Roland

PICZA

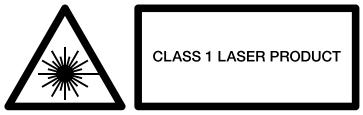
3D LASER SCANNER

LPX-250

USER'S MANUAL

Thank you very much for purchasing the LPX-250.

- To ensure correct and safe usage with a full understanding of this product's performance, please be sure to read through this manual completely and store it in a safe location.
- Unauthorized copying or transferral, in whole or in part, of this manual is prohibited.
- The contents of this operation manual and the specifications of this product are subject to change without notice.
- The operation manual and the product have been prepared and tested as much as possible. If you find any misprint or error, please inform us.
- Roland DG Corp. assumes no responsibility for any direct or indirect loss or damage which may occur through use of this product, regardless of any failure to perform on the part of this product.
- Roland DG Corp. assumes no responsibility for any direct or indirect loss or damage which may occur with respect to any article made using this product.



Roland DG Corporation

For the USA

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Unauthorized changes or modification to this system can void the users authority to operate this equipment.

The I/O cables between this equipment and the computing device must be shielded.

For Canada

CLASS A NOTICE

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

CLASSE A AVIS

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

ROLAND DG CORPORATION
1-6-4 Shinmiyakoda, Hamamatsu-shi, Shizuoka-ken, JAPAN 431-2103
MODEL NAME : See the MODEL given on the rating plate.
RELEVANT DIRECTIVE : EC LOW VOLTAGE DIRECTIVE (73/23/EEC)
EC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE (89/336/EEC)

This system (including the housing and safety device) is a Class 1 laser product. However, the laser light emitted internally is Class 2.
Laser specifications of this system (including the housing)
Wavelength: 600 to 700 nm, maximum output: 0.39 µW, pulse width 350 µs, pulse frequency: 2,875 Hz

This product complied with 21 CFR Chapter I Subchapter J
Complied with IEC Publication 60825-1, Amendment 1, 1997

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in radiation exposure.

To Ensure Safe Use

Please read this document completely before operating the machine. It contains safety cautions and information essential in assuring safe operation. Observe all cautions in operation.

Cautions related to the safe operation of this machine are indicated as shown below.

About ⚠WARNING and ⚠CAUTION Notices

⚠WARNING	Used for instructions intended to alert the user to the risk of death or severe injury should the unit be used improperly.
⚠CAUTION	Used for instructions intended to alert the user to the risk of injury or material damage should the unit be used improperly. * Material damage refers to damage or other adverse effects caused with respect to the home and all its furnishings, as well to domestic animals or pets.

About the Symbols

	The ⃠ symbol alerts the user to items that must never be carried out (are forbidden). The specific thing that must not be done is indicated by the design contained within the circle. The symbol at left means the unit must never be disassembled.
	The ● symbol alerts the user to things that must be carried out. The specific thing that must be done is indicated by the design contained within the circle. The symbol at left means the power-cord plug must be unplugged from the outlet.

The following symbols are also used.

NOTICE : Indicates information to prevent machine breakdown or malfunction and ensure correct use.

: Indicates a handy tip or advice regarding use.

⚠WARNING

Do not disassemble, repair, or modify.

Doing so may lead to fire or abnormal operation resulting in injury.
Class 2 laser light may be emitted outside the machine. Staring directly into the laser beam for an excessive length of time may result in eye injury.

Do not use while in an abnormal state (i.e., emitting smoke, burning odor, unusual noise, or the like).

Doing so may result in fire or electrical shock. Immediately unplug the power-cord plug from the electrical outlet, and contact your authorized Roland DG Corp. dealer or service center.

Do not use with any electrical power supply that does not meet the ratings displayed on the AC adapter.

Use with any other power supply may lead to fire or electrocution.

Use only with the power cord included with this product.

Use with other than the included power cord may lead to fire or electrocution.

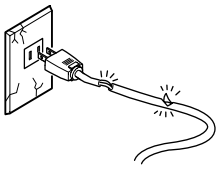
Do not use with any power supply other than the dedicated AC adapter.

Use with any other power supply may lead to fire or electrocution.

⚠CAUTION

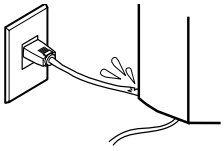
Do not use with a damaged AC adapter, power cord, or power-cord plug or with a loose electrical outlet.

Use with any other power supply may lead to fire or electrocution.



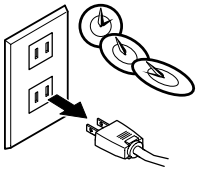
Do not injure or modify the electrical power cord, nor subject it to excessive bends, twists, pulls, binding, or pinching, nor place any object of weight on it.

Doing so may damage the electrical power cord, leading to electrocution or fire.



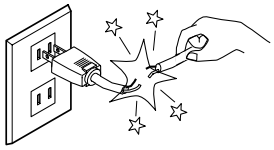
When not in use for several hours, unplug the power-cord plug from the electrical outlet.

Failure to do so may result in danger of shock, electrocution, or fire due to deterioration of the electrical insulation.



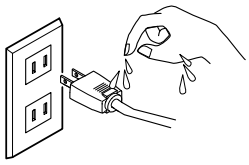
When unplugging the electrical power cord from the power outlet, grasp the plug, not the cord.

Unplugging by pulling the cord may damage it, leading to fire or electrocution.



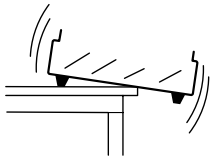
Do not attempt to unplug the power-cord plug with wet hands.

Doing so may result in electrical shock.



Install on a stable surface.

Failure to do so may result in falling of the unit, leading to injury.



⚠CAUTION

Do not insert metal objects, flammable objects, or any other foreign object into interior areas other than the top of the table. Also, do not place water or other liquids on any area, including the table.

Doing so may cause fire.

Lifting and carrying are operations that must be carried out by two persons, by grasping the bottom of the machine.

Failing to do so may result in injury.

Do not attempt to scan objects that are highly reflective or refractive, such as mirrors, prisms, or lenses.

In such cases, there is danger of external emission of Class 2 laser light. Staring at externally emitted laser light may cause eye injury.

Do not use if the housing or window area is cracked or deformed.

In such cases, there is danger of external emission of Class 2 laser light. Staring at externally emitted laser light may cause eye injury.

Securely fasten the object to be scanned to the table so that it does not slip or topple over.

The table rotates during scanning. Tipover or contact by the scan object may cause damage. Scan-object damage is not covered by warranty.

■ Important Cautions Regarding Laser Light

This machine uses a laser beam to scan objects, but dangerous laser radiation is not emitted outside the machine. It is safe to view the laser light through the window.

However, this may not be the case if the machine is disassembled or if its cover or safety devices are broken or disabled. Please observe the cautionary notes in this documentation and never attempt to use this machine if the machine is in an abnormal state.

The natural blink reflex protects the eye in the event that laser light from the machine directly enters the eye due to incorrect use or the like, but staring directly into the laser beam may result in eye injury. Direct contact with the laser beam will not cause burns or fire.

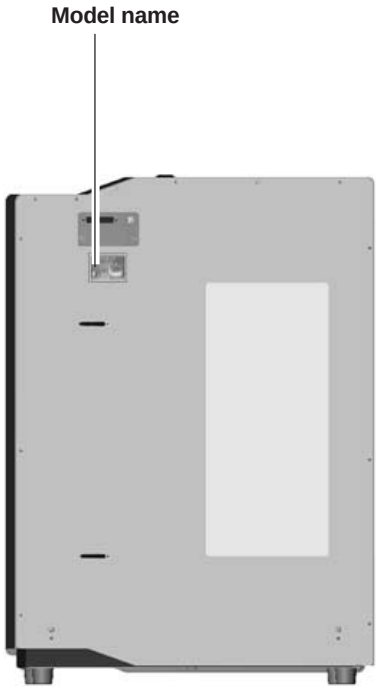
Items That may Not Be Copied

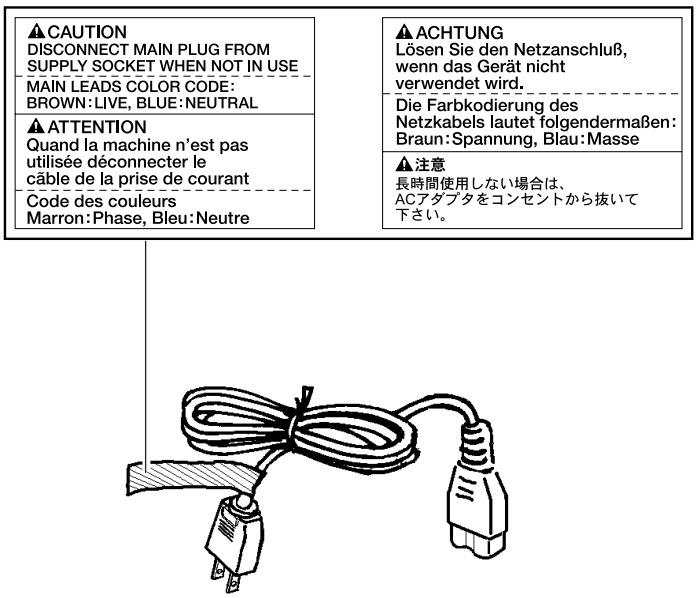
Unauthorized reproduction of a copyrighted item for any purpose other than personal use may be a violation of copyright. Roland DG Corp. will not be responsible for any violation of third-party copyright by any article made through use of this product.

About the Labels Affixed to the AC Adapter and Unit

This machine bears caution labels. These are intended to ensure the safety of the operator. They must be affixed at the appropriate locations. Do not allow them to become soiled or attempt to peel them off. Also, be sure to observe the stated cautions during use.

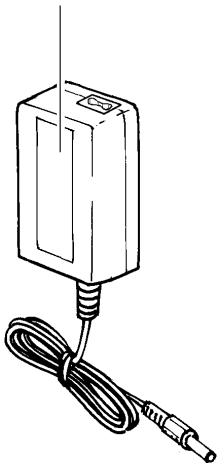
Model name





Rating label

Do not use with any electrical power supply that does not meet the ratings displayed on the AC adapter.



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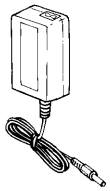
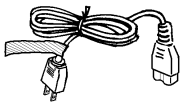
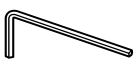
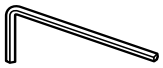
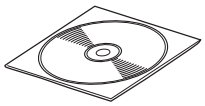
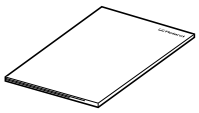
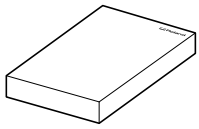
Part 1

Startup

1. Checking the Accessories

The following included items are packed with the LPX-250. Check first to make sure that all items are present.

 AC adapter : 1	 Power cord : 1	 Hexagonal wrench (size : 2.5 mm) : 1	 Hexagonal wrench (size : 3 mm) : 1
Caps : 3	 CD-ROM (Roland Software Package) : 1	 User's Manual : 1	 Roland Pixform™ : 1

The Contents of the CD-ROM

The included CD-ROM contains the following items.

- Dr. PICZA3 program
- 3D Editor program
- Dr. PICZA3 User's Manual (PDF)
- 3D Editor User's Manual (PDF)
- Adobe Acrobat Reader ver. 4 program

Also included are programs and documentation for MODELA series modeling machines from Roland DG Corp., but they are not for use with the LPX-250.

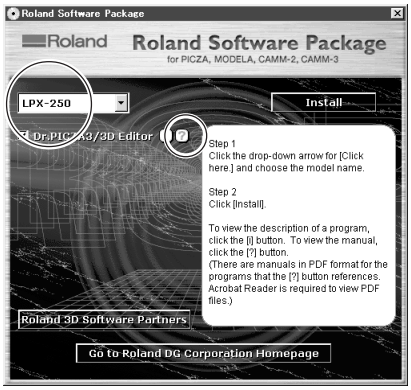
2. Three Manuals for Using the LPX-250

Three manuals are included with this machine.

LPX-250 User's Manual (this manual)	Read this first. This describes important notes, setup, operation, troubleshooting, and other matters related to using the LPX-250.
Dr. PICZA3 User's Manual (electronic-format manual)	Refer to these as required. They describe in detail all the functions of the included Dr. PICZA3 and 3D Editor programs. These manuals are in electronic (PDF) format, and printed versions are not included. They are found on the included "Roland Software Package" CD-ROM. You can easily view them or even print them out by following the steps below. You can also view the same information from the online help for each program.
3D Editor User's Manual (electronic-format manual)	

Viewing the Included Electronic Documentation (PDF Format)

1. Insert the included CD-ROM into the computer's CD-ROM drive. A menu window appears automatically.
2. Click the place that says "Click here," then select "LPX-250."
3. Click the [?] button to the right of the program name. Acrobat Reader starts and the window for choosing the manual appears. Click the item you want to view.



4. When you are viewing for the first time, installation and setup of Acrobat Reader may start. If this happens, follow the on-screen instructions to proceed with installation and setup.
5. You can go on to the next page or go back to the previous page by pressing the left and right arrow keys on the keyboard. (You can also do this using the on-screen [◀] and [▶] buttons.)

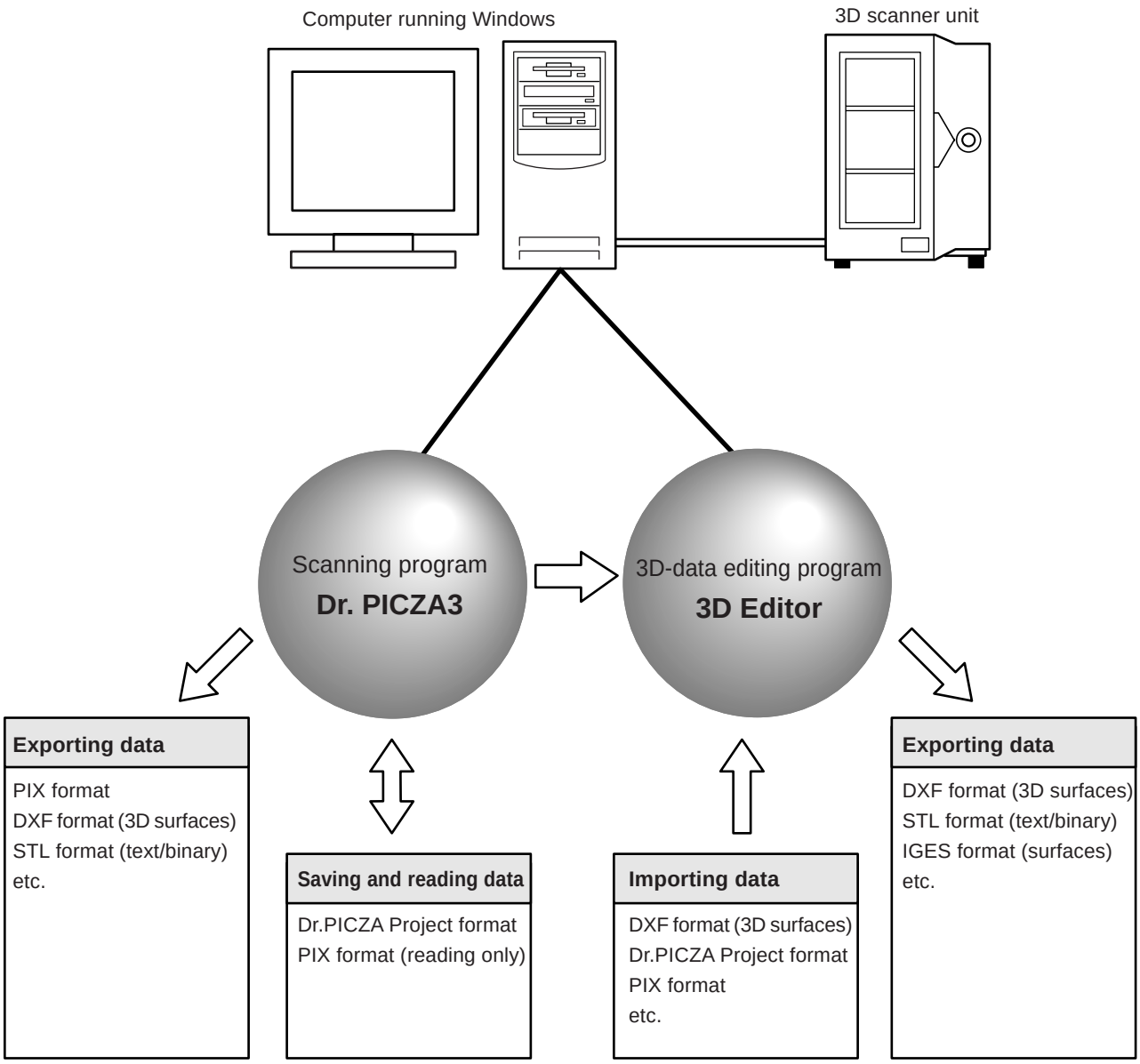
About Adobe Acrobat Reader

Acrobat Reader is a program required to view files in PDF format. Acrobat Reader is found on the included CD-ROM. If Acrobat Reader is not set up on the computer you're using, then it is installed automatically to enable you to view the manual easily, no matter what kind of computer you're using.

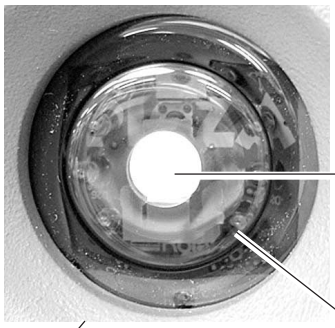
* Acrobat Reader is a product of Adobe Systems Incorporated. For detailed information on how to use it, go to the Acrobat Reader menu and select [Help] to view the online help.

3. LPX-250 System Configuration

The LPX-250 system is made up of the 3D scanner unit, a computer running Windows (available separately), a scanning program, and a program for editing 3D data.



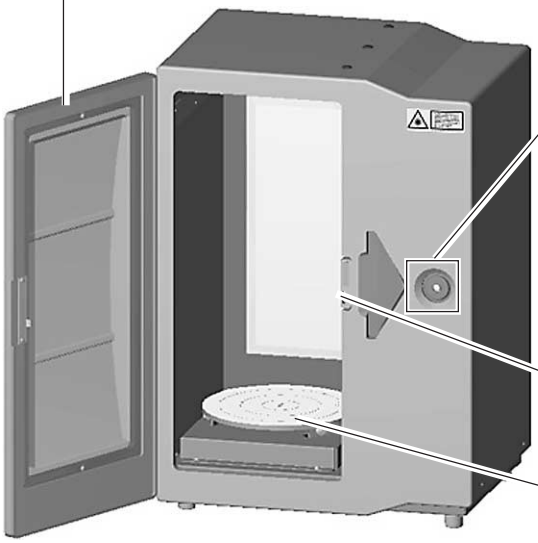
4. Names and Functions



Door
Be sure to keep this closed during scanning operations.

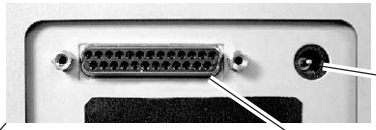
Standby key
This button switches the power on and off. When on, it lights up green. It flashes when the door is open.
When an error occurs, it lights up orange and red.

Movement LEDs
During scanning operations, the green lights flash one at a time.
During initialization, the green lights flash two at a time.



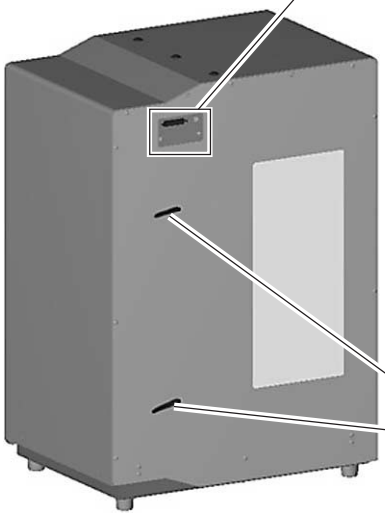
Interlock switch
This is one of the safety devices. Do not insert any objects here.

Table
This is the base on which you place the object to be scanned. It rotates during scanning.
Do not touch any other internal devices.



AC adapter jack
This is the jack for connecting the AC adapter.

Serial connector
This connector is for connection to the computer's COM port.



Cable hooks
These are used to bundle and hold the connected cables.

5. Installation and Cable Connections

Removing the Head Retainers and Installing

⚠CAUTION

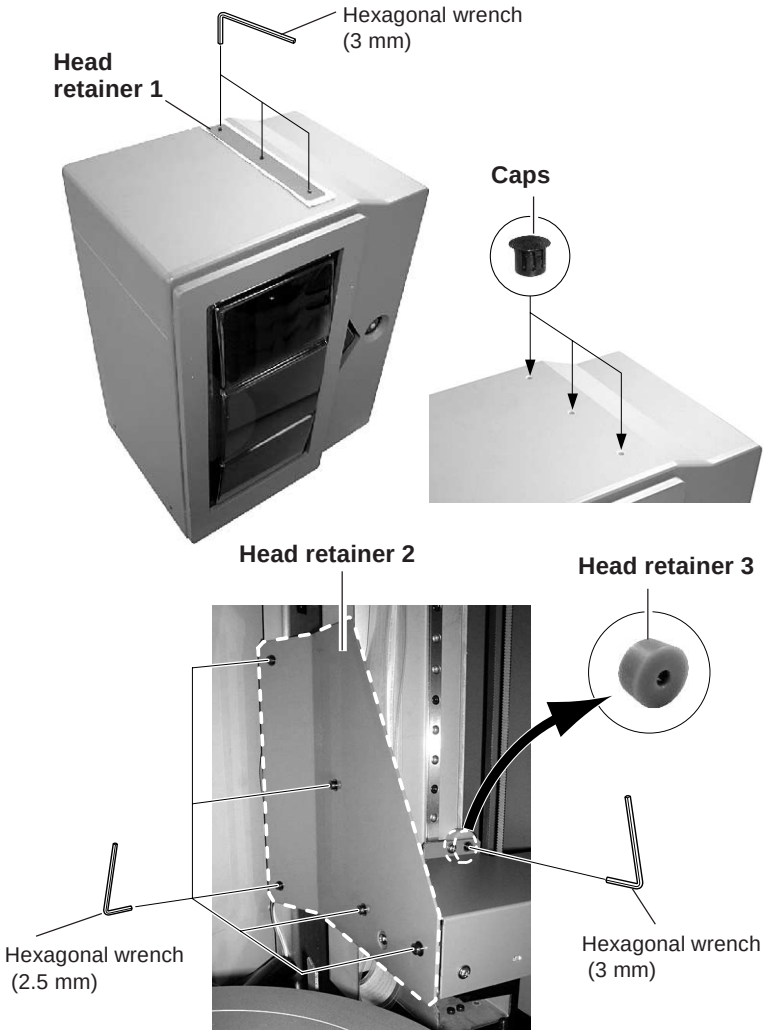
Lifting and carrying are operations that must be carried out by two persons, by grasping the bottom of the machine. Failing to do so may result in injury.

NOTICE

Be sure to remove the head retainers before use. Failure to remove them may not only impede operation, but may cause breakdown.
Do not attempt to touch any internal area other than the items described below, or to use excessive force to move any item. Doing so may result in breakdown.

After you take the machine out of the carton, the first thing you need to do is to remove the head retainers. Carry out this operation before you connect the AC adapter. When transporting the machine, reattach the head retainers. Store the head retainers in a safe place so that they do not get lost.

1. Use the hexagonal wrench (3 mm) to remove the three screws, then detach head retainer 1.
2. Attach the three included caps.
3. Open the door. The blue panel visible to the right of the table at the back is head retainer 2. Use the hexagonal wrench (2.5 mm) to remove the five screws, then detach head retainer 2.
4. Remove head retainer 3, which is blue and located at the top of the head unit. Use the hexagonal wrench (3 mm) to remove one screw, then pull head retainer 3 up and out to extract it. Take care not to drop the retainer when extracting it.



NOTICE

When installing, be careful of the following points.

- Do not install in an unstable location. Doing so may not only lead to danger of falling, but may result in breakdown or malfunction.
- Avoid use in locations exposed to large amounts of electrical noise, such as areas near motors.
- Do not install in a location exposed to high humidity or dust.
- Because the machine generates heat when in use, do not install in a location where heat radiation is poor.
- Do not install in locations exposed to severe vibration.
- Use in an environment where temperature is between 10 ˚C and 40 ˚C (between 50 ˚F and 104 ˚F) and relative humidity is between 35 % and 85 % (with no condensation).
- Avoid using in an environment exposed to severe changes in temperature. Such use may affect scanning accuracy.

Connect the Cable

⚠WARNING

- Do not use with any power supply other than the dedicated AC adapter.
  Use with any other power supply may lead to fire or electrocution.
- Do not use with any electrical power supply that does not meet the ratings displayed on the AC adapter.
  Use with any other power supply may lead to fire or electrocution.
- Use only with the power cord included with this product.
  Use with other than the included power cord may lead to fire or electrocution.

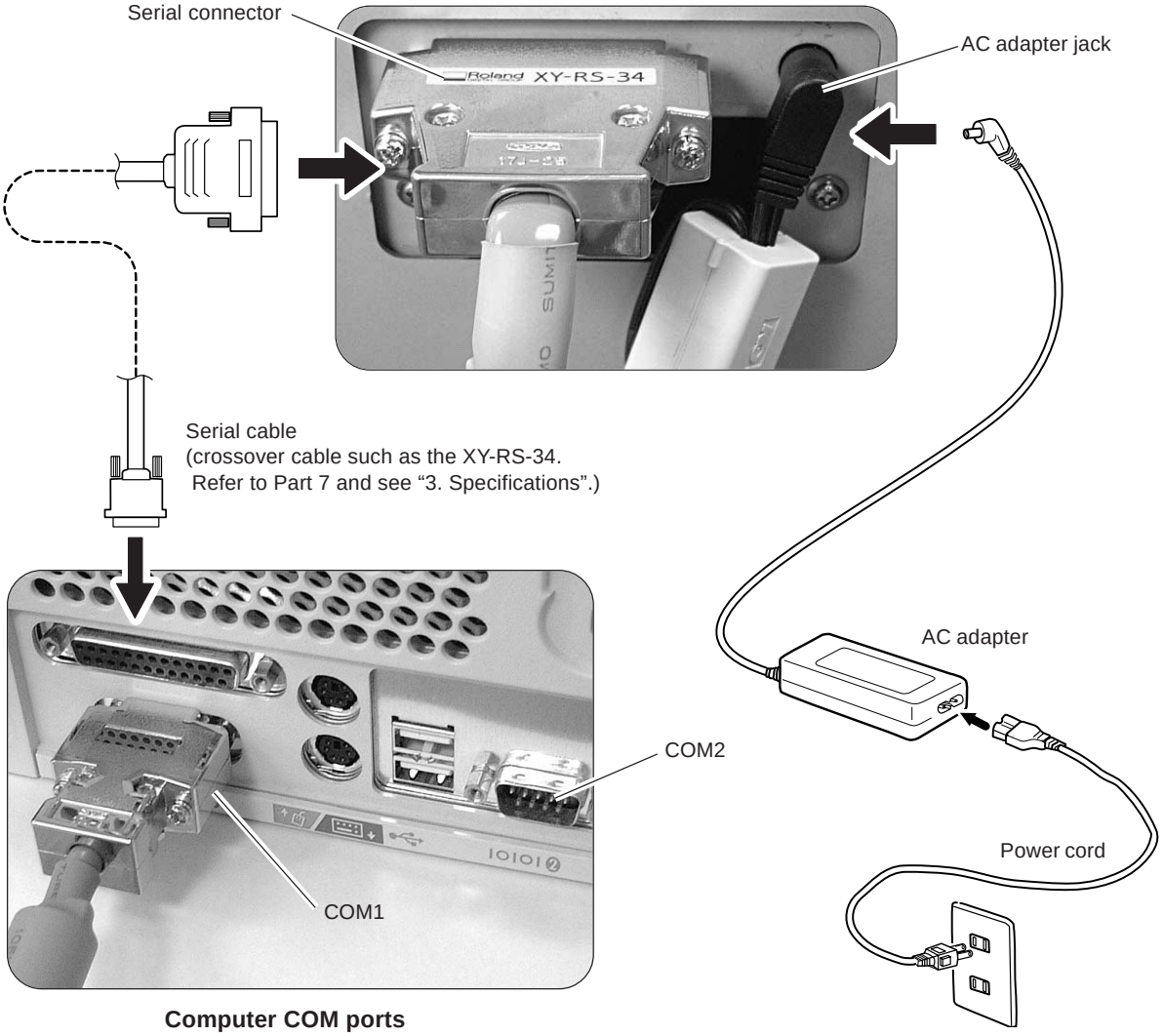
⚠CAUTION

- Do not injure or modify the electrical power cord, nor subject it to excessive bends, twists, pulls, binding, or pinching, nor place any object of weight on it.
  Doing so may damage the electrical power cord, leading to electrocution or fire.
- Do not attempt to unplug the power-cord plug with wet hands.
  Doing so may result in electrical shock.

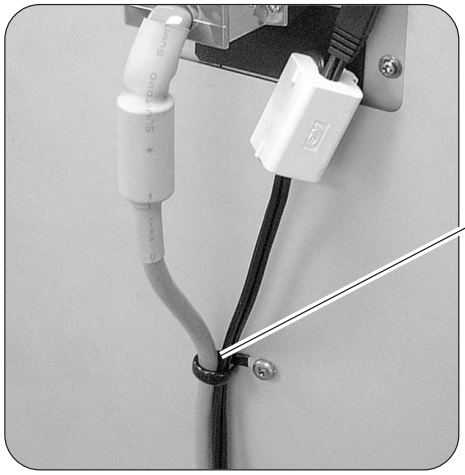
Connect the power cord and the AC adapter.

Also make the connection to the computer's COM port (RS-232C port, serial port). The computer may have two or more COM ports, so make sure of the number of the connected COM port.
Use a serial cable from Roland DG Corp. sold separately (for an IBM-compatible computer, use a crossover cable such as the XY-RS-34). Straight-wired cables like those used mainly for modem connections cannot be used for operation.

Back of the scanner



Computer COM ports



NOTICE

Connect the AC adapter and power cord securely so that they do not come loose or experience faulty connection. Failure to do so may result in breakdown or malfunction.

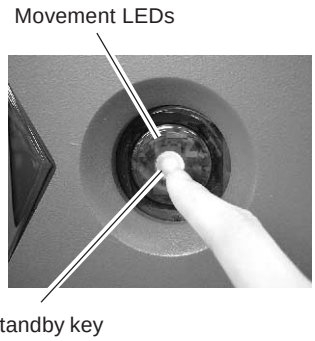
Switch off the power to the computer and the machine before you make the cable connections.

Be sure to make the connection to a COM port. Connection to an incorrect port such as a printer port, may not only result in the system failing to operate, but may lead to breakdown.

6. Switching the Power On and Off and Opening and Closing the Door

Steps for Switching On the Power

There is a proper procedure for switching on the power to the machine. Follow the steps below.



1. Close the door.
2. Press the Standby key.
3. The Movement LEDs flash. Keep the door closed until the flashing stops. During this interval, the machine is performing initialization.
4. When initialization ends, the Standby key lights up green and the Movement LEDs go dark. Scanning is now possible.

NOTICE

Initialization may take up to about 40 seconds. If the door is opened during initialization, operation is interrupted to ensure safety. In such cases, correct scanning cannot be performed. Switch off the power, close the door, then switch the power on again. Also, sound that is differ from what you usually hear may be heard for several seconds during initialization, but this does not indicate a malfunction.

Starting the computer after switching on the machine may make it impossible to perform scanning. This may occur depending on the computer, but does not indicate a malfunction. If this happens, start the computer first, and then switch on the power to the machine. Also, if the computer is restarted, reset the power to the machine as well.

Switching Off the Power

⚠CAUTION

When the machine will not be in use for a prolonged period, unplug the power cord from the electrical outlet. Failure to do so may result in deterioration of the insulation, leading to electrical shock, short circuit, or fire.

Hold down the Standby key for 1 second or longer.

Opening and Closing the Door

When you open the door, the Standby key flashes green. Scanning cannot be performed while in this state. Close the door, then start scanning.

To ensure safety, an emergency stop occurs when the door is opened while scanning is in progress. Scanning cannot be resumed even after the door is closed.

NOTICE

If the Standby key does not flash when you open the door, the safety device may have failed. If this happens, immediately stop use and contact your authorized Roland DG Corp. dealer or service center.

7. Preparing the Programs

Programs Installed and Set Up

Dr. PICZA3 and 3D Editor are both installed and set up.

System Requirements

The computer's system requirements for Dr. PICZA3 and 3D Editor are as follows.

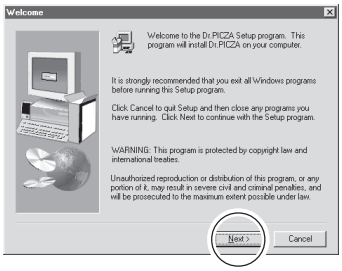
Operating system	Windows 95, Windows 98, Windows Me, Windows NT 4.0, Windows 2000, and Windows XP
Processor	Pentium II or higher recommended
Memory (RAM)	128 MB or more recommended
Free hard-disk space for installation	10 MB (for both Dr. PICZA3 and 3D Editor)
Monitor	640 x 480 resolution, 256 colors or higher (800 x 600 resolution or higher, 16-bit color (High Color) or higher, and OpenGL-compatible or more recommended)
Interface	COM port (Serial port)

* Memory requirement are affected by scanning conditions and the like. Larger scanning areas and finer scanning pitches require increasingly more memory. We recommend installing enough memory to match your usage conditions.

Steps for Installing and Setting Up the Programs

1. Start Windows. If you are installing under Windows NT 4.0/2000/XP, log on to Windows as "Administrators."
2. Insert the included CD-ROM (Roland Software Package) into the computer's CD-ROM drive. The setup menu appears automatically.
3. Click the place that says "Click here," then select "LPX-250."
4. Click the [Install] button.

5. Follow the on-screen setup instructions, clicking the [Next] button to proceed. If you want to specify a particular folder for installation, do it here. In most cases you can simply click [Next] to proceed. Installation starts.
6. When all installation and setup finishes, the final window appears. Click [Close] to finish setup.



Starting Dr. PICZA3

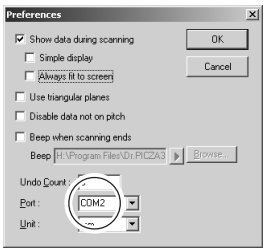
1. First switch on the power to the LPX-250.
2. Next, in Windows, click the [Start] button, then click [Programs], then [Roland PICZA], then [Dr. PICZA3].

When Dr. PICZA3 starts, it attempts to verify the name of the model of the 3D scanner that is connected. Be sure to turn on the LPX-250 before you run Dr. PICZA3.

With this system, the [Run MODELA Player] and [Run 3D Engrave] buttons in Dr. PICZA3 are not used. Use them when you are using together with the MODELA series or the like.

Selecting the Communication Port

1. In Dr. PICZA3, go to the [File] menu and click [Preferences].
2. For [Port], select the number of the COM port on the computer to which the LPX-250 is connected.
3. Click [OK]. The LPX-250 can now perform scanning.



Special Notes for Windows NT 4.0/2000/XP

Care is required when another printer driver or the like is set to use a COM port. Scanning cannot be performed when the same COM port is selected for the other driver and Dr. PICZA3. Take action such as connecting to a different COM port to avoid conflicts with the other driver.

Checking the Connection

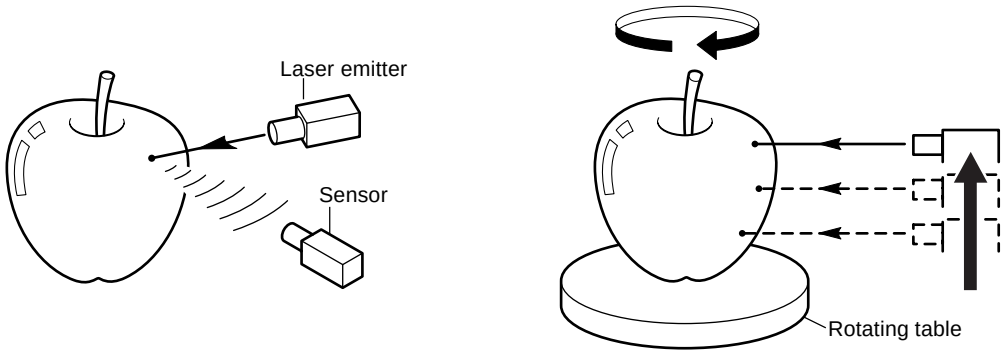
In Dr. PICZA3, go to the [Help] menu and display [About]. If the firmware version and model name are displayed, the connection is correct.

Part 2

Basics of the LPX-250

1. Scanning System

The LPX-250 scans objects using laser light. It emits a spot beam onto the scan object and detects reflected light from the object with sensors. It performs scanning as it rotates the scan object and moves the laser beam from bottom to top.



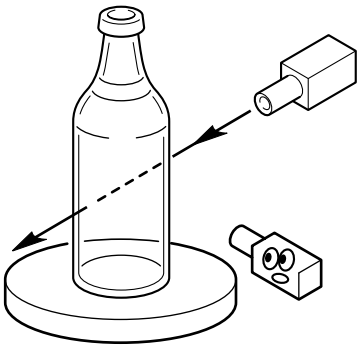
The LPX-250 has two scanning modes. Each has its own features, so you can choose the optimal scanning mode for the object to be scanned.

2. Suitable and Unsuitable Objects for Scanning

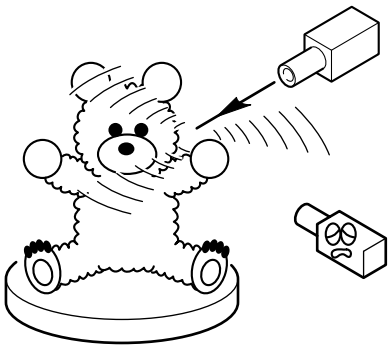
The LPX-250 cannot scan every single kind of object. Adequate thought must be given to the material of an object, because it greatly affects the scanning results.

Yes	Objects that do not pass light
No	Clear or transparent objects

* Applying white surfacer (primer) may produce better results.

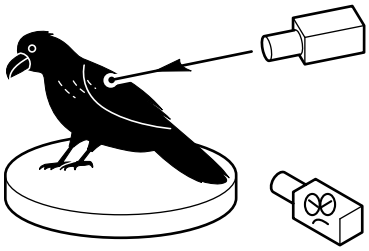


Yes	Relatively smooth-surfaced objects
No	Fabric or fuzzy objects



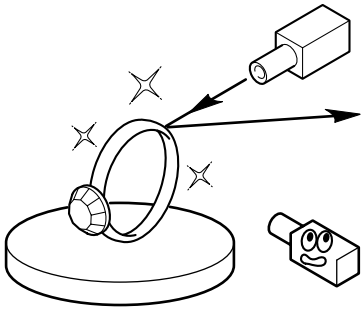
Yes	Brightly colored objects (white, yellow, red, etc.)
No	Dark-colored objects (black, blue, green, etc.)

* Applying white surfacer (primer) may produce better results.

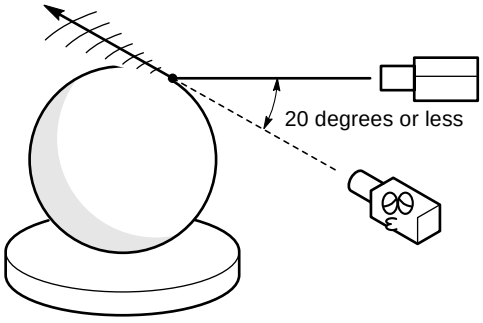


Yes	Objects of a nonglossy material such as plaster, wood, or modeling clay
No	Glossy and highly reflective objects (metals, mirrors, etc.)

* Applying white surfacer (primer) may produce better results.
* Avoid highly reflective objects because of danger of eye injury.



No	Areas where the angle of the laser beam is too shallow

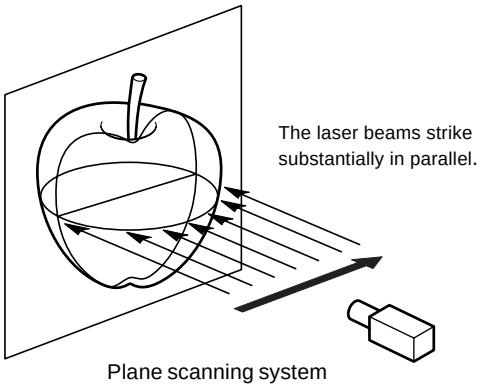


3. Two Scanning Modes

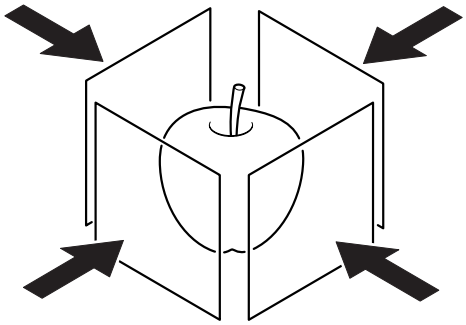
The LPX-250 has two scanning modes: plane scanning and rotary scanning.

Plane Scanning

This mode uses parallel laser beams to scan while rotating the table and laser head in synchronization. Because this mode can obtain comparatively stable scanning results regardless of the shape of the object, you can use it as an all-purpose mode. You can use it to scan up to six surfaces at one time (multi-plane composition).



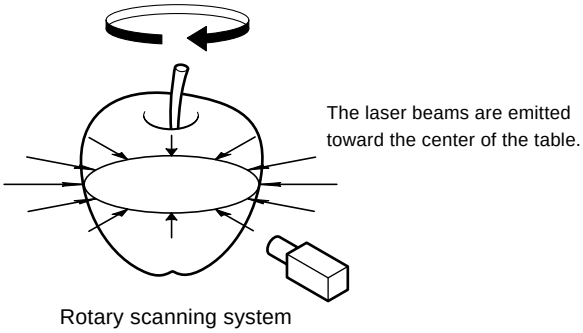
Plane scanning system



Multi-plane composition
(four scanning surfaces)

Rotary Scanning

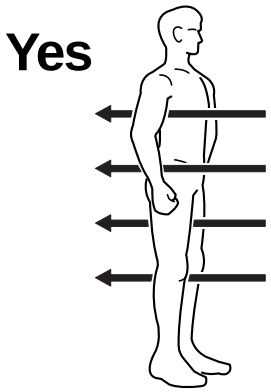
This mode scans the outer perimeter of an object while rotating the table in one direction. This is suited to scanning objects that have relatively little unevenness and are close in shape to a sphere or cylinder. It can reproduce smooth curved surfaces even when the pitch is fairly coarse, so it can also shorten scanning times.
However, the shapes of the objects that you can scan are more limited than with plane scanning.



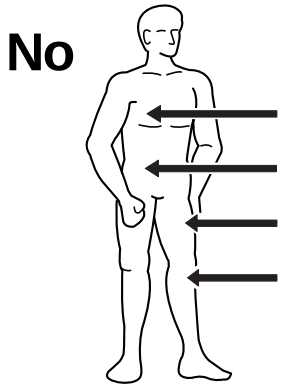
Rotary scanning system

Scan Object and Scanning Direction

When the object to be scanned has areas with cavities or voids, plane scanning, which uses parallel laser beams, can capture such cavities more easily than rotary scanning. This is because the laser beam can easily pass through the voids. However, when the laser beams are blocked by another area and cannot pass into the cavity, as shown in figure B, the cavity cannot be captured.

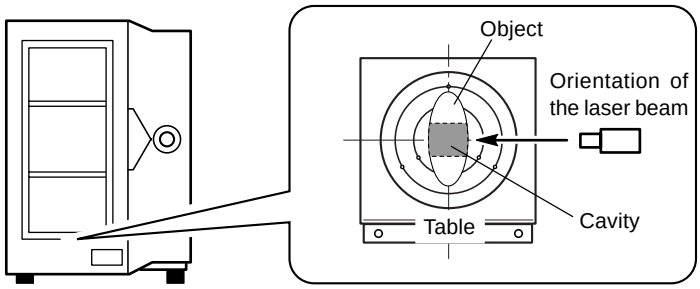


A: The laser beams pass into the cavity.



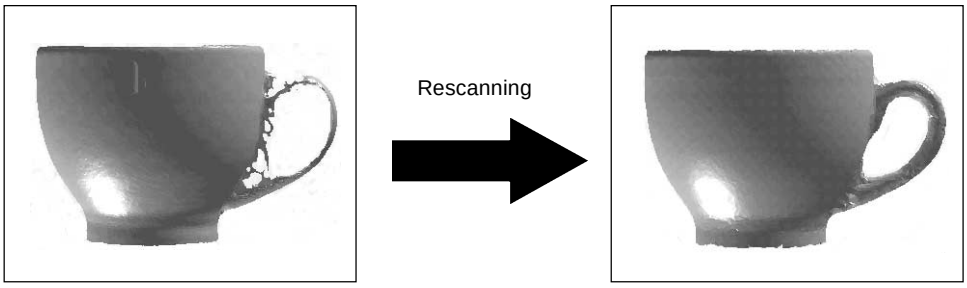
B: The laser beams are blocked.

This means that the incident angle of the laser beam is important. With plane scanning, you perform scanning after first making the settings for an orientation that ensures an incident angle for the laser beam than allows cavities to be captured. For more information, go to Part 3 and refer to "2. Scanning Operation."
Also, when you mount the object, refer to the figure below to orient cavities or voids in the direction of laser-beam emission so as to make it easier for the laser beam to pass into the cavities.



Finishing by Rescanning

If the object is highly uneven, there may be many areas that the laser beam does not reach. Rotary scanning is more susceptible to this effect than plane scanning, and sometimes there are scattered areas that cannot be scanned. In such cases, you specify the areas that could not be scanned and perform rescanning.
For more information, go to Part 4 and refer to "1. Finishing Detailed Areas Using Rescanning."



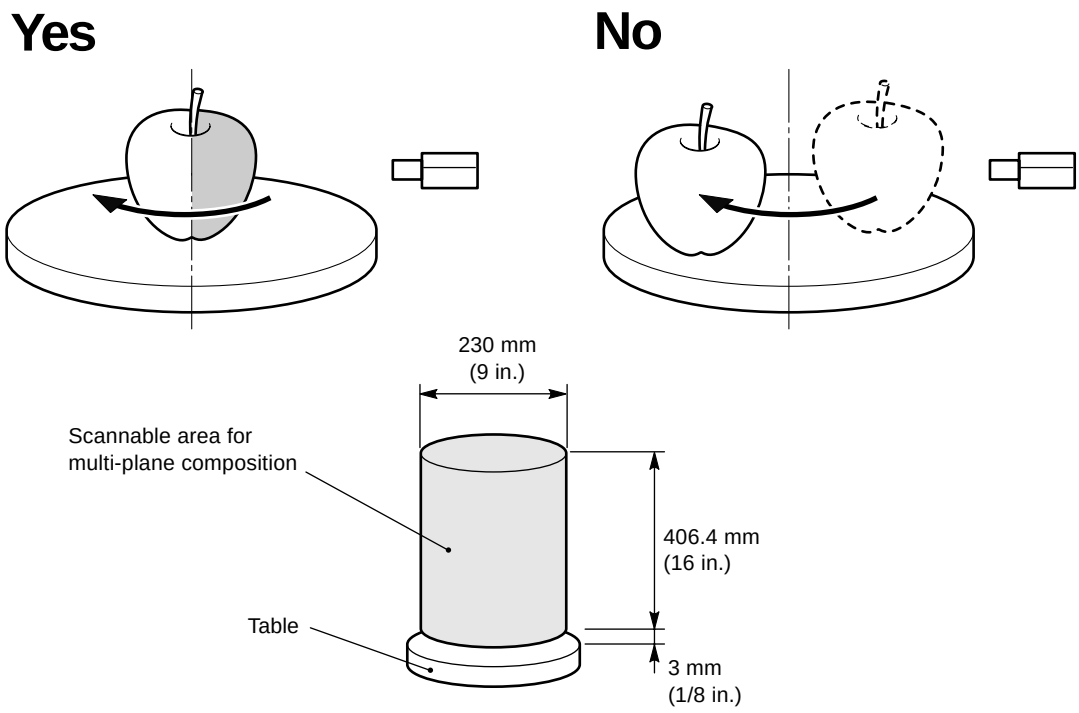
4. Mounted Position of the Object and the Scannable Area

The scannable area may differ slightly according to the scanning mode. The area that you can actually scan is affected by the mounted position of the object. Also, mount the object so that it does not extend beyond the table.

Plane Scanning

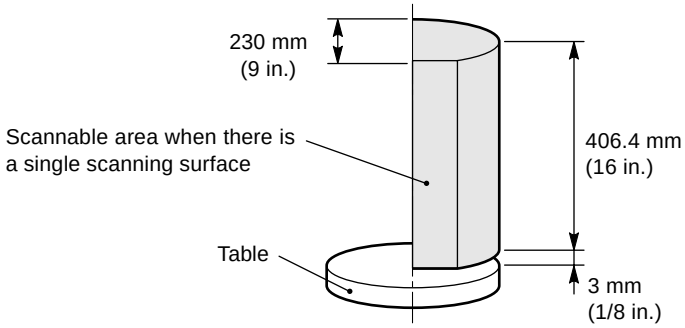
Multi-plane Composition (Two to Six Scanning Surfaces)

For multi-plane composition, mount the object near the center of the table. If it is mounted at the edge of the table it will fall outside the effective sensor area, making correct scanning impossible.



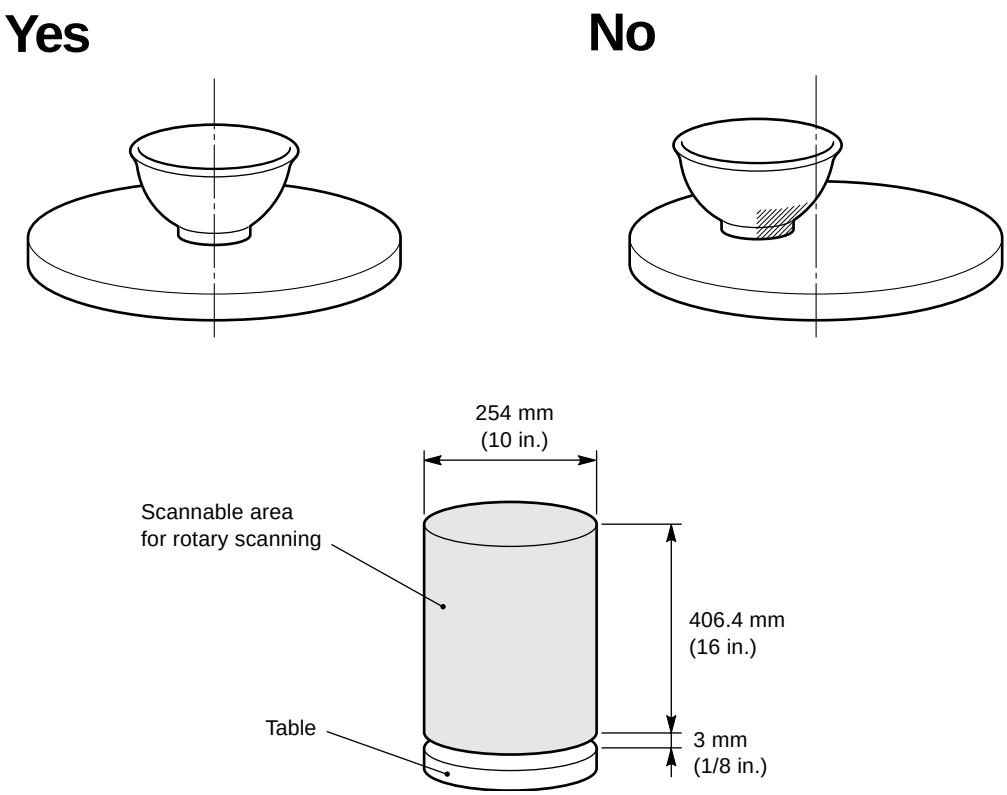
When There Is a Single Scanning Surface

When you are scanning only one surface, mount the object so that the surface you want to scan lies to the right of the center of the table.



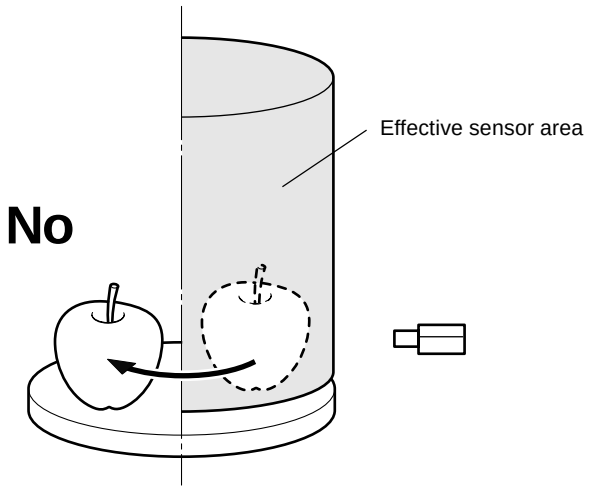
Rotary Scanning

The basic principle is to mount the object to be scanned at the center of the table. All areas to be scanned must be at the table center. The area away from the center of the base (the shaded portion in the figure) cannot be scanned correctly.



Effective Sensor Area

The area where the laser sensor detects reflected laser light is to the right of the center of the table. This is the effective sensor area. When laser light is reflected from the area to the left of the table center, the LPX-250 decides that there is no object to scan. The surface of an object mounted at the table center always passes within the effective sensor area, and the laser light is always reflected from the area to the right. This effective sensor area must also be taken into account when the object has large depressions or shelf-shaped areas.



Part 3

Basic Operation

1. Getting Ready to Scan

Selecting a Scan Object

Before you start scanning, give thought to what objects are suited to scanning.

	Conditions for suitable scanning	Remedies when unsuitable
Object material and color	Does the objects not pass light? Is the object a bright color such as white or yellow? Is the object of a nonglossy material?	Consider applying a white surfacer (primer).
Object size	Does the object fit on the table?	Think about whether you can break down the object into separate parts.
Object shape	Can the object be placed on the table in a stable way? Does the object have many areas that laser light cannot reach?	Consider using a fixing frame or clay to secure in place. Think about whether you can break down the object into separate parts.

Deciding on the Scanning Mode

Give thought to whether to perform scanning in the plane scan mode or the rotary scan mode. In general, it is a good idea to select rotary scanning for objects that are nearly cylindrical and have relatively little unevenness, and plane scanning for other objects.
If an object is nearly cylindrical overall but has one or more areas that are not suited to rotary scanning (such as the handle of a coffee cup), you may consider using rotary scanning to scan the entire object, then using rescan for finishing. For detailed information about rescanning, go to Part 4 and refer to "3. Finishing Detailed Areas Using Rescanning."

Mounting the Scan Object

⚠CAUTION

Do not insert metal objects, flammable objects, or any other foreign object into interior areas other than the top of the table. Also, do not place water or other liquids on any area, including the table. Doing so may cause fire.

Securely fasten the object to be scanned to the table so that it does not slip or topple over. The table rotates during scanning. Tipover or contact by the scan object may cause damage. Scan-object damage is not covered by warranty.

Mount the scan object near the center of the table. For Rotary scanning in particular, mounting the object away from the center may make it difficult to obtain good scanning results.
The table rotates during scanning, so secure the object in place using double-sided tape, clay, or an optionally available vise to keep the object from falling over or slipping.

NOTICE

Do not touch any internal components other than the table. Doing so may result in breakdown.

Do not attempt to move the table, laser head, or any other working parts by hand. Doing so may result in breakdown.

Make sure the scan object does not extend beyond the table. The object may touch the interior of the machine, causing breakdown or damaging the scan object.

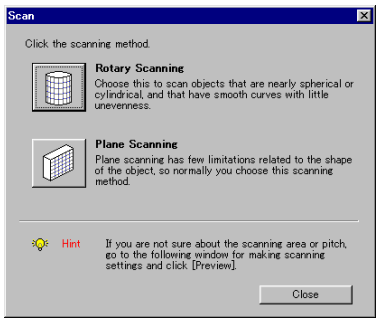
2. Scanning Operation

NOTICE

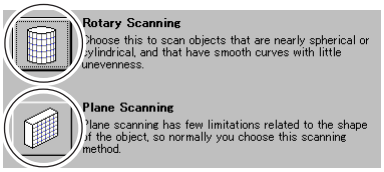
Do not open the door while scanning operations are in progress. To ensure safety, an emergency stop of scanning operations occurs. Scanning cannot be resumed even after the door is closed.

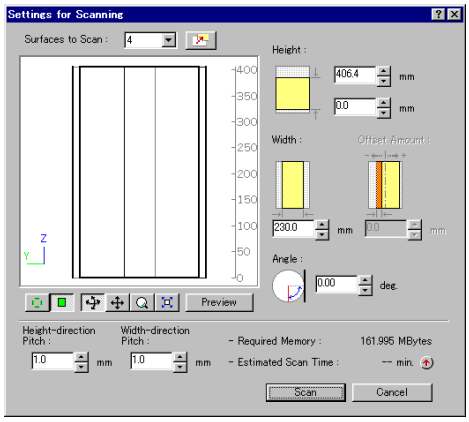
This section describes how to carry out scanning operations.

1. In Dr. PICZA3, click the [SCAN] button. The [Scan] dialog box appears.

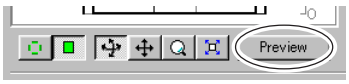


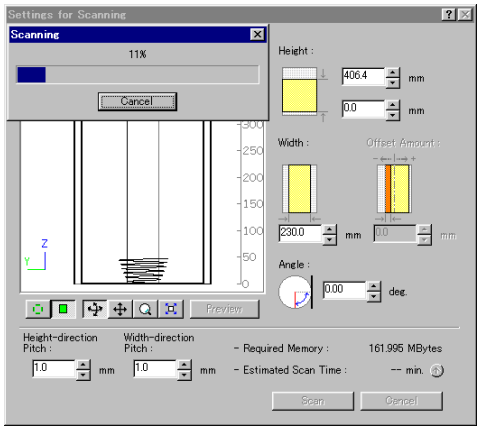
2. Click either the Plane Scanning or the Rotary Scanning button. The [Settings for Scanning] dialog box appears.



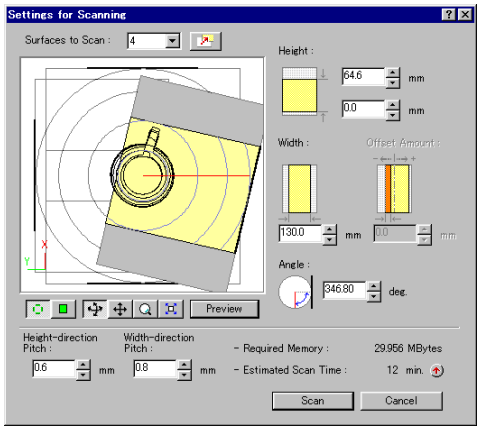


3. Click the [Preview] button.
   The preview starts.
   The general shape of the object to be scanned is displayed.
   The height of the scanning area is setting automatically at this time.

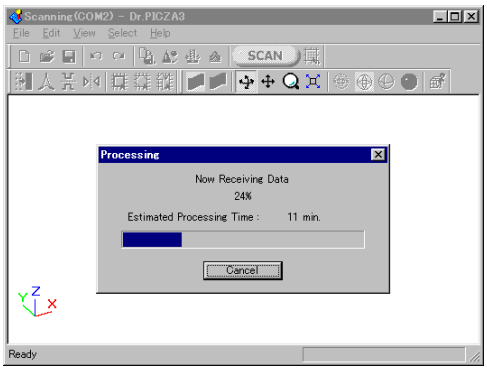




4. Using these results as a guide, make the settings for the scanning area and scanning pitch. For more information on how to make the settings for scanning conditions, refer to "Parameter Settings for Plane Scanning" and "Parameter Settings for Rotary Scanning" in this section.

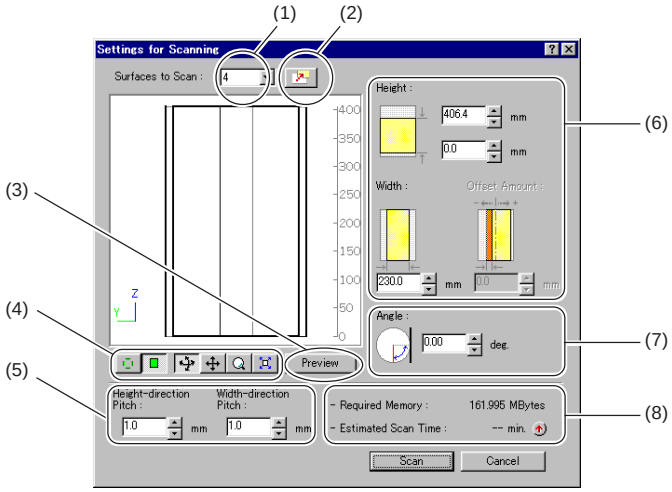


5. Click the [Scan] button.
   Scanning starts.



6. The results of scanning are displayed.
   If necessary, perform finishing by rescanning or change the scanning conditions and redo scanning from the beginning. For more information about viewing the scanning results, refer to the following section, “3. Viewing the Results of Scanning.” For information about rescanning, see Part 4.

Parameter Settings for Plane Scanning



(1) This sets the number of scanning surfaces. For multi-plane composition, select a number from [2] to [6]. The preview window shows the scanning surfaces.

(2) When there is more than one scanning surface, this changes the displayed scanning surface.

(3) Clicking this displays the general shape of the object and sets the height of the scanning area automatically. Using these results as a guide, make the settings for the scanning area.

(4) These control the orientation of the display in the preview window. You can perform such operations as changing between a front or top view, rotating the preview, zooming in and out, and moving.

(5) These set the height-direction and width-direction scanning pitch.

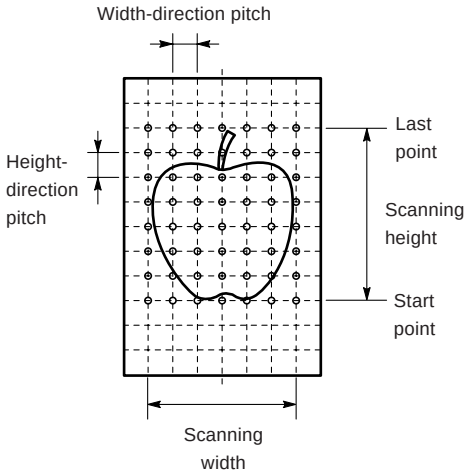
(6) This sets the scanning area. You can make the setting for [Offset Amount] only when the number of surfaces to scan is set to [1].

(7) This specifies the incident angle of the laser beam on the scanning surface now selected. You can specify a different angle for each scanning surface.

(8) This displays the amount of memory that scanning requires. Scanning that exceeds the amount of free memory of the computer may greatly reduce performance for such tasks as updating the screen display. We recommend installing sufficient memory in the computer when you are performing large-size scanning.
Clicking the [ ] button displays the estimated scanning time.

The Important Point Is to Use the Minimum Required Scanning Area

The smaller the scanning area is, the sooner scanning finishes. You can achieve efficient scanning by making the setting for the minimum area that is required. If you don't actively set the scanning area, the entire scannable area is scanned.



Tips for Setting the Scanning Pitch

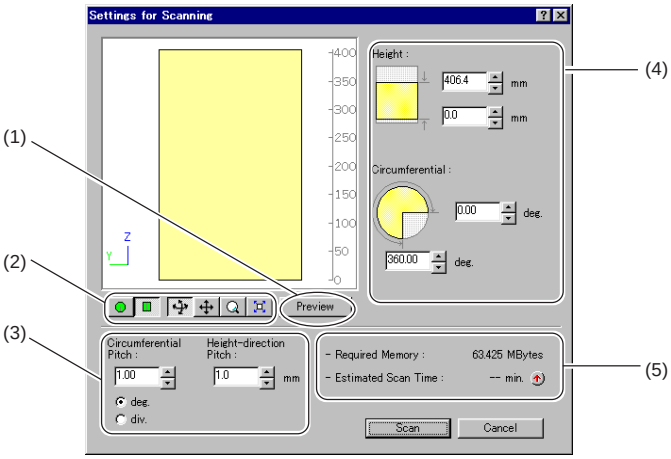
This settings determines the extent to which detailed portions are reproduced. Smaller (finer) pitches do not make for correspondingly greater smoothness. When extreme detail is not necessary, it can actually be more effective to set a coarse pitch.

Units Used by Dr. PICZA3

Dr. PICZA3 can display values in either millimeters or inches. The default setting is determined by the setting for the measurement system in Windows. To change the unit, follow the steps below.

1. In Dr. PICZA3, go to the [File] menu and click [Preferences].
2. Set [Units] to either [mm] or [inch].
3. Click [OK].

Parameter Settings for Rotary Scanning



(1) Clicking this displays the general shape of the object and sets the height of the scanning area automatically. Using these results as a guide, make the settings for the scanning area and scanning pitch.

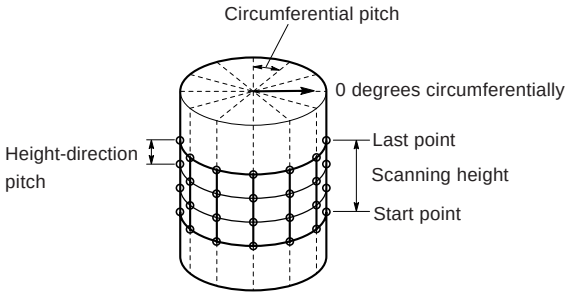
(2) These control the orientation of the display in the preview window. You can perform such operations as changing between a front or top view, rotating the preview, zooming in and out, and moving.

(3) These set the circumferential and height-direction scanning pitch. For the unit of measurement for circumferential pitch, you can select either degrees or the number of segments of the circumference (360 degrees).

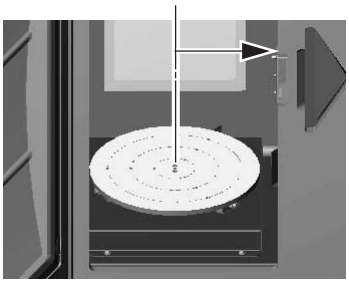
(4) This sets the scanning area. Setting [Circumferential] to either [0] or [360] results in scanning of the entire 360-degree circumference.

(5) This displays the amount of memory that scanning requires. Scanning that exceeds the amount of free memory of the computer may greatly reduce performance for such tasks as updating the screen display. We recommend installing sufficient memory in the computer when you are performing large-size scanning.
Clicking the [ ] button displays the estimated scanning time.

Scanning Area and Scanning Pitch



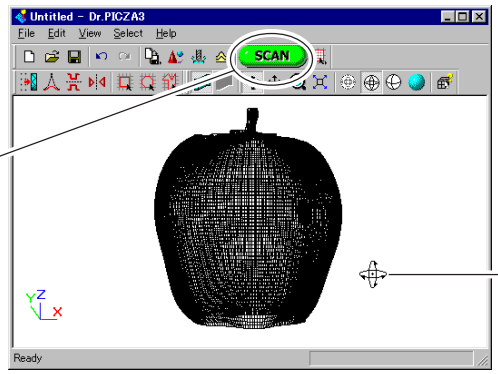
Oriented 0 degrees circumferentially



3. Viewing the Results of Scanning

You can check the scanning results while viewing the results in various ways.

Manipulating the Perspective and the Zoom Rate



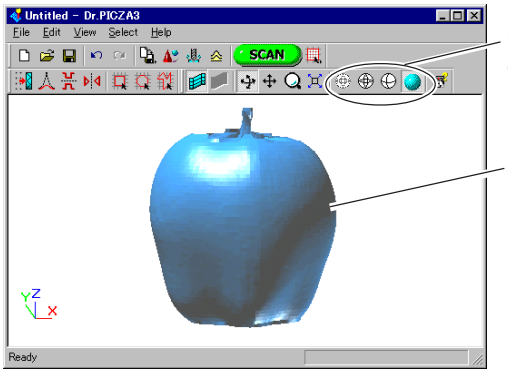
1. Click one of these buttons to enable the mode for shifting the perspective or for zooming.

2. Drag the object.

Changing the Display Method

Clicking these buttons changes the display method.

[Point Group] button	This displays the scanning points as points.
[Wire Frame] button	This displays the scanning results using wire-frame lines.
[Hide Lines] button	This uses wire-frame lines but does not show areas that are in shadow.
[Rendering] button	This displays surfaces and provides a view that most closely resembles the actual article.



Click one of these buttons to change the viewing method.

View when set to "Rendering"

Speeding Up Screen Display

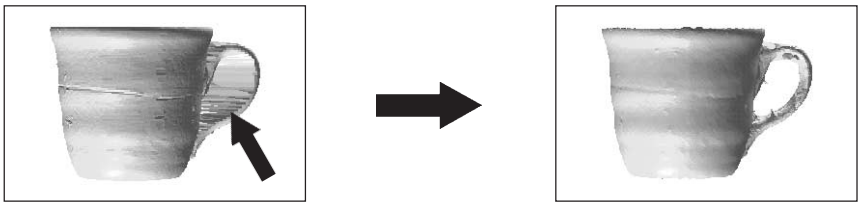
If the operating system and graphics card support OpenGL and the like, it may be possible for you to speed up the screen display. Make the settings as follows.

1. In Dr. PICZA3, go to the [View] menu and click [Options].
2. For [Drawing Method], select OpenGL or the like, then click [OK].
3. If the screen display is corrupted, it means the selected method is not supported. If that happens, return the [Drawing Method] setting to [Software].

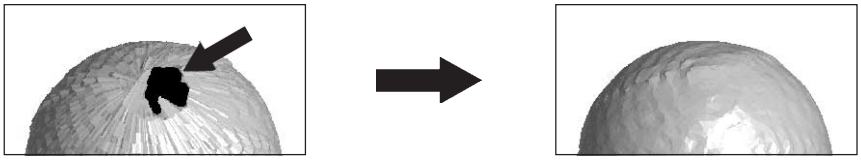
4. Creating a Polygon Mesh

Depending on the conditions, the scanning results may be as shown below. Creating a polygon mesh allows you to produce finished data closer to the original image of the scan object.

Areas joined because the laser light does not reach

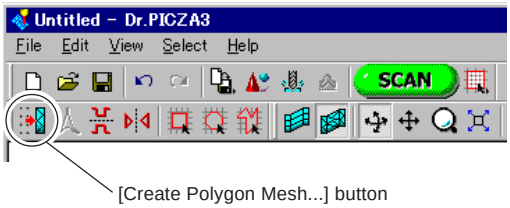


Areas with holes due to surface drop-out



A polygon mesh is composed of polygons created by estimating the original shape of the scan object from the scanning points. They differ from the polygons displayed immediately after scanning, which are generated simply by connecting the scanning points.
A polygon mesh can be generated from data measured by either a plane scan or a rotary scan. A single set of polygon-mesh data is generated even from Multiple-plane scanning data, such as multi-plane composition.
Creating a polygon mesh enables you to make cavities in areas where there are no scanning points and to fill in holes according to the surrounding shape.
This section describes how to create a polygon mesh.

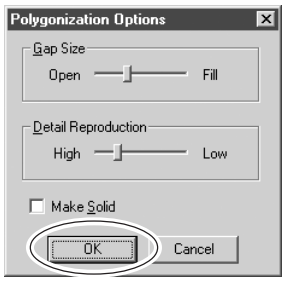
1. Click the [Create Polygon Mesh...] button. The [Polygonization Options] dialog box appears.



[Create Polygon Mesh...] button

2. Select the parameters for creating a polygon mesh, then click [OK].

   For more information about the [Polygonization Options] dialog box, refer to the “Dr. PICZA User’s Manual” (electronic-format manual).



3. If the polygon mesh is not what was intended, change the parameters and create it again.

Tips for Creating a Polygon Mesh

Creating a polygon mesh generates polygons only in areas where there is a high density of scanning point. Using data with a large number of scanning points can raise the degree of completeness of the polygon-mesh data. To increase the number of scanning points, you use a finer scanning pitch. Note that this also increases both the scanning time and the amount of memory required. If not enough memory is available, or if you want to shorten the scanning time, it may be helpful first to perform scanning at a coarse pitch, then rescan just the necessary areas at a fine pitch, and then generate the polygon mesh.
Rescanning may also be effective in situations like the following.

- When there are areas that have few scanning points with respect to the undulations on the scan object
- When areas with holes are too big or the shape of them is complex

For more information about rescanning, see Part 4.

5. Saving the Results of Scanning

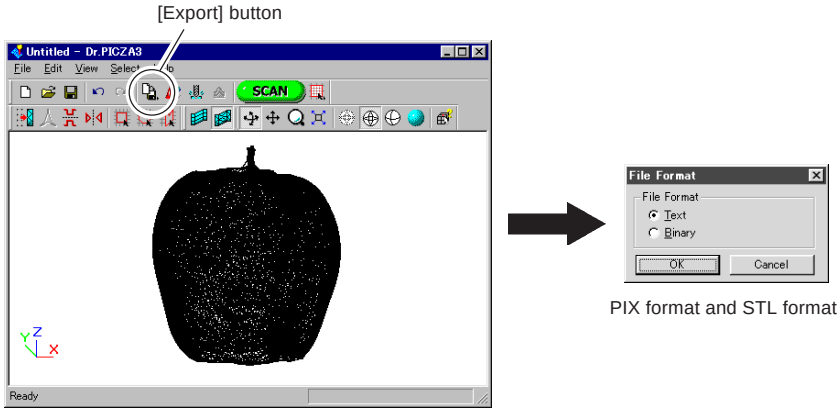
Saving the Results of Scanning

To save the results of scanning, then in Dr. PICZA3, go to the [File] menu and click [Save As].
The data is saved in Dr. PICZA project format (with the file extension .pij). A single file saved in this format contains both the scanning data and the polygon-mesh data. If no polygon mesh has been generated, then only the scanning data is saved.
In addition to Dr. PICZA3, the 3D Editor program for editing 3D data can also open files in this format.

Exporting Data

Using the [Export] command allows you to make use of scanning results with another program. You choose and export either the scanning data or the polygon-mesh data. You can save (export) files in such formats as PIX (text or binary) and STL (text or binary). For more information, refer to the "Dr. PICZA3 User's Manual" (electronic-format manual).

1. Display the data you want to export. From the [View] menu, choose either [Scanning Data] or [Polygon Mesh].
2. In Dr. PICZA3, click the [Export] button. Click the file format you want to use for exporting.
3. Depending on the file format you clicked, a dialog box may appear. Choose a selection supported by the program with which you want to share the data, then click [OK]. For example, for PIX or STL format, choose either text or binary, then click [OK].



PIX format and STL format

4. Type in the name of the file to export, then click [Save].

Scanning Data and Polygon-mesh Data

Scanning data is data for measuring points (scanning points) obtained by scanning.
Polygon-mesh data is data composed of new polygons created by estimating the proper shape of the scan object from the scanning data.
When exporting data, take into account the differences just described and choose the appropriate data for the purpose.
When raw measurement data is needed, export the scanning data. When polygon data for creating three-dimensional computer graphics is needed, it may be best to export the polygon-mesh data.

Part 4

Features for Better Scanning

1. Finishing Detailed Areas Using Rescanning

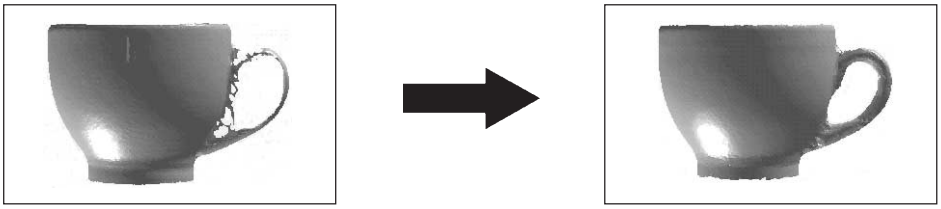
After you have scanned an entire object, this feature rescans just one portion with changed conditions. Basic scanning should always be performed using the best possible conditions, of course, but by using rescan to finish detailed portions you can make the data even more highly finished. If a created polygon mesh is not what you intended, then it may be possible to generate more highly finished data by creating the polygon mesh again after using rescanning to increase the number of scanning points.
There are two modes of rescanning: plane rescanning and rotary rescanning. You may freely choose the scanning mode for both basic scanning and rescanning, so you can also use different modes in combination by taking advantage of the characteristics of each.

Finishing Areas That Could Not Be Scanned

Depending on the parameters, the polygon mesh generated after scanning may end up as described below. If this happens, you can use rescanning to perform finishing. Note that you cannot expect any benefits from rescanning in cases such as those where the shape of the object blocks the laser beam no matter how the object is oriented.

There are few scanning points and the original shape cannot be reproduced

When performing a rotary scan of an object having a shape as shown in the figure, the necessary number of scanning points may not be obtained.

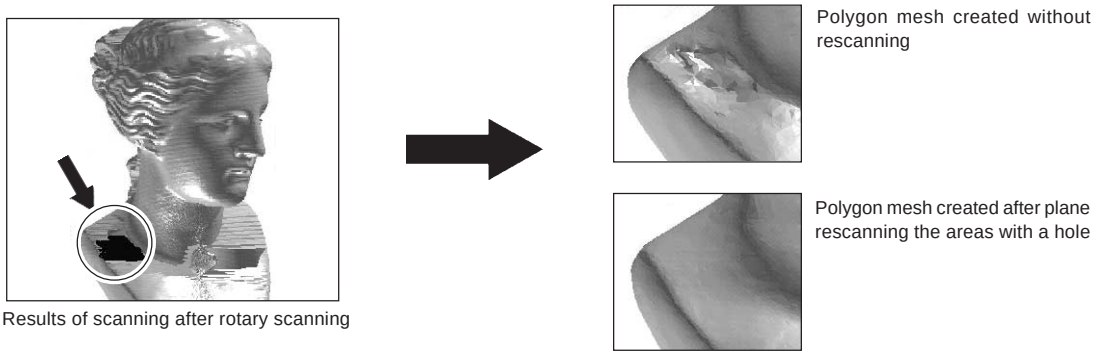


Polygon mesh created after performing only rotary scanning

Polygon mesh created after plane rescanning of the handle area

The areas with holes are too big or the shape of them is too complex

The shape of the generated polygon mesh may differ from the original shape.



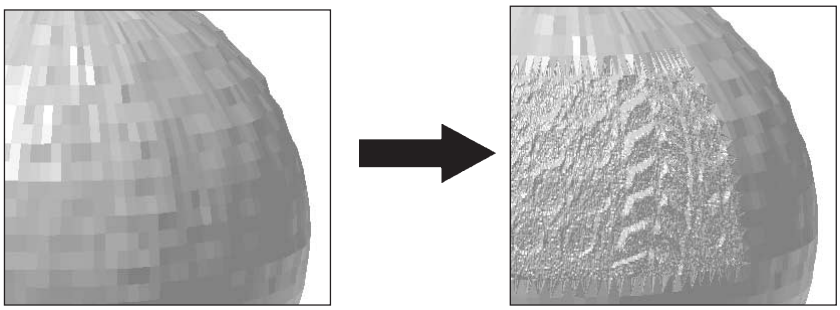
Results of scanning after rotary scanning

Polygon mesh created without rescanning

Polygon mesh created after plane rescanning the areas with a hole

Scanning a Specific Area in Greater Detail

You perform coarse scanning of the entire object, then rescan just the required areas at a finer pitch. This can reduce the size of the data and also shorten the scanning times. You choose either plane rescan or rotary rescan, according to the shape of the scan object.



Choosing the Scanning Mode

• **When you're rescanning areas that could not be scanned**

Plane rescanning is more effective than rotary rescanning. Scanning can be accomplished in a shorter time than with rotary rescanning. Even when the scan object has a complex shape, it may be better to use plane rescanning to perform overlapping scanning, changing the scan angle between each scanning pass.

• **When you're rescanning a specific area at a fine scanning pitch**

It may be a good idea to perform rescanning in the same mode as the basic scanning.

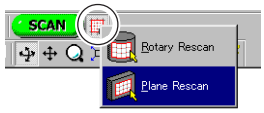
For example, when you want to perform fine-detail scanning of the surface pattern of a scan object whose shape is cylindrical or close to cylindrical, you first perform coarse rotary scanning, then choose rotary rescanning.

Performing Rescanning

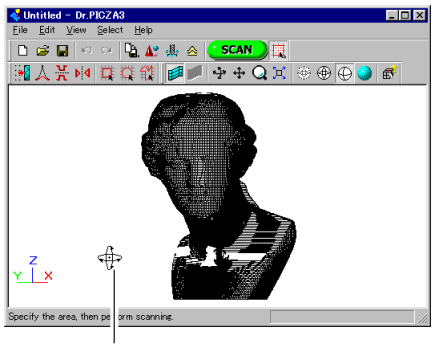
You perform rescanning using the following procedure. The screens shown are those for plane rescanning.

1. First, scan the entire object. Choose a scanning mode according to the shape of the scan object. From this point on, until rescanning is finished, the mounted position of the scan object must not be moved.

2. When you have finished scanning the entire object, click the [ ] button. Then click either [Rotary Rescan] or [Plane Rescan].

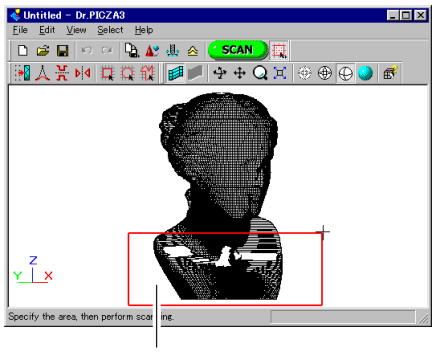


3. Hold down the SPACE key and drag to position the area you want to rescan at the front.



SPACE key + drag left or right to shift the perspective.

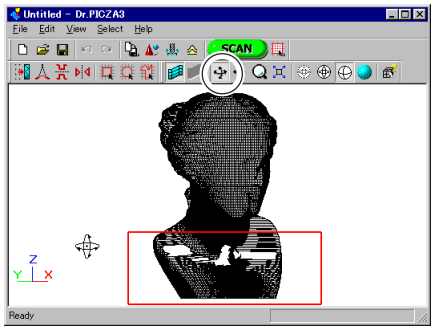
4. Drag (without holding down any keys) to specify the rescanning area. In plane scanning, the on-screen orientation at this time is the scanning direction.



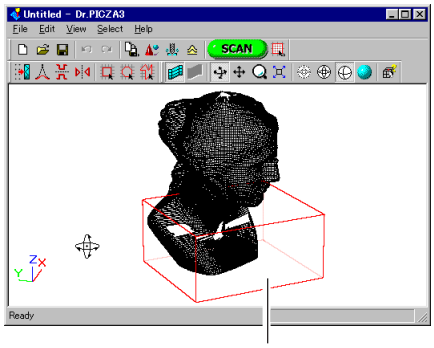
Drag to specify the rescanning area.

5. You can specify more than one rescanning area. In this case, you repeat steps 3 and 4. You cannot specify a scanning pitch for each individual area at this time.

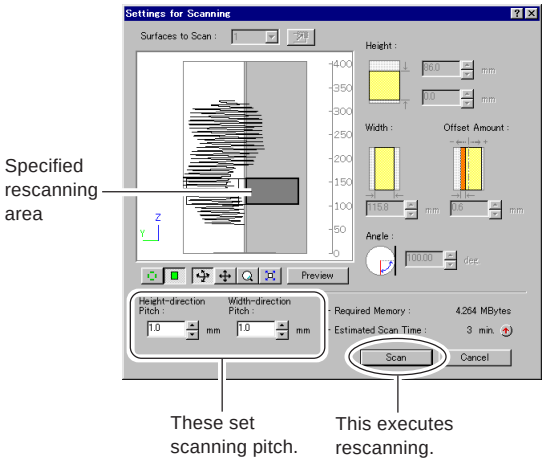
6. Click the [ ] button. The mode for specifying the rescanning area is canceled.



7. Drag to verify the area to rescan. The specified rescanning area is displayed as a three-dimensional form.



8. Click the [SCAN] button. The [Settings for Scanning] dialog box appears. For rescanning, you cannot change any settings other than the scanning pitch.



9. If necessary, change the scanning pitch, then click [Scan].

Shortcut Keys for Shifting the Perspective

You can also use the arrow keys to shift the perspective when specifying the rescanning area. Also, you can shift in parallel or zoom in or out by holding down the CTRL key or the SHIFT key while dragging.

Specifying an Area and Rescanning

Clicking anywhere on the object after you have specified the rescanning area releases the area you specified. Also, even if you have performed rescanning, you can return to the state before rescanning by using the [Undo] button.

[Undo] button

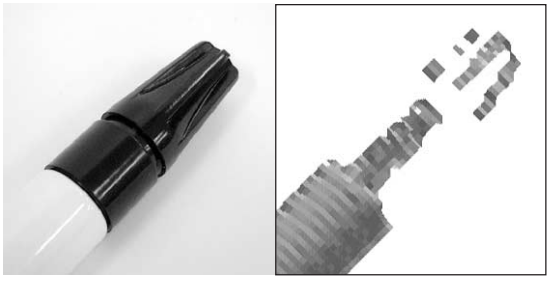
Rescanning and the Scanning Pitch

When you're rescanning a portion of a complex shape, making the scanning pitch as fine as possible increases the number of scanning points and allows you to create more highly finished polygon mesh. When there is little free memory, it may be a good idea to use a narrow scanning area and perform rescanning in several passes.

2. Case Studies for Better Scanning

Scanning Results for Objects That Are Difficult to Scan

These are some examples of scans of difficult materials. (The plated object was specially scanned for experimental purposes only. Avoid highly reflective objects because of danger of eye injury.)



Black marker pen
Plane scanning
Pitch: 1.0 mm x 1.0 mm

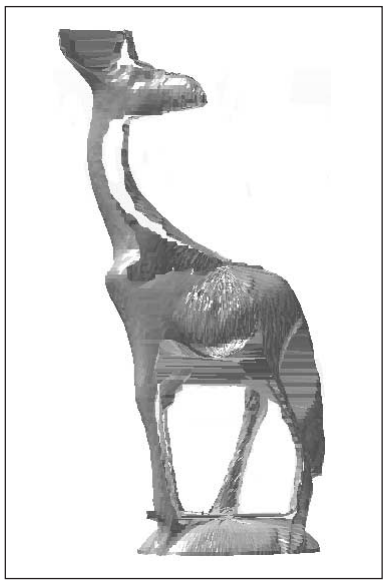
Scanning errors occurred at black areas.

Plated object
Rotary scanning
Pitch: 1.0 mm x 3 degrees

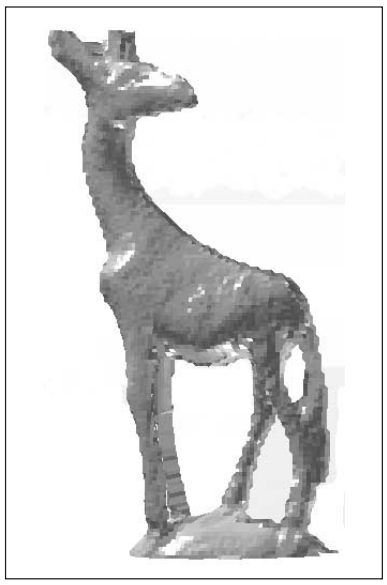
* In these cases, applying a white surfacer (primer) or the like may yield good results.

Choosing the Scanning Mode

This example involves using the two scanning modes to scan an object that has cavities and a complex shape. Plane scanning is suited to objects like this.



Rotary Scanning



Plane Scanning

This example involves using the two scanning modes to scan an object that has a nearly cylindrical shape. You can use either mode for scanning, but rotary scanning achieves the shortest scanning times. The scanning pitch is equivalent for both, but rotary scanning produces smoother surfaces.

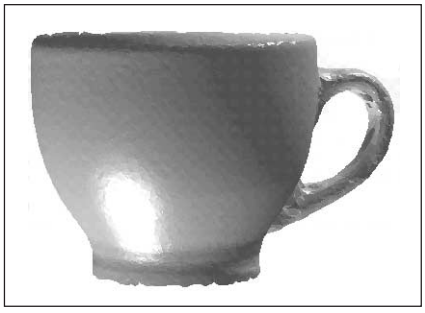
Rotary scanning

Pitch of 1.4 mm x 1.6 degrees
Scanning time of 3 minutes 30 seconds

Plane scanning

Pitch of 1.4 mm x 1.4 mm
Scanning time of 6 minutes

This is an example of a polygon mesh generated after rotary scanning and rescanning, and a polygon mesh generated after only plane scanning. To determine which of the two modes to use, you should decide how much you want to take advantage of the features of rotary scanning. Using plane scanning may eliminate the need to perform rescanning, but if smooth curves are important, then rotary scanning may be more effective.

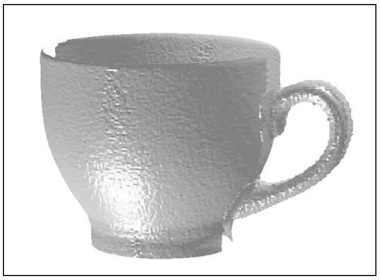


Rotary scanning
(with finishing by rescanning)

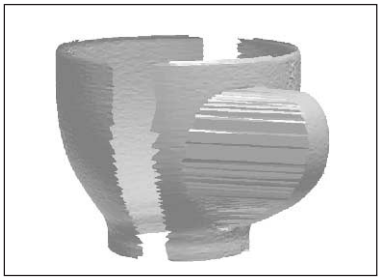
Plane scanning
(three scanning surfaces)

Scanning Direction for Plane Scanning

This is an example where the scanning direction is changed with plane scanning. It is a good idea to consider the direction in which cavities and voids can be most easily captured (that is, the direction in which the laser beam passes), and also to keep in mind what area of the object is most important.



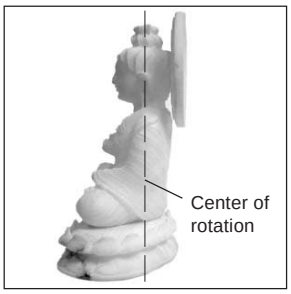
Example of scanning from the front surface
(two scanning surfaces)



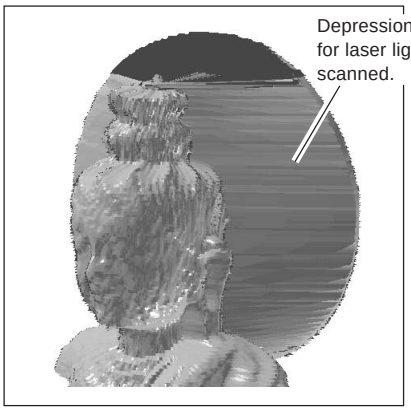
Example of scanning from the front at an angle
(two scanning surfaces)

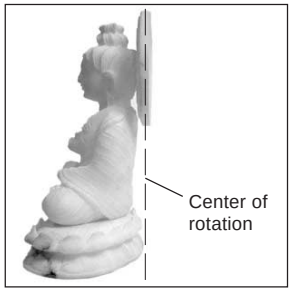
Object Mounting Location for Rotary Scanning

In rotary scanning, the laser light is beamed toward the center of the table. This means that when the object is uneven, the penetration of the laser light varies greatly according to the object's mounting location. This case takes this point into account and deliberately shifts the mounted position away from the center. Note that plane scanning may be better suited to an object like this one. At this mounted position, the back portion is not scanned correctly.

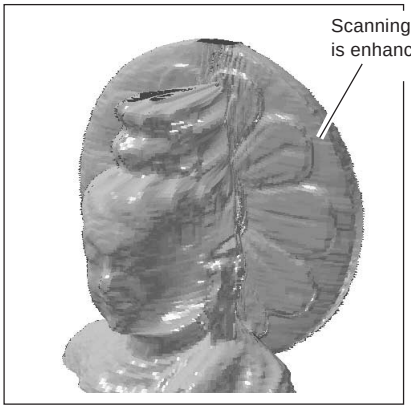


Plaster figure
Rotary scanning
Pitch: 0.6 mm x 1.0 degree





Plaster figure
Mounting position changed under the same conditions.



Part 5

Editing Scanning Results–Using 3D Editor

1. What You Can Do Using 3D Editor

3D Editor lets you do things like the following.

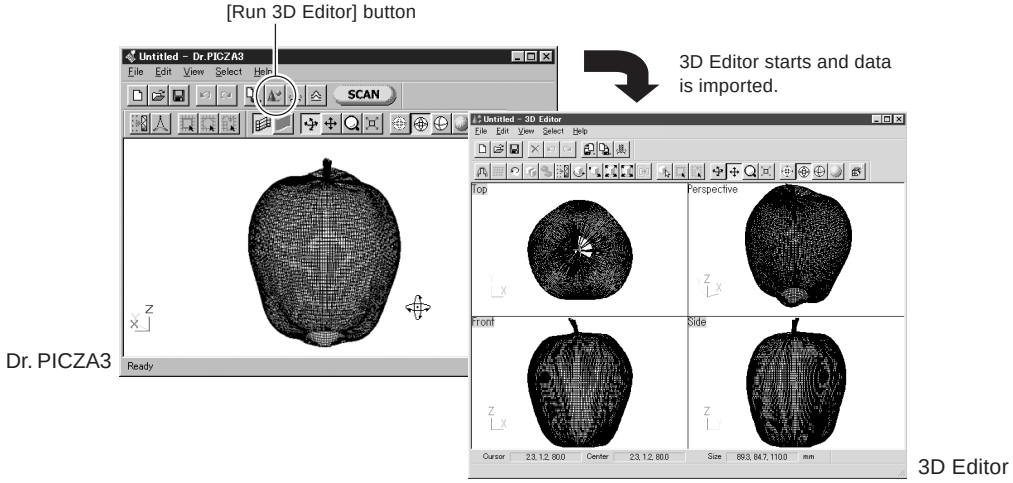
Enlarge and reduce	Deforming operations such as stretching in one direction are also possible.
Move and rotate	Specifying numerical values for the movement distance and angle of rotation is also possible.
Sever	You can divide an object into parts. Filling cut surfaces is also possible.
Delete	You can delete unneeded objects.
Merge	You can unite a number of objects. There is even an alignment feature for doing this.
Reduce the number of polygons	This reduces the amount of data while keeping detail. This is an essential feature of 3D scanners.
Smoothing feature	This smooths the surfaces of objects.
Export	Data can be saved in such formats as DXF, STL, IGES, VRML, and Point Group.
Repolygonization	This creates a polygon mesh by using imported data.

The features of 3D Editor are described in detail in the "3D Editor User's Manual" (electronic-format manual). Refer to it as well. Note that 3D Editor can only work with surface models.

2. Importing and Exporting Data

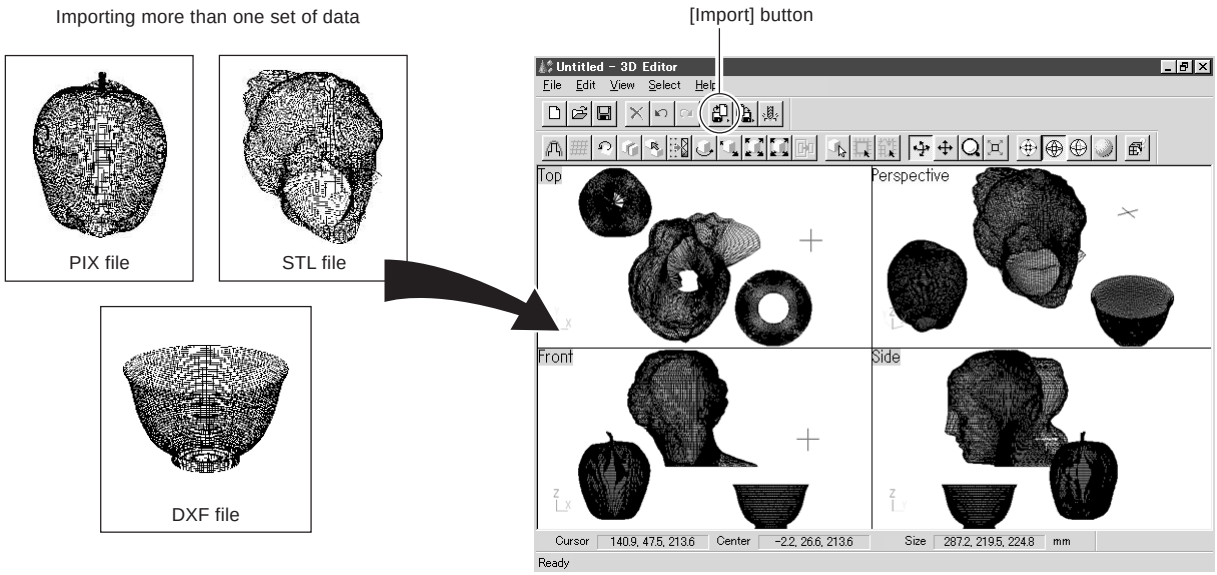
Importing Scanning Results Immediately

In Dr. PICZA3, clicking the [Run 3D Editor] button starts 3D Editor and simultaneously imports the displayed scanning results.



Importing More Than One Set of Data

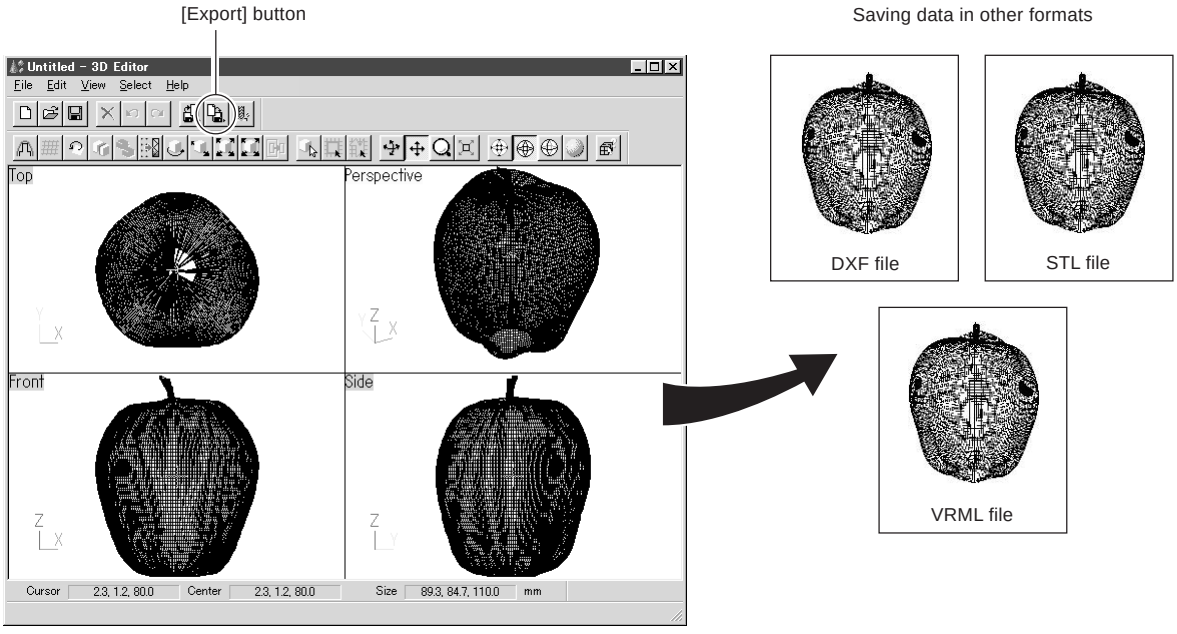
You can use the [Import] button to import more than one set of data and place a number of object in the 3D Editor window. You can import Dr. PICZA project format files, PIX-format files, DXF-format files (3D surface models only), and STL-format files.



3D Editor also supports importing for PIX-format files from Dr. PICZA versions 1 through 2.

Exporting Data in Other Formats

You can use the [Export] button to save data an a wide variety of formats, including DXF, STL, IGES, VRML, and Point Group.



3. Basic Operations for Objects

How to View the 3D Editor Window

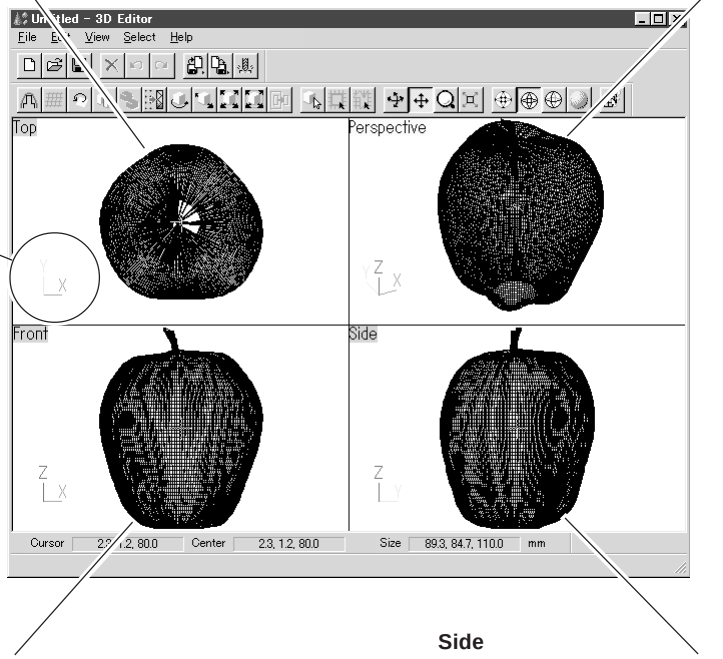
3D Editor displays an object from four different perspectives at the same time. You can manipulate any one of these at any time. The important point is that you get four different views from four angles. However, each of the four windows has its own features.

Top

This is a view of the object seen from directly above. You can move only in the X and Y directions; there is no movement in the Z-axis direction. Use this at times such as when you want accurate movement in only the X and Y directions.

Perspective

You can move in all three directions (X, Y, and Z). Operations such as accurate movement in the X-axis direction are difficult, and there is no way to tell how much movement is made in the X, Y, and Z directions. It may be a good idea to use this mainly as a viewer to visualize the entire object.



This indicates the X, Y, and Z orientation.

Front

This is a view of the object seen from directly in front. You can move only in the X and Z directions; there is no movement in the Y-axis direction. Use this at times such as when you want an accurate view of movement along the Z axis.

Side

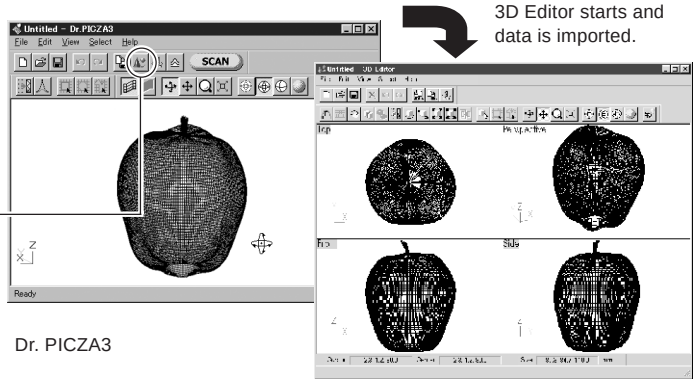
This is a view of the object seen directly from the side. You can move only in the Y and Z directions; there is no movement in the X-axis direction. Use this at times such as when you want an accurate view of movement along the Z axis.

Let's Try Editing Data with 3D Editor

Let's try some simple editing. We'll scan an apple with the LPX-250, then try cutting and moving it.

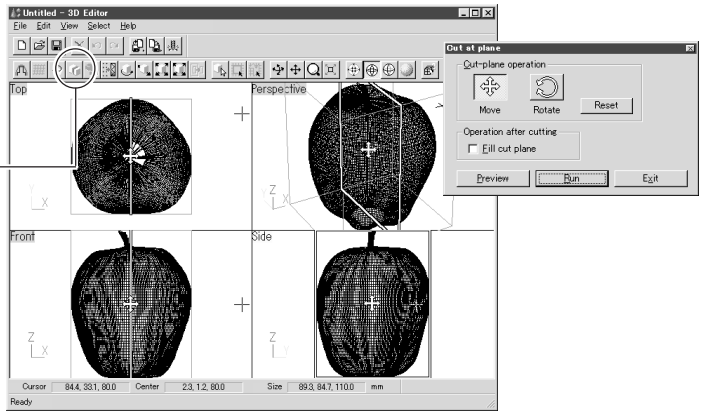
1. First, do a scan of an apple. Then, in Dr. PICZA3, click the [Run 3D Editor] button. When 3D Editor starts, the data for the apple is imported at the same time.

[Run 3D Editor] button

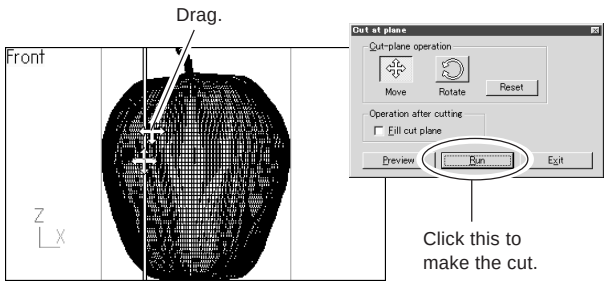


2. Try cutting the apple vertically. Clicking the [Cut at Plane] button displays the cut surface and a dialog box.

[Cut at Plane] button



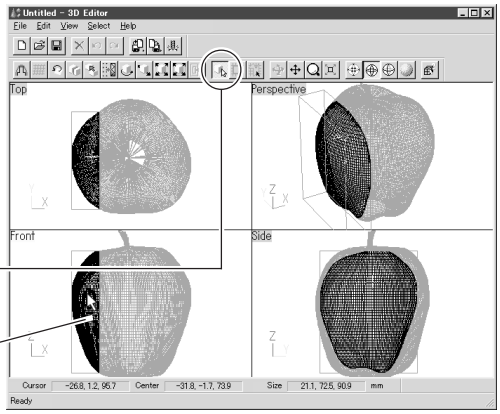
3. Try shifting the cut location a little to one side. This may be easiest to do in the [Front] window. Drag the cut surface to move it to the left.



4. When you have decided on the cut location, click [Run]. The apple is divided into two parts. However, its still looks like a single object. Try separating the two parts. Click the [Select Object] button, then click the left part of the apple to select it.

[Select Object] button

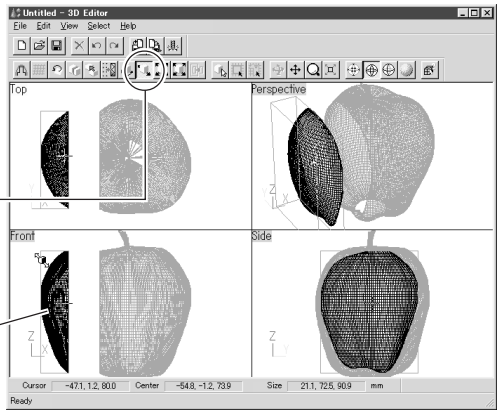
Click this portion to select it.



5. Click the [Move Object] button, then drag the portion you selected to the left. The two parts separate. When you're done with the operation, right-click to quit the [Move Object] mode.

[Move Object] button

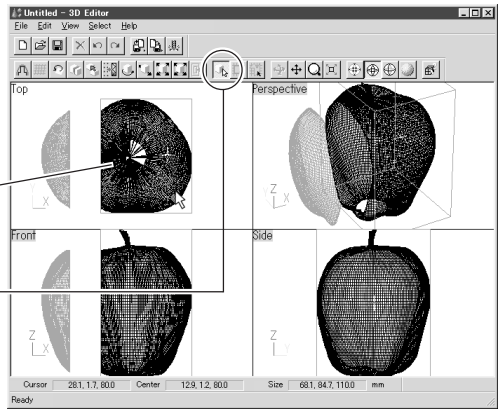
Drag the object you want to move.



6. Now try orienting the cut surface of the apple on the right to face the front. You can only do this when you're in the [Top] window. First click the [Select Object] button, then click the right side of the apple to select it.

Click this portion to select it.

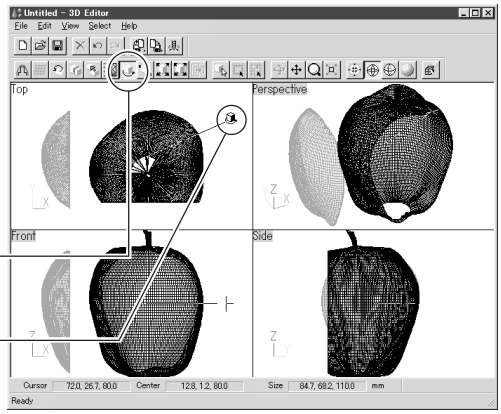
[Select Object] button



7. Click the [Rotate Object] button, then drag to turn the object counterclockwise. Try turning it until the cut surface faces down. Look at the [Perspective] window to see how the cut surface faces the front. When you're done with the operation, right-click to quit the [Rotate Object] mode.

[Rotate Object] button

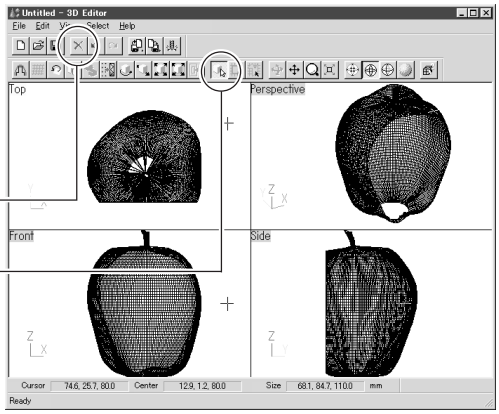
Drag to rotate.



8. Finally, try deleting the cut part. You can do this in any window except the [Side] window. First click the [Select Object] button, then click the cut-off portion to select it. Then click the [Erase] button.

[Erase] button

[Select Object] button



Part 6

Troubleshooting

If operation is not as expected, try taking corrective action as described below. If that doesn't correct the problem, or if you determine that there is a breakdown, then contact your authorized Roland DG Corp. dealer or service center.

Symptom	Remedy	If the problem persists
The power does not come on when the Standby key is pressed.	- Make sure the AC adapter and power cord are connected correctly. - Unplug the AC adapter from the electrical outlet, redo the connections, then press the Standby key.	The scanner unit or the AC adapter may be broken, or there may be a broken wire in the power cord.
The power does not go off when the Standby key is held down for 1 second or longer.	- Unplug the AC adapter from the electrical outlet.	
When the power is turned on an unusual sound is heard for about 40 seconds.	- Make sure all the head retainers have been removed. - Make sure no scan objects or other items are caught inside the machine.	The scanner may be broken.
When the power is switched on the Standby key lights up green, but scanning cannot be performed.	- Make sure all the head retainers have been removed. - Make sure the correct COM port number is set in the preferences for Dr. PICZA3. - Restart the computer. - Make sure the connection to the computer is correct. - Unplug the scanner's AC adapter from the electrical outlet, redo the connections, then switch on the power.	The cable used for the connection with the computer may not be the right kind or may be broken. Alternatively, the computer's COM port may not be functioning, or the scanner unit may be broken.
When the power is switched on the Standby key flashes green and there is no movement at all.	- Close the door securely. - Unplug the AC adapter from the electrical outlet, redo the connections, then switch on the power.	The scanner may be broken.
The Standby key flashes orange and scanning cannot be performed.	- First start the computer, then switch on the power to the scanner unit. - Restart the computer, then reset the power to the scanner unit. - Unplug the scanner's AC adapter from the electrical outlet, redo the connections, then switch on the power. - Make sure the right kind of cable is used for the connection with the computer. - Reinstall the program.	The cable used for the connection with the computer may be faulty or there may be faulty contact at one of the connectors.
The Standby key flashes (or lights up) red.	- Unplug the AC adapter from the electrical outlet, redo the connections, then switch on the power.	The scanner may be broken.
Scanning ended, but the computer then stopped.	- Scanning that exceeds the amount of free memory in the computer may drastically impair the performance of the computer. In Dr. PICZA3, go to the [Settings for Scanning] dialog box and check the amount of required memory, and consider increasing the scanning pitch or installing more memory.	

Symptom	Remedy	If the problem persists
The message "Cannot communicate with present scanner" appears on the computer and there is no operation.	- Switch on the power to the scanner before you run Dr. PICZA3. - Make sure the correct COM port number is set in the preferences for Dr. PICZA3. - Restart the computer. - Make sure the connection to the computer is correct. - Unplug the scanner's AC adapter from the electrical outlet, redo the connections, then switch on the power. - Reinstall the program.	The cable used for the connection with the computer may not be the right kind or may be broken. Alternatively, the computer's COM port may not be functioning, or the scanner unit may be broken.
The message "COM: not ready" appears on the computer.**	- Restart the computer. - Unplug the scanner's AC adapter from the electrical outlet, redo the connections, then switch on the power. - If you're using Windows NT/2000/XP, make sure no other printer driver or the like is using the same COM port. - Reinstall the program.	
The message "Can't find MODELA Player" or "Can't find 3D Engrave" appears on the computer.	- The buttons for running these do not function on this system. They become available when you are using together with the MODELA series or the like.	

Part 7

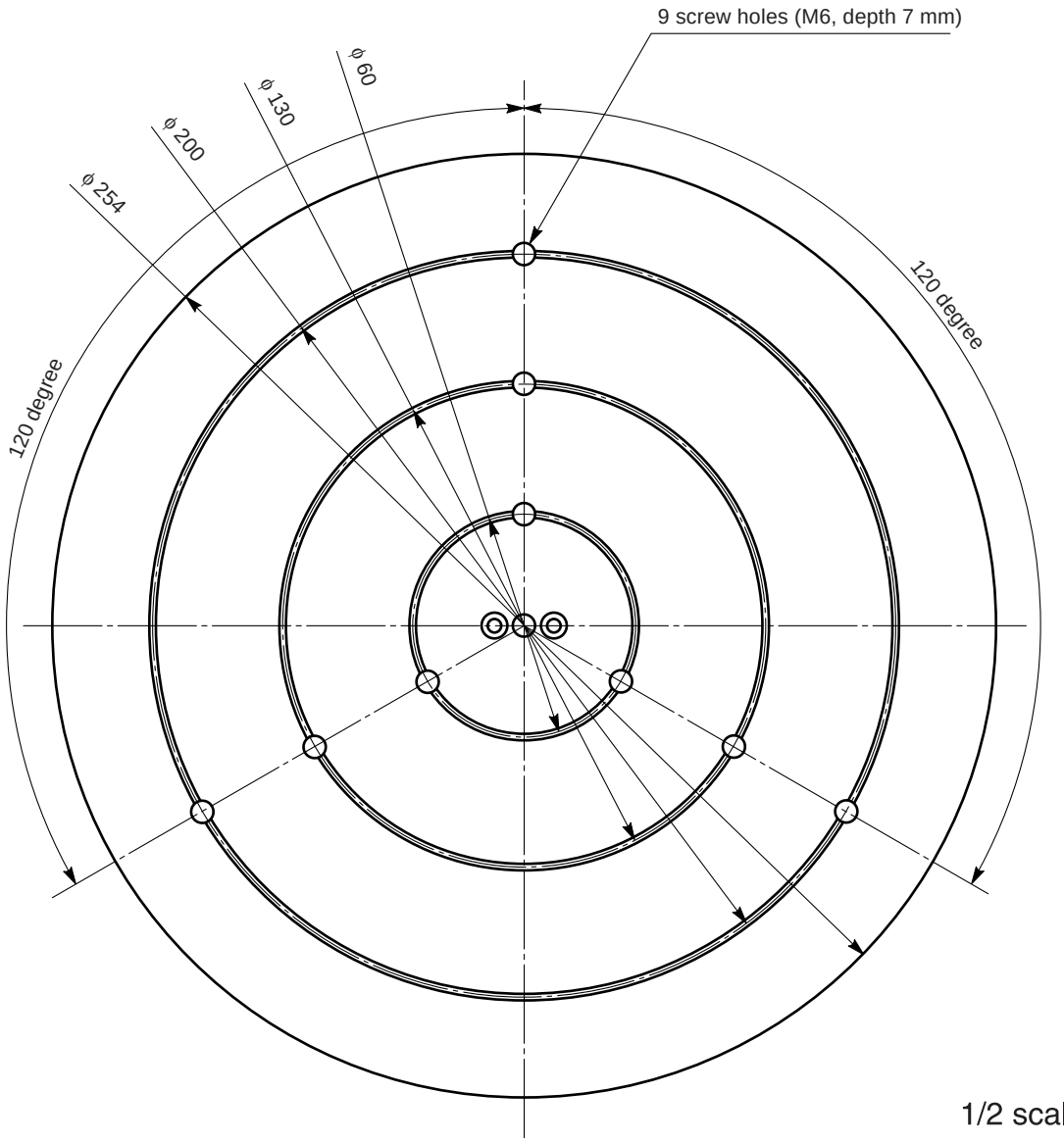
Appendix

1. Sample Data Sheet

This is a data sheet from an actual scan. Refer to it when you are setting scanning conditions.

Object	Material: plaster	
Scanning mode	Rotary scanning	
Scanning area	Height direction 0 to 325 mm, Circumferential 0 to 360 degrees	
Scanning pitch	Height direction 1.0 mm, Circumferential 1.0 degrees	
Scanning time	Approx. 23 minutes	
Memory used	Approx. 53 MB (estimate of use by Dr.PICZA3)	
Data size	Dr. PICZA project format	7.6 MB (included polygonmesh data)
	PIX format (text)	5.1MB
	DXF format	23.1MB
	STL text format	64.5 MB
	STL binary format	11.0 MB
	IGES format	724 KB (portion of bust front; 6,724 control points)
	VRML format	7.7 MB
	3DMF format	7.5 MB
	* All the data size is the result exported from the scan data.	
Computer	Windows 98, PentiumIII 650 MHz, 320 MB RAM	

2. Table Dimensional Drawing



1/2 scale

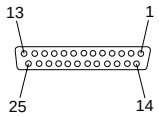
3. Specifications

Table size	Diameter 254 mm (10 in.)
Maximum scanning area	Rotary scanning: Diameter 254 mm (10 in.), height 406.4 mm (16 in.) Plane scanning: Diameter 230 mm (9 in.), height 406.4 mm (16 in.)
Scanning pitch	Rotary scanning: circumference 0.2 to 60 degrees, height direction 0.2 to 406.4 mm Plane scanning: width direction 0.2 to 230 mm, height direction 0.2 to 406.4 mm
Maximum table load weight	5 kg (11 lb.) (not including optional vise)
Laser	Wavelength: 600 to 700 nm, maximum output: less than 1.0 mW (maximum output discharged outside housing is 0.39 µW), pulse width: 350 µs, pulse frequency: 2,857 Hz
Sensor	Noncontact laser sensor
Scanning method	Spot-beam triangulation
Operating speed	Table rotation speed: 15 rpm, head rotation speed: 7.5 rpm, head movement speed: 50 mm/sec.
Interface	Serial (RS-232C standard, D-Sub 25 pin) Transfer method: Asynchronous/full duplex data communication, 9,600/115,200 bps transfer speed, 8 data bits, 1 stop bit, no parity, hardware flow control
Control keys and LEDs	Standby key, Standby LED, and Movement LEDs
Power consumption	Dedicated AC adapter (DC 19 V, 2.1 A)
External dimensions	528 (W) x 742 (D) x 431 (H) mm (20-13/16 (W) x 29-3/16 (D) x 16-15/16 (H) in.)
Weight	32 kg (70.5 lb.) (main unit only)
Operating temperature	10 to 40 ˚C (50 to 104 ˚F)
Operating humidity	35 to 80% (no condensation)
included items and accessories	AC adapter: 1, power cord: 1, 2.5-mm hexagonal wrench: 1, 3-mm hexagonal wrench: 1, caps: 3, Roland Software Package CD-ROM: 1, user's manual: 1, Roland Pixform™: 1

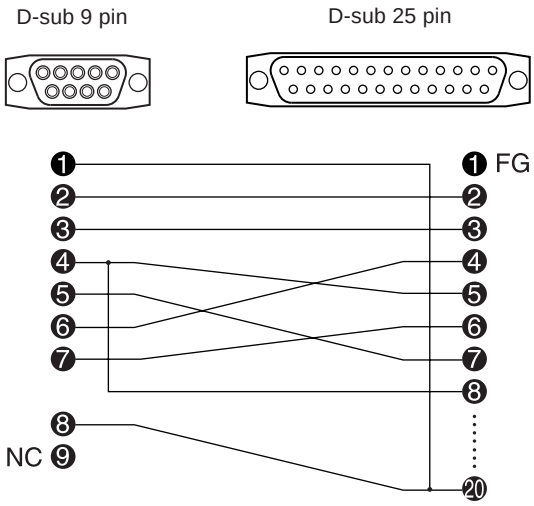
Serial connector (RS-232C)

Signal number	Terminal number		Signal number
NC	25	13	NC
NC	24	12	NC
NC	23	11	NC
NC	22	10	NC
NC	21	9	NC
DTR	20	8	NC
NC	19	7	SG
NC	18	6	DSR
NC	17	5	CTS
NC	16	4	RTS
NC	15	3	RXD
NC	14	2	TXD
		1	FG

Pin connection



XY-RS-34/14 cable connection



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