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Progeny Vantage Panoramic X-ray System

Product Generation 2.1

Technical Service Manual

00-02-1698
Revision B01

Contents

1 How to Use This Manual

In this Chapter

Introduction

The *Technical Service Manual* is used for regular maintenance and service of the Progey Vantage® panoramic X-ray system. The work should be performed by a technician familiar with this product.

Quick References

For information on…	Go to …
How the Progeny Vantage® system works	Chapter *2*, *System Overview on page 15* Chapter *2*, *About the Components on page 16*
Error messages	Chapter 3, *Message Center on page 28*
Boards and test points	Chapter *3*, *Printed Circuit Boards on page 38* Chapter *3*, *Troubleshooting with Printed Circuit Boards on page 43*
IP addresses	Chapter *3*, *Network Communications on page 56*
Troubleshooting	Chapter *4*, *Troubleshooting Procedures on page 58*
Improving image quality	Chapter *5*, *Typical Problems and Their Causes on page 72*
Service screen	Chapter *6*, *Service Screen Overview on page 76*
Maintenance procedures	Chapter *7* through Chapter *14* starting *from page 80*
Readiness checklists	Chapter *15*, *System Function Checklist on page 93*
Operator panel screens	*Appendix A*, *Operator Panel on page 95*

Related Manuals

The following manuals will be helpful when servicing the Progey Vantage® panoramic X-ray system.

Related Manuals

Title	Description
Progey Vantage® panoramic X-ray system, Installation Guide	The *Installation Guide* identifies requirements for installation; explains client computers setup; and describes how to install the Progey Vantage® device, how to install cables, and how to start up.
Progey Vantage® panoramic X-ray system, User Guide	The *User Guide* explains the components of the Progey Vantage® system and provides instructions on getting started, positioning a patient, acquiring images, and resolving image problems.

Warnings and Cautions

⚠WARNING

Ionizing Radiation

This X-ray unit may be dangerous to patient and operator unless safe exposure factors, operating instructions, and maintenance schedules are observed. Removing build-in protection devices increases the risk of undesired X-ray irradiation.

Trained and authorized personnel only shall operate unit.

Read and understand all enclosed documents before installation, use, maintenance, or repair.

RADIATION SAFETY INSTRUCTIONS

1. Operate by observing all laws and regulations concerning radiation protection.
2. Remain at a safe distance from the X-ray beam at all times for operator protection.
3. Use all radiation safety features on the equipment.
4. Do not operate without X-ray sensor and X-ray beam-limiting devices (collimator), primary and secondary when equipped.
5. Do not open the X-ray tubehead. There are no serviceable parts inside.
6. Use all radiation protection devices, accessories, and procedures available to protect the patient, operator, and the service personnel from X-ray radiation.

⚠WARNING

Dangerous Voltage Inside

Contact may cause electric shock or burn.

Under the covers, there are exposed parts carrying currents with the line voltage, with 48 V, and with 24 V or lower voltages.

Do not allow water or any other liquid to leak inside the equipment to protect against short-circuit and corrosion. This is an ordinary medical device without protection against ingress of liquids.

Trained and authorized personnel only should install equipment and remove covers.

Connect to supply mains with protective earth (ground).

Disconnect equipment from the electrical supply mains before cleaning, disinfecting, maintenance, or servicing. Wait 30 s before touching any internal parts.

Read and understand all enclosed documents before installation, use, maintenance, or repair.

ELECTRICAL SAFETY INSTRUCTIONS

1. Do not change X-ray sensor when any part of the equipment or the operator touches the patient.
1. Do not execute any maintenance or repair services that require removing of protective covers when the patient is present.
2. Do not open the X-ray sensor or the X-ray tubehead. There are no serviceable parts inside.
3. Do not touch the internal metal parts when energized.
4. Do not short two test points together or short a test point to any other part.
5. Install and use in areas that comply with all applicable laws and recommendations concerning electrical safety in rooms used for medical purposes, e.g., U.S. National Electrical code, local regulations, or IEC standards concerning provisions of an additional protective earth (ground) terminal for power supply connection. Consult with a licensed professional if needed.

⚠CAUTION

Pinch Points Exists Inside

This equipment contains closing motion of mechanical parts that create pinch points when the covers are removed.

Disconnect equipment from the electrical supply mains before cleaning, disinfecting, maintenance, or servicing.

Read and understand all enclosed documents before installation, maintenance, or repair.

OPERATION SAFETY INSTRUCTIONS

1. Replace all enclosures before operating the equipment.
2. Keep all parts of the body away from the equipment when initiating motion.

⚠CAUTION

Laser Radiation

This equipment contains CLASS 2 LASER PRODUCT, 650 nm, 3 mW with a 40° fan line beam and non-removable optical system. Laser on time does not exceed 100 s per activation.

Read and understand all enclosed documents before installation, use, maintenance, or repair.

LASER RADIATION SAFETY INSTRUCTIONS

3. Do not stare into the beam.
4. Do not place eyes closer than 100 mm.

⚠CAUTION

Risk of Explosion

Do not use in in the presence of flammable or potentially explosive gases or vapors, which could ignite, causing personal injury and/or damage to the equipment.

EXPLOSION SAFETY INSTRUCTIONS

1. Allow vapor to disperse before using the equipment after cleaning or disinfecting with chemicals that create flammable or potentially explosive vapors.

⚠CAUTION

Electrostatic Sensitive Devices Inside

This equipment contains electrical circuit that has not been tested for immunity to electrostatic discharge and may be damaged when improperly handled.

ESD SAFETY INSTRUCTIONS

1. Do not touch or disconnect the electrical components and assemblies, i.e. boards, cables, connectors, etc., unless this manual contains instructions to do so.
2. Do not remove electrical components and assemblies from the metal carrier or enclosure unless instructed by this manual or by technical support.
3. Do not touch the conductive parts of the test leads when a measurement is taken.
4. Do not short two test points together or short a test point to any other part.
5. Keep the replacement components inside of the protective packaging until ready for installation.
6. Place a removed component board-side-up on an antistatic surface or in a static-shielding container.

OTHER SAFETY INSTRUCTIONS

⊕ Trained and authorized personnel only should service equipment or remove covers.
⊕ Use the tools and the equipment specified in this manual for the performed task.

7. When finished servicing equipment, perform functional check and maintenance procedures listed in this document and in the *User Guide*.
8. Use this document as a guidance. Contact technical support when help is needed

Symbols and Conventions

Symbol	Explanation
	General warning sign Advice for the presence of a hazardous situation. The operator must consults with the written instructions in the *User Guide*, *Installation Manual*, and *Service Manual* if the hazardous situation is not explained next to the sign.
	Caution X-ray Advice for the presence of X-ray related hazardous situation. Attention : Rayons-X Conseils pour la présence de rayons X liées situation dangereuse.
	Warning, Ionizing Radiation (X-ray) Advice for the presence of X-ray related hazardous situation.
	Warning, Electricity Advice for the presence of dangerous electricity.
	Warning, Crushing of hands Advice for the presence of a dangerous closing motion of mechanical parts.
	Caution, Laser beam Advice for the presence of a dangerous laser beam. This device contains laser sources that are: Class 2 Laser Product 650 nm, 3 mW
	Warning, Explosive material Advice for the ability of this equipment to cause explosion when this equipment is used near or when handling explosive materials.
	Caution, Electrostatic sensitive devices Advice that the package or this equipment contains electrostatic-sensitive devices.
	General prohibition sign Advice for presence of a hazardous situation that will be prevented by not doing an action specified by the supplementary sign.
	Do not spray with water Advice for presence of a hazardous situation that will be prevented by not spraying with water on this equipment.

Symbol	Explanation
	Refer to instruction manual/booklet Advice that the operator must read and understand all enclosed documents such as the *User Guide*, *Installation Manual*, and *Service Manual*.
	Connect an earth terminal to the ground Advice that this equipment must be connected to a protective earth (ground) conductor of power supply mains.
	Disconnect before carrying out maintenance or repair Advice that the equipment, which is not connected to mains by a plug, has to be disconnected from all sources of power before carrying out maintenance or repair.
	Disconnect mains plug from electrical outlet Advice that the mains plug of the equipment must be disconnected from electrical outlet for the purposes of maintenance of electrical equipment, in the case of malfunction or when left unattended.
	Type B applied part (IEC 60601-1) This device provides protection against electric shock as required for Type B applied parts per IEC 60601-1.
L	Connection point for the line conductor Shows the connection point for the ungrounded conductor of the power supply mains (a.k.a. line or hot wire).
N	Connection point for the neutral conductor Shows the connection point for the grounded conductor of the power supply mains (a.k.a. neutral wire).
	Protective Earth (Ground) Terminal Shows the connection point for the protective earth (ground) conductor.
	Indicate connection to the power mains: • Power OFF (circle) • Power ON (line)
	X-ray source assembly, emitting Indicates the emission of X-radiation.
	Separate collection for electrical and electronic equipment according Directive 2002/96/EC (WEEE) Advice that this Progeny Vantage® is subject to Directive 2002/96/EC (WEEE) and therefore must be disposed as electrical or electronic equipment in E.U.

Specifications

Parameter	Specification
X-ray source	Constant potential (DC), with microprocessor controlled time, voltage, and current.
X-ray Tube	Canon (Toshiba) D-054SB, rated max 1750 W
Focal spot size	0.5 mm^2 (IEC 60336:2005)
Total Filtration	min 3.2 mm Al
Anode Voltage *(internal control)*	50 kV to 84 kV Regulated to ± 10% of the indicated value.
Anode Current	4 mA to 14 mA Regulated to ± 20% of the indicated value and limited by the total anode power of 1140 W.
Exposure Time	Panoramic: 2.5 s to 16 s Cephalometric: 9 s to 15.6 s Precision: 50 ms plus ± 5% of the indicated value.
Cooldown Time	Automatically controlled based on the X-ray tube heat load.
SID	Panoramic: 500 mm (approx. 20 in.) Cephalometric: left, 1645 mm (approx. 64.75 in.) right, 1670 mm (approx. 65.75 in.)
Magnification	Panoramic: 1.2 ± 0.05 in horizontal and vertical direction Cephalometric: 1.1 ± 0.05 in horizontal and vertical direction
Image pixel size	96 µm × 96 µm (after 2 × 2 binning)
CCD active area	Panoramic: 6 mm × 147 mm (approx. 0.24 in. × 5.8 in.) Cephalometric: 6 mm × 221 mm (approx. 0.24 in. × 8.7 in.)
Image field	Panoramic: 14 cm × 30 cm (approx. 5.8 in. × 12 in.) Cephalometric: 21 cm × 30 cm (approx. 8.2 in. × 12 in.)
Pixels per exposure	Panoramic: 1509 lines x 3180 columns, 16-bits per pixel Cephalometric: 2288 lines x 3180 columns, 16-bits per pixel

Parameter	Specification
Image Transfer Time	Panoramic: max 30 s Cephalometric: max 45 s
Image data size	Panoramic: average 11.8 MB Cephalometric: average 17.4 MB
Attenuation Equivalent of Image Receptor	max 0.4 mm Al
Electrical Safety Classification	Class I, Type B
Rated Line Voltage	~ 110 V – 240 V, 50 Hz or 60 Hz max 20 A (long term 1 A) measured at 110 V
Duty Cycle	Approx. 1:30
Heat Dissipation into Surrounding Air	max 320 J (approx. 0.3 BTU)
Operating Temperature	+10 °C to +35 °C (+50 °F to +95 °F)
Storage Temperature	-35 °C to +66 °C (-31 °F to +150 °F)
Maximum Altitude	3000 m (approx. 9842 ft.)

Obtaining Technical Support

For technical support, contact:

MIDMARK CORPORATION
1001 Asbury Drive
Buffalo Grove, Illinois 60089 U.S.A.
Phone: 800-MIDMARK (1-800-643-6275)
+1 847-415-9800, ext. 108126
Fax: 847-415-9801
imagingtechsupport@midmark.com
Hours: 8:00 a.m. – 5:00 p.m. Central Time

2 Theory of Operations

In this Chapter

System Overview

Panoramic radiography is a branch of tomography, particularly a branch of rotational tomography. Images of internal structures of the jaw are created by moving the source and receptor in such a way as to cause the foreground and background structures to blur, leaving a defined focal trough.

Cephalometric radiography is craniofacial radiography of the bony parts and soft tissue of the head. It uses parallel X-ray technique to preserve the distance and angle relationship between the anatomic landmarks.

System Description

The Progeny Vantage® panoramic X-ray system is a computer-controlled multi-axis dental panoramic and cephalometric radiographic device incorporating:

- X-ray source
- Digital X-ray receptor
- Distributed processing
- WVGA LCD touch screen based operator panel

The Progeny Vantage® panoramic X-ray device is adjustable to the patient's height with the motorized, 3-speed, telescoping column. Multiple lasers are used to locate the patient and configure the device to the patient's morphology.

The outer portion of the column, the fixed column, is mounted to the wall and/or floor. It supports the inner, moving, or telescoping portion of the column. This inner, telescoping column supports both the patient positioning table and the overhead arm. The overhead arm supports the C-arm, which in turn supports the X-ray source, or tubehead, and the panoramic X-ray receptor, or panoramic sensor. The cephalometric attachment is an accessory that is installed to the highest point of the column. It contains a cephalometric support arm and a cephalometric scanning mechanism. The scanning mechanism supports the cephalometric sensor and the cephalometric scanning mechanism.

Powering the panoramic X-ray system

The Progeny Vantage® system employs a universal power supply with automatic input voltage selection and is suitable for most dental offices worldwide. The Progeny Vantage® device should be connected to power supply mains with voltage in the range of 110 V to 240 V and frequency 50 Hz or 60 Hz. The device should be connected also to protective earth (ground) through dedicated wire incorporated in the power cable or provided separately.

Network Communications

The Progeny Vantage® device employs a fixed, dedicated network between the components inside of the machine. The Progeny Vantage® also uses connection to an external Ethernet based Local

Area Network (LAN) that allows images to be transferred from the device to any client computer connected to that network and running the client software. At least one client computer should be designated to receive the acquired radiographic image at any given time.

Distributed Processing

The Progeny Vantage® is a multi-processor system. Each system monitors itself and reports errors to the Operator Panel.

The separate processing systems are:

- Real Time Controller (RTC, or system controller) together with the combined X-ray power and logic boards, and all motor controllers
- Image sensors
- Operator panel

Inter-module communications utilize Ethernet based network, with power over Ethernet (PoE) switch being located below the patient positioning table.

Movement profiles and the X-ray technique factors are stored in the Real Time Controller and initiated by communications from the Operator Panel and by the exposure switch. The RTC controls the motion produced by the individual motors via commands send thru a dedicated serial link. The RTC also controls the X-ray generation by commands send to the power and logic boards via a second serial interface.

Software Architecture

The three separate processing systems run a software to control all aspects of device operation. The operator panel keeps track of overall system operation, communicating with all subsidiary processors. The remaining processing systems (RTC and X-ray sensors) all report status to the operator panel, where the appropriate operations are initiated. Movement and X-ray control are handled by the RTC, under the parameters communicated to it by the operator panel. The sensor performs all initial collection and processing of the image before delivering it to the operator panel, wherein secondary image processing is applied. All system user settings are maintained on the operator panel. Mechanical and X-ray calibration information are maintained on the RTC and X-ray controller respectively. The sensor calibration information is maintained on the operator panel and on the sensor, depending on the level of the calibration information (high vs. low). The processing systems move together through the various states used to produce the device functions.

About the Components

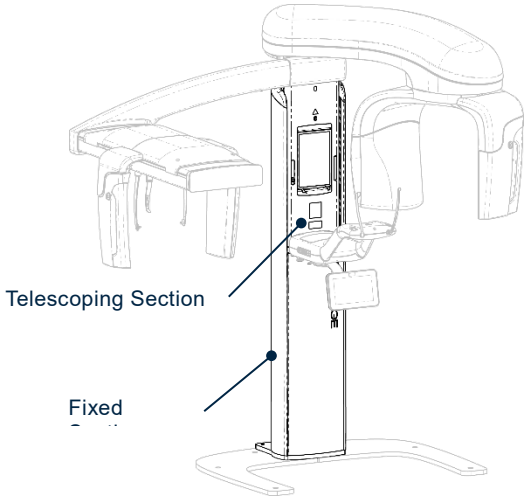
The Progeny Vantage® panoramic X-ray system includes the following components.

Vertical Column

The vertical column has two main parts: the fixed section and the moving, or telescoping, section. The fixed section contains the actuator to control up and down movement of the panoramic X-ray device. The telescoping section contains the positioning lasers. Optical sensors in the telescoping section define the maximum and minimum extension of the column.

The column is comprised of two extrusions, connected by bearings and a linear actuator. The bearings are adjustable to align the extrusions to each other, and to minimize slop. The linear actuator is a gear driven screw with integral brake. The column, actuated by a push button operator panel located on the side of the patient positioning table, moves at three progressively faster speeds, with a smooth transition between speeds.

Vertical column



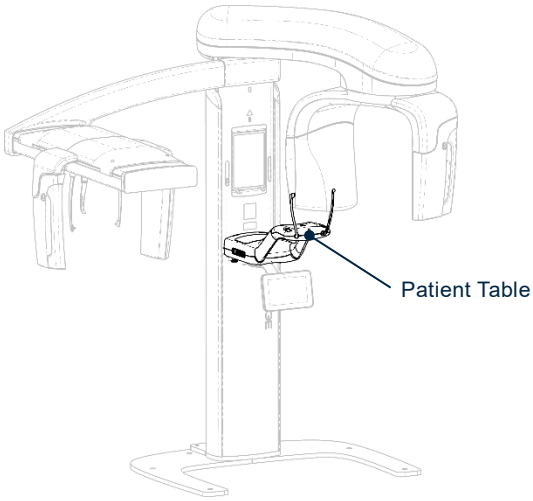
Patient Positioning Table

The patient positioning table guides and supports the patient during acquisition of panoramic X-ray images by means of the chin rest, bite guide, and positioning wands.

Correct and repeatable patient positioning is essential to producing a clinical-quality image. Patient positioning is accomplished by the telescoping column, the temple wands, and the reference lasers. All of these subsystems are actuated by a push-button panel located on the left and the right sides of the patient positioning table.

The temple wands are located on either side of the chinrest/bite piece assembly. The wands use a spring to close against the patient's head, and a motor to open. The maximum opening is controlled by an optical sensor mounted inside the positioning platform. At any point, the wands can be manually opened further against the spring.

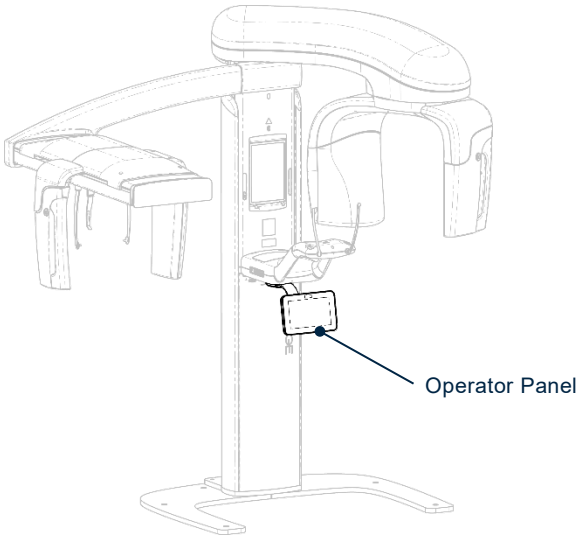
Patient positioning table



Operator Panel

The operator panel, mounted under the patient positioning table, acts as the user interface for the device. It is connected to and powered from the column computer. The operator panel and the column computer, together, provide top-level control on the Progeny Vantage® device based on user commands given via touch screen interface in the operator panel.

Operator panel



Column Computer

The column computer, mounted on the lower half of the telescoping section of the column, acts as interface controller to the machine and provides the basic image processing. It has two network interfaces, one connected to the in-machine network, and the other connected to the office LAN. The column computer is powered through the 48 V power supply embedded in the column carrier board located below the patient positioning table.

The column computer is a PC with x86 compatible processor and Windows operating system. Progeny Vantage® software comes installed on the column computer, as do the sensor calibration files. The software on the column computer provides top-level control on the Progeny Vantage® device based on the touch screen commands given by the operator panel. The software also transfers the image to the Client computer for further processing and storage.

Lasers

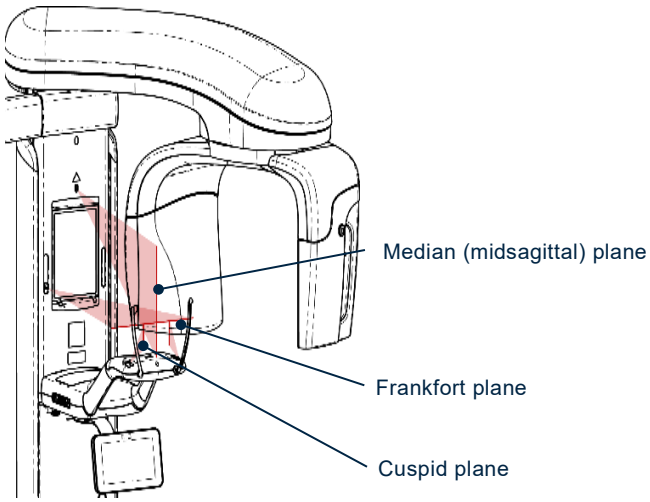
There are four reference lasers for locating the patient's head relative to the device: the Median (midsagittal) plane, the Frankfort plane, and two Cuspid plane lasers.

The Median (midsagittal) plane provides the vertical center plane reference. It is a fixed laser and is located on the telescoping section of the column behind the upper cover.

The Frankfort plane provides a horizontal planar reference, and is adjustable vertically to correspond to the patient's physiognomy. It is mounted to the inside of the upper column cover, and is mountable to either the left or the right side of the column upper cover.

The Cuspid lasers are mounted within the patient positioning table and are directed by mirrors up to the patient's mouth. The Cuspid lasers are carried on a transit that moves fore and aft. The transit movement is reported to the real-time controller (RTC) by a slide potentiometer. To define the *zero position* for the Cuspid lasers, a hole in the transit is aligned with a similar hole in the patient table using a precision pin.

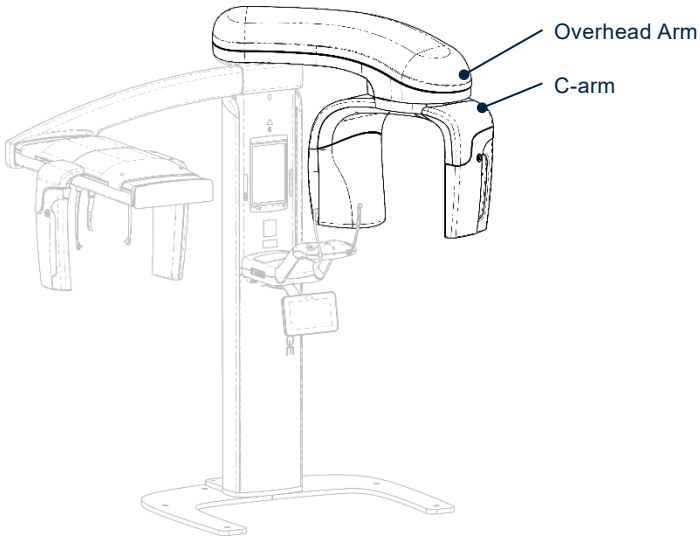
Lasers



Overhead Assembly

The overhead assembly consists of an overhead (swing) arm and C-arm. The overhead arm supports the C-arm, which rotates. The C-arm includes the tubehead and the removable sensor. The tubehead produces the X-ray beam, and the sensor is a digital image receptor.

Overhead assembly



Overhead Arm – Y-axis

For the lateral Y-axis motion, the overhead arm pivots about bearings located in the mounting casting fastened at the top of the column. Its motion is produced by a ball screw drive with one end connected to the mounting casting and other end to the overhead arm itself. The stepper motor is near the column. Both mechanical connections of the drive assembly are through ball bearing assemblies.

An optical sensor on the mounting casting engages a flag on the overhead arm to define a home reference for the system. Motion is monitored by a potentiometer connected to the ball bearings at the column end of the drive assembly. To define the *zero position* for the system, a hole in the swing arm is aligned with a similar hole in the mounting casting using a precision pin.

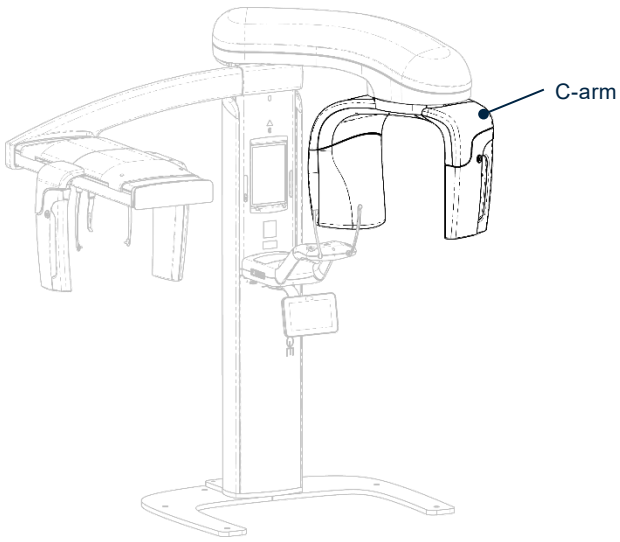
Overhead Arm – X-axis

For the in-and-out X-axis motion, the translation drive of the overhead arm (X-axis) is comprised of a plate mounted on linear bearings attached to the overhead arm casting. The plate is moved by a backlashless screw drive with a stepper motor on the fixed end. Position feedback is via a linear potentiometer with an optical sensor and flag for home reference. A hole in the plate aligns with a hole in the overhead arm casting using a precision pin to define a system zero position.

C-arm

The C-arm is suspended on a pair of bearings mounted to the underside of the X-axis translation plate. The C-arm casting incorporates an internal tooth ring gear that meshes with a pinion gear on a stepper motor mounted on the X-axis translation plate. The motor is spring loaded to maintain positive mesh and minimize slop.

C-arm



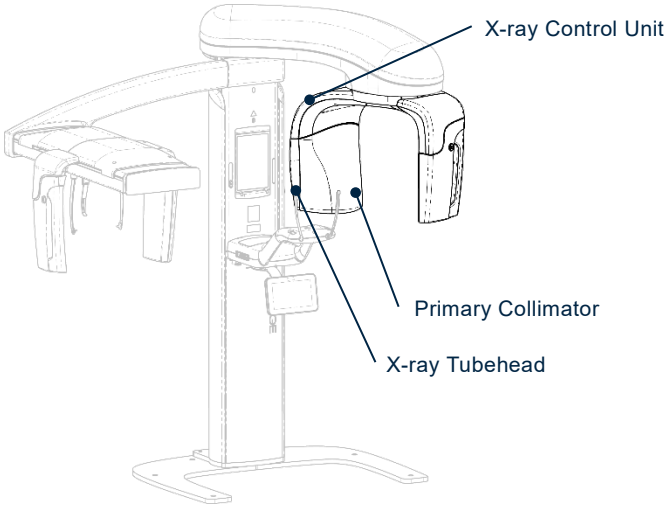
X-ray Source

The X-ray tubehead contains a high-frequency X-ray source that uses a stationary anode X-ray tube (See Appendix in Progeny Vantage® *User Guide* for X-ray tube information). The X-ray control unit that is comprised of a power board and a logic board controls and monitors the operation of the X-ray tubehead. The operation of this circuit is governed by the RTC and is locally controlled by microprocessor on the logic board. Power for the X-ray source is derived directly from the power supply mains.

There are no serviceable parts inside of the X-ray tubehead and it must not be opened in the field. Opening the X-ray tubehead will compromise the high-voltage and X-ray protections embedded inside of the device and may endanger patient and operator.

The primary collimator is mounted on the output port of the X-ray tubehead. The collimator is a 2-axis motorized automatic beam-limiting device, whose operation is governed by the RTC and locally controlled by a motor controller. The two axes are controlled by a single motor controller in sequential manner. A relay mounted the collimator (motor controller) carrier board directs the motor drive current as appropriate for the controlled collimator axis.

X-ray source



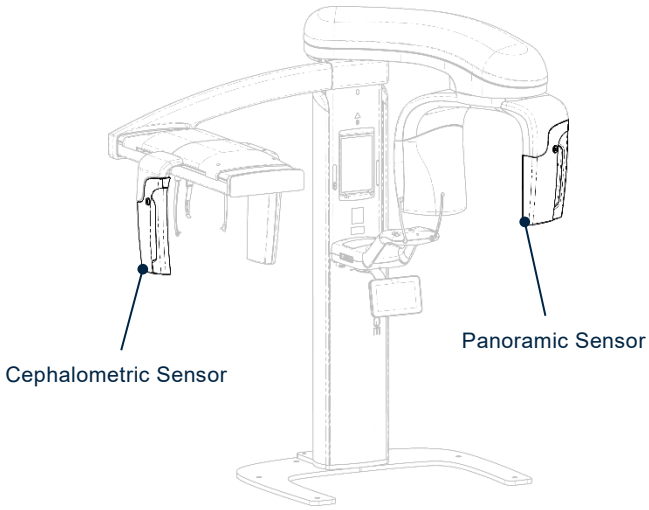
X-ray Sensors

The image sensor detects X-rays and manipulates the detection to produce an image. It contains a very large X-ray camera that converts the X-ray to electrical signals, precise circuitry that processes these signals, frame memory that stores the image between the imaging sessions, and microprocessor that controls the sensor operation and communicates with the column computer via an Ethernet connection. The device is powered through the Ethernet connection from the PoE switch located below the patient table.

The X-ray sensor circuitry is sensitive to impact and the device must be handled with care. There are no serviceable parts inside of the X-ray sensor and it must not be opened in the field. Opening the sensor will compromise the X-ray performance of the device and may endanger the patient.

The Progeny Vantage® supports two types of X-ray sensors – panoramic sensor and cephalometric sensor. The difference between the two types is the size of the X-ray active area. The cephalometric sensor has 50% larger active area than panoramic sensor and therefore the cephalometric sensor may be used as a panoramic sensor, but the panoramic sensor cannot be used as a cephalometric sensor.

X-ray sensors



The X-ray sensor implementation automatically converts the cephalometric sensor to panoramic sensor based on the position ID reported from the floating connector board embedded in the sensor mount on the C-arm or on the cephalometric transit. In addition, the sensor mount on the cephalometric transit and the cephalometric sensor contain a mechanical key that do not allow a panoramic sensor to be attached to the cephalometric accessory. This mechanical key consists of a pin attached to the sensor mount on the cephalometric transit and a hole embedded in the cephalometric sensor.

Cephalometric Attachment

The Cephalometric Extension consists of the support arm, the cephalometric scanning mechanism, and the cephalometric sensor.

Support Arm

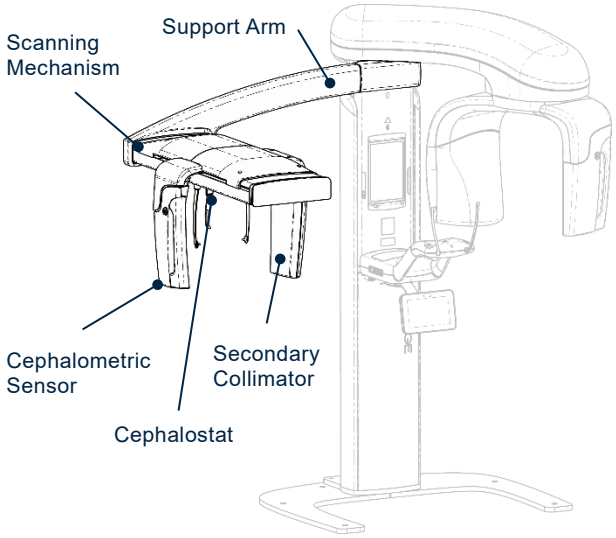
The support arm is an aluminum casting that mounts to the panoramic column's inner (mobile) component. It mounts via a support casting that allows vertical adjustment of the position of the cephalometric mechanism. The arm can be mounted either to the right, or to the left of the column.

Cephalometric Scanning Mechanism

The cephalometric scanning mechanism is comprised of the rail and the transit assembly. The rail supports the transit mechanism, and houses the motor and bearings that cause the transit mechanism to move. The transit assembly mounts the cephalometric sensor and the secondary collimator, maintaining the alignment of the sensor and secondary collimator to the X-ray tubehead.

The rail also supports the cephalostat, used to position the patient. The cephalostat is comprised of two earposts that adjust to conform to the width of the patient's head, and a nasion locator, which adjusts vertically and laterally to align the patient's head. The entire cephalostat rotates in 45° increments to support many cephalometric imaging positions.

Cephalometric attachment



Client Computer

The client computer is a computer connected to the same local network where the Progeny Vantage® device is connected. The client computer executes the Client software designed by Midmark and exclusively communicates with the operator panel in the process of radiographic image acquisition in order to obtain, process, and store the acquired image.

The client computer could be installed either in close proximity to the Progeny Vantage® machine or could be located in a dental operatory or other suitable and accessible location. It could be also permanently or temporary assigned. In case of temporary assigned client computer, multiple computers could act as client computer, one at a given time.

Operational Systems

The various processing systems in the Progeny Vantage® panoramic X-ray system are stand-alone modules, each with their own diagnostic procedures.

User Interface

The user interface is provided by a tablet-style operator panel that is connected to the column computer running the Progeny Vantage® interface software. The operator panel provides direct and indirect views of the Progeny Vantage® system. Users use gesture controls, such as swiping and sliding, on the operator panel to interact with the Progeny Vantage® system.

X-ray Generation

For the generation of X-rays, parameters are passed from the operator panel to the RTC defining the desired technique factors and exposure time. Upon actuation of the exposure switch, the RTC passes the necessary information to the X-ray controller to produce the desired exposure. The exposure switch is also connected to the X-ray controller. Upon receipt of the exposure parameters from the RTC, and the signal from the exposure switch, the X-ray controller then initiates, controls, and terminates the exposure.

The exposure switch is routed through the emergency stop switch, before it reaches any control functionality in RTC or the X-ray controller. That will cause the X-ray generation to be interrupted in case of activation of the emergency stop switch by the operator.

Motion Control

The Progeny Vantage® utilizes eight motors:

- Telescoping column drive motor
- Patient positioning wand motor
- Primary collimator x-axis motor
- Primary collimator y-axis motor
- Swing arm motor (overhead assembly)
- Transition drive motor (overhead assembly)
- C-arm drive motor (overhead assembly)
- Cephalometric transit motor

The column drive is an integral DC linear actuator embedded in the telescoping column. Limit of motion is governed by flags, mounted on the fixed portion of the column, which are sensed by two optical sensors mounted on the telescoping portion of the column. The column drive uses a motor controller board similar to the others, but it is designed to operate a brushless DC motor instead of a stepper motor.

The positioning wands use a stepper motor to open the wands. Closure of the wands is produced using a spring. In any position defined by the motor, the wands are free to open against the spring. The open position of the wands is defined by an optical sensor.

The collimator is a 2-axis motorized beam-limiting device. The two axes are controlled by a single controller in sequential manner. A relay mounted the collimator (motor controller) carrier board directs the motor drive current as appropriate for the controlled collimator axis.

The tomographic effect needed for panoramic image is produced by a 3-axis, computer-controlled assembly resident completely in the swing arm of the overhead assembly. The three axes are:

- Y-axis – the swing arm of the overhead assembly, which produces the side-to-side motion
- X-axis – the translation drive of the overhead assembly, which produces the in and out motion
- R-axis – the C-arm drive which produces the rotational motion

The cephalometric image in the Progeny Vantage® is produced by 5-axis, computer-controlled motion – the 3-axis of the swing arm, one additional axis in the cephalometric scanning mechanism, and the x-axis motion of the collimator.

All motion components except the primary collimator are controlled by separate motor controller boards and the two axis of the primary collimator are controlled by a single motor controller board. The boards are linked to the main system controller (RTC) via dedicated serial communication channel, which addresses each of the motor controllers by their unique address.

All motors are powered by a dedicated motor power supply line (24 V), called motor power, that is enabled or disabled by RTC also. Each motor controller is set to a power level that corresponds to the needs of the motor driven.

The motor power is routed through the emergency stop switch. That allows the motion to be stopped immediately at any time when the emergency stop switch is activated by the operator.

System Diagnostics

The Progeny Vantage® incorporates an extensive diagnostic system to aid in recording and troubleshooting system errors.

Errors generated by any subsystem are reported to the column computer, which records them in a log. The errors are reported to the user via a pop-up window. Within the pop-up window is a link to the system Message Center where the detailed message can be reviewed. The Message Center can sort system error messages by date, subsystem, and content. Error messages contain a high-level error number, which identifies the subsystem, and a low-level error number to identify the exact error.

Image Acquisition and Transfer

To produce an image, the motion profile and X-ray technique factors are selected on the operator panel, and the column computer communicates them to the RTC. When the column computer receives a command to move to the Ready for imaging (RFI) position, it passes the profile and technique factors to the RTC, and commands the RTC to move to RFI. After moving to RFI, the RTC arms itself and arms the X-ray controller. Meanwhile, the column computer has also commanded the sensor to prepare to receive X-rays.

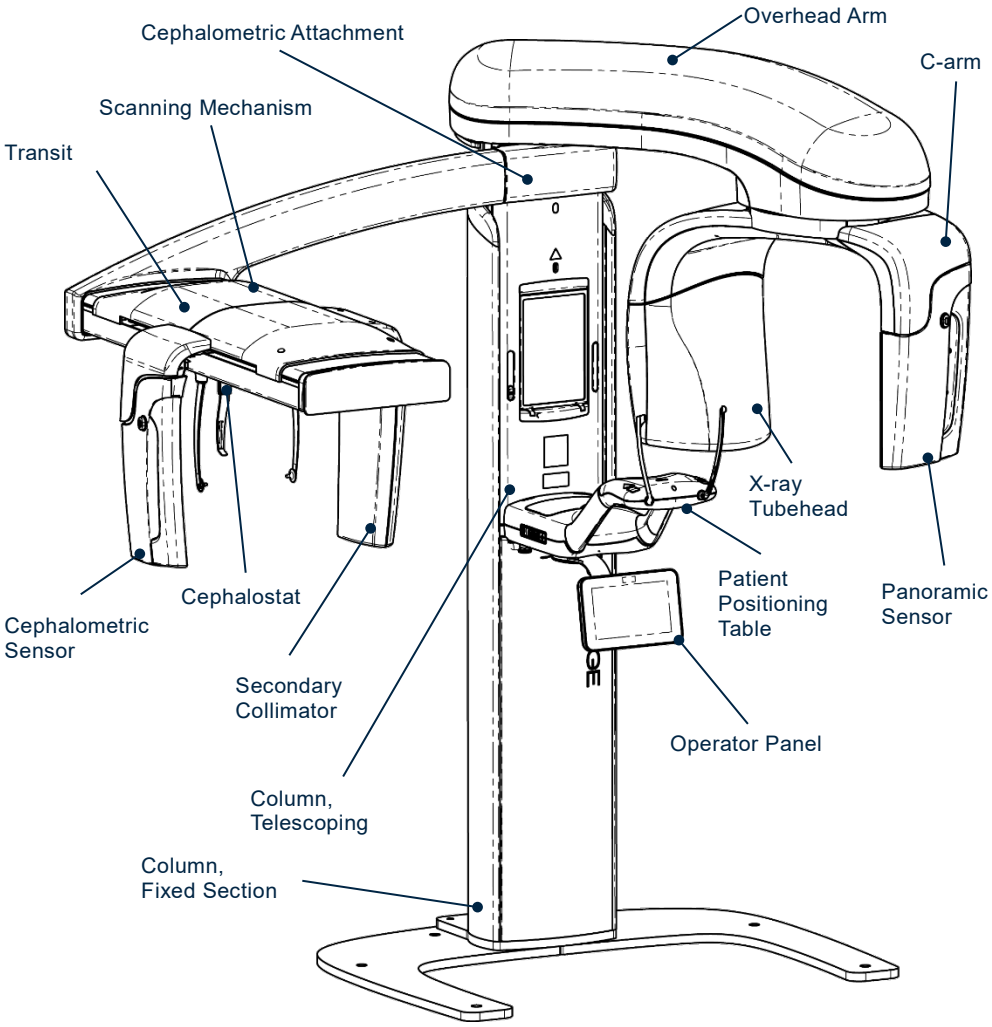
Upon closure of the exposure switch, the RTC begins providing motion parameters to the various motor controllers and X-ray parameters to the X-ray controller. This continues for as long as the exposure switch remains closed, or until the parameters of the profile are exhausted.

When the sensor detects X-rays, it begins recording the image. The sensor continues recording for a time sufficient for the longest exposure. The sensor transfers a preview image (low resolution) and final image (high resolution) to the operator panel. The preview image is used to generate progress indication for the image acquisition. When the operator panel receives the complete final image, it then processes it with the relevant calibration data and sends the final image to the client computer for further processing with the user-selected filters. The client computer then stores the image and passes the image to the imaging application.

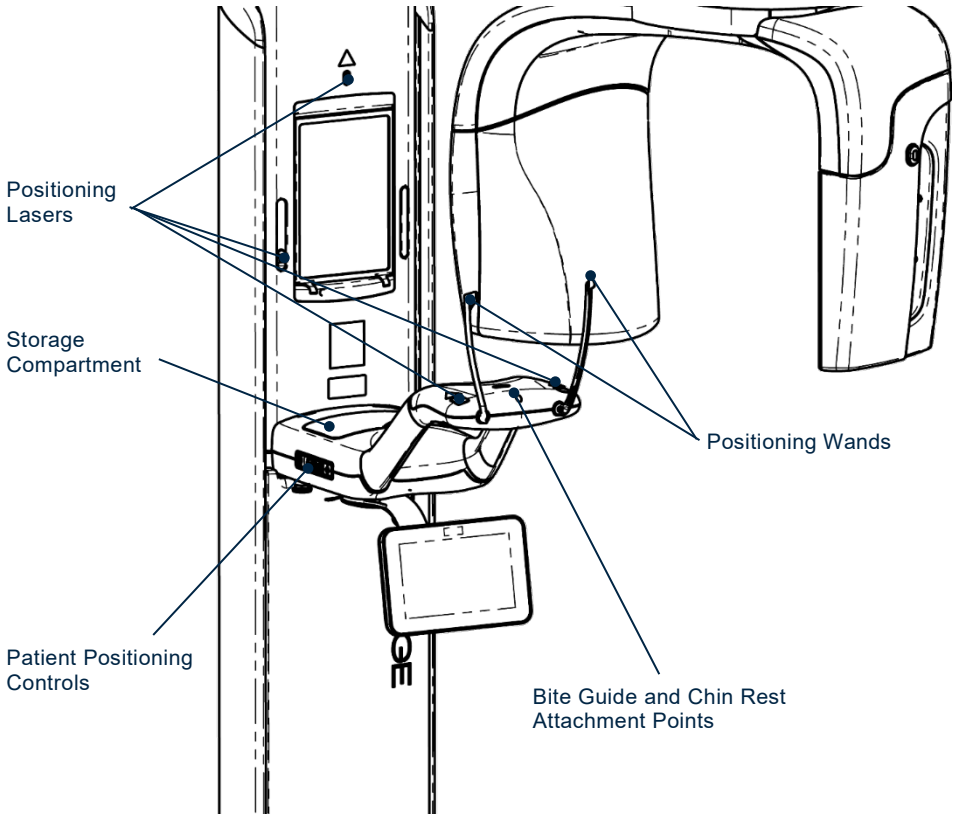
If, at any time during the creation of the image, the exposure switch is released (opened), the RTC immediately ceases transmitting parameters and instead transmits a stop command to the motor controllers and deactivates the X-ray controller. It also advises the column computer of the

occurrence. The X-ray controller detects the release of the exposure switch simultaneously and independently from the RTC, and terminates the X-ray power immediately even if the stop command from RTC is not received.

Progeny Vantage® panoramic X-ray system



Progeny Vantage® patient positioning table



3 Troubleshooting Resources

In this Chapter

Obtaining Assistance through Remote Access

Remote access enables technical support to have access to a Progeny Vantage® panoramic X-ray system while the service technician is present at the machine.

1. Permission from the user is required for access to the Progeny Vantage®.
2. In order to gain access, a connection from the Progeny Vantage® to the Internet is necessary.
3. The service engineer must be present at the location.
4. With the active participation of technical support, the “on-site” person will use the operator panel to gain access to the Internet and log on to a remote access website. Remote access may require the downloading and activation of a short application program from the website.
5. Once communications are established, technical support will be able to review the content of the Progeny Vantage® Message Center, see images, and make limited changes in the settings of the device. Technical support will not be able to facilitate all manner of repairs remotely. Technical support will be able to review historical events and make recommendations as to the next course of action. The “on-site” participant must be able to perform the repairs or adjustments in order to complete the task.

Service Kit

Midmark offers a service kit for the alignment and image evaluation of the Progeny Vantage® panoramic X-ray system that is available through the technical support. The service kit contains the following fixtures and tools:

- Positioning Laser Alignment Fixture
- X-ray Source Alignment Fixture
- C-arm Calibration Setup Fixture
- Copper Filter
- Zero Position Pins
- Laser Module Assembly

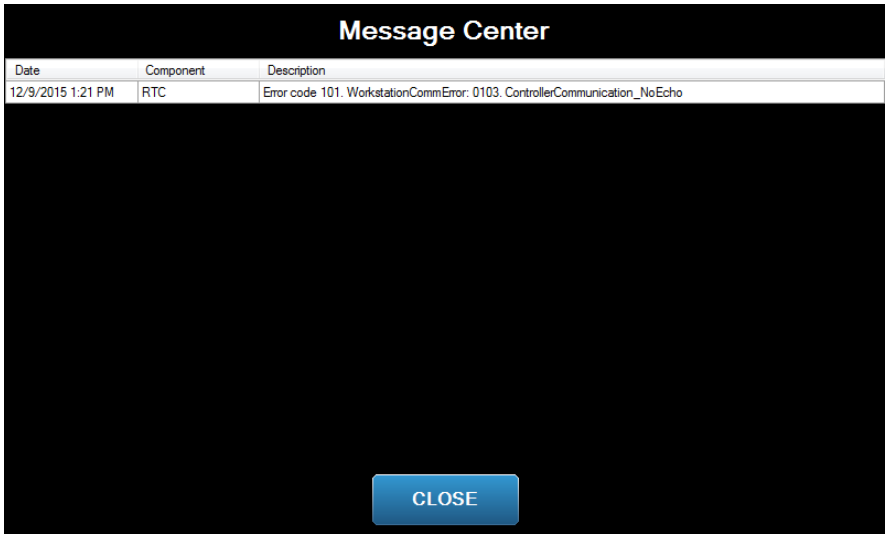
- Projection Head Kit
- Molteni Phantom

Message Center

The Message Center screen is an interactive screen on the operator panel that displays up to 100 error messages for the components of the Progeny Vantage® Panoramic system. The messages are sorted by time, with the most recent at the top of the list.

Tapping a column heading, such as Component, sorts the messages by that heading. Tapping a Progeny Vantage® component, for example the telescoping column, highlights all messages for the component.

Message Center Screen



Messages also appear as pop-ups on the operator panel, as illustrated below.

Pop-up Message

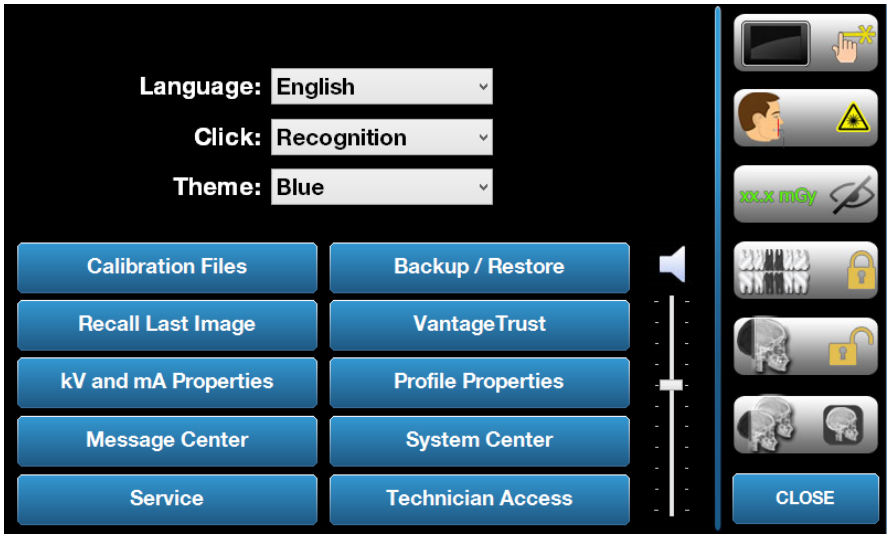
Accessing the Message Center

The Message Center is accessed from the Options screen, from the SAFE or OFFLINE screens, and from a pop-up message screen.

To Access the Message Center from the Options Screen

1. On the Acquisition Setup screen, tap Options to display the Options screen.

Options Screen



2. Tap the Message Center button.

To Access the Message Center from the SAFE or OFFLINE Screens

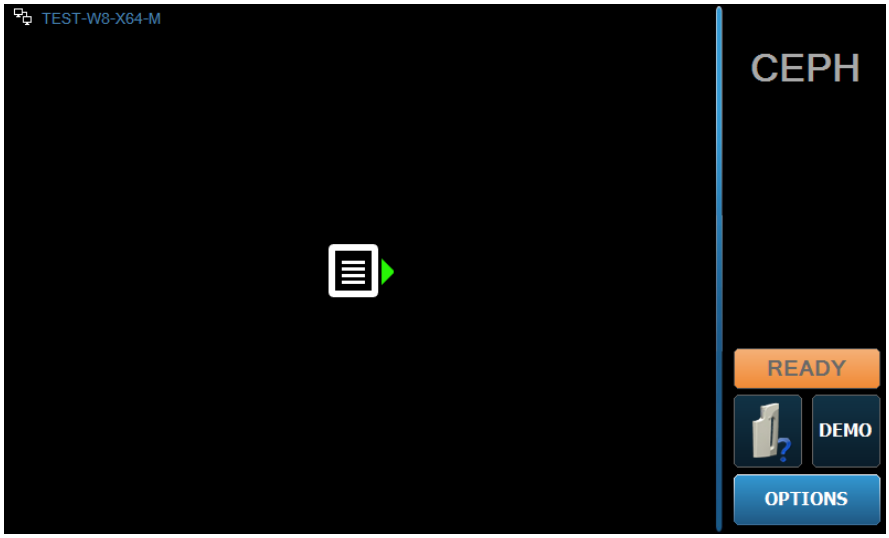
The SAFE and OFFLINE screens are not directly accessible. The SAFE screen is transitional and appears when the Progeny Vantage® system is trying to recover. The OFFLINE screen appears when the operator panel is disconnected from the computer workstation.

On the SAFE screen, tap the Message Center icon to display the Message Center screen.

SAFE Screen

On the OFFLINE screen, tap the Message Center icon to display the Message Center screen.

OFFLINE Screen



To Access the Message Center from a Message Screen

On the message screen, tap the Message Center icon.

Message Screen

Error Codes

This section lists all the Progeny Vantage® error codes, including system and subsystem errors for the RTC. These codes help in troubleshooting when trying to pinpoint the source of a problem.

Error codes will either state a condition or offer a direction to investigate. In the case of directly stated conditions, follow the instruction. In the case of coded messages that indicate a direction to investigate, review the content of the Message Center for guidance.

Error messages may refer to a node number based on the assigned motor controller address for communication with RTC as listed below:

- C-arm arm motor is referenced as *Node 0*.
- X-axis motor is referenced as *Node 1*.
- Y-axis motor is referenced as *Node 2*.
- Collimator motors are referenced as *Node 3*.
- Wand motor is referenced as *Node 4*.
- Cephalometric motor is referenced as *Node 5*.

Error Codes and Messages

Error Code	Pop-up Message	Message Center Error Description
100	Connection to the device is not detected. (100)	Connection to RTC is not possible. Reported Error Code is ControllerCommunication_SocketUnrecoverable. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_NoAdapter. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_NoEcho. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_SocketNotConnected. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_SocketNotSending. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_SocketNotReceiving. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_BadResponse. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_BadProtocolVersion. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is ControllerCommunication_BadFirmwareVersion. Trying to recover...
		Connection to RTC is not possible. Reported Error Code is Unknown. Trying to recover...
101	Device Controller has encountered an error. (101)	Reported Error Code is {0}. Trying to recover...
		Reported Error Code is WorkstationCommunication_Error. Trying to recover...
		Reported Error Code is WorkstationCommunication_BadMessageLimit. Trying to recover...
		Reported Error Code is WorkstationCommunication_LinkTimeout. Trying to recover...
		Reported Error Code is MotorControllerCommunication_Error. Trying to recover...
		Reported Error Code is MotorControllerCommunication_PollTimingCollision. Trying to recover...
		Reported Error Code is MotorControllerCommunication_PeriodicTimerCollision. Trying to recover...

Error Pop-up Message Code	Message Center Error Description
	Reported Error Code is MotorControllerCommunication_NoAckNode0. Trying to recover...
	Reported Error Code is MotorControllerCommunication_NoAckNode1. Trying to recover...
	Reported Error Code is MotorControllerCommunication_NoAckNode2. Trying to recover...
	Reported Error Code is MotorControllerCommunication_NoAckNode3. Trying to recover...
	Reported Error Code is MotorControllerCommunication_NoAckNode4. Trying to recover...
	Reported Error Code is MotorControllerCommunication_NoAckNode5. Trying to recover...
	Reported Error Code is MotorControllerCommunication_NoAckNode6. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode0. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode1. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode2. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode3. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode4. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode5. Trying to recover...
	Reported Error Code is MotorControllerCommunication_BadAckNode6. Trying to recover...
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode0. Trying to recover...

Error Pop-up Message Code	Message Center Error Description
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode1. Trying to recover...
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode2. Trying to recover...
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode3. Trying to recover...
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode4. Trying to recover...
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode5. Trying to recover...
	Reported Error Code is MotorControllerCommunication_FlagTimeoutNode6. Trying to recover...
	Reported Error Code is XRayControllerCommunication_Error. Trying to recover...
	Reported Error Code is XRayControllerCommunication_LowKV. Trying to recover...
	Reported Error Code is XRayControllerCommunication_HighKV. Trying to recover...
	Reported Error Code is XRayControllerCommunication_LowMA. Trying to recover...
	Reported Error Code is XRayControllerCommunication_HighMA. Trying to recover...
	Reported Error Code is XRayControllerCommunication_ExcessiveArcing. Trying to recover...
	Reported Error Code is XRayControllerCommunication_Timeout. Trying to recover...
	Reported Error Code is XRayControllerCommunication_UnexpectedPretermination. Trying to recover...
	Reported Error Code is BadMotorControllerVersion_Node0. Trying to recover...
	Reported Error Code is BadMotorControllerVersion_Node1. Trying to recover...
	Reported Error Code is BadMotorControllerVersion_Node2. Trying to recover...
	Reported Error Code is BadMotorControllerVersion_Node3. Trying to recover...
	Reported Error Code is BadMotorControllerVersion_Node4. Trying to recover...

Error Pop-up Message Code	Message Center Error Description
	Reported Error Code is BadMotorControllerVersion_Node5. Trying to recover...
	Reported Error Code is BadMotorControllerVersion_Node6. Trying to recover...
	Reported Error Code is BadXRayControllerVersion_0 through _1F. Trying to recover...
	Reported Error Code is BadXRayControllerVersion_1F. Trying to recover...
	Reported Error Code is ExposureKey_StuckLow. Trying to recover...
	Reported Error Code is ControlButton_Error. Trying to recover...
	Reported Error Code is ControlButton_Lasers. Trying to recover...
	Reported Error Code is ControlButton_Wands. Trying to recover...
	Reported Error Code is ControlButton_Wands_Lasers. Trying to recover...
	Reported Error Code is ControlButton_ColumnDown. Trying to recover...
	Reported Error Code is ControlButton_ColumnDown_Lasers. Trying to recover...
	Reported Error Code is ControlButton_ColumnDown_Wands. Trying to recover...
	Reported Error Code is ControlButton_ColumnDown_Wands_Lasers. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp_Lasers. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp_Wands. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp_Wands_Lasers. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp_ColumnDown. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp_ColumnDown_Lasers. Trying to recover...
	Reported Error Code is ControlButton_ColumnUp_ColumnDown_Wands. Trying to recover...
	Reported Error Code is ControlButton_All. Trying to recover...

Error Code	Pop-up Message	Message Center Error Description
		Reported Error Code is NoCalibration_Node0. Trying to recover...
		Reported Error Code is NoCalibration_Node1. Trying to recover...
		Reported Error Code is NoCalibration_Node2. Trying to recover...
		Reported Error Code is NoCalibration_Node3. Trying to recover...
		Reported Error Code is NoAlignment_Sensor. Trying to recover...
101	Emergency Switch was activated. Please, release the switch by rotating it clockwise. (101)	Reported Error Code is MotorController_PowerError. Trying to recover...
102	Device Controller has encountered an error. (102)	RTC is out of sync with the system. Trying to recover...
120	Connection to the sensor is not detected. (120)	Connection to Sensor is not possible. Trying to recover to Demo mode...
121	Device has encountered an error. Current procedure was interrupted due to timeout. (121)	Sensor is not ready for image acquisition in the time interval allowed. The workflow was interrupted. Trying to recover...
122	Sensor has encountered a calibration error. (122)	The sensor calibration files are not available and no imaging is possible. Re-installation of the calibration files is required.
123	Sensor has encountered an error. (123)	Sensor is out of sync with the system. Trying to recover...
124	Sensor has encountered a malfunction. Please, replace the sensor. (124)	Sensor is out of sync with the system and cannot recover. Remove Sensor to continue recovering to Demo mode...
125	Device is not connected to the Imaging application. (125)	A connection to the Imaging application is not available and no imaging is possible. Re-start of the Imaging application is required.
126	Image transmission is not complete. (126)	Image was not transmitted successfully. User could re-transmit the image from Options screen.
141		The communication protocol version {0} is not supported. Replace Operator Panel or the system software.
142	Device has encountered an error. Current procedure was interrupted due to timeout. (142)	User did not start an exposure in the time interval allowed. The workflow was interrupted. Trying to recover...
143	Device cannot execute selected function. Please, try again. (143)	User selected a function which is not possible to execute due to RTC or Sensor error, or because the system is transitioning to another state. User could select the function again later...
144	Device is cooling down. Please, try again after that. (144)	User selected a function, which is not possible to execute due to cooling down. User could select the function again after cooling down completed...

Error Code	Pop-up Message	Message Center Error Description
997	Selected combination of segments is not valid. The selection should be contiguous.	Invalid segment selection. User could change the selection.
998	Procedure was interrupted before completion.	User interrupted image acquisition before its completion. The image might be received.
999	Device has to return to Patient entry position. Please, stand back and tap Ready for imaging button to proceed.	The device was moved out of the correct position and has to be positioned properly. Please, stand back and tap the Ready for imaging button to proceed...

Error Logs

The Progeny Vantage® error logs provide an internal view of the Progeny Vantage® system. Their purpose is to track the interactions of the system, including actions by the user.

Description

The Progeny Vantage® system has four Progeny error logs and one Windows error log.

- **Panoramic.Rtc** is the RTC error log created by Progeny. It contains messages related to communication with the RTC, and start up and termination routines.
- **Panoramic.Cm** is the communications log for the operator panel created by Progeny. It contains communication errors with the operator panel, and start up and termination routines.
- **Panoramic.Stm** is the system log created by Progeny. It is the main log and includes RTC errors, sensor errors, operator panel errors, transitions between states, and actions. The system log also contains user actions, such as the user tapping a button on the operator panel, as well as recording startup and termination routines.
- **Panoramic.PanDevice** is a device log file containing sensor-related messages and driver information.
- **Panoramic.Network** is the network communications log created by Microsoft Windows. It contains whatever happens with the network on the Windows level.

Location of Error Logs

On a Windows system, the system-level logs are located on the PC hard drive:

`<ROOT DIRECTORY>\ProgramData\Progeny`

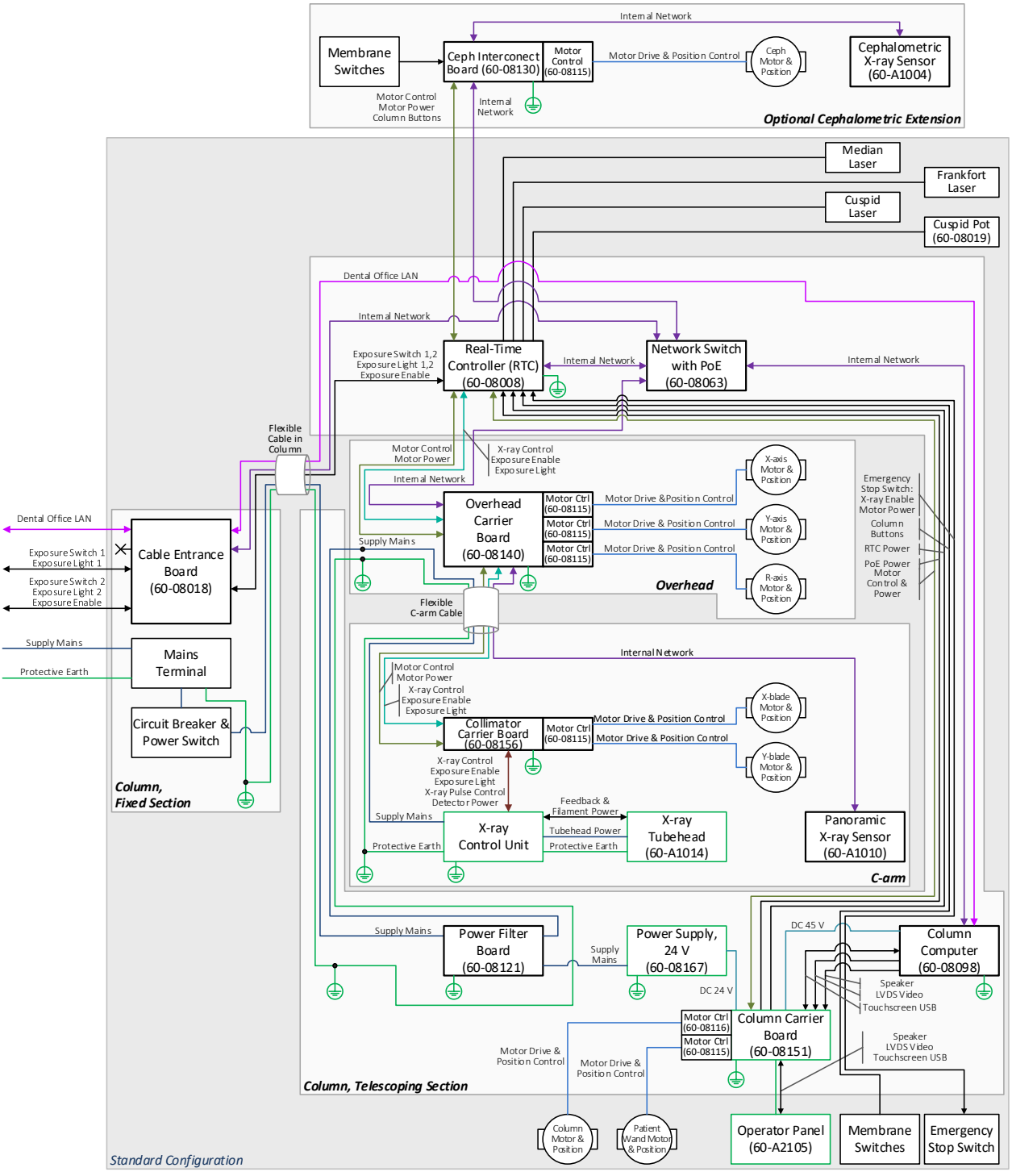
The logs for the operator panel are in a folder in this directory:

`<ROOT DIRECTORY>\ProgramData\Progeny\Logs`

Wiring Diagrams

The wiring diagram in this section incorporates wiring for all Progeny Vantage® panoramic system components.

Wiring Diagram



Printed Circuit Boards

This section provides an overview of the printed circuit board (PCB) assemblies used in the Progeny Vantage® Panoramic X-ray device. The section contains:

- A table of PCB assemblies with information on each assembly
- A diagram of the Progeny Vantage® device showing the board locations

There are no serviceable parts in the X-ray tubehead, X-ray sensors, and Operator Panel. The printed circuit boards in these assemblies are not listed here.

Table of PCB Assemblies

The Progeny Vantage® PCB assemblies table lists the board assemblies in the Progeny Vantage® Panoramic device. Each board is discussed in detail in the next section.

PCB Assemblies

PCB Assembly	Function	Location	Part number	Testing and Troubleshooting
Cable Entrance Board	Provides connections for external cables, including the Dental office LAN, hand exposure switch, and remote exposure switch.	On the back of the telescoping column.	60-08018	Reference "*Cable Entrance Board*" section on page 45.
Power Filter Board	Provides supply mains connection and noise filtering function for the power supply 24 V and the X-ray source.	Telescoping column, above patient table	60-08121	Reference "*Power Filter Board*" section on page 45.
Power Supply 24 V	Provides power to the components of the machine except for the X-ray source.	Telescoping column, under patient table	60-08167	Reference "*Power Supply 24 V*" section on page 45.
Column Carrier Board	Provides carrier and interconnect for the patient wand motor controller board and telescoping column motor controller board, links the 24 V power supply with its loads, provides 24 V to 48 V conversion to power the network switch with PoE board and the column computer, and connects the column computer and the operator panel.	Telescoping column, under patient table	60-08151	Reference "*Column Carrier Board*" section on page 46.
Patient Wand Motor Controller Board	Provides the motor control for the wand.	Top side of the column carrier board	60-08115	Reference "*Motor Controller Board for Stepper Motors*" section on page 43.
Telescoping Column Motor Controller Board	Provides the motor control for the telescoping column.	Bottom side of the column carrier board	60-08116	Reference "*Motor Controller Board for Brushless DC Motors*" section on page 44.

PCB Assembly	Function	Location	Part number	Testing and Troubleshooting
Column Computer Board	Acts as interface controller to the machine and provides the basic image processing.	Telescoping column, under column carrier board	60-08098	Reference "*Column Computer Board*" section on page 47.
Network Switch with PoE Board	Provides communications for the in-machine network. Powers the sensor by utilizing Power-over-Ethernet (PoE).	Telescoping column, under column computer board	60-08063	Reference "*Network Switch with Power-over-Ethernet (PoE)*" section on page 48.
Cuspid-Position Potentiometer Board	Holds the sensor for the cuspid-positioning laser.	Patient table beneath chin rest	60-08019	Reference "*Cuspid-Position Potentiometer Board*" section on page 48.
Operator Panel	Acts as user interface for the device.	Mounted on an arm under the patient table.	60-A2105	No serviceable parts inside. Reference "*Operator Panel*" section on page 18.
Real-Time Controller (RTC) Board	Controls operation of the motors, drives the laser function, provides technique factors to X-ray source, and controls the exposure switch configuration.	Telescoping column, near the overhead	60-08008	Reference "*Real-Time Controller Board*" section on page 49.
Overhead Carrier Board	Provides carrier and interconnect for the X-axis (linear drive), Y-axis (swing drive), and R-axis (C-arm drive) motor controllers. Provides pass through interface for the motor power, motor control serial bus, and X-ray control signals.	Overhead arm	60-08140	Reference "*Overhead Carrier Board*" section on page 51.
Y-axis Motor Controller Board (swing arm)	Provides the motor control for the swing arm.	Overhead carrier board, near to the telescoping column	60-08115	Reference "*Motor Controller Board for Stepper Motors*" section on page 43.
X-axis Motor Controller Board (linear drive)	Provides the motor control for the linear drive.	Overhead carrier board, middle controller	60-08115	Reference "*Motor Controller Board for Stepper Motors*" section on page 43.
R-axis Motor Controller Board (C-arm)	Provides the motor control for the C-arm.	Overhead carrier board, near to C-arm	60-08115	Reference "*Motor Controller Board for Stepper Motors*" section on page 43.

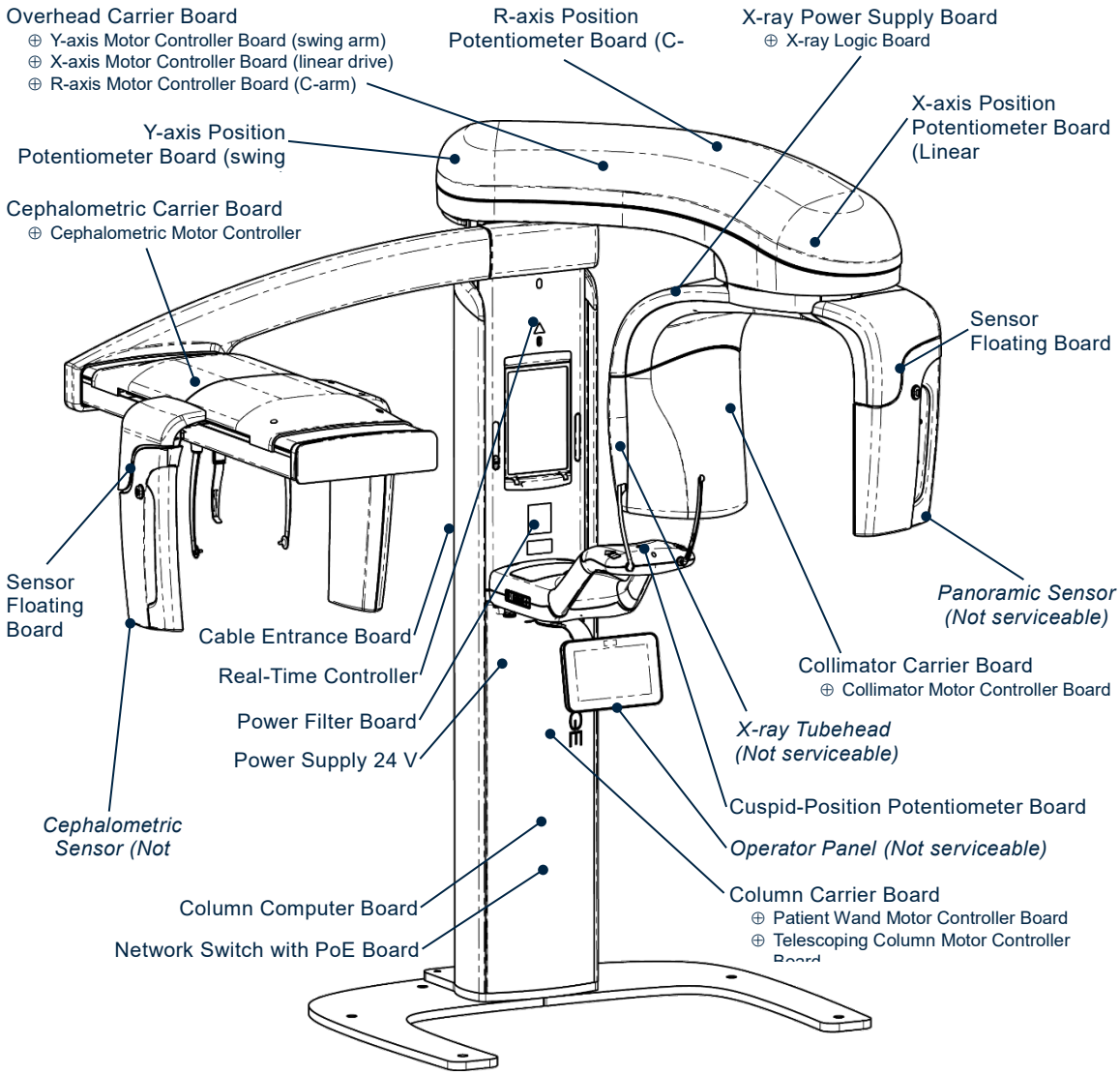
PCB Assembly	Function	Location	Part number	Testing and Troubleshooting
Y-axis Position Potentiometer Board (swing arm)	Positions the sensor for Y-axis motor (swing arm).	Overhead arm near the telescoping column	60-08081	Reference "*Position Potentiometer Board*" section on page 51.
R-axis Position Potentiometer Board (C-arm)	Positions the sensor for the R-axis motor (C-arm).	Overhead arm near C-arm	60-08081	Reference "*Position Potentiometer Board*" section on page 51.
X-axis Position Potentiometer Board (Linear Potentiometer)	Positions the sensor for the X-axis motor (linear drive).	Overhead arm	60-08017	Reference "*Linear Potentiometer Board*" section on page 52.
X-ray Power Supply Board	Supplies power for the X-ray tubehead.	C-arm, tubehead side	60-08136	Reference "*X-ray Power Supply Board*" section on page 52.
X-ray Logic Board	Controls operation of the X-ray tubehead.	C-arm, tubehead side, inserted in the X-ray power supply board	60-08138	Reference "*X-ray Logic Board*" section on page 53.
X-ray Tubehead	Produces X-ray.	C-arm, facing X-ray sensor.	60-A1014	No serviceable parts inside. Reference "*X-ray Source*" section on page 20.
Collimator Carrier Board	Provides carrier and interconnect for the collimator motor controller that powers the two axes of the primary collimator.	Tubehead, inside, facing sensor, on the right, above the collimator	60-08156	Reference "*Collimator Carrier Board*" section on page 54.
Collimator Motor Controller Board	Provides the motor control for the two axes of the primary collimator.	Collimator carrier board	60-08115	Reference "*Motor Controller Board for Stepper Motors*" section on page 43.
Sensor Floating Board	Holds the connection for the X-ray sensor assembly and provides a selection switch to indicate Pan or Ceph sensor attachment position.	Where C-arm meets sensor and where cephalometric transit meets the sensor	60-08010	Reference "*Sensor Floating Board*" section on page 55.
Panoramic X-ray Sensor	Converts the X-ray to a digital panoramic image.	C-arm, facing X-ray tubehead.	60-A1010	No serviceable parts inside. Reference "*X-ray Sensors*" section on page 21.

PCB Assembly	Function	Location	Part number	Testing and Troubleshooting
Cephalometric X-ray Sensor	Converts the X-ray to a digital cephalometric image. May serve as panoramic X-ray sensor when attached to the C-arm.	Cephalometric transit mechanism.	60-A1004	No serviceable parts inside. Reference "*X-ray Sensors*" section on page 21.
Cephalometric Membrane Switch Board	Provides interconnect for the membrane switches mounted on the Cephalometric arm.	Cephalometric transit mechanism.	60-08126	No serviceable parts inside. Reference "*Cephalometric Membrane Switch Board*" section on page 55.
Cephalometric Arm Interconnect Board	Provides carrier and interconnect for the cephalometric motor controller.	Part of the cephalometric transit mechanism	60-08130	Reference "*Cephalometric Arm Interconnect Board*" section on page 56.
Cephalometric Motor Controller	Provides the motor control for the cephalometric imaging.	Cephalometric carrier board	60-08115	Reference "*Motor Controller Board for Stepper Motors*" section on page 43.

Locating a PCB Assembly

This diagram illustrates the general location of each board.

Location of PCB assemblies



Troubleshooting with Printed Circuit Boards

This section presents detail on each PCB assembly. The motor controllers are described first and the other boards are presented in the order used in the "*PCB Assemblies*" section. For each board, the section contains:

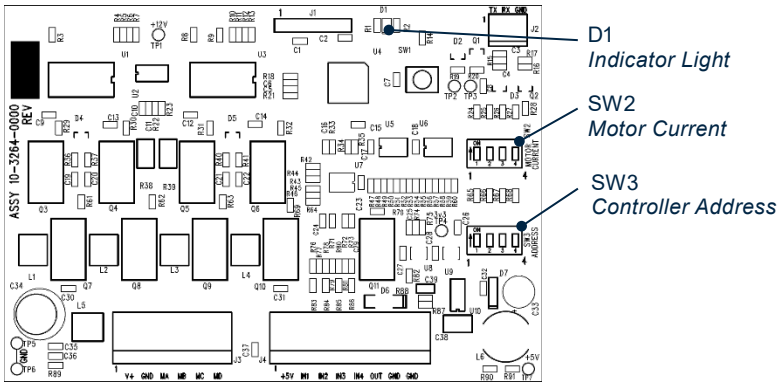
- A diagram or picture of the board
- Location of test points, indicator lights, jumpers, and switches used for maintenance or Troubleshooting
- Test point function, measuring technique, reference, expected value, and what to do if out of range.
- Indicator light name and/or designator, color, purpose, normal status, and notes

Motor Controller Board for Stepper Motors (60-08115)

Progeny Vantage® utilizes five motor controller boards to control the stepper motors associated with different components. The boards for the C-arm, linear drive, and overhead (swing) arm are located in the overhead assembly. The board for the collimator motors is located on the tubehead, the board for the patient wands is located in the telescoping column, and the cephalometric motor controller is placed on the cephalometric scanning mechanism.

All five boards have jumpers and indicator lights.

Motor controller boards for stepper motors



DIP switch settings on the motor controller boards for stepper motors

Motor Controller Name	Address	SW3-1	SW3-2	SW3-3	SW3-4	SW2-1	SW2-2
R-axis motor controller (C-arm)	0	On	On	On	On	On	Off
X-axis motor controller (linear drive)	1	Off	On	On	On	Off	On
Y-axis motor controller (swing arm)	2	On	Off	On	On	On	On
Collimator motor controller (x and y)	3	Off	Off	On	On	Off	Off
Patient wands motor controller	4	On	On	Off	On	Off	Off
Cephalometric motor controller	5	Off	On	Off	On	On	Off

Note: SW2, positions 3 and 4 are not used.

Note: The settings for each of the motor controllers with the exception of the cephalometric attachment are printed on the carrier board next to the switch.

Indicator lights on the motor controller board for stepper motors

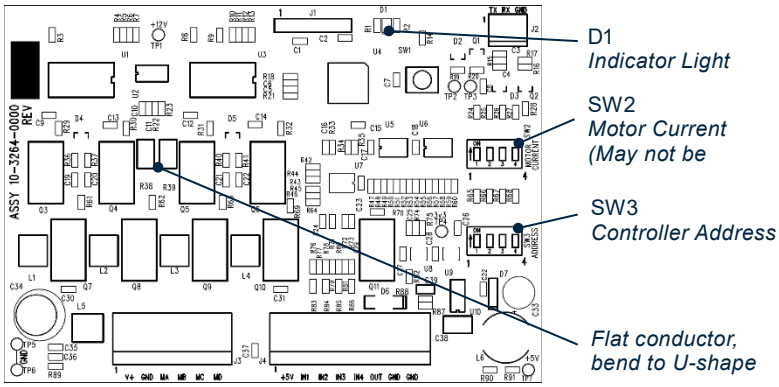
Name	Designator	Color	Purpose	Normal Status	Notes
Indicator Light	D1	green and amber	• power is on • communication	• green • flashing amber	

Motor Controller Board for Brushless DC Motors (60-08116)

Progeny Vantage® uses a motor controller board to control the brushless DC motor responsible for telescoping column high adjustment. The board is located in the telescoping column.

This board has three jumpers and an indicator light.

Motor controller board for brushless DC motors



DIP switches on the motor controller for brushless DC motors

Motor Controller Name	Address	SW3-1	SW3-2	SW3-3	SW3-4	SW2-1	SW2-2
Telescoping column motor controller	6	On	Off	Off	On	Off	Off

Note: SW2, positions 3 and 4 are not used.

Note: The settings for each of the motor controllers are printed on the carrier board next to the switch.

Indicator lights on the motor controller for brushless DC motors

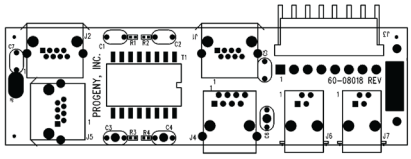
Name	Designator	Color	Purpose	Normal Status	Notes
Indicator Light	D1	green and amber	• power is on • communication	• green • flashing amber	

Cable Entrance Board (60-08018)

This board provides the connections for external cables, including Dental office LAN, hand exposure switch, remote exposure switch, and remote operator panel.

There are no test points, indicators, switches, or jumpers on this board.

Cable entrance board

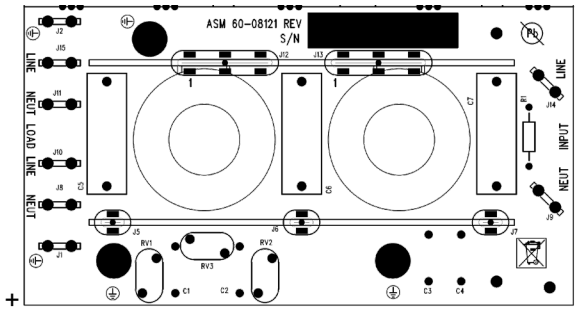


Power Filter Board (60-08121)

The board provides supply mains connection and noise filtering function for the power supply 24 V and the X-ray source.

There are no test points, indicators, switches, or jumpers on this board.

Power filter board

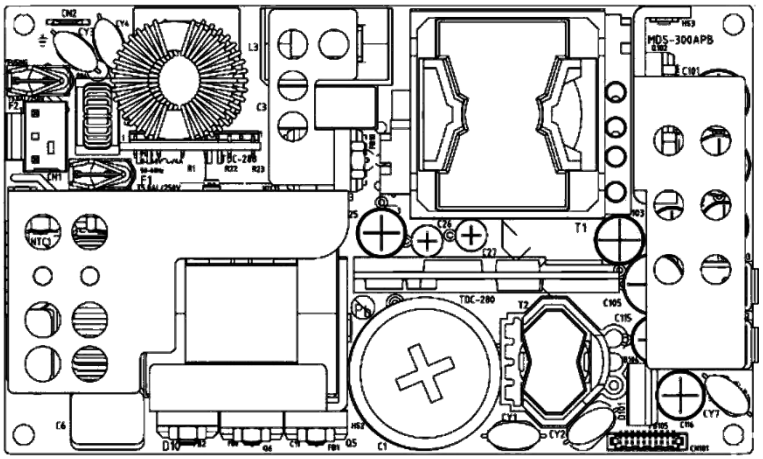


Power Supply 24 V (60-08167)

The power supply 24 V power to the components of the machine except for the X-ray source.

There are no test points, indicators, switches, or jumpers on this power supply.

Power supply 24 V

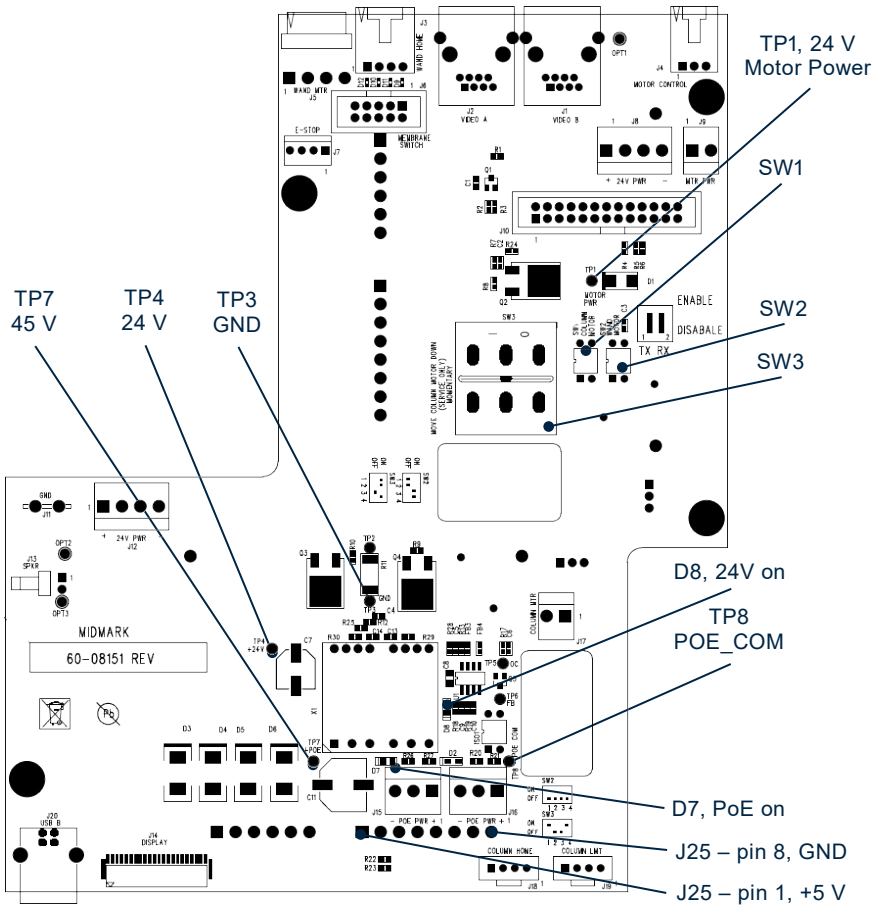


Column Carrier Board (60-08151)

The board provides a carrier for the patient wand motor controller board and telescoping column motor controller board, and interconnects them with RTC (for motor control), patient wand motor, the wand optical switch, telescoping column motor, and the two optical switches that define the column minimum and maximum height. The column carrier board links also the 24 V power supply with its loads, converts the 24 V to 48 V to power the network switch with PoE and the column computer, and connects the column computer and the operator panel

The column carrier board has test points, indicator lights, and jumpers. When a motor does not move or a display does not turn on, take measurements on the column carrier board.

Column carrier board



Test points on the column carrier board

Name	Designator	Function	Measuring Technique	Reference	Expected value	If out of range, do this:
24V	TP4	24 V power supply	Measure DC voltage	GND, TP3	24 V ± 1 V	Disconnect cable at J12. Measure 24 V at 24V power supply (60-08167) on terminals CN102 (24 V) and CN103 (GND).
24VM (Motor power)	TP1	Motor controller power supply	Measure DC voltage	GND, TP3	24 V ± 1 V	Power to the motor controllers is software controlled. It may be off when the machine is idle.

Name	Designator	Function	Measuring Technique	Reference	Expected value	If out of range, do this:
						Verify Emergency stop switch is released. Enter Maintenance mode from the operator panel. Test voltage. If TP1 still measure incorrect, disconnect J9, and measure voltage on RTC on test points TP5 (Motor power) and TP7 (GND).
+PoE power	TP7	PoE power supply	Measure DC voltage	POE_COM,45 TP8	V ± 1 V	Disconnect cables at J15 and J16. Test voltage on TP7. If 45 V is not present on TP7, replace column carrier board.

Indicator lights on the column carrier board

Name	Designator	Color	Purpose	Normal Status	Notes
PoE	D7	green	Indicates operational status	on	On indicates that PoE power is provided.
24 V	D8	green	Indicates operational status	on	On indicates that 24 V power is provided.

The DIP-switches SW1 and SW2 configure whether the motor controllers are connected to the serial motor control bus from RTC. There is one switch for transmit (TX) and one switch for receive (RX) line of each motor controller. To operate both lines, TX and RX, must be connected to the serial motor control bus from RTC, i.e. all switches must be in ON state.

Switch SW3 allows the telescoping column to be lowered manually without RTC control when Progeny Vantage® must be moved or packaged. Press the emergency stop switch to remove the RTC control and then hold switch SW3 until the telescoping portion of the column moves to the lowest possible position.

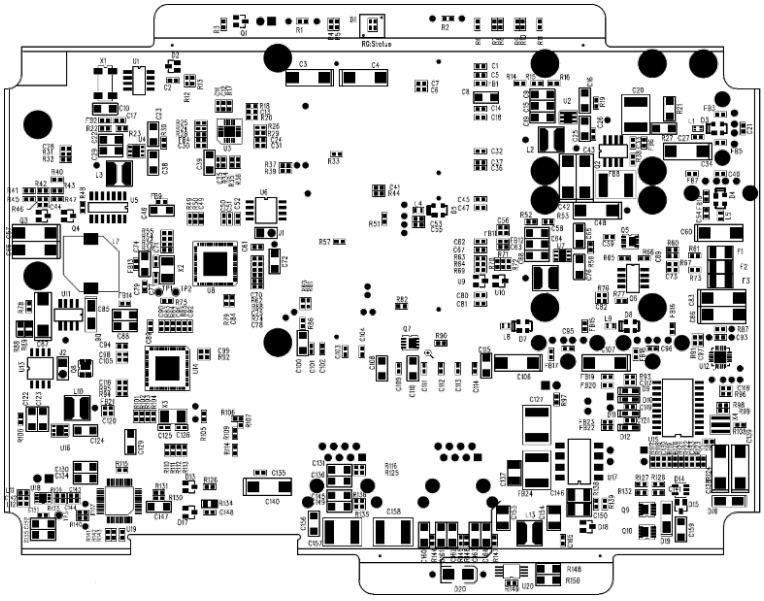
Note that, the DIP-switch settings for each of the motor controllers are printed on the silkscreen of the carrier board, next to the switch.

Column Computer Board (60-08098)

The column computer board acts as interface controller to the machine and provides the basic image processing.

There are no test points, indicators, switches, or jumpers on this board.

Column computer board

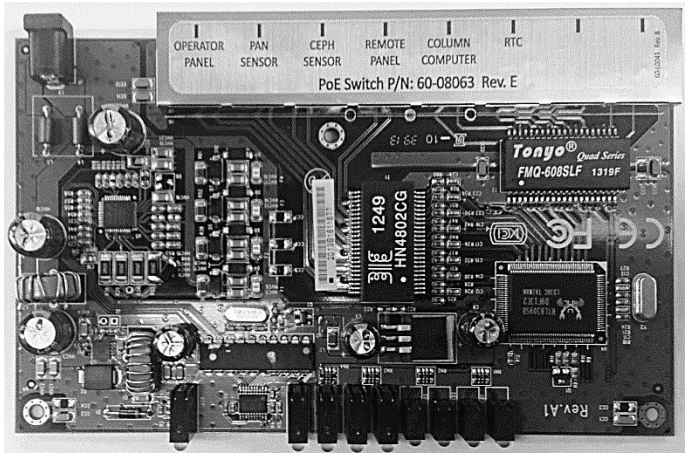


Network Switch with Power-over-Ethernet (PoE) (60-08063)

The network switch provides all communications for the in-machine network. It also powers the operator panel (attached or remote) and the sensor by utilizing Power-over-Ethernet (PoE) protocol.

There are no test points, indicators, switches, or jumpers on this board.

Network switch with PoE

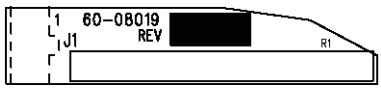


Cuspid-Position Potentiometer Board (60-08019)

This board positions the sensor for the cuspid-positioning laser.

There are no test points, indicators, switches, or jumpers on this board.

Cuspid-position potentiometer board

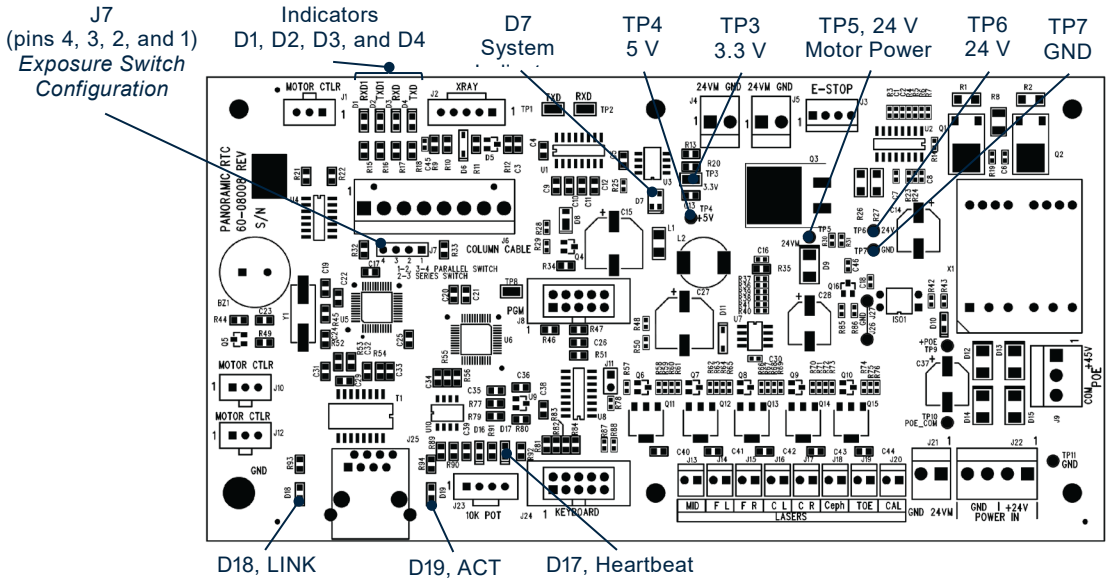


Real-Time Controller Board (60-08008)

The Real-Time Controller (RTC) implements the essential system functionality based on commands from the column computer. It controls operation of the motors, provides technique factors to X-ray source, drives the laser function, and controls the exposure switch configuration.

The RTC board has test points, indicator lights, and jumpers. When a motor does not move, take measurements on the RTC board.

Real-time controller board



Test points on the real-time controller

Name	Designator	Function	Measuring Technique	Reference	Expected value	If out of range, do this:
24V	TP6	24 V power supply	Measure DC voltage	GND, TP7	24 V ± 1 V	Disconnect cable at J22. Measure 24 V at 24V power supply (60-08167), TB2 (designator for 24V power supply output connector.)
24VM (Motor power)	TP5	Motor controller power supply	Measure DC voltage	GND, TP7	24 V ± 1 V	Power to the motor controllers is software controlled. It will be and may be off when the machine is idle. Verify Emergency stop switch is released. Enter Maintenance mode from the operator panel. Disconnect cables to J4, J5, and J21. Test voltage. If TP5 still measure incorrect, replace RTC.

Name	Designator	Function	Measuring Technique	Reference	Expected value	If out of range, do this:
+5V	TP4	5 V power supply	Measure DC voltage	GND, TP75	V ± 0.25 V	Disconnect all lasers at J13-J20. Test voltage. If TP4 still measure incorrect, replace RTC.
3.3V	TP3	3.3 V power supply	Measure DC voltage	GND, TP73	.3 V ± 0.1 V	Replace RTC.

Indicator lights on the real-time controller

Name	Designator	Color	Purpose	Normal Status	Notes
RXD1	D1	green	Indicates communication with motor controllers	off	Flashes when communicating with motor controllers (when motors are moving)
TXD1	D2	green	Indicates communication with motor controllers	off	Flashes when communicating with motor controllers (when motors are moving)
RXD	D3	green	Indicates communication with X-ray power supply	flashing	Flashes when communicating with the X-ray power supply.
TXD	D4	green	Indicates communication with X-ray power supply	flashing	Flashes when communicating with the X-ray power supply.
System Indicator Light	D7	amber	X-ray indicator that is visible externally.	off	Located in the telescoping column, upper section. On indicates when the unit emits X-ray.
LINK	D18	green	Indicates network connection	on	On indicates that network connection with network switch is established.
ACT	D19	green	Indicates network connection	flashing	On indicates that there is transfer between RTC and the network switch is established.
HB (Heartbeat)	D17	green	Indicates operational status	flashing	Flashing indicates that the RTC microcontroller is operational. Solid on light indicates no network connection. Slow flashing with period approx. 2.2 s indicates searching for network connection.

The jumpers configure the remote exposure switches on the Progeny Vantage®. To operate either remote switch 1 or remote switch 2, configure the jumpers as shown below. If the requirement is for both exposure switches to be pressed simultaneously, configure the jumpers 2 & 3.

Jumpers on the real-time controller board

Exposure Switch Configuration	Switch Status
Enable remote switch 1	1 & 2
Enable remote switch 2	3 & 4
Enable remote switches 1 and 2 simultaneously	2 & 3

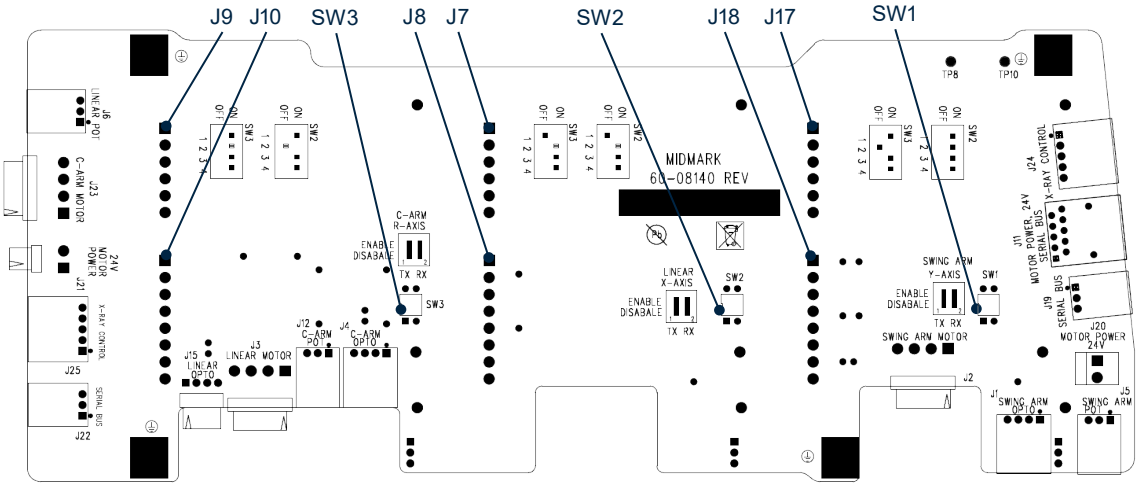
Overhead Carrier Board (60-08140)

This board provides carrier and interconnect for the X-axis (linear drive), Y-axis (swing drive), and R-axis (C-arm drive) motor controllers. It creates a pass-through interface for the motor power and motor control serial bus for the primary collimator mounted on the C-arm. It also has a pass-through for the X-ray control signals for the X-ray source mounted on the C-arm.

There are no test points, indicators, or jumpers on this board. The DIP-switches SW1, SW2, and SW3 configure whether the motor controllers are connected to the serial motor control bus from RTC. There is one switch for transmit (TX) and one switch for receive (RX) line of each motor controller. To operate both lines, TX and RX, must be connected to the serial motor control bus from RTC, i.e. all switches must be in ON state.

Note that, the DIP-switch settings for each of the motor controllers are printed on the silkscreen of the carrier board, next to the switch.

Overhead carrier board

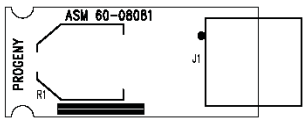


Position Potentiometer Board (60-08081)

There are two position potentiometer boards, each positioning its respective motor sensor. The position potentiometer board in the overhead arm near the C-arm has the position potentiometer for the R-axis (C-arm) motor. The position potentiometer board in the overhead arm near the telescoping column has the position potentiometer for the Y-axis (swing arm) motor.

There are no test points, indicators, switches, or jumpers on these boards.

Position potentiometer board

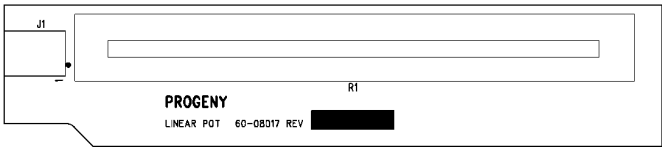


Linear Potentiometer Board (60-08017)

This board has the position potentiometer for the X-axis (linear drive) motor.

There are no test points, indicators, switches, or jumpers on this board.

Linear potentiometer board



X-ray Power Supply Board (60-08136)

This board is part of the X-ray control unit that supplies power for the X-ray tubehead and controls that power to achieve the tube loading factors (technique factors) requested by RTC. The board has an indicator light, which turns on when X-rays are being emitted even though the light is not visible from the outside of the machine. There are also test points used for troubleshooting. The test points are accessed when the X-ray control unit is removed from the C-arm.

If no X-ray is generated, as evidenced by no image, make measurements on the back of the X-ray power supply board using the test point values in the table.

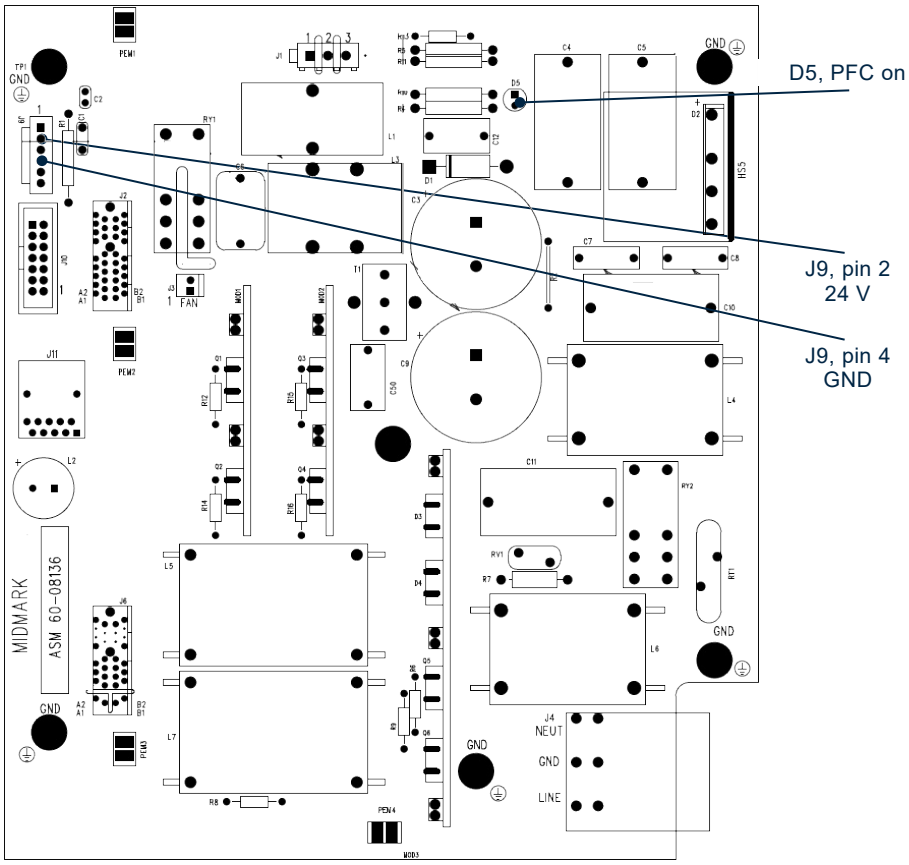
Test points on the X-ray power supply board

Name	Designator	Function	Measuring Technique	Reference	Expected value	If out of range, do this:
+24V	J9, pin 2	24 V power supply	Measure DC voltage	Ground, J9, pin 4	28 V ± 1.0 V	Check connection between X-ray power supply and Logic board.

Indicator light on the X-ray power supply board

Name	Designator	Color	Purpose	Normal Status	Notes
PFC on	D5	green	Indicates presence of energy sufficient to make X-ray	off	The light is on during exposure.

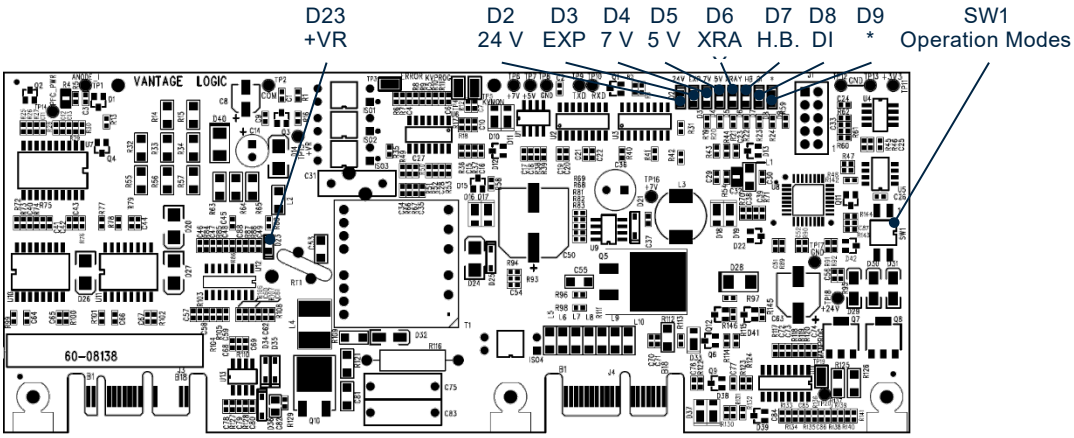
Front of the X-ray power supply board



X-ray Logic Board (60-08138)

This board controls operation of the X-ray tubehead. The logic board has multiple indicator lights and a switch.

X-ray logic board



Indicator lights on the X-ray logic board

Name	Designator	Color	Purpose	Normal Status	Notes
+VR	D22	green	Indicates boost circuit is on	off	On during exposure
*	D9	green	Indicates tube current level	• off • flicker during X-ray exposure • on during exposure • off during exposure	• Tube current is currently correct • Tube current is currently too high • Tube current is currently too low
EXP	D3	green	Indicates exposure switch is pressed	off	On when exposure switch is pressed
5V	D5	green	Indicates presence of 5 V power	on	
DI	D8	green	Indicates absence of calibration	off	On indicates need of calibration
24V	D2	green	Indicates presence of 24 V power	on	
XRAY	D6	green	X-ray indicator	• Off when unit is idle • On when unit is emitting X-ray	On indicates emitting of X-ray
H.B.	D7	green	Indicates communication with RTC	• flashing	
+7V	D4	Green	Indicates presence of 7 V power	• on	

Switch settings on the X-ray logic board

Operation mode of the X-ray logic board		Switch Status
Calibration mode,	enabled disabled	SW1-1 = OFF SW1-1 = ON
Error conditions mode,	disabled enabled	SW1-1 = OFF SW1-1 = ON

Collimator Carrier Board (60-08156)

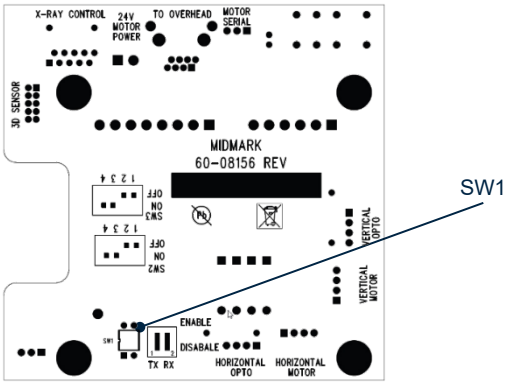
This board provides carrier and interconnect for the collimator motor controller. It powers the X- and the Y-axes of the primary collimator by switching the motor control signals to one of the motors at a time utilizing a relay.

There are no test points, indicators, or jumpers on this board. The DIP-switch SW1 configures whether the motor controller is connected to the serial motor control bus from RTC. There is one switch for transmit (TX) and one switch for receive (RX) line of the motor controller. To operate both lines, TX

and RX, must be connected to the serial motor control bus from RTC, i.e. all switches must be in ON state.

Note that, the DIP-switch settings for the motor controller are printed on the silkscreen of the carrier board, next to the switch.

Collimator carrier board

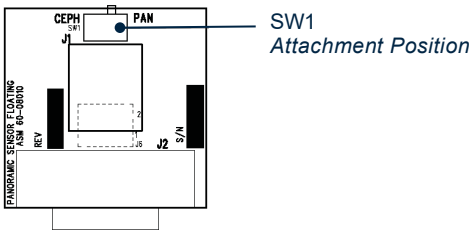


Sensor Floating Board (60-08010)

This board holds the connection for the X-ray sensor assembly and provides a selection switch to indicate Pan or Ceph sensor attachment position. For normal operation, the selection switch must be in the PAN position when the board is installed in the C-arm.

Besides the selection switch, there are no other test points, indicators, switches, or jumpers on this board.

Sensor floating board



Switch settings on the sensor floating board

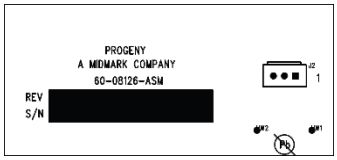
Function of the Sensor Floating Board	Switch Status
Panoramic attachment position: Use when board installed in C-arm	PAN
Cephalometric attachment position: Use when the board is installed in cephalometric attachment	CEPH

Cephalometric Membrane Switch Board (60-08126)

Provides interconnect for the membrane switches mounted on the Cephalometric arm.

There are no test points, indicators, switches, or jumpers on this board.

Cephalometric membrane switch board

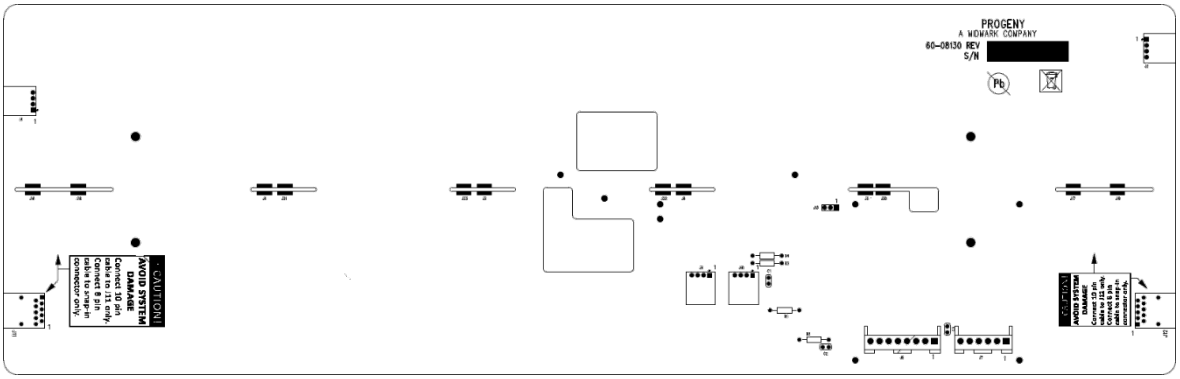


Cephalometric Arm Interconnect Board (60-08130)

This board provides carrier and interconnect for the cephalometric motor controller.

There are no test points, indicators, switches, or jumpers on this board.

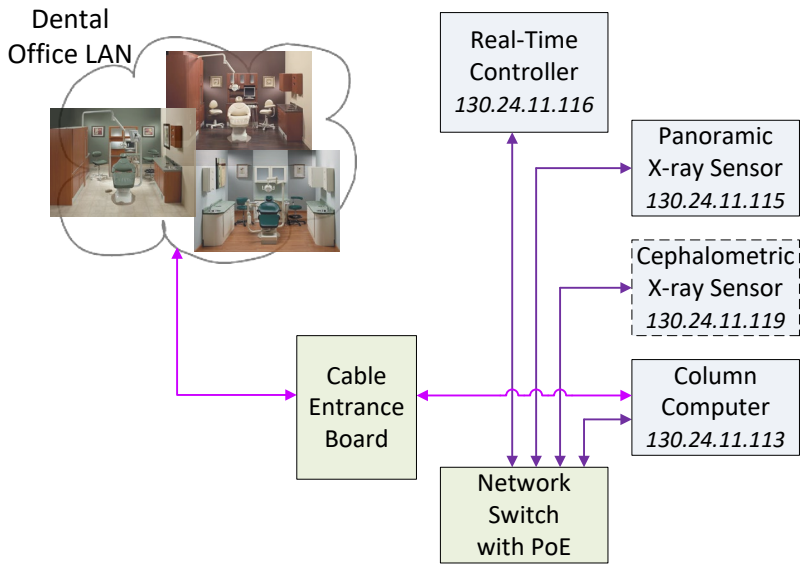
Cephalometric arm interconnect board



Network Communications

The Progeny Vantage® system uses an internal Ethernet-based network to connect the X-ray sensors, RTC, and column computer. The column computer also connects to the Local Area Network (LAN) of the dental office allowing image exchange between the panoramic X-ray system and the client computer.

Network diagram



IP Addresses

Progeny Vantage® uses static IPv4 addressing scheme 130.24.11.112/28 with 4-bit subnet and 28-bit network mask of 255.255.255.240. This allows 14 devices to be connected in the in-machine network. The selected network scheme selected provides minimal risk of collision and/or improper transmission of packets.

IP addresses

Name	Value
IP address range	130.24.11.113 to 130.24.11.126
Local subnet address	130.24.11.112
Operator panel	130.24.11.113
PAN sensor	130.24.11.115
Real time controller	130.24.11.116
CEPH sensor	130.24.11.119
Local broadcast address	130.24.11.127

4 Troubleshooting Procedures

In this Chapter

Communications Failure

The Device Does Not Synchronize With Client Computer

This section assumes that the client computer and the panoramic X-ray device are connected and energized. This will be apparent from the illuminated operator panel and the active client computer.

1. Verify the Progeny Vantage® client application is active on the client computer. The Progeny Vantage® requires up to 60 s to start initially, after its power is turned on. In addition, it may take up to 30 s for the client application to establish a link and synchronize with the device. A red “X” on the operator panel demonstrates this condition. If, after this waiting period, the synchronization has not occurred, proceed to the next step.
2. If a direct connection between the Progeny Vantage® and the client computer is not used:
   - Verify the condition of the network cable connected between the office network and the electrical box located at the top of the vertical column fixed section.
   - Verify the condition of the network cable connected between the office network and the client computer. Verify the integrity of the connection by accessing another network service available to the client computer.
   - Observe the LEDs on the network switch for the network ports used if accessible. Proper illumination indicates functionality. Refer to the switch documentation for instructions.
   - Confirm that the network interface of Progeny Vantage® is configured to be compatible with the network infrastructure and to allow communication between the device and the client computer (verify IP address, default gateway, DNS, etc.). Consult with the network administrator if necessary.
   - Make sure that the firewall on the client computer or in the dental network infrastructure has not shut off communications.
3. If a direct connection between the Progeny Vantage® and the client computer is used:
   - Verify the condition of the network cable connected between the client computer and the electrical box located at the top of the vertical column fixed section.
   - Confirm that the network interface of Progeny Vantage® is configured to be compatible with the network settings on the client computer and to allow communication between the two devices (verify the static IP address, default gateway, DNS, etc.). Consult with the network administrator if necessary.
   - Make sure that the firewall on the client computer has not shut off communications.

TWAIN Does Not Collect Image

1. The Progeny Vantage® device will not allow an exposure to begin, nor will the panoramic X-ray device drive to the *Ready* position if the image management software is not open, functioning, and a patient is selected. Follow the indicated error codes to investigate the cause.
2. Once the TWAIN interface is open and active, verify that the green ready indicator on the window is illuminated.
3. If the indicator is red, open the pull down menu to the left of the red indicator and labeled *Default Pan*. From the pull down selections, select another choice such as *Vision DX USB*. Return to the pull down menu and select *Default pan*. This process performs a reset of the communication.
4. If the indicator continues to be red, the sensor is not communicating with the operator panel and the image management software. Open the *Task Manager* and verify that the Progeny Vantage® client application is open only once. Occasionally, a previous instance of the client application may remain in the memory and will prevent the correct operation of the software. Close all currently active instances and restart the client application to correct this issue.
5. Check to see that the panoramic X-ray device is not in *Demo* mode. If the panoramic X-ray device will not exit *Demo* mode, verify that the X-ray sensor is properly set to the sensor attachment position.
6. Finally, review the steps outlined in the section of this chapter entitled "*X-ray Sensor Is Not Detected" on page* 69.

Image Does Not Transfer From Progeny Vantage® to Client Application

Open the *Task Manager* and verify that the Progeny Vantage® client application is open only once. Occasionally, a previous instance of the client application may remain in the memory and will prevent the correct operation of the software. Close all currently active instances and restart the client application to correct this issue.

The Device Does Not Communicate With the Facility Network

1. Connect a keyboard to the column computer.
2. Press *Ctrl-Alt-Del* keyboard key combination and log in as a technician.
3. Identify the network IP address assigned to Progeny Vantage® panoramic X-ray system.
4. Verify the internal connectivity by pinging each of the sensors and the RTC by using the IP addresses listed in section "*Network Communications*" on page 56. Correct the internal network issue if any of the communications fail. The activity indicators on the PoE switch may provide additional help for where the failure is. Reference the section in this manual corresponding to the failed component for more information.
5. Verify that the device external address is properly assigned by using the *ipconfig* command. Reassign that address or correct the external network issue if that address is incorrect.
6. Verify the external connectivity by pinging a node from the external network. Correct the external network issue if the communication fails.

The Device Does Not Energize

1. The panoramic X-ray device will require up to 60 s to activate initially when the power is turned on. During this time, the operator panel may be blank. After a short waiting period, the operator panel will illuminate. If not, continue with the following tests.
2. Make sure that the emergency stop switch is not actuated.

3. Verify that the panoramic X-ray device is connected as specified in section "*Powering the panoramic X-ray system*" on page 15.
4. Incoming line power converted to 24 V arrives to the column carrier board (60-08151) first. Verify the voltage at TP4.
5. The column carrier board steps up the voltage to 45 V. The 45 V power may be measured on test point TP7.
6. The 45 V power is provided to the PoE switch (60-08063). Power to this board will be apparent from the series of illuminated LEDs on the board.
7. The 45 V power is provided to column computer (60-08098). Power to this board will be apparent from the illuminated display.
8. The PoE switch provides the X-ray sensors with power and signals. The network cables from each device must be connected to the network ports marked with corresponding name. All LEDs corresponding to each port should be illuminated and blinking with very short pulses.

Operator Panel Failure

Operator Panel Does Not Energize

Follow the steps outlined in section "*The Device Does Not Energize*" on page 59.

Operator Panel Does Not Respond to Selections

1. The following tests assume that the operator panel (60-A2105) is illuminated and displaying the *Acquisition Setup* screen. If this is not the case, review the steps outlined in the section "*The Device Does Not Energize*" on page 59.
2. The operator panel signals and power originate from the column computer board (60-08098) and pass through column carrier board (60-08151). Verify that the Cat. 5 cables from the operator panel are connected to the specifically labeled ports on the column carrier board (60-08151). Reseat these cables if necessary.

Movement Operations Failure

Telescoping Column Does Not Drive Up

Normal vertical drive operation is a sequence of events. Pressing the drive switch causes the column movement to begin slowly after a short delay period. The speed gradually increases with the time.

1. If, instead of normal operation after the switch is pressed, three short beeps are enunciated, the RTC (60-08008) indicates that it will not be able to command column movement because of a possible short in one of the positioning controls or in the exposure switch.
2. Column movement has boundaries. An optical limit switch, once interrupted, will no longer allow movement in the selected direction. Verify that the limit of movement has not been reached by selecting the positioning control for the opposite direction.
3. Inspect the condition of the optical limit switch, the cable, and the connector, which lead to the column carrier board (60-08151). Signals from the upper limit switch (60-08192) arrive at J19 of the column carrier board.

4. On a temporary basis, it is permissible to swap the limit switch inputs to the column carrier board (60-08151) in an effort to demonstrate the cause of the problem to be sensor related. If the cables are swapped, return the input cables to the original locations after the test in order to prevent mechanical damage.
5. Actual monitoring of the optical limit switch occurs on the motor controller board (60-08116). The motor controller board activity could be observed at indicator light D1 on that board visible through the column carrier board (60-08151).
6. The operating signal and supply to operate the limit switches originates at J18 and J19 of the column carrier board (60-08151). The circuit can be tested by observing the DC voltage presence of 5 V across pins 1 and 8 of J25 and observing a logic state change across pins 3 and 8, while actuating the optical sensor.
7. Actual motor drive ability may be tested from the operator panel *Service* screen. On the *Service* screen, select the column and perform the *Service Column* task. This test directly signals the motor controller and, subsequently, the motor.
8. Failure at this stage requires the verification of the output voltage from the motor controller to the motor. This will be found at column carrier board (60-08151), connector J26 at pins 5 and 6 and is DC voltage up to 24 V that depends on the motion speed.
9. Switchable voltage at this point indicates a problem directly with the motor. No voltage presence while motion is expected requires the replacement of the motor controller board.
10. In one particular case, both optical limit switches may be blocked and motion will not occur. This will happen when the column is in the full down (shipping) position. In this case, on the operator panel *Service* screen, select the column and select the *Service Column* task. Then use the positioning controls to move the column up.
11. It is also possible that debris have blocked one or both sensors. Make sure that the sensors are not blocked by debris or damaged.

Telescoping Column Does Not Drive Down

Normal vertical drive operation is a sequence of events. Once the appropriate drive switch is pressed, the column movement will begin after a short delay period. Movement begins very slowly and then the speed gradually increases.

1. If, instead of normal operation after the switch is pressed, three short beeps are enunciated, the RTC (60-08008) indicates that it will not be able to command column movement because of a possible short in one of the positioning controls or in the exposure switch.
2. Column movement has boundaries. An optical limit switch, once interrupted, will no longer allow movement in the selected direction. Verify the limit of movement has not been reached by selecting the movement switch for the opposite direction.
3. Inspect the condition of the optical limit switch, the cable, and the connector, which lead to the column carrier board (60-08151). Signals from the lower limit switch (60-08192) arrive at J18 of the column carrier board.
4. On a temporary basis, it is permissible to swap the limit switch inputs to the column carrier board (60-08151) in an effort to demonstrate the cause of the problem to be sensor related. If the cables are swapped, return the input cables to the original locations after the test in order to prevent mechanical damage.
5. Actual monitoring of the optical limit switch occurs on the motor controller board (60-08116). The motor controller board activity could be observed at indicator light D1 on that board visible through the column carrier board (60-08151).
6. The operating signal and supply to operate the limit switches originates at J25 of the column carrier board (60-08151). The circuit can be tested by observing the DC voltage presence of 5 V across

pins 1 and 8 of J25 and observing a logic state change across pins 2 and 8, while actuating the optical sensor.

7. Actual motor drive ability may be tested from the operator panel *Service* screen. On the *Service* screen, select the column and perform the *Service Column* task. This test directly signals the motor controller and, subsequently, the motor.
8. Failure at this stage requires the verification of the output voltage from the motor controller to the motor. This will be found at column carrier board (60-08151), connector J26 at pins 5 and 6 and is DC voltage of up to 24 V that depends on the motion speed.
9. Switchable voltage at this point indicates a problem directly with the motor. No voltage presence while motion is expected requires the replacement of the motor controller board.
10. In one particular case, both optical limit switches may be blocked and motion will not occur. This will happen when the column is in the full down (shipping) position. In this case, on the operator panel *Service* screen, select the column and select the *Service Column* task. Then use the positioning controls to move the column up.
11. It is also possible that debris have blocked one or both sensors. Make sure that the sensors are not blocked by debris or damaged.

Unrequested Telescoping Column Movement (Up or Down)

1. Column movement is commanded by the membrane switch (60-08068) mounted on the patient table or on the transit of the cephalometric attachment. The signal is conducted to the RTC (60-08008). Isolating each component will reveal if the switch or cable is shorted.
2. The RTC (60-08008) powers the motor controller board (60-08116). The RTC provides motor enable, motor direction, and other control signals to the motor controller board with the request of movement.
3. Presence of these signals before a movement request is made indicates a problem within the RTC. Reported the issue to technical support.
4. If one of the column control circuits is shorted, pressing the wand button will cause the RTC to emit three short beeps.

Telescoping Column Drive Noisy

1. Inspect the condition of the column actuator (H7-00013), column bearing tracks, and the column bearing blocks. Any foreign materials must be cleared away. Excessive wear must be reported to technical support.
2. If it is determined that the column actuator must be replaced, contact technical support for assistance.

Wands Do Not Close or Open

1. Wand movement is activated by the membrane switch (60-08068) mounted on the patient table. The signal is conducted through the membrane switch cable (60-08077) to the RTC (60-08008). Isolating each component will reveal if the switch or cable is shorted.
2. The activation signal from the membrane switch arrives on connector J24 of RTC. That signal is processed and RTC provides two outputs. The first is a serial interface signal to the patient wand motor controller (60-08115) conducted from J12 of the RTC to J4 of the column carrier board (60-08151). The second output is the motor power from J21 of the RTC to J9 of the column carrier board (60-08151). The patient wand motor controller is connected to J5 on the column carrier board.

3. The wand optical sensor (60-08024) will stop movement in the open direction when interrupted. To remove this input, disconnect the cable arriving at J3 of the column carrier board. Briefly activate the wand switch. If the wand motor drives, inspect the condition of the sensor and replace if necessary. If the motor does not drive, replace the motor controller.

Wand Closure Uneven

1. Activate the median (midsagittal) laser. Place a ruler from one wand to the other. Measure the distance between the laser indicator and each wand tip. This distance should be equal.
2. If not, remove the bite guide and chin rest, then open the top of the patient positioning table by removing the two screws on the underside of the patient positioning table and the one screw under the chinrest.
3. Identify the wand link (60-F1002) within the patient positioning table. Identify the wand return spring (60-F3003).
4. Disconnect the wand return spring from its right hand attachment.
5. Disconnect the wand link from its right hand attachment.
6. Bend, or straighten, the wand link as required.
7. Replace the wand link and wand return spring.
8. Repeat steps as necessary.

C-arm Does Not Drive

1. The C-arm structure is powered from the RTC (60-08008) by way of the column to overhead cable (60-08040), which provides motor power (24 V) to the overhead carrier board (60-08140) at the connector J20. This same voltage should also appear at J7, J9, J17, and J21.
2. If DC voltage of 24 V (motor power) is not measured on the overhead carrier board J20, begin by verifying that the panoramic X-ray device is connected as specified in section "*Powering the panoramic X-ray system*" on page 15.
3. Incoming line power converted to 24 V arrives to the column carrier board (60-08151) first. Verify the voltage at TP4.
4. The 24 V is carried to the J22 on RTC (60-08008), is converted to motor power by RTC, and after it is routed through the emergency stop switch, it is distributed to the overhead carrier board.
5. Returning to the overhead carrier board, if the motor power (24 V) is present at J20, the power will be transferred to the R-axis (C-arm) motor controller board (60-08115).
6. A DC voltage of 24 V is measured at J9 of the overhead carrier board on pins 1 and 2. Bi-directional motor drive is also a part of J9. Output signals are presented to the motor from pins 3, 4, 5 and 6.
7. Position sensing and limits are provided to the motor controller through J4 and J12 of the overhead carrier board. A DC voltage of 5 V may be measured across pins 1 and 8 of J10. An analog DC value representing the position of the C-arm structure may be observed across pins 5 and 8. A logic state change may be observed as the C-arm movement reaches the optical limit sensor across pin 3 and 8. These signals originate on the R-axis (C-arm) position potentiometer board (60-08081) located just above the C-arm rotation point at the overhead assembly.
8. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task. Select the R-axis. Use the positioning controls to induce motion. On the operator panel, select *Move to Home* and *Move to Zero*. If there are any errors given, they will help to identify the non-functioning component.

C-arm Movement is Noisy

1. Inspect the condition of the C-arm drive assembly (60-A2030) and fasteners. Replace if necessary.
2. Perform C-arm alignment as described in section "*C-arm Alignment*" on page 80.

Overhead Arm Does Not Drive

1. The overhead arm is powered from the RTC (60-08008) by way of the column to overhead cable (60-08040), which provides motor power (24 V) to the overhead carrier board (60-08140) at the connector J20. This same voltage should also appear at J7, J9, J17, and J21.
2. If DC voltage of 24 V (motor power) is not measured on the overhead carrier board J20, begin by verifying that the panoramic X-ray device is connected as specified in section "*Powering the panoramic X-ray system*" on page 15.
3. Incoming line power converted to 24 V arrives to the column carrier board (60-08151) first. Verify the voltage at TP4.
4. The 24 V is carried to the J22 on RTC (60-08008), is converted to motor power by RTC, and after it is routed through the emergency stop switch, it is distributed to the overhead carrier board.
5. Returning to the overhead carrier board, if the motor power (24 V) is present at J20, the power will be transferred to the Y-axis (swing arm) motor controller board (60-08115).
6. A DC voltage of 24 V is measured at J17 of the overhead carrier board on pins 1 and 2. Bi-directional motor drive is also a part of J17. Output signals are presented to the motor from pins 3, 4, 5 and 6.
7. Position sensing and limits are provided to the motor controller through J18 of the overhead carrier board. A DC voltage of 5 V may be measured across pins 1 and 8. An analog DC value representing the position of the overhead structure may be observed across pins 5 and 8. A logic state change may be observed as the overhead movement reaches the optical limit sensor across pin 3 and 8. These signals originate on the Y-axis (swing arm) position potentiometer board (60-08081) located at the top rear of the overhead assembly.
8. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task. Select the Y-axis. Use the positioning controls to induce motion. On the operator panel, select *Move to Home* and *Move to Zero*. If there are any errors given, they will help to identify the non-functioning component.

Overhead Arm is Noisy

1. Inspect the condition of the linear drive assembly (60-A2023), the ball screw assembly (H7-00004), and fasteners. Replace if necessary.
2. Perform Y-axis (overhead arm) alignment as described in section "*Y-axis Alignment*" on page 81.

Linear Drive Does Not Operate

1. The linear drive is powered from the RTC (60-08008) by way of the column to overhead cable (60-08040), which provides motor power (24 V) to the overhead carrier board (60-08140) at the connector J20. This same voltage should also appear at J7, J9, J17, and J21.
2. If DC voltage of 24 V (motor power) is not measured on the overhead carrier board J20, begin by verifying that the panoramic X-ray device is connected as specified in section "*Powering the panoramic X-ray system*" on page 15.
3. Incoming line power converted to 24 V arrives to the column carrier board (60-08151) first. Verify the voltage at TP4.

4. The 24 V is carried to the J22 on RTC (60-08008), is converted to motor power by RTC, and after it is routed through the emergency stop switch, it is distributed to the overhead carrier board.
5. At the overhead carrier board, if the motor power (24 V) is present at J7, the power will be transferred to the X-axis (linear drive) motor controller board (60-08115).
6. A DC voltage of 24 V is measured at J7 of the overhead carrier board on pins 1 and 2. Bi-directional motor drive is also a part of J7. Output signals are presented to the motor from pins 3, 4, 5 and 6.
7. Position sensing and limits are provided to the motor controller through J8 of the overhead carrier board. A DC voltage of 5 V may be measured across pins 1 and 8. An analog DC value representing the position of the overhead structure may be observed across pins 5 and 8. A logic state change may be observed as the linear drive movement reaches the optical limit sensor across pin 3 and 8. These signals originate on the X-axis (linear drive) position potentiometer board (60-08017) located on the overhead assembly near to the R-axis (C-arm) motor.
8. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task. Select the X-axis. Use the positioning controls to induce motion. On the operator panel, select *Move to Home* and *Move to Zero*. If there are any errors given, they will help to identify the non-functioning component.

Linear Drive is Noisy

1. Inspect the condition of the X-axis Drive Assembly (60-A2028) and fasteners. Replace if necessary.
2. Perform X-axis (linear drive) alignment as described in section "*X-axis Alignment*" on page 82.

Cannot Move the Device to the Patient entry Position

1. Verify proper operation of the operator panel by following the steps outlined in the section "*Operator Panel Does Not Respond to Selections*" on page 60.
2. Error codes related to movement are classified as "*Device Controller Errors / 101*". The complete error message can be viewed by accessing the Message Center on the operator panel (reference section "*Message Center*" on page 28). Based on this information, the specific cause of the malfunction may be traced.
3. Contact technical support for guidance once the complete error message is known.

Cannot Move the Panoramic X-ray Device to the Ready for imaging Position

1. Verify proper operation of the operator panel by following the steps outlined in the section "*Operator Panel Does Not Respond to Selections*" on page 60.
2. This condition is monitored by the operator panel. Error codes related to movement are classified as "*Device Controller Errors / 101*". The complete error message can be viewed by accessing the Message Center on the operator panel (reference section "*Message Center*" on page 28). Based on this information, the specific cause of the malfunction may be traced.
3. Contact technical support for guidance once the complete error message is known.

Overhead and C-arm Do Not Drive to Repeatable Location

1. This condition is monitored by the operator panel. Error codes related to movement are classified as "*Device Controller Errors / 101*". The complete error message can be viewed by accessing the Message Center on the operator panel (reference section "*Message Center*" on page 28). Based on this information, the specific cause of the malfunction may be traced.
2. Contact technical support for guidance once the complete error message is known.

Overhead and C-arm Collide with Patient Positioning Table

1. Place the system in the “off” condition so that the position sensing circuits can be reset. Before energizing the system, move the X-ray sensor towards the column and the tubehead assembly away from the column. The C-arm should then align with the patient table. Next, push the overhead arm to the extreme right, making sure to keep the sensor and tubehead in parallel to the patient table.
2. Reenergize the system.
3. This condition is monitored by the operator panel. Error codes related to movement are classified as “*Device Controller Errors / 101*”. The complete error message can be viewed by accessing the Message Center on the operator panel (reference section “*Message Center*” on page 28). Based on this information, the specific cause of the malfunction may be traced.
4. Contact technical support for guidance once the complete error message is known.

X-ray Output Failure or Is Incorrect

System Does Not Initiate an Exposure, with Motion

1. The X-ray source is powered from the power supply mains. The pathway is from the rear power connection, located under the electrical box cover mounted on the fixed portion of the column through the power filter board (60-08121) mounted on the front of the telescoping portion of the column. Then through the overhead assembly and through the C-arm assembly. Each connection will contain line voltage. Use caution when making measurements.
2. Line voltage arrives on the X-ray power supply board (60-08136) at the J4 terminal block.
3. Once incoming power is verified, observe the status of D5 of the X-ray power supply board. This indicator should be *ON* during X-ray for proper operation.
4. Next, observe the status of the following logic board (60-08138) LEDs in the standby condition: D2 = on, D3 = off, D4 = on, D5 = on, D6 = off, D7 = flashing, D8 = off, D9 = off, and D23 = off. Observing different combination, with the exceptions of D7, D8, and D23, indicates a failure of the X-ray power supply board that requires the replacement of the X-ray source.
5. The significance of D7 in the flashing state indicates that the logic board processor is running normally. If the D7 indicator does not flash, switch power off on the unit, and wait for all LEDs on the logic board to fade. Resume power and see if D7 resumes flashing. If not, replace the X-ray source.
6. The communications between the logic board and RTC (60-08008) are indicated by the flashing of D3 and D4 on the left side of the top edge of the RTC.
7. If D3 is not flashing, then begin by inspecting the condition of the connections at J11 of the X-ray power supply board, J25 of the overhead carrier board, and the J2 on the RTC. If this series of steps does not restore communication, it may be necessary to replace either the RTC or the X-ray source.
8. If D17 on the RTC is not flashing then the RTC has locked up. Switch power off on the unit, and wait for all LEDs on the logic board to fade. Resume power and see if D17 resumes flashing. If not, replace the RTC.
9. If D8 on the logic board is illuminated, the X-ray source requires calibration. Contact technical support for instructions.
10. If D23 on the logic boards is illuminated at this stage, it indicates a request from the X-ray control unit microprocessor to start providing power to the X-ray tubehead. Since the X-ray control unit

microprocessor is interlocked by commands from the RTC, an active D23 circuit in the standby condition requires replacement of the X-ray source.

11. If the correct set of indicators is present (as outlined in this procedure), attempt to initiate an exposure. To do so, it is assumed that the system begins from the *Ready for imaging* position and that the operator panel portrays a green *Ready* indication. Press the exposure button and hold it through the scan motion.
12. During the exposure, observe the following indicators on the logic board: D2 = on, D3 = on, D4 = on, D5 = on, D6 = on, D7 = blinking, D8 = off, D9 = on, D23 = on. As identified earlier, D2, D4, and D5 are for power supplies.
13. D3 indicates that an exposure has been requested. For the exposure to occur, a specific serial transmission must arrive from the RTC. In order to operate the above functions, the RTC and operator panel are presumed to be functioning properly. Therefore, it will be necessary to repeat the evaluation of “no X-ray output” by the use of a fluorescent screen placed in the X-ray field.
14. D6 indicates that the X-ray source circuit is active and proper feedbacks are present. In this case, repeat the evaluation of “no X-ray output” by the use of a fluorescent screen placed in the X-ray field.
15. The D3, D6, and D9 are always illuminated during X-ray exposure.

System Does Not Initiate an Exposure, without Motion

This evaluation presumes that the panoramic X-ray device is in the *Ready for imaging* position and the *Ready* indicator on the operator panel is green.

1. Panoramic scans are initiated by the exposure switch (30-A2040) or the remote exposure station (30-A2044). The system has two identical input connectors for exposure release on the back of the vertical column. It is permissible to connect the exposure switch into the other connector and test the functionality. It is also advisable to perform an electrical continuity test on the switch to eliminate the presence of open circuits.
2. If the exposure switch is determined to be in working order, inspect the condition of the exposure switch connector on the rear column and the cable, which ultimately lead to the J6 connector on the RTC (60-08008).
3. System operation can be further determined from this point by reviewing the message listed in the Message Center (reference section “*Message Center*” on page 28).
4. Check to confirm the presence of jumpers on positions 1-2 and 3-4 of J7 on the RTC (or 2-3, if two exposure switches are being used in series).

Exposure Possible, without Motion

1. This condition is monitored by the operator panel. Error codes related to movement are classified as “*Device Controller Errors / 101*”. The complete error message can be viewed by accessing the Message Center on the operator panel (reference section “*Message Center*” on page 28). Based on this information, the specific cause of the malfunction may be traced.
2. Contact technical support for guidance once the complete error message is known.

Images Too Light

1. Underexposed images can occur for several different reasons. Before detailed troubleshooting begins, it would be expedient to verify the selected radiographic technique factors and the image filter settings in the image management program.
2. If the problem persists, review the system for error messages pertaining to the X-ray source, such as kV or mA too high or too low. In such cases, it will be necessary to replace the X-ray source.

3. If no error messages related to the X-ray source are present, use the operator panel *Service* screen functions to verify collimator alignment. This process will demonstrate placement of the X-ray tube central ray, the collimator shutters, and the position of the X-ray sensor.
4. Optionally, if the proper equipment is available, measure the dose and the kV of the X-ray output produced by the X-ray source. Replace the X-ray source if the device does not meet its specification.
5. If the collimator verification is successful and the X-ray source output is adequate, it will be necessary to replace the X-ray sensor.

Images Too Dark

1. Overexposed images can occur for several different reasons. Before detailed troubleshooting begins, it would be expedient to verify the selected radiographic technique factors and the image filter settings in the image management program.
2. If the problem persists, review the system for error messages pertaining to the X-ray source, such as kV or mA too high or too low. In such cases, it will be necessary to replace the X-ray source.
3. Optionally, if the proper equipment is available, measure the dose and the kV of the X-ray output produced by the X-ray source. Replace the X-ray source if the device does not meet its specification.
4. If no error messages related to the X-ray control unit are present and the X-ray source output is adequate, it will be necessary to replace the X-ray sensor.

Poor Image Sharpness

1. Image sharpness is generally a function of image manipulation software. Verify the image filter settings in the image management program and the selected radiographic technique factors to verify proper operation.
2. Secondarily, sharpness will be compromised with patient movement. During examination, remind the patient to remain motionless and, if possible, suspend respiration.
3. In rare cases, the condition of the X-ray tube target may contribute to poor image sharpness. In this case, it will be necessary to replace the X-ray source.

Poor Image Contrast

1. Image contrast is generally a function of image manipulation software. Verify the image filter settings in the image management program.
2. The selected tube voltage (kV) in the radiographic technique will also control image contrast. Lower kV settings will produce images with more black and white with less shades of grey; higher kV will produce images with less black and white and more shades of grey.
3. If the problem persists, review the system for error messages pertaining to the X-ray source, such as kV too high or too low. In such cases, it will be necessary to replace the X-ray source.

Poor Image Brightness

1. Image brightness is generally a function of image manipulation software. Verify the image filter settings in the image management program.
2. The selected tube current (mA) in the radiographic technique will also control image brightness. Lower mA settings will produce images with less black and more white; higher mA will produce images with more black and grey.

3. If the problem persists, review the system for error messages pertaining to the X-ray source, such as mA too high or too low. In such cases, it will be necessary to replace the X-ray source.

Loss of Image Quality in Area of the Spine

1. Image informational quantity and quality is generally a function of image manipulation software. Verify the image filter settings in the image management program.
2. Insufficient dosage in the spine area will contribute to loss of details in that area of the image. Check the selected technique factors (mA and kV) for appropriateness.
3. If the problem persists, review the system for error messages pertaining to the X-ray source, such as kV too high or too low. In such cases, it will be necessary to replace the X-ray source.

Unacceptable Phantom Image or Consistent Patient Misalignment in the Image

This condition is caused by mechanical misalignment of the imaging and positioning components of the device. Perform mechanical alignments as outlined in the alignment and calibration sections of this manual related to the primary collimator and X-ray source, lasers, C-arm, overhead arm, X-ray sensor, and patient positioning table.

Sensor Failure

X-ray Sensor Is Not Detected

1. With the system in the *ON* condition, disconnect and then reconnect the X-ray sensor (60-A1010) on the panoramic X-ray device. It will take approximately 60 s for the sensor to restart and to be recognized.
2. If the condition persists, inspect floating board (60-08010). Verify the position of the SW1 is set properly for the panoramic and cephalometric sensor position. Correct the switch position if necessary.
3. Inspect the sensor attachment. Ensure that the sensor inserts completely without noticeable space between the sensor and the sensor support casting. Adjust positioning pins 60-M0038 and 60-M0039 if necessary.
4. Inspect the network connection at the overhead arm. Bypass the C-arm cable with known functioning network cable to help troubleshoot the issue.
5. X-ray sensor signals exit the PoE switch at one of the four right hand Ethernet ports named to correspond to the sensor type, pass through the patient table. Bypass the in-machine cables with known functioning network cable to help troubleshoot the issue.
6. Continued lack of communication will require the replacement of the X-ray sensor.

Indicators Failure

Lasers Do Not Turn On or Do Not Turn Off

1. All four positioning lasers are activated by the membrane switch (60-08068) mounted on the patient table. The signal is conducted to the RTC (60-08008).
2. The activation signal arrives from the membrane switch on connector J24. The signal is processed by the RTC and provides parallel 5 V outputs on J13 (for the median or midsagittal line), J14 (for the Frankfort plane), J16 (for the left cuspid), and J17 (for the right cuspid).
3. Verify the DC supply voltage of 24 V at J22. Replace the RTC if necessary.

Inoperative Audible X-ray Indicator

Replace the X-ray source or RTC (60-08008) depending from which indicator is not operational.

Inoperative Audible Motion Indicator

Replace the RTC (60-08008) and reload the calibration data on the RTC as outlined in this manual.

Inoperative Visual X-ray Indicator

Replace the RTC (60-08008) and reload the calibration data on the RTC as outlined in this manual.

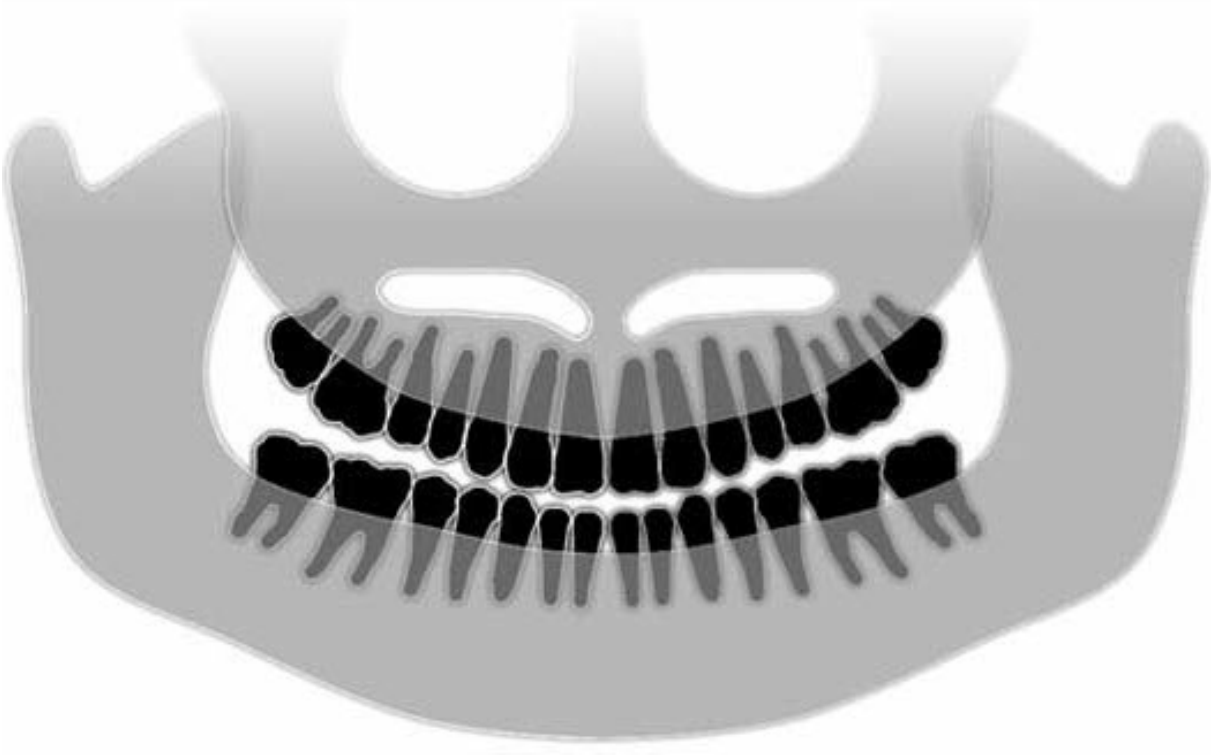
5 Troubleshooting Image Quality

In this Chapter

Characteristics of a Quality Image

A quality panoramic image will look like the following image.

Correct image

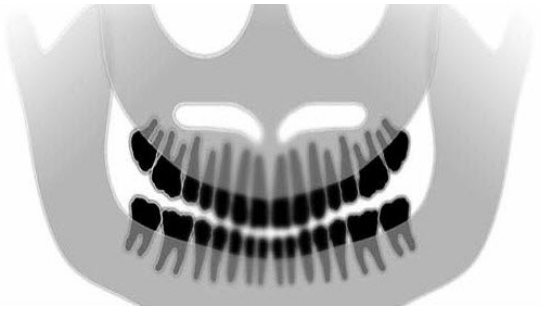
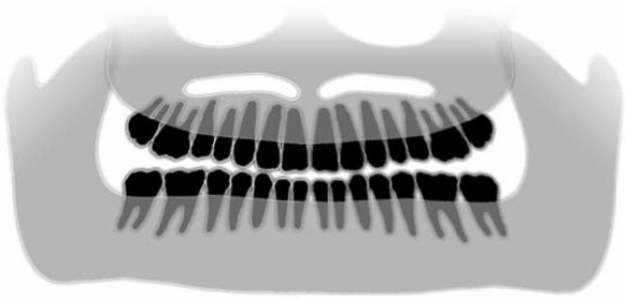
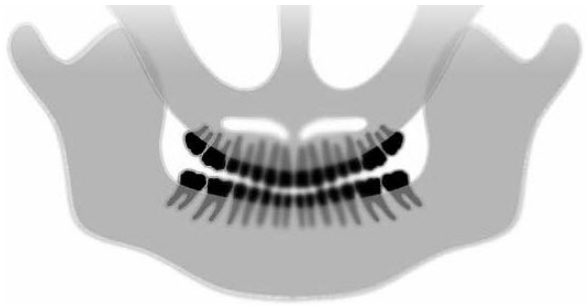
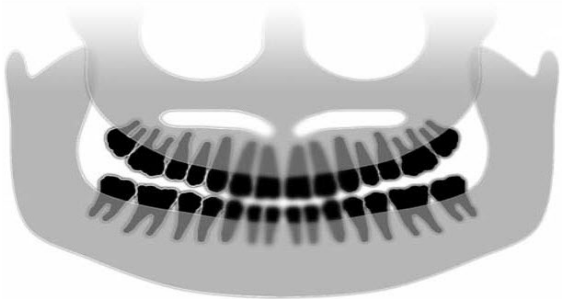


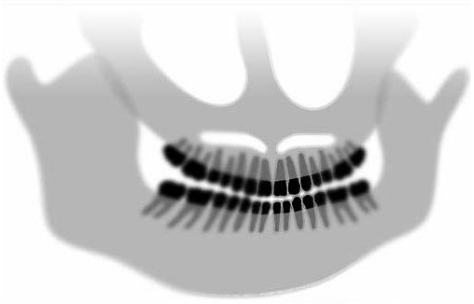
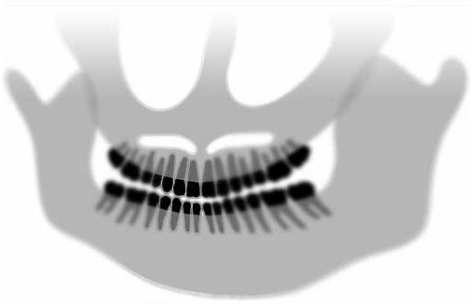
A quality image has the following characteristics:

- Symmetry of structures about the midline.
- Slight downward tip of the occlusal plane or smiling appearance.
- Good density, visibility, and sharpness of all structures.
- Spine and ramus ghost artifacts should be minimal.

Typical Problems and Their Causes

The table that follows offers examples of problem images, their characteristics, and steps to take to resolve the problem

Problem Images	Characteristics and Solutions
	Identifying problem characteristics: • Occlusal plane “smile” opens upward. Cause for the problem: Patient’s head is tilted down. Resolving the problem: Use the Frankfort plane laser to align the horizontal tilt of the patient’s head.
	Identifying problem characteristics: • Occlusal plane “smile” opens down. • Anterior teeth are above posterior. Cause for the problem: Patient’s head is tilted upward. Resolving the problem: Use the Frankfort plane laser to align the horizontal tilt of the patient’s head.
	Identifying problem characteristics: • Anterior teeth are narrow and blurred. • Significant spinal image. Cause for the problem: Patient is positioned too far forward. Resolving the problem: Guide the patient to place firmly the anterior teeth between the ridges of the bite guide and align the bicuspid teeth to the leading edge of the corresponding canine teeth.
	Identifying problem characteristics: • Anterior teeth are large and blurred. • Condyles may be cut off. Cause for the problem: Patient is positioned too far to the rear. Resolving the problem: Guide the patient to place firmly the anterior teeth between the ridges of the bite guide and align the bicuspid teeth to the leading edge of the corresponding canine teeth.

Problem Images	Characteristics and Solutions
	Identifying problem characteristics: • Unequal magnification from right to left side. • Patient's right side is too large. Cause for the problem: Patient's head is rotated to the right. Resolving the problem: Align the patient ensuring that the bite guide is centered on incisors and the positioning wands are in contact with patient's head. Confirm with median (midsagittal) laser.
	Identifying problem characteristics: • Unequal magnification from left to right side. • Patient's left side is too large. Cause for the problem: Patient's head is rotated to the left. Resolving the problem: Align the patient ensuring that the bite guide is centered on incisors and the positioning wands are in contact with patient's head. Confirm with median (midsagittal) laser.

Checking Image Quality

Midmark offers an image quality phantom that simulates the position of average human teeth roots, and markers allow you to check the position of the focal trough. Take an X-ray exposure with that phantom and make measurements on the image according the following procedure.

Install the Image Phantom

The Progeny Vantage® panoramic device is designed so that the chin rest accessory can easily be replaced with the image phantom.

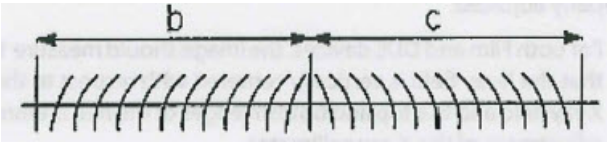
9. To install the image phantom, lift the chin rest from the chin rest hole on the patient positioning table.
4. Set the image phantom in the chin rest hole.

Image Verification Procedure

10. Install ImageJ software that is downloadable from http://imagej.nih.gov/ij/.
11. Turn on the power supply for the Progeny Vantage®.
12. Start ImageJ software.
5. Connect to the Progeny Vantage® through the TWAIN interface by using command TWAIN import in ImageJ.

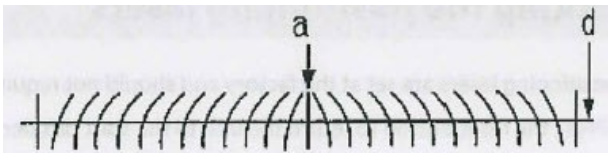
6. Mount the copper filter on the sensor to cover the panoramic active area of the sensor marked on the X-ray sensor enclosure as shown on the picture below.

7. Select technique factors of 68 kV and 8 mA.
8. Tap on the *Ready for imaging* button to move the C-arm to Patient entry position and the indicator become yellow. Tap again the *Ready for imaging* button to move the C-arm to Ready for imaging position.
9. When the status indicator turns green, press and hold down the exposure key to make an X-ray exposure until the X-ray indicators finish and the device returns to the Patient exit position.
10. Tap on *OK* on the image preview screen.
11. Click on the diskette on the TWAIN screen and save as a TIFF file to a temporary folder.
12. Open the image in Image J.
13. Select *Image* | *Properties* from the menu. Make sure the ImageJ units are set to mm, and the pixel size is set to 0.096 mm width and height. Click *OK*.
14. Using the line tool, draw a line between the following features in the image. After each line, press simultaneously keys *Ctrl-M*:
    - Using the "*Straight*" selection function, measure the width of the image from the vertical line adjacent to the *R* to the vertical line adjacent to the *L*. The *b* + *c* distance should be 156 mm ± 6 mm.

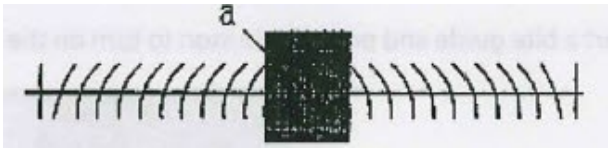


    - Using the "*Straight*" selection function, measure the width of the image from the vertical line adjacent to the *R* to the centerline. The *b* distance should be 78 mm ± 3 mm.
    - Using the "*Straight*" selection function, measure the width of the image from the vertical line adjacent to the *L* to the centerline. The *c* distance should be within 3 mm of the distance obtained in the previous step, i.e. *b* = *c* ± 3 mm.
    - Using the "*Point*" selection function, click on the lowest point of the centerline then, hold *Shift* key from the keyboard and click with the left mouse button on the highest point of the horizontal centerline on the *L* or *R*. Distance should not be more than 6 mm.

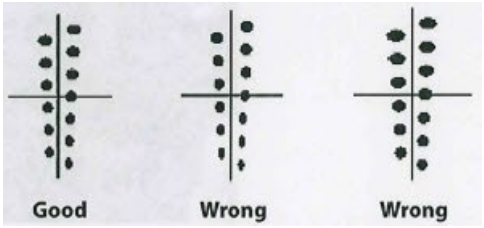
- Using the "*Straight*" selection function, measure the angle of vertical line adjacent to the *R*. Angle should be vertical within 6°.
- Using the "*Straight*" selection function, measure the angle of the vertical line adjacent to the *L*. Angle should be vertical within 6°.
- Using the "*Straight*" selection function, measure the angle of the central vertical line. Angle should be vertical within 4°.



- Using the "*Straight*" selection function, measure the distance from the left edge of the image to the central line. Distance should be 150 mm ± 3 mm.
- Verify that the darkened area is centered with respect to the central vertical line with a tolerance of ± 4 mm.



15. Examine the solid circles adjacent to the central line:
    - Circles at and next on either side of the horizontal centerline should be round.
    - Circles at the highest extent of the vertical centerline should be stretched sideways.
    - Circles at the lowest extent of the vertical centerline should be narrowed sideways.



16. If any of the above conditions are not met, re-align the machine.

6 Overview of Service Tasks

In this Chapter

Service Screen Overview

The *Service* screen is home to the *Troubleshooting* options for the Progeny Vantage® panoramic X-ray system. From the *Service* screen, you can access, test, and calibrate the various Progeny Vantage® system components.

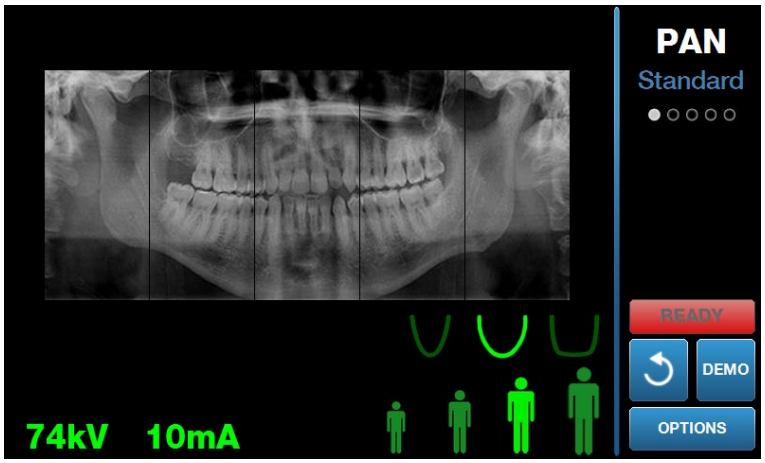
This section explains how to open the *Service* screen and identifies the maintenance functions and the device components that can be accessed from this screen.

The *Service* screen is password protected. Only trained service technician and support personnel should access it.

Opening and Using the Service Screen

The home screen on the operator panel is the *Acquisition Setup* screen. The *Acquisition Setup* screen provides access to the *Service* screen. The procedure below explains how to access the *Service* screen from the *Acquisition Setup* screen.

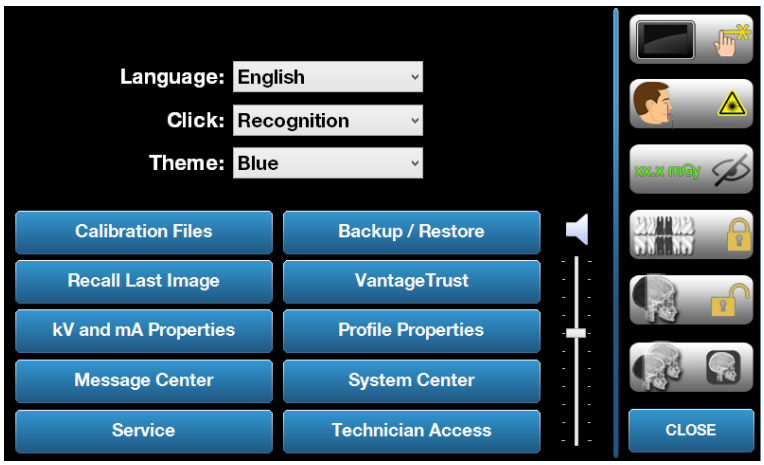
Acquisition Setup screen



Opening the Service Screen

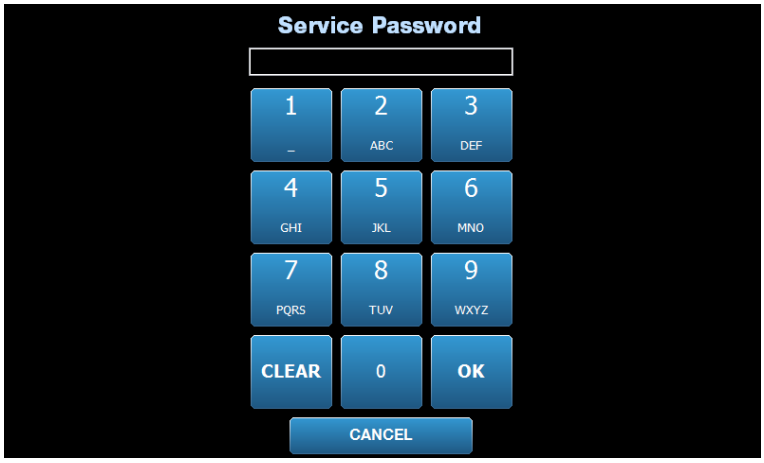
- On the *Acquisition Setup* screen, tap the *Options* button.

Options screen



17. On the *Options* screen, tap the *Service* button.

Service Password screen



18. On the *Service Password* screen, enter the password (77469) and tap the *OK* button. The *Service* screen appears if the correct password was entered.

Service screen

Using the Service Screen

The *Service* screen provides maintenance and Troubleshooting functions for the panoramic X-ray device. The *Service* screen is interactive. Tapping an icon initiates a specific task, as described in the Icon Tasks table below.

Icon tasks

Function	Icon	Description
Shipping		Select the *Shipping* function to return the Progeny Vantage® device to its original, full down shipping position.
Network Settings		Select the *Network Settings* function to view information about the IP address, TCP/UDP, and Port number for the sensor, RTC, and column computer.
Update		Select the *Update* function to update the Progeny Vantage® software.
Cycle Test		Select the *Cycle Test* function to run a short or open-ended mechanical cycle test. Separate test are available for the panoramic and cephalometric functionality.
Information		Select the *Information* function to display the error logs, *System Center*, or *Message Center*.
Left or Right		Select the *Left or Right* function to set the direction for approaching and exiting the panoramic X-ray device.

Tapping a Progeny Vantage® component displays a list of tasks, as illustrated below for the tubehead. Each task may lead to additional tasks.

Component Task – Tubehead

Component tasks

Component	Description
Telescoping column	Tap the telescoping column to: • Check the column motor functionality. • Move the column motor to full down position. • Move the column motor to full up position.
Operator panel	Tap the operator panel to verify the operation of the touch screen.
Patient table	Tap the patient table to: • Align the Cuspid laser. • Test the operation of the positioning controls (column up/down, open/close wands, laser lights on/off). • Check the functioning of the wands and motor.
X-ray sensor	Tap the X-ray sensor to initiate a calibration or alignment.
Tubehead	Tap the tubehead to: • Calibrate the height and width of the X-ray beam. • Adjust the screw for the angle of the beam. • Check the collimator X-motor functionality. • Check the collimator Y-motor functionality. • Verify the collimator calibration. • Preheat calibration.
Overhead arm	Tap the overhead arm to: • To align manually the zero position of the overhead arm (Y-axis). • Check the motor functionality for the Y-axis. • To align manually the zero position of the linear drive (X-axis). • Check the motor functionality for the X-axis. • To align manually the zero position of the C-arm (R-axis). • Check the motor functionality for the R-axis.

Cycle Test

The *Cycle Test* function moves the panoramic X-ray device through all mechanical motions performed while taking an image. After any service or maintenance, run the *Life Test* to verify all panoramic or cephalometric X-ray device motions.

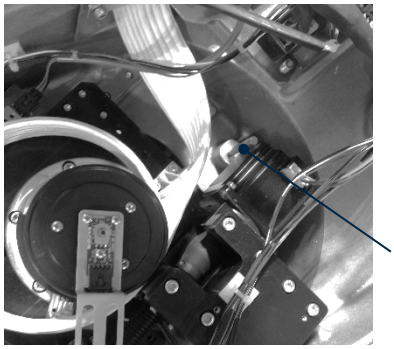
1. Start the panoramic X-ray device and wait for the *Image Acquisition* screen to appear
2. Tap *Options* button.
3. Tap the *Service* button.
4. Tap the *System Cycle Test* button.
5. Make sure the *Normal* indicator is lit.
6. Select *Short*.
7. During testing, monitor the device for unusual noises or other behavior.
8. After 50 cycles have finished the device will stop.

7 C-arm

In this Chapter

C-arm Alignment

1. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task.
2. Select the X-axis.
3. Tap *Move to Zero* and wait for movement to stop.
4. When movement has stopped, insert the pin in the zero position hole, confirming that it inserts fully. If it does not insert fully, remove the pin and then perform the alignment procedure provided in section "*X-axis Alignment*" on page 82 and restart this procedure.
5. On the operator panel, tap *Finish* to return to the *Axis Service and Diagnostics* task.
6. Select the *R* axis.
7. Manually move the overhead arm until the medium alignment pin (part # 60-T0029) fits in the zero position hole, as shown in the picture below.



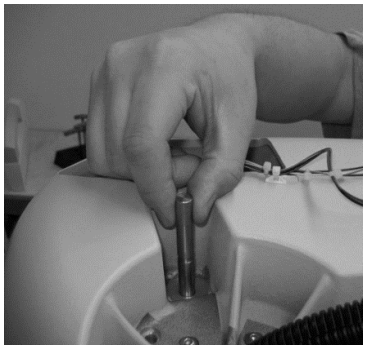
8. Remove the pin.
9. On the operator panel, tap *Set Alignment*.
10. Wait for the panoramic X-ray device to stop moving.
11. On the operator panel, tap *Move to Home* and wait for the movement to stop.
12. On the operator panel, tap *Move to Zero* and wait for movement to stop.
13. When movement has stopped, insert the pin in the zero position hole, confirming that it inserts fully. If the pin does not insert fully, go back to step 3.
14. Remove the pin.
15. On the operator panel, tap *Finish* twice to return to the *Service* screen.

8 Overhead Arm

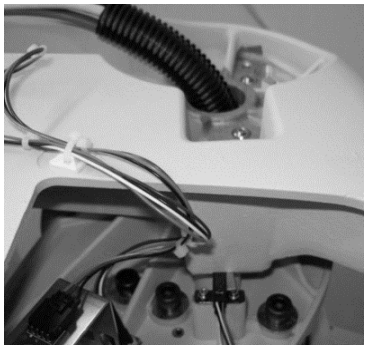
In this Chapter

Y-axis Alignment

1. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task.
2. Select the *Y*-axis.
3. Manually move the overhead arm until the large alignment pin (part # 60-T0028) fits in the zero position hole, as shown in the picture below.



4. Remove the pin.
5. On the operator panel, tap *Set Alignment*.
6. Wait for the panoramic X-ray device to stop moving.
7. On the operator panel, tap *Move to Home* and wait for the movement to stop.
8. Confirm that the flag is centered in the optical sensor, as shown in the picture below.

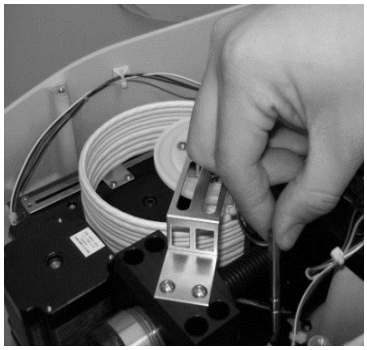


9. On the operator panel, tap *Move to Zero* and wait for movement to stop.
10. When movement has stopped, insert the pin in the zero position hole, confirming that it inserts fully. If the pin does not insert fully, go back to step 3.

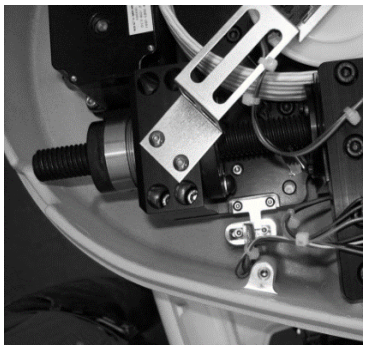
11. Remove the pin.
12. On the operator panel, tap *Finish* twice to return to the *Service* screen.

X-axis Alignment

1. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task.
2. Select the *X*-axis.
3. Manually move the overhead arm until the medium alignment pin (part # 60-T0029) fits in the zero position hole, as shown in the picture below. The overhead arm can be moved using the column keys or by turnin`g the screw manually.



4. Remove the pin.
5. On the operator panel, tap *Set Alignment*.
6. Wait for the panoramic X-ray device to stop moving.
7. On the operator panel, tap *Move to Home* and wait for the movement to stop.
8. Confirm that the flag is centered in the optical sensor, as shown in the picture below



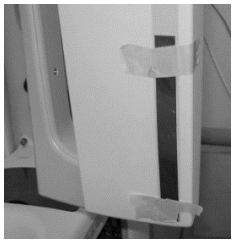
9. On the operator panel, tap *Move to Zero* and wait for movement to stop.
10. When movement has stopped, insert the pin in the zero position hole, confirming that it inserts fully. If the pin does not insert fully, go back to step 3.
11. Remove the pin.
12. On the operator panel, tap Finish twice to return to the Service screen.

9 Collimator and X-ray Source

In this Chapter

Collimator Calibration

1. Mount the copper filter on the sensor to cover the panoramic active area of the sensor marked on the X-ray sensor enclosure as shown on the picture below.



13. In the *Service* screen, tap on the tubehead and select the *Calibrate Collimator* task.
14. Calibrate axis.
15. Wait until the status line asks you to make an exposure.
16. Wait until the *Moving* status indicator goes back to grey.
17. Hold down the exposure switch until the cooling indicator lights or the audible X-ray indicator finishes.
18. The status line will indicate the necessary angular adjustments to the collimator. Using a hex key, loosen the two screws holding the collimator in place and tighten them until they just contact the collimator body.
19. Turn the angle adjustment screw the amount indicated in the status line.
20. Tighten the two screws holding the collimator in place.
21. Click on *Continue*.
22. When the cooling indicator clears, the status line will ask for an exposure.
23. Wait until the *Moving* status indicator goes back to grey.
24. Hold down the exposure switch until the cooling indicator lights or the audible X-ray indicator finishes.
25. If the angular adjustment was sufficient, the procedure will move to the next step. If not, the status line will indicate the necessary adjustment. Repeat steps 2 through 12 until this happens.
26. Wait until the status line asks you to make an exposure.
27. Wait until the *Moving* status indicator goes back to grey.

28. Hold down the exposure switch until the cooling indicator lights or the audible X-ray indicator finishes.
29. If the calibration is successful, the status line will indicate this. If not, repeat steps 2 through 16.
30. Make one final exposure to verify the calibration. If not, repeat steps 2 through 16. The angle needs to be under 0.25.
31. Wait until the status line asks you to make an exposure.
32. Wait until the *Moving* status indicator goes back to grey.
33. Hold down the exposure switch until the cooling indicator lights or the audible X-ray indicator finishes.
34. The status line will indicate successful verification.
35. Click on *Finish* two times to exit the procedure.

Beam Alignment

1. Mount the tubehead alignment laser from the service kit on the tubehead in place of the collimator, as shown in the picture below.

2. Mount the beam alignment fixture to the underside of the C-arm, as shown in the picture below.

3. Connect the laser power.
4. Loosen the four bolts supporting the tubehead.
5. Adjust the tubehead by rotating/sliding the tubehead until the laser beam passes through the slit in the beam alignment fixture.
6. Tighten the four bolts supporting the tubehead making sure the laser line stays in position.
7. Remove the beam alignment fixture from the Progeny Vantage® and disconnect the laser power.

10 Telescoping Column

In this Chapter

Column Optical Limit Switch Function

1. On the *Service* screen, select the column and perform the *Service Column* task.
2. Use the positioning controls on the panoramic X-ray device to move the telescoping column up away from lower end stop.
3. On the operator panel, tap *Move to Upper Limit*.
4. Use the positioning controls on the panoramic X-ray device to move the telescoping column down approximately 5 cm (2 in.).
5. On the operator panel, tap *Move to Lower Limit*.
6. Click *Finish*.
7. Click *Exit*.

11 Lasers

In this Chapter

Align Lasers

Initial Procedure (All Lasers)

1. Remove the cover from the patient positioning table, if it has been installed.
2. Assemble the upper cover to the column, connecting the Frankfort Plane laser to the appropriate terminal on the RTC.
3. Place the laser alignment fixture on the positioning platform by fitting the two pins in the screw holes close to the grips and the thumbscrew at the outermost end, as shown in the picture below.

4. Press the laser button to illuminate the lasers.

Frankfort Plane Laser

1. Move the Frankfort Plan slider until the laser contacts the horizontal line.
2. If the laser does not align with the mark on the fixture, remove the cover and loosen the screw on the side of the Frankfort Plane transit that retains the laser.
3. Rotate the laser and replace the cover onto the column.
4. Repeat from step 3 until laser aligns.
5. Remove cover and tighten screw.
6. Check alignment one final time.

Median (midsagittal) Laser

1. If the laser does not align with the mark on the fixture, loosen the screws mounting the bracket to the column and slide the bracket from side to side.
2. If necessary, loosen the screw clamping the laser to the bracket and move the laser into alignment.

Cuspid Lasers

1. Move the Cuspid laser transit until the detent in the sensing pot is felt (center of movement).
2. If the lasers do not align with the mark on the fixture, loosen the screw holding the laser/mirror assembly to the transit and pivot the laser into alignment. Repeat with the other Cuspid laser.

Final Procedure (All Lasers)

Remove the alignment fixture and reassemble the patient positioning table.

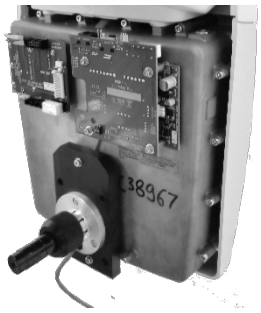
12 X-ray Sensors

In this Chapter

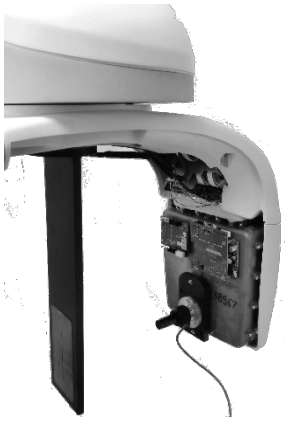
Align the X-ray Sensor

Part 1

1. Mount the tubehead alignment laser from the service kit on the tubehead in place of the collimator, as shown in the picture below.



2. Mount the beam alignment fixture to the underside of the C-arm, as shown in the picture below.



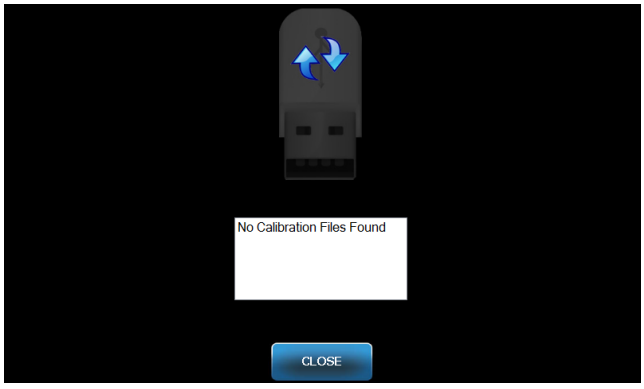
3. Connect the laser power.
4. Loosen the two bolts supporting the sensor mount casting.
5. Align the vertical graphic line on the sensor to the center of the beam by rotating the adjustment screw.
6. Tighten the two mount screws, making sure the laser line stays in position.
7. Remove the beam alignment fixture from the Progeny Vantage® and disconnect the laser power.

Part 2

After the collimator has been calibrated, perform this procedure for fine sensor alignment.

1. Plug-in and power-up the panoramic X-ray device.
2. Make sure the panoramic X-ray device shows connected in the interface screen.
3. On the operator panel, enter open the *Service* screen.
4. Open the Progeny TWAIN application.
5. Mount the copper filter on the sensor to cover the panoramic active area of the sensor marked on the X-ray sensor enclosure as shown on the picture below.

6. Mount the beam alignment fixture to the underside of the C-arm.
7. Press the *Options* button on the operator panel. Press *Calibration Files* button and the calibration files screen will open.



8. Put the sensor on the unit.
9. Connect the USB drive with the sensor calibration files to the USB port on the column computer as shown on the picture below.

10. Wait for the calibration files to be detected.
11. Click on the green arrow to transfer the calibration file.
12. Click on the *Close* button to close the calibration file dialog.
13. Press the *Service* button to enter in the service mode. Service code is 77469.
14. Select sensor.
15. On the *Service* screen, tap the sensor and perform the *Perform Alignment* task.
16. Select *Adjust Sensor*.
17. When the collimator stops moving, or when prompted on the message box, make an exposure.
18. If failure occurs, the beam image is not centered in the sensor. Loosen the two mounting screws and turn the adjusting screw as instructed by the software. Then tighten mounting screws and select *Continue*.
19. When successful, select *Continue*, and then the program will automatically go to verify alignment.
20. Make an exposure when message box says to.
21. When successful select *Finish*.
22. Remove the beam alignment fixture.

13 Patient Positioning Wands

In this Chapter

Set Wand Open Position

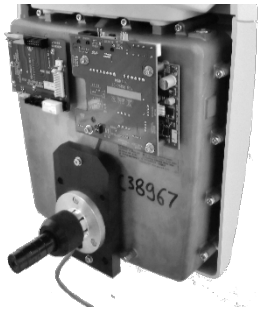
1. Install wands on positioning platform shafts, making sure the keying features align.
2. Press the positioning control until the wands are at their furthermost apart position.
3. Measure the distance between the wand tips.
4. If the distance is not equal to 150 mm (6 in.), loosen the screws holding the optical sensor. Slide the optical sensor in the appropriate direction.
5. Tighten the optical sensor screws and press the positioning control until the wands are at their furthermost apart position.
6. Repeat steps from step 3 to 5 until the wand tip distance is 150 mm (6 in.).
7. Turn on the lasers. Place a ruler across the tops of the wands. The median (midsagittal) laser must be equidistant from each wand within 1 mm.
8. If the median (midsagittal) laser is not equidistant, then bend the link wand down to adjust the table position.
9. Reassemble the patient positioning table cover.

14 Patient Positioning Table

In this Chapter

Patient Positioning Table Alignment

1. Mount the tubehead alignment laser from the service kit on the tubehead in place of the collimator, as shown in the picture below.



2. On the *Service* screen, select the overhead arm and perform the *Axis Service and Diagnostics* task.
3. Select the *Y*-axis.
4. Tap *Move to Table*.
5. Connect the laser power.
6. Remove the cover assembly on the patient positioning table platform.
7. Mount the laser alignment fixture on the patient positioning table platform.
8. The tubehead laser should fall on the back edge of the Cuspid laser alignment plate.
9. Loosen the four bolts holding the table in place and shift the table left or right as needed.
10. If the shifting of the table is unable to align the laser with the fixture, use the positioning controls to move the overhead until the laser is aligned.
11. On the operator panel, tap *Calibrate Table*.
12. Tighten up the four bolts holding the table in place.
13. Remove tubehead alignment laser and replace collimator.
14. Repeat for X-axis, omitting the loosening of bolts etc.

15 Operational Readiness

In this Chapter

System Function Checklist

Perform the tasks on this checklist to verify electrical, mechanical, and software readiness of the Progeny Vantage® panoramic X-ray system.

System readiness checklist

☑	Task Area	Description
	Floor and Wall	Ensure that the wall support is adequate and that the system is securely attached to the wall and floor. For freestanding units, the structure must be firmly attached to the floor.
	Mechanical Safety	Inspect the structure for mechanical integrity of the telescoping column. Inspect the condition of the main drive lead screw, bearings, overhead attachment and pivot points, C-arm attachment and pivot points, and the patient table attachment.
	Electrical Safety	Verify integrity of the power line and its connections, and the connection to protective earth (ground).
	Labels	Ensure that all certified components bear labels that include the model and serial number, date of manufacture, and a statement of certification.
	Diagnostic Source Assembly	Under the tubehead cover, evaluate the condition of the following items: collimator attachment, collimator blade mechanism, electrical connections, and mechanical attachment of the tubehead and collimator to the structure. Check for oil leaks.
	Power Switch	Verify that the switch is working and that the operator panel illuminates when the power switch is in the ON position.
	Operator Panel	A few seconds after power up, the splash screen should appear. The panel must switch to the main screen after no more than 60 s. The panel functions must respond to interrogation.
	Movement Control Switches	Verify wand positioning and column vertical drive.
	Laser Operation and alignment	The median (midsagittal), frankfort plane, and cuspid lasers operate on demand by way of the activation switches on the patient table. Verify alignment by use of the laser test fixtures.
	Exposure Switch	Verify that the exposure switch is functioning properly. To make an exposure, follow the procedures outlined in this manual.
	Exposure Indicators	Make several exposures. Verify that the visual radiation indicator illuminates and that the audible radiation indicator generates a tone.
	Premature Exposure Termination.	During an exposure, release the exposure switch before the normal end of the panoramic sweep. All movement must cease, the X-ray output must stop, and the visual and audible indicators must end.

☑	Task Area	Description
	Error Messages	During normal operation, the appearance of any error message must be investigated and corrected. Error messages may occur due to operator error or machine malfunction. Contact technical support with any questions.
	X-ray source Inspections	Perform complete panoramic trial exposures. Absence of error messages demonstrates proper generator operation.
	Beam alignment Verification	Verify alignment between X-ray source and image receptor.
	Sensor Operation	Perform a trial examination on the test phantom. Evaluate the outcome of this trial exam. Sufficient contrast, sharpness, and penetration must be evident in the image.
	Focal Trough Verification	Perform a trial examination on the test phantom. Evaluate the outcome of this trial exam. The focal trough must be located in the predicted position.
	User Information	The *User Guide* should remain in the possession of the primary system operator. Replacement copies are available through technical support.
	Imaging Software	Make sure the imaging software is running and available.

Appendix A.
Operator Panel
Non-Service Menus

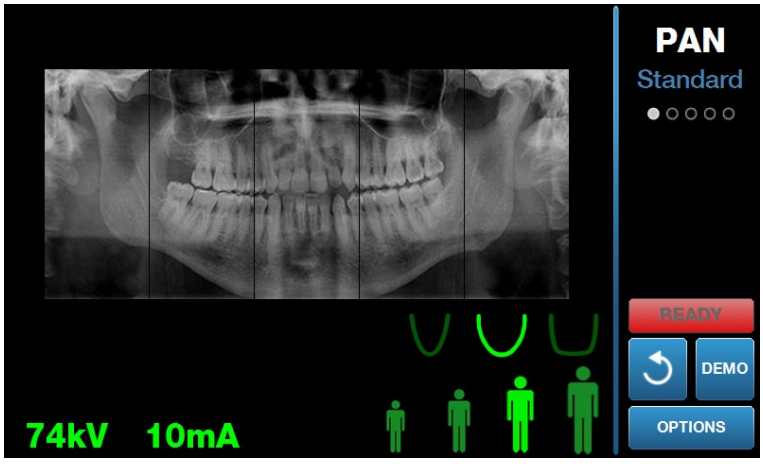
In this Chapter

Acquisition Setup Screen

The *Acquisition Setup* screen is the principal screen used to acquire an image. At the upper left corner is the patient name and dental office. The other information on this screen - the technique factors – is the information you customize for each patient's X-ray.

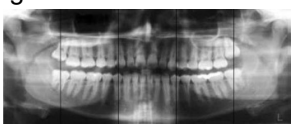
The technique factors define the intensity and duration of the X-ray. Technique factors include the settings of the projection type, segmentation, patient size, jaw size, and the tube voltage and current.

Acquisition Setup screen



The following table describes the information and functions on the *Acquisition Setup* screen. The order of the options in the table is not indicative of the entry order.

Options on the *Acquisition Setup* screen

Option	Description
Projection 	Five projections are available: Pan Standard, Pan Enhanced, Pan Bitewing, TMJ, and Ceph if cephalometric attachment is installed. Swipe left or right to change the projection.
Patient size 	The Progeny Vantage® System has four patient sizes, each with its own default kV and mA settings. The patient sizes are Child, Small Adult, Adult, and Large Adult. Adult is the default patient size.
Jaw Size 	The jaw size setting determines the form of the focal trough. The three sizes - narrow, normal, and wide -accommodate patients with different jaw shapes and sizes.
Segmentation 	By default, the Progeny Vantage® System images the entire jaw. You can use the segment panels to restrict the image to one or more contiguous segments. The segment panel is dark when unselected, and light when selected. For a TMJ projection type, the Progeny Vantage® automatically selects the outermost two segments and does not allow changes. For a Pan Enhanced projection type, the Progeny Vantage® automatically selects the innermost three segments, and does not allow changes. Swipe up or down to toggle the segments on or off.
kV and mA 	The tubehead voltage and current (kV and mA) that appear are the default tube voltage and current values for the selected patient size, as configured on the *Profile Properties* screen. The default values appear as green and change to yellow when a value is no longer the default value. You might see one value in green and the other in yellow, indicating that the yellow value is no longer the default value. This table shows the initial default values of the kV and mA settings.

Patient Size	Default Values	
	kV	mA
Child	66	6
Small adult	70	8
Adult	74	8
Large adult	78	10

To adjust, touch the displayed value and then adjust it by taping on the up or down arrows.

Ready for imaging 	Tapping on the *Ready for imaging* button moves the C-arm sequentially through imaging positions: *Patient entry*, *Ready for imaging*, and *Patient exit*. When you tap this button, the status indicator flashes *WAIT* to indicate a moving status while the Progeny Vantage® System moves to the ready position for image acquisition.
Demo 	The *Demo* button turns on a demo mode, which allows to execute the image acquisition procedures as it will normally execute with exception that no X-rays is emitted.

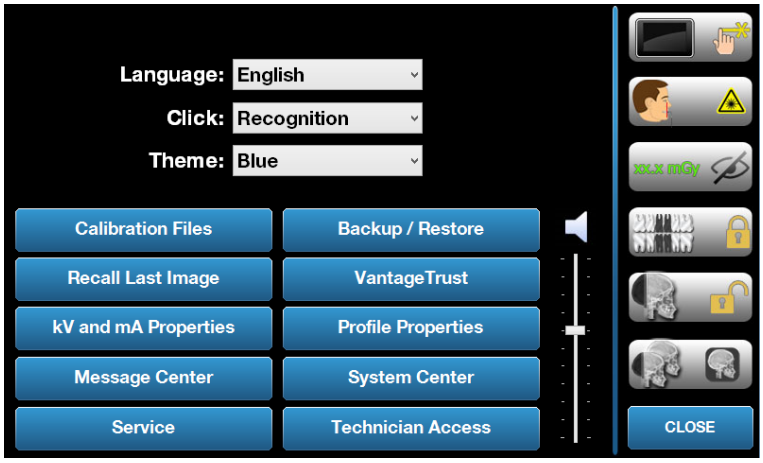
Option	Description
Options 	The *Options* button opens the *Options* window where you can configure the default values for the Progeny Vantage® System. For more information, see "*Options Screen*" on page 97.
Exposure Time  Cooldown Time 	This indicator displays the patient *Exposure Time*, in seconds. It appears when the unit is in *Ready for imaging* state. After an image acquisition, the *Exposure Time* indicator becomes a *Cool Down Time* indicator and displays the remaining cooldown time needed for the X-ray tubehead.
Est. Dose	To assist medical personnel and the patient to make informed decisions, the Progeny Vantage® displays an estimated dose for the selected image survey to be executed. The estimated dose is shown as Dose-Area Product (DAP) in SI units of $mGy \cdot cm^2$. The displayed value is calculated based on a model for the Progeny Vantage® X-ray performance and is not calibrated. **NOTICE**: Use the displayed DAP values only as guidance to the level of X-ray exposure before the actual irradiation. Do not use the estimated DAP value when a precise dose reading is expected. Instead, use calibrated equipment to measure the actual value of interest during the X-ray irradiation.
Status Indicator 	The status indicator has multiple appearances as listed below: • *Ready* in green – the device is Ready for imaging; • *Ready* in gray – the device is in the exit position; • *Ready* in yellow – the device is in the entry position; • *Ready* in red – the device is in an unknown position, as at initial power up, and moving to find the home position; • Flashing *Wait* – the device is in motion; • *Safe* – the device is busy checking components or is in transition to another screen. This state is temporary. If it lasts more than 5 min, restart the Progeny Vantage® System. • *Offline* – the link between the RTC and the column computer is not established. This state is temporary. If it lasts more than 5 min, restart the Progeny Vantage® System.

Options Screen

As delivered, the operator panel comes with default settings for images and is completely ready to use. The *Options* screen is used to change any of the default settings or configure differently the behavior of the operator panel. For example, you can use the *Options* screen to set the default technique factors (kV and mA) values for each patient size.

The *Options* screen is accessed through the *Options* button on the *Acquisition Setup* screen.

Options screen



The following table describes the information and functions of the *Options* screen.

Options on the *Options* screen

Option	Description
Backup and Restore	This button allows you to back up the system's configuration in the event of a system failure.
Calibration Files	This button allows you to load calibration files for the X-ray sensors.
Click	The dropdown menu lets you decide what type of sound is heard when you tap a button on the Operator panel. The options include standard Microsoft Windows™ sounds.
Language	The dropdown menu lets you select a language. English is the default language.
Audio Level	The slider button controls the volume of the *Click* sound. Moving the slider to the left makes the sound less audible; moving it to the right makes it more audible.
Recall Last Image	This button is used to retrieve and redisplay the most recent image acquired. The most recent image is always stored until another image is acquired, or until the Progeny Vantage® System is turned off.
kV and mA Properties	This button is used to set the minimum and maximum X-ray tube voltage and current (kV and mA).
Message Center	This button allows you to view interactively messages for specific components of the Progeny Vantage® Panoramic system.
Profile Properties	This button is used to set the default X-ray tube voltage and current (kV and mA) and the jaw size for each patient size.
System Center	This button provides access to information on the sensor type, serial number, and number of images taken since the last sensor controller reset.
Service icon	This button is used for device maintenance or servicing. It is password protected.
VantageTrust	This button lets you access the VantageTrust information for the system.

Option	Description
Slide On/Off 	This toggle button allows you to choose tap or sliding motion to select the projection and one or more segments on the segmentation panel. The button is circled in green when the slide selection is activated.
Cuspid Laser Warning 	This toggle button lets you choose whether you want to see the warning to use the cuspid laser before enter the imaging position.
Estimated Dose On/Off 	This toggle button is used to enable and disable the dose display.
Segment Lock 	This toggle button is used to either allow or disallow individual segment changes in pan mode.
Ceph Segment Lock 	This toggle button is used to either allow or disallow individual segment changes in cephalometric mode.
Ceph Full/Half Exposure 	This toggle button is used to change the default exposure for a cephalometric to a full or half exposure.

Recall Last Image

After an X-ray image has been acquired, or when you tap the *Recall Last Image* button on the *Options* screen, an *Image Preview* appears. This *Image Preview* remains on the screen of the operator panel until you tap the *OK* button. Be sure to verify that the image acquired is the one desired for the patient.

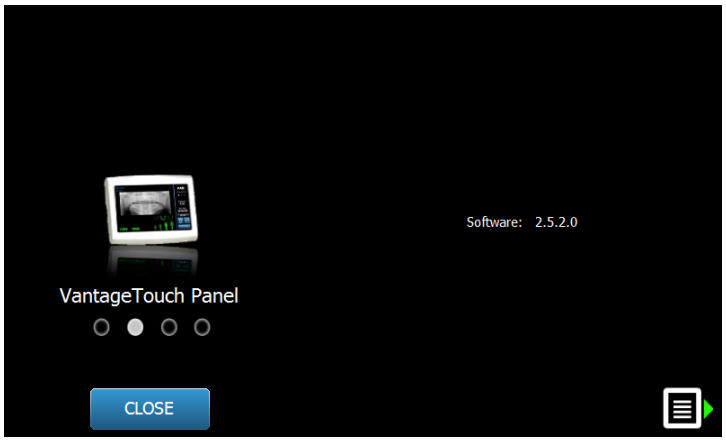
If you just powered on the Progeny Vantage® System, and you tap the *Recall Last Image* button, a non-diagnostic image may appear. This image may not be useful for diagnostic purposes.

Recall Last Image screen

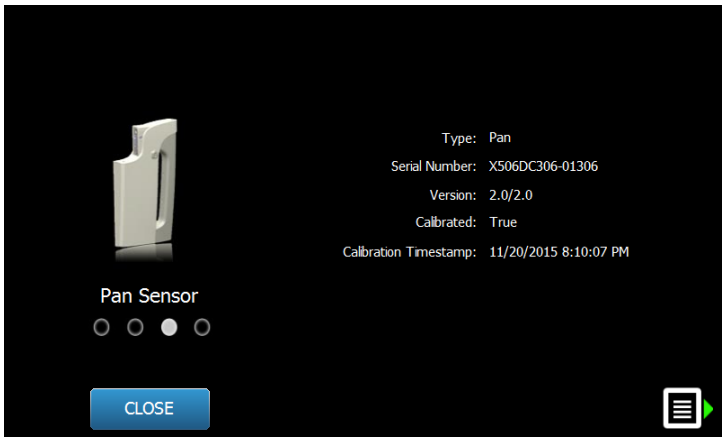
System Center

The *System Center* will allow access to screens that display system information. These screens are *VantageTouch Panel*, *Panoramic X-ray Sensor*, *Cephalometric X-ray Sensor*, and *Real Time Controller*. The information in these screens allows the user to verify system revision information and usage information. The information provided is shown in the following screen displays:

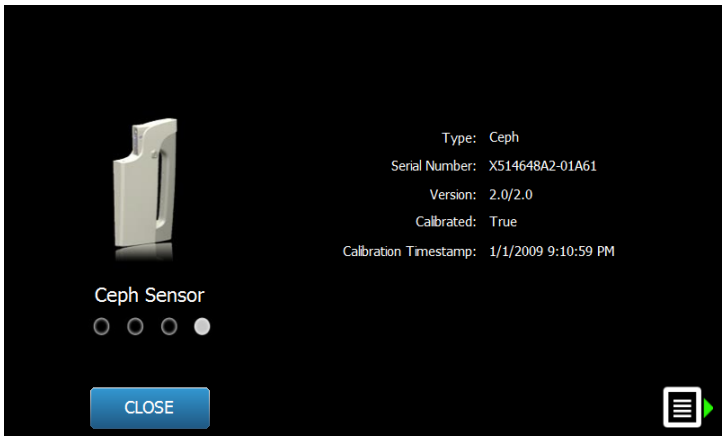
VantageTouch panel screen



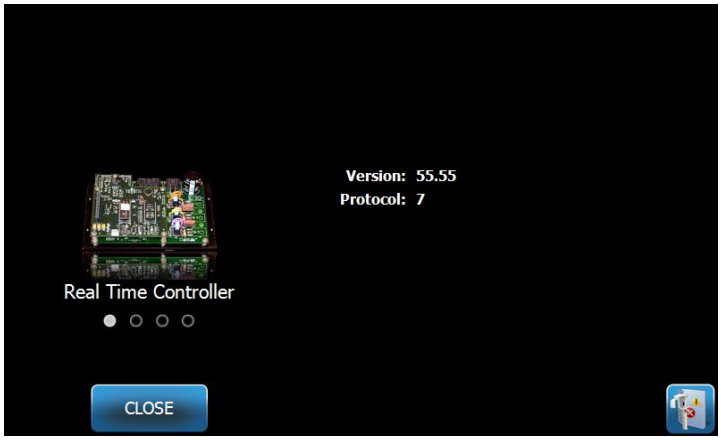
Panoramic X-ray sensor screen



Cephalometric X-ray sensor screen



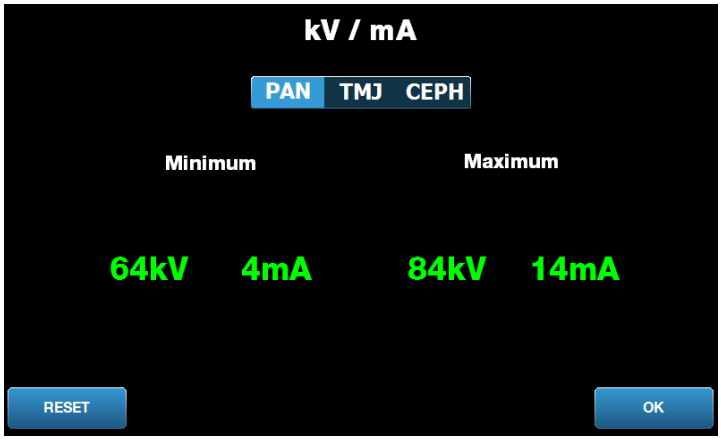
Real Time Controller screen



X-ray Voltage and Current Properties Screen

The property screen for the X-ray tube voltage and current (kV and mA) provides the user with the ability to limit the minimum and maximum tubehead voltage (kV) and current (mA) that can be selected for Pan, TMJ, and Ceph images on the operator panel. Tapping the *kV and mA Properties* button on the *Options* screen opens the technique factors properties screen.

kV and mA Properties Screen



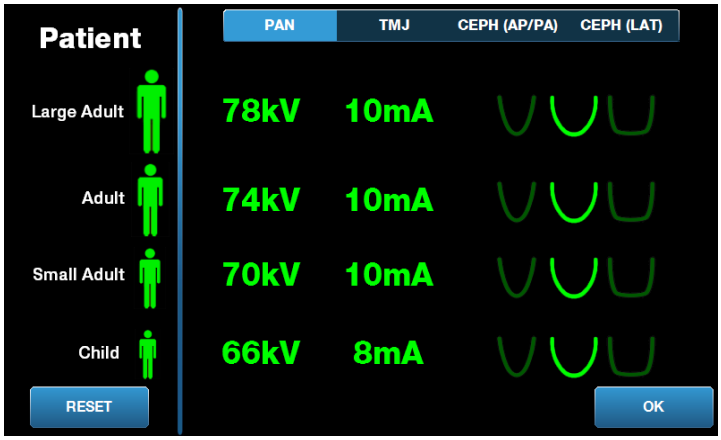
Profile Properties Screen

The operator panel comes with default values for each patient size and is completely ready for use. With the *Profile Properties* screen, you can modify these values. The default values appear when you select PAN, TMJ, or CEPH and a patient size on the *Acquisition Setup* screen.

For panoramic images, for each patient size, you can define the technique factors (kV and mA) and the jaw size. The kV and mA values must fall within the range already defined on the *kV and mA Properties* screen. For TMJ images, you can define the kV and mA peak values for each patient size. For cephalometric images, you can define the kV and mA peak values for each patient size.

When you tap *Profile Properties* on the *Options* screen, the *Profile Properties* screen opens.

Profile Properties screen



The following table describes the information on the *Profile Properties* screen.

Options on the *Profile Properties* screen

Option	Description
PAN/TMJ/CEPH	Select the type of image for which you are setting defaults.
Patient	All values are set for a specific patient size. This is where you select the patient size to edit.
kV and mA Values	Each patient size can have unique kV and mA values that will be used in image acquisition. These values can be adjusted for panoramic and TMJ projections.
Jaw Profile	For panoramic images, you can customize the patient size further by specifying a jaw size: Narrow, Normal, and Wide.

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