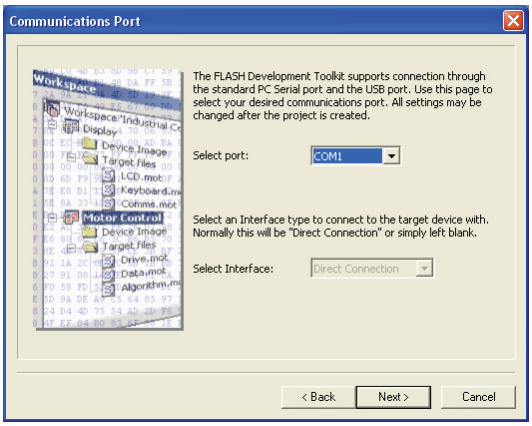
Select Start>Control Panel>System and the window for 'System Registration Information" will be displayed. Select the "Hardware" tab and then click "Device Manager" button.

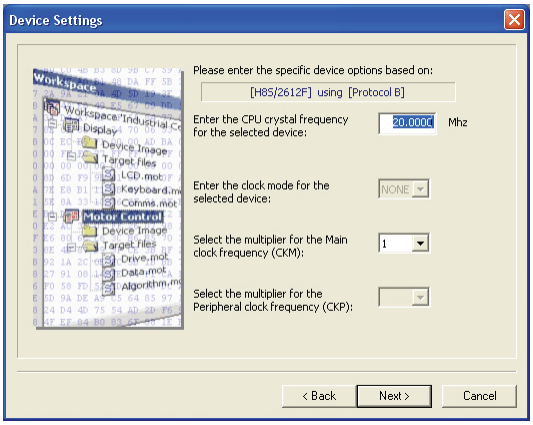
At the 'Device Manager' window, check the communication port that is connected to the equipment.

If it is an extension of 1 communication port, it usually appears as 'Com3'. If it is an extension of 2 or more communication ports, you can have it verified by checking the manufacturer and product name of the extension card.

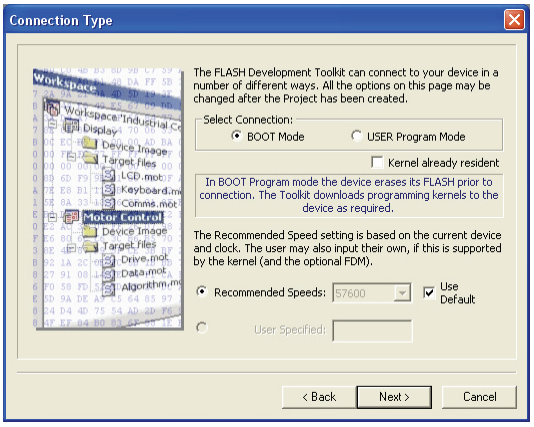


5. Check and select the communication port (=Comport) between the equipment and the computer.
   Then click “Next” button.

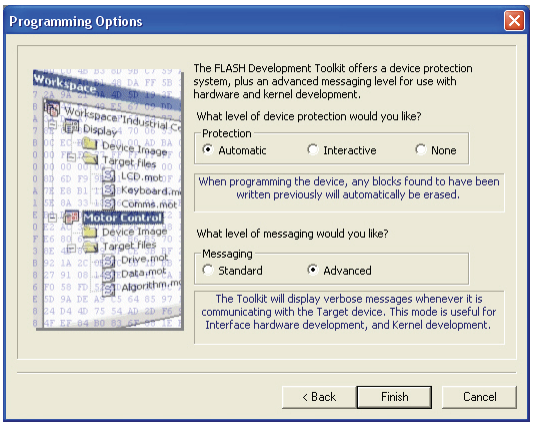




6. Select ‘BOOT Mode’ as the connection type, then click “Next” button.



7. Select ‘Automatic’ for the Device Protection level and ‘Advanced’ for message notification level; then press “Finish” button.

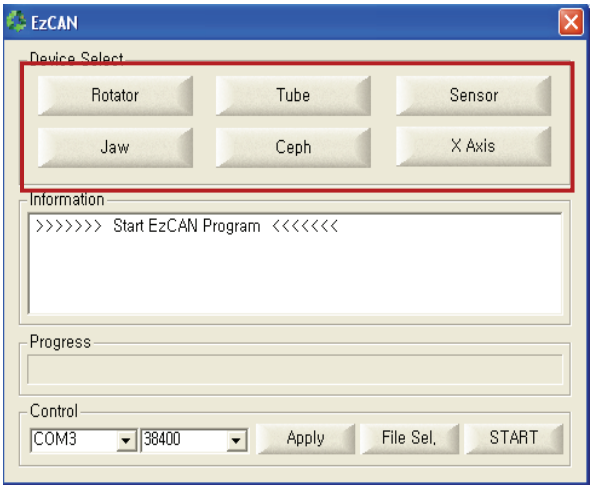


A.2 EzCAN Installation

PaX-Primo equipment shares details of its current condition by exchanging information through CAN (controlled area network) communication between the boards. This program is used for upgrading the Firmware of the boards, which carry out CAN communication.

1. **Execution of EzCAN Program**

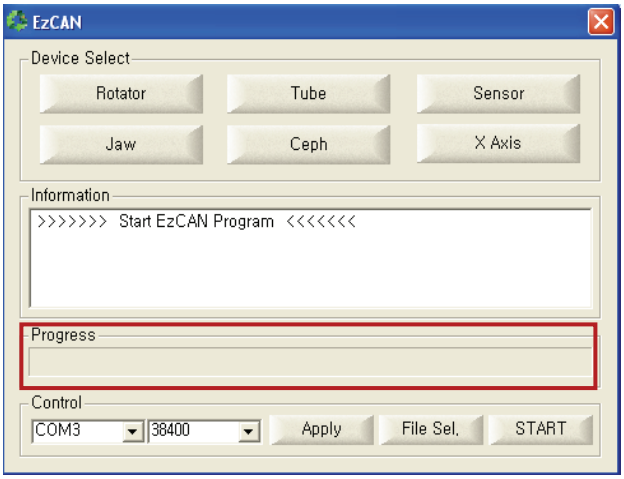
   Double click **"EzCAN.exe"** then the following screen will be displayed.



2. **Description per function of EzCAN**

   The following are descriptions of the EzCan functions.

   Device Select panel: Composed of 6 function buttons depending on which board is to be upgraded.
   Rotator: To be used for Rotator Unit Upgrade
   Tube: To be used for Tube System Upgrade (Not used).
   Sensor: To be used for Sensor MCU Board Upgrade.
   Jaw: To be used for the Jaw MCU Board Upgrade of the chinrest unit.
   Ceph: To be used for Ceph MCU Board Upgrade (Not used)
   X-Axis: To be used for X-Axis MCU Board Upgrade (Using FDT.)
   Information panel: Indicates the status of each Upgrade step.
   Progress panel: Indicates the progress status.



<Control panel>

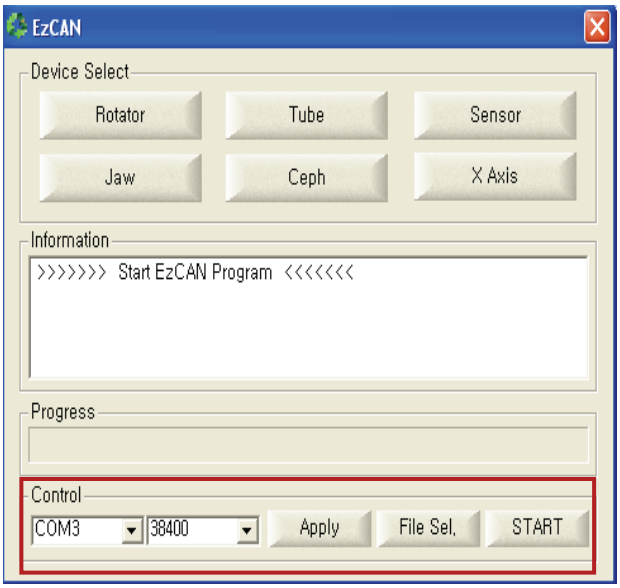
Com port: Serial Com port to be used

Bits per second: Speed bps to be used. Use **"19200"** (Default value is 38400)

Apply: Save the inputted parameter value.

File Sel (file select): Select the Upgrade file**". bin"**.

START: Start the downloading of Upgrade



Firmware files related with the Upgrade:

These files are **:\Firmware_with_EzCAN\Firmware**.

Uni3D_jaw_v1.07.bin: Firmware files for Chinrest

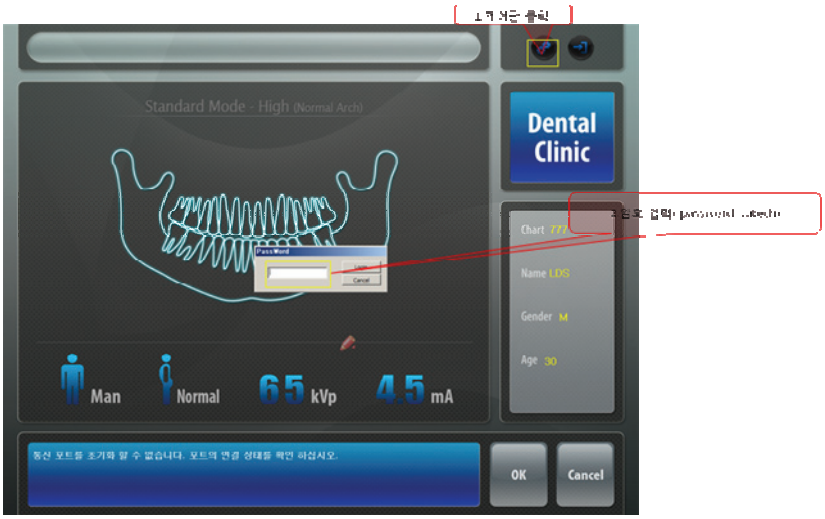
Uni3D_rotator_v1.15.bin: Firmware files for Rotator

Uni3D_sensor_v1.07.bin: Firmware files for Sensor

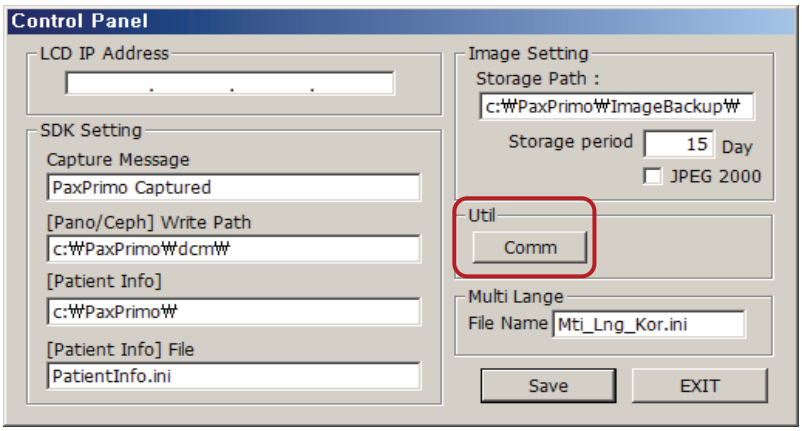
NOTE **The above file names are samples only. The actual file names differ depending on the equipment used.**

B. Use of commands on the Scan Program

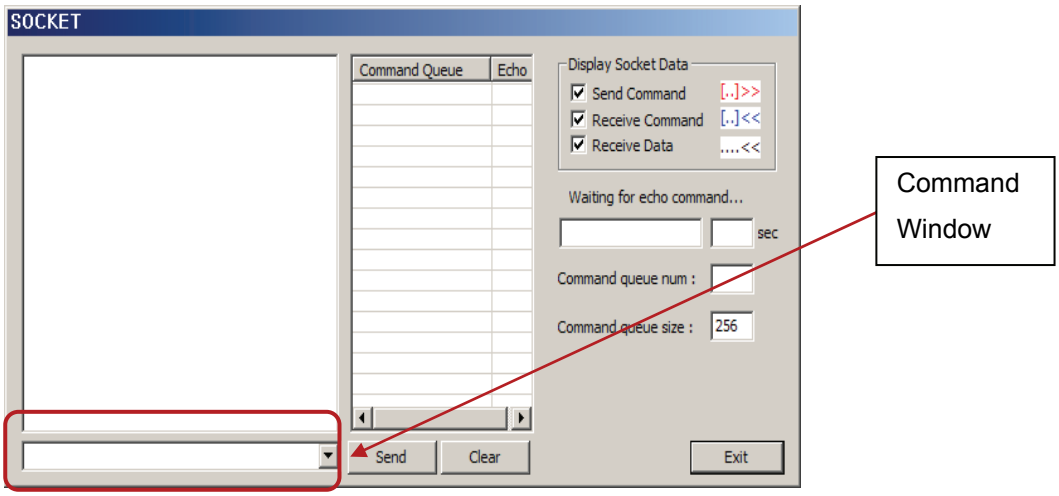
① Run the Scan program to bring up the following window.



② Input the password “vatech” (all in small letters), then click “Confirm”.
Click **“Comm”** button, as shown below.



③ Then, the commands will be sent through the following command window.



C. PaX-Primo Equipment Drive Command Set up

Command is a series of collective protocols in a language that were preprogrammed between the equipment and the PC in order to execute the equipment through the PC, to perform the Firmware Upgrade, and to maintain the equipment in its optimal condition.

1. Communication protocol

Use the Hyper-terminal.

The preprogrammed communication protocol is in the following format:

- **Communication Setup**

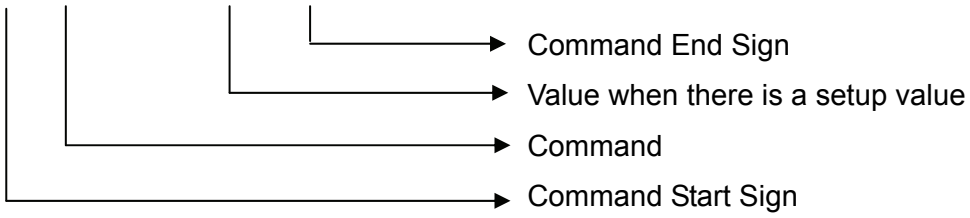
  All commands being used for PaX-Primo input data use of the Hyper-terminal (RS232 Communication) and the communication setup parameter values are as follows:

parameter	Setup Value
Baud(Speed)	19200bps
Data bit	8bit
Stop bit	1bit
Parity	None
Flow control	None

- **The format of command**

  The forms of command is

  [Command Value]



Ex: **[SPM_HV___0800]:** Tube Voltage Setting Command

NOTE

The following are the rules regarding the commands:

1. ***It should consist of 4 letters.***
2. ***No delimit between Capital and Small letters.***
3. ***S: Send, P: Scanning S/W, L: LCD, M: firmware***
4. ***Backspace does not work when inputting a command***

2. Common Commands

Command	Description	Direction
STAN	Set Arch to Standard Arch(Basic Mode) Set Arch to Adult Arch(Intelligent Mode)	Both
NARR	Set Arch to Narrow Arch(Basic Mode Only)	Both
WIDE	Set Arch to Wide Arch(Basic Mode Only)	Both
CHIL	Set Arch to Child Arch	Both

Command	Description	Direction
MAN_	Set Gender to Man	Both
WMAN_	Set Gender to Woman	Both
CHD_	Set Gender to Child	Both

Command	Description	Direction
AVER	Set Volume to Average	Both
HARD	Set Volume to Hard	Both
SOFT	Set Volume to Soft	Both

Command	Description	Direction
HA___abc0	Set mA to (abc)mA.	Both
HV___abc0	Set kVp to (abc)kVp.	Both
LVER	Query LCD's F/W Version. Return Format is [SLP_LVER_xxxx].	PC →LCD LCD →PC

3. Capture Sequence Commands

Command	Description	Direction
BOOT	Set to Initial Parameters	PC → LCD
PCON	Set LCD to PC on status.	PC → LCD
PCOF	Set LCD to PC off status. Initialize LCD parameters.	PC → LCD
CFRM	Set LCD to Confirm Status. LCD will do Confirm Action. -Send [SLP_CFMS] -Panorama Confirm actions to Machine -Send [SLP_CFME]	PC → LCD
CFMS	Confirm Sequence Start	LCD → PC
CFME	Confirm Sequence End	LCD → PC
RDY_	Set LCD to Ready Status(ready to shoot) LCD will do Ready Action. -Send [SLP_RETS] to PC -Send [SLM_RET_] to Machine -Send [SLP_RETE] to PC -Freeze All buttons excluding Return Button.	PC → LCD
RETS	Ready Sequence Start	LCD → PC
RETE	Ready Sequence End	LCD → PC
STAR	Exposure Switch Pressed. Does nothing.	Machine to others
END_ **STOP**	Exposure Switch Released. Set LCD to Initial State Capture Sequence Completed	Machine to others
LMP_	Cancel all Capture sequence and initialize.	LCD → PC & Machine
LON_	Laser On	PC or LCD → Machine
LOF_	Laser Off	PC or LCD → Machine
LTOG	Toggle Laser On/Off	PC or LCD → Machine

PKEN_000a	Package Mode Enable or Disable 0 to Disable, 1 to Enable	PC or LCD → Machine

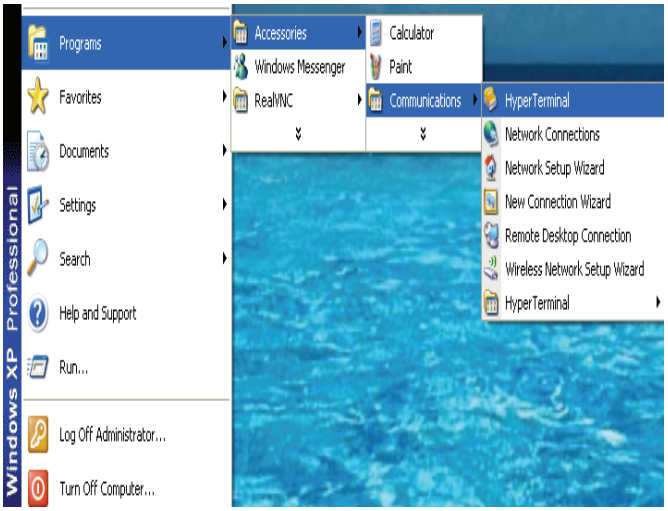
4. Panorama Mode Selection Commands

Command	Description	Direction
SNO_	Normal Mode Standard Panorama (Basic Mode Only)	Both
SNOI	Normal Intelligent Mode Standard Panorama (Intelligent Mode Only)	Both
SHI_	High Mode Standard Panorama (Basic Mode Only)	Both
SHII	High Intelligent Mode Standard Panorama (Intelligent Mode Only)	Both
SSH_	Segment Horizontal Mode Special Panorama	Both
SSV_	Segment Vertical Mode Special Panorama	Both
SBW_	Bitewing Mode Special Panorama	Both
SOR_	Orthogonal Mode Special Panorama (Basic Mode Only)	Both
SORI	Orthogonal Intelligent Mode Special Panorama (Intelligent Mode Only)	Both
TLO_	Lateral Open Mode TMJ	Both
TLC_	Lateral Close Mode TMJ	Both
TPO_	PA Open Mode TMJ	Both
TPC_	PA Close Mode TMJ	Both
SPA_	PA Mode Sinus	Both
SLA_	Lateral Mode Sinus	Both

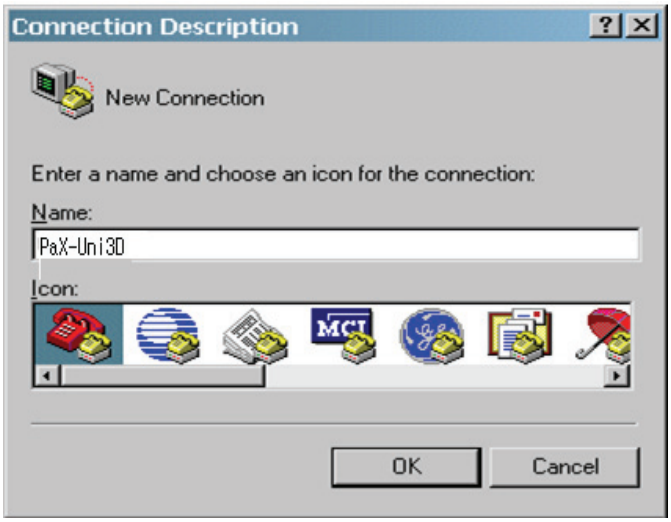
D. Use of HyperTerminal

This utility program is for the serial communication in use of RS-232 protocol between the PC and the device, as the communication program provided within Windows XP.

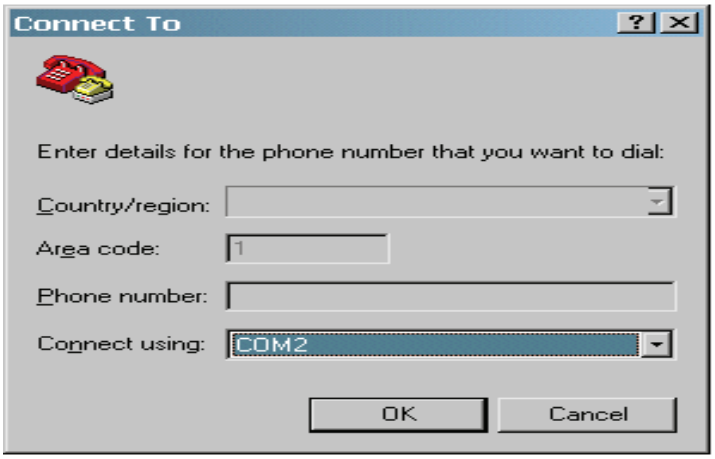
In order to open the Hyper-terminal, click the following in order: **Start | Program | Auxiliary Program | Communication | HyperTerminal**



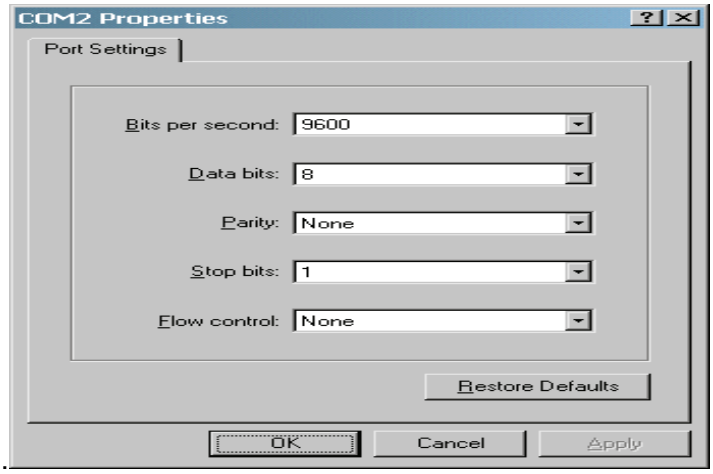
Then, the following window will be displayed.



① Choose a desired icon and input "**PaX-Primo**" in the name input box from the connection description window, then click "**OK".** This will display the connection subject window.
(The illustrations herein are for showing samples only.)

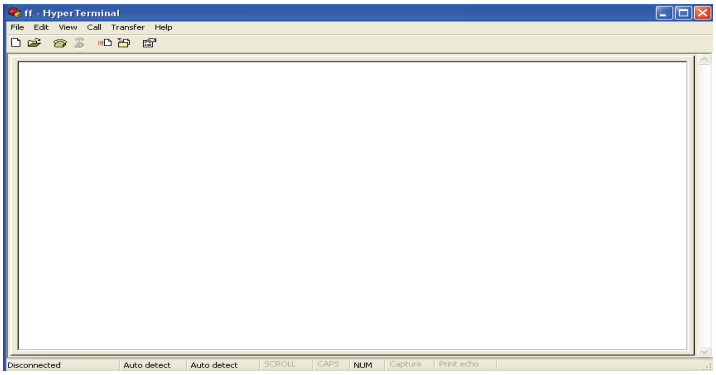


② From the **Connect to** window, set COM2 (sample) as the Main COM Port, then click "**OK**".
(In this sample, the fields for country/region, area code, and phone number cannot be used.) The window for COM2 properties will be displayed.



Now, the system is ready to perform serial communication.

But if the setting appears as in the illustration below, reset the parameters. This is caused by an incorrect setup value.



If there are strange characters or trash-like contents that appear on the terminal, they are caused by incorrect setup. In this case, check whether the same **Com Port** is being used by the equipment and the Hyper-terminal, and check the cable conditions as well. If the set up is not correct, you will likely not be able to use the Key Board input. In this case, changing into a different communication speed is one of the troubleshooting methods.

Release Version 1.0.0
Dated Sep. 25th, 2009

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