Section II Certification & Records

Flow Dental certifies that this equipment complies with applicable Regulations and Standards when assembled, checked, calibrated, and maintained in accordance with the instructions in this manual.

The installer is responsible for:

1. Installing the X-ray in accordance with the manufacturer’s instructions.
2. Checking the calibration of the machine and performing the calibration procedures when required.
3. Maintaining records of the location of the equipment.
   Use the Maintenance Record below for this purpose.
4. Providing the Installation, Operation and Maintenance Manual to the owner. The owner/purchaser is responsible for maintaining the manual for future reference.

This product complies with DHHS standards under the Radiation Control for Health and Safety Act of 1968 applicable at date of manufacture.

Tube Head Model No. ____________________________
Serial No. ____________________________
Cone Model No. ____________________________
Serial No. ____________________________
Control Panel Model No. ____________________________
Serial No. ____________________________

* Manufactured by Flow Dental, Deer Park, NY 11729

<table>
<thead>
<tr>
<th>Component</th>
<th>Replacement Part #</th>
<th>Label</th>
<th>Model #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube Head Assy.*</td>
<td>380300</td>
<td>Rear of Housing</td>
<td>300300</td>
</tr>
<tr>
<td>20 cm Round Cone*</td>
<td>381218</td>
<td>Inside</td>
<td>301218</td>
</tr>
<tr>
<td>20 cm Rectangular Cone*</td>
<td>302971</td>
<td>Near</td>
<td>302971</td>
</tr>
<tr>
<td>30 cm Round Cone*</td>
<td>300061</td>
<td>the Open End</td>
<td>300061</td>
</tr>
<tr>
<td>30 cm Rectangular Cone*</td>
<td>302972</td>
<td></td>
<td>302972</td>
</tr>
<tr>
<td>Wall Plate Assy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120V: Integrated</td>
<td>380400</td>
<td>Bottom of</td>
<td>300400</td>
</tr>
<tr>
<td>120V: Remote</td>
<td>380401</td>
<td>Wall Plate Assy.</td>
<td>300401</td>
</tr>
<tr>
<td>230-240V: Integrated</td>
<td>380402</td>
<td></td>
<td>300402</td>
</tr>
<tr>
<td>230-240V: Remote</td>
<td>380403</td>
<td></td>
<td>300403</td>
</tr>
<tr>
<td>Control Panel*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated</td>
<td>380453</td>
<td>Right Side</td>
<td>300453</td>
</tr>
<tr>
<td>Remote</td>
<td>380455</td>
<td></td>
<td>300455</td>
</tr>
</tbody>
</table>

* = Certified Component

Maintenance Record

<table>
<thead>
<tr>
<th>Installed By</th>
<th>Date</th>
<th>Checks &amp; Calibration By</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Routine Maintenance By</th>
<th>Date</th>
<th>Checks &amp; Calibration By</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section III  Statements and Symbols Used

Product Safety/Warning Statements and Symbols used in this manual and on the HDX X-ray System.

Note: Read all special safety instructions and warnings in this manual, and carefully note the meanings of each.

- Alternating current

⚠️ Attention, consult accompanying documents

⚡ Dangerous voltage

Fuse

IN-position of the Main Switch

OUT-position of the Main Switch

Ionizing radiation

OFF (power)

ON (power)

Protective earth (ground)

Type B

X-ray source assembly

X-ray source assembly: emitting
Section I Introduction

This manual contains installation, operation, and maintenance instructions for the Flow HDX Intraoral X-ray System. These procedures should only be performed by an authorized service technician experienced in installing and servicing dental X-ray systems.

**WARNING:**

This X-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.

After installing the X-ray, please review the Operation Section, the Maintenance Section and the two different Suggested Exposure Time Settings with the staff.

HDX Intraoral X-ray Features

- Self-diagnostic control panel
- Microcomputer and specialized circuitry that monitors and precisely regulates the exposure technique factors (kV, mA, and exposure time)
- Compatible with a wide range of line voltage conditions
- Very short exposure time
- Up and down arrows to change time setting by .01 second increments
- A long reach folding arm.
- Precise, smooth operation with a lightweight head
- An unobstructed view of the patient’s face
- Fast, accurate alignment of X-ray beam with film

Constant Emission Power (CEP™) Technology

The HDX CEP™ X-ray emits continuously during an exposure rather than in bursts as in conventional X-rays as illustrated. “Constant potential dental X-ray machines can reduce radiation dose by up to 30% . . .”.*

Section IV Preinstallation

1.87 m Reach Coverage Profile - Coverage Between 2 Surgeries 1.47 m Reach

Solid line -20 cm Cone; Dashed line -30 cm Cone.

1.87 m Reach Coverage Inside an Individual Surgery 1.47 m Reach

Notes: * Horizontal Arm Radius Approximately Equal to Short Cone Path.

Flow Dental HDX Intraoral X-ray
Vertical Profile

Shown at 1.52 m
Solid or Dropped Ceiling

2.5 cm Top Bolt Hole

28.6 cm

15.2 cm

129.5 - 154.9 cm

97.8 cm 90.2 cm

20.3 cm

85.1 cm

34.9 cm

127.0 cm

53.3 - 78.7 cm Depending on Ceiling

Window Dimensions for Swing Through Arrangement

(Solid or Dropped Ceiling)

NOTE: For coverage on both sides of wall, see Coverage Profile, opposing page.

Inside Dimensions of Opening in Divider Between Two Surgeries

<table>
<thead>
<tr>
<th>Height A</th>
<th>129.5 - 154.9 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width B</td>
<td>Minimum 81.3 cm</td>
</tr>
<tr>
<td>Height C</td>
<td>Minimum 124.4 cm</td>
</tr>
<tr>
<td>Depth D</td>
<td>Minimum 30.5 cm – Integrated Model</td>
</tr>
<tr>
<td></td>
<td>Minimum 25.4 cm – Remote Model</td>
</tr>
<tr>
<td>Height E</td>
<td>Minimum 43.2 cm</td>
</tr>
</tbody>
</table>
Section IV Preinstallation

System Weight: 24 kg

Mounting Strength

The specification for the top bolt includes a safety factor that allows an outward force of 250 kg. The wall, depending upon construction, may require reinforcement to match bolt specification.

If the wall conforms to preinstallation requirements, one person can install the X-ray in less than 2 hours. The power cable must protrude at least 15 cm from wall. The remote cable (when applicable) must protrude at least 30 cm from wall; the remote cable carries only low voltages. The X-ray is designed to mount on a single stud with 3 lag bolts. See template (in the back of manual) for location of holes. Installation on various wall types are shown.

Installation on Wall with Single Wooden Stud

Installation with Mounting Plate

Installation with Mounting Plate and Back Plate

Concrete Wall or Cinder Block Wall Installation

Installation on Wall with Metal Studs

* If mounting plate and back plate are not purchased, 18 mm plywood may be substituted.
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Section V  Installation

Unpacking the Components

Components of the Integrated Version
Carton Contents
- Tube head Assembly
- Wall Plate Assembly
- Arm Assembly
- Control Panel with Mounting Plate
- 20 cm Round Cone
- Exposure Switch with Cord
- Wall Plate Template
- Instruction Manual
- Hardware Bag

Components of the Remote Version
Carton Contents
- Tube head Assembly
- Wall Plate Assembly
- Arm Assembly
- Remote Control Panel with Mounting Plate
- 20 cm Round Cone
- Wall Plate Template
- Remote Control Panel Template
- Instruction Manual
- Hardware Bag
- 10.7 m, 7 Lead, Shielded 22 AWG Cable

Optional Items
- 30 cm Round Cone
- 30 cm Rectangular Cone
- 20 cm Rectangular Cone
- Power Cord Kit

Tools Required
- Fluke® 73 Digital Multimeter** or equivalent
- Digital™ Pulse Counter, EDS Model XR201* or equivalent
- Power Drill
- 1/49” Drill Bit
- 7/16” Drill Bit
- 9/16” Nutdriver
- 6” Pliers
- Phillips Head Screwdriver
- Small and Large Slotted Screwdrivers
- 9/16” Socket with Small Extension
- 6-8” Adjustable Wrench
- 5/64” Allen Wrench
- 9/64” Allen Wrench
- Level
- Solder
- Soldering Iron
- Measuring Tape
- Clear Adhesive Tape
- Wire Cutters

Drilling the Mounting Holes
Using the wall plate template provided, mark the location of the three wall plate mounting holes. Use a level or plumb line to make sure holes are vertical. The power cable and remote cable may be concealed in the wall or may be surface mounted.

** Fluke® is a registered trademark of the Fluke, Corp., Everett, WA.
* EDS® is a registered trademark of Engineered Design System, Wilmington, DE.
Section V Installation

Installation of Wall Plate Assembly

Remove 6 screws on the wall plate cover, 2 on top, 4 on the bottom using a Phillips head screwdriver.

To access 2 of the mounting holes, remove arm pivot support. Drill 6 mm pilot holes at least 65 mm deep in a wall with wooden studs, and secure wall plate with three 8 mm x 76 mm lag bolts provided. For concrete, cinder block, and walls with metal studs, use 8 mm threaded rods cut to correct length and fasten with hardware provided. See Preinstallation for more information.

Note: The upper and lower holes in the wall plate are slightly larger than the center to allow minor horizontal adjustment.
Loosen upper and lower bolts, and level wall plate.
Reinstall arm pivot support. Be sure no wires are pinched.
If wall is not plumb, adjust set screws on arm pivot support to level horizontally.

Installation of the Arm Assembly

CAUTION: Do not remove tie wrap restraining scissor arm until tube head is assembled to arm.
Due to the spring tension of counterbalance mechanism, the arm might suddenly swing open and cause injury.
Section V Installation

Arm Cable Connection to Wall Plate

Connect wires from arm cable to 6 screws on the terminal block, TB101 and 102, as shown in the previous illustration, using a small slotted screwdriver.

Installation of the Tube Head & Cone

**CAUTION:** Do not install tube head if an oil leak is evident. Do not remove head covers or attempt to disassemble tube head. Always return tube head assembly to the factory for repair or replacement.

Remove distal arm cover and two #6-32 screws using a 5/64" Allen wrench.

Remove #8-32 screw from yoke stem using a 9/64" Allen wrench.

**WARNING:** Do not remove wire guide until yoke is installed.

Insert connectors through distal arm while supporting tube head. Align yoke stem hole with hole of the plastic bearing inside distal arm. Reinstall the #8-32 Allen head screw to secure yoke to distal arm and remove wire guide.

Attach arm cable and yoke polarized connectors. Polarized connectors have unique configurations ensuring correct installation. Slide black sheathing over cable bundle.

Installation, Operation and Maintenance Instructions
Section V Installation

Rotate head through a full 600°. Verify smooth head rotation, and positive stops.

Note: The cone has no filters attached.
Verify O-ring is on threaded base of cone.
Thread cone into tube head, and align grooves.
Carefully remove tie wrap, and gently guide scissor arm open to prevent it from automatically springing.

Tube Head Brake Adjustment
A plastic bearing in the distal arm functions as a brake for the tube head. Find the set screw on top of the bearing, directly opposite the head support screw. Using a 1/16” Allen wrench, turn set screw either clockwise, to increase, or counterclockwise to decrease, brake friction. Adjust brake so head rotates freely, but does not drift.

Reinstall distal arm cover and fasteners.

Electrical Installation

<table>
<thead>
<tr>
<th>VAC</th>
<th>Breaker</th>
<th>Wire Size (AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>15 Amp</td>
<td>14 AWG up to 18 m</td>
</tr>
<tr>
<td>230-240</td>
<td>10 Amp</td>
<td>12 AWG up to 30 m</td>
</tr>
</tbody>
</table>

Connect to 3-wire system, one wire grounded.
Maximum permissible line regulation is 4%.
(See Page 16.)

With concealed wiring, route primary power cable through oval access hole in wall plate. For surface wiring or with a power cord, follow instructions for power cord preparation.

Adjustment of Brakes

Level and plumb X-ray as described on Page 10 before adjusting brakes.
Adjust brake tension by gently tightening or loosening small hex socket screw in the brake using a 9/64” Allen wrench, allowing scissor arm to rotate before the horizontal arm.

System connected to incoming power

concealed through-the-wall wiring (hardwired)

power cord

Install in fuseholder at bottom of wall plate

concealed shunt and fuseholder cap

proper fuse and fuseholder cap
Section V Installation

Connect power cable to terminal block for 120 VAC & 230-240v as shown in the previous illustration.

![Diagram showing power switch and wiring connections for 120 VAC and 230-240 VAC]

**WARNING**: Turn power OFF at source before connecting power cable.

**Power Cord Preparation**

Remove plastic plug on bottom of wall plate and install black bushing supplied with power cord.

**Note**: The plastic plug on the bottom of the wall plate is reserved for surface routing of the remote cable.

Be sure power cord will not touch the floor when connected to outlet. If needed, cut cord to correct length.

Remove approximately 76 mm of power cord jacket.

Strip 7 mm of insulation. Twist wire ends together, and tin with solder.

**Remote Control Cable Connection**

*Complete the steps in this section only if a remote version is being installed.* For integrated versions skip this section and continue with **Inspection of Wall Plate Wiring**.

With concealed wiring, route remote cable through circular hole in wall plate. With surface wiring, route cable through black bushing at the bottom of wall plate.

Connect remote cable to remote terminal block. Match wire colors to those marked on label.

---

**Remote Version**

- Connect Shield Lead to Chassis
due with Green/Yellow Wire
- Remote Cable Entry for Surface Wiring (Black Bushing)
- Circular Access Hole for Concealed Wiring of Remote Cable
- Remote Cable Terminal Block

Slide control panel off mounting bracket, and set aside.

**Install Remote Control Panel**

1. Route remote cable through access hole.
2. Install mounting bracket using two hollow wall anchors and screws.
3. Connect remote cable as shown.

**Note**: Control panel is attached to mounting bracket only after calibration checks are completed.

---

![Diagram showing remote control panel connections and mounting instructions]

**CAUTION**: Do not connect shield lead at the remote control panel. Trim off excess shield lead.

---

Installation, Operation and Maintenance Instructions 13
Section V Installation

Inspection of Wall Plate Wiring
Inspect wall plate wiring to be sure all connectors are fully seated, cables are dressed (to protect against sharp edges), and no wires are pinched.

Calibration Checks and System Checks
To complete installation, follow these steps:
- Temporary connection of control panel
- Preliminary checks
- Power-ON sequence checks
- Line voltage regulation check
- Calibration checks for kV and mA
- Calibration procedure, if required
- Installation of control panel

Temporary Connection of Control Panel (Remote Model Only)
Connect polarized 7-pin connector to control panel. On integrated units, connect exposure switch cable to control panel.

Installation of Integrated Control Panel

CAUTION: Wait 4 minutes for capacitors to discharge after power is OFF. Voltage at red and green wires must be below 2 VDC before connecting control panel.

Turn OFF power to unit.
Remove control panel from temporary connection.
Hold wall plate cover in front of wall plate assembly. Reconnect 2-pin polarized connector to left side of I/O PC board. Route control cable through rectangular hole in wall plate cover. Carefully slide wall plate cover onto wall plate assembly while simultaneously sliding excess control cable into wall plate. Secure wall plate cover with 6 screws.
Connect control cable to 7-pin connector at rear of control panel.
Install control panel to mounting bracket on front of wall plate cover by aligning 3 mounting studs with holes, and slide control panel downward.
If not done before, install exposure switch and coiled cord assembly by inserting RJ-11 telephone type connector into receptacle at bottom right of control panel. Place exposure switch into holder on right side of wall plate cover.

Installation of Remote Control Panel

CAUTION: Wait 4 minutes for capacitors to discharge after power is OFF. Voltage at red and green wires must be below 2 VDC before connecting control panel.

Turn OFF power to unit.
Remove control panel from temporary connection.
Reconnect 7-pin connector to remote cable terminal in the wall plate assembly.
Hold wall plate cover in front of wall plate assembly, and connect power-ON indicator cable to 2-pin polarized connector to left side of I/O PC board. Carefully slide wall plate cover onto wall plate assembly; secure with 6 screws.

CAUTION: Verify wires are not pinched between the wall plate cover and wall plate.
At remote control site, secure mounting bracket to wall if not yet installed.
Connect remote control cable to 7-pin connector at rear of the remote control.
Install remote control panel to mounting bracket by aligning 3 mounting studs with holes, and slide control panel downward.

CAUTION: Make sure control panel does not rest on any electrical terminals.

Strap control panel to bottom of wall plate using the rubber band provided.
Proceed to Preliminary Checks, page 15.
Section VI System Checks and Calibration

System Checks – General Information

The X-ray is factory calibrated and should not require adjustment during installation. However, upon installation perform the preliminary checks listed below and again during annual maintenance. If these checks and calibrations are not performed, compliance with regulations cannot be assured.

RADIATION HAZARD: Do not use X-ray if it fails preliminary checks, or if it cannot be calibrated. DO NOT operate X-ray until repair is complete.

Note: Refer to User Service Information for replacement of components. Contact Flow Dental Customer Service for technical assistance if a problem persists.

### Preliminary Checks

<table>
<thead>
<tr>
<th>Item</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labels</td>
<td>Verify that labels for the following components are legible and in place:</td>
</tr>
<tr>
<td></td>
<td>- Tube Head Assembly</td>
</tr>
<tr>
<td>Other Labels</td>
<td>Verify legibility of all other labels.</td>
</tr>
<tr>
<td>Warning Statement</td>
<td>Verify legibility of warning statement on the wall plate cover.</td>
</tr>
<tr>
<td>Tube Head</td>
<td>Check for oil leaks. <strong>If found, return tube head to factory for replacement.</strong></td>
</tr>
<tr>
<td>Cone (BLD)</td>
<td>Inspect for damage. Lead lining must cover entire interior surface of cone. Replace cone if necessary.</td>
</tr>
<tr>
<td>Exposure Switch</td>
<td>Inspect cord for damage. Switch operation should be smooth and positive. Replace if damaged.</td>
</tr>
</tbody>
</table>

RADIATION HAZARD: *X-rays are emitted when control panel is energized, and the exposure switch is activated. Unauthorized use is prohibited.*

| Line Voltage    | Measure incoming line voltage at power input terminal block. Voltage range under load is either 108 to 132 VAC or 207 to 264 VAC. If outside of these limits, DO NOT ATTEMPT TO OPERATE THIS SYSTEM. Contact an electrician or local power utility company to correct. |

| Mechanical Checks | Check tube head for smooth vertical and horizontal rotation. If drift is noticed, adjust tube head brake (See Page 12). Check scissors arm for correct spring tension. The same force should be required to move the tube head up or down. Adjust the spring tension, if necessary. Check arm and tube head assembly for smooth lateral motion. The spring arm should rotate at the distal end of the horizontal arm before the horizontal arm rotates at the wall plate. Adjust both arm brakes as necessary. |

---

Installation, Operation and Maintenance Instructions 15
Section VI  System Checks and Calibration

Power-ON Sequence  Refer to Page 18, Operation, to turn system ON.

Calibration Check for kV and mA

Note: The X-ray is factory calibrated and SHOULD require only a calibration check during installation.

The mA and kV sense voltages can be checked without removing the wall plate cover. Remove yoke end cap.

Connect multimeter to terminals inside of yoke following the chart below.

<table>
<thead>
<tr>
<th>Check</th>
<th>Meter</th>
<th>Power Switch</th>
<th>Exposure Setting</th>
<th>Exposure Switch</th>
<th>Meter Reads</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>Multimeter to Yoke: (+) lead to Yellow (-) to White</td>
<td>ON</td>
<td>2.00 seconds</td>
<td>Press &amp; Read Meter</td>
<td>+6.4 to +6.6 VDC</td>
</tr>
<tr>
<td>mA</td>
<td>Multimeter to Yoke: (+) lead to Brown (-) lead to White</td>
<td></td>
<td></td>
<td></td>
<td>+6.8 to +7.2 VDC</td>
</tr>
<tr>
<td>Time</td>
<td>Digital Impulse Counter (XR201): Place in front of cone</td>
<td></td>
<td></td>
<td></td>
<td>2.00 +/-0.02 sec.</td>
</tr>
</tbody>
</table>

CAUTION: Before taking any long exposures to check calibration, take several 0.10 second exposures waiting 15 seconds between exposures. The microprocessor is programmed to prevent an operator from exceeding the system duty cycle.

Calibration check is complete. Reinstall yoke end cap. If kV, mA, and time are within limits as listed in the above chart, proceed to Measure Line Voltage. If kV, mA, or time are out of range, continue Calibration.

Measure Line Regulation

1. Measure incoming line voltage. (See illustration below.)
2. Set timer to 2 second exposure time.
3. Make exposure while reading multimeter.

4. Calculate line regulation as follows:

\[ \text{Regulation} \% = 100 \times \frac{(V_{\text{ml}} - V_{L})}{V_{L}} \]

where \( V_{\text{ml}} \) = voltage with no load
\( V_{L} \) = voltage under load.

<table>
<thead>
<tr>
<th>Examples</th>
<th>120 Volts</th>
<th>230-240 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>No load voltage</td>
<td>118 volts</td>
<td>236</td>
</tr>
<tr>
<td>Voltage under load</td>
<td>115 volts</td>
<td>230</td>
</tr>
<tr>
<td>Regulation %</td>
<td>100 x (118-115)/115 = 2.6%</td>
<td>100 x (236-230)/230 = 2.6%</td>
</tr>
</tbody>
</table>

Result of either example is within 4% tolerance.

If not within 4%, call the local utility company. If the under load voltage is not within operating range (108 to 132 VAC or 207 to 264 VAC), install a buck-booster transformer. Remeasure line regulation after installing transformer.

If calibration is not necessary, install the appropriate control panel as described on Page 14.

Setup for Calibration

SHOCK HAZARD: All circuits inside wall plate are at dangerous voltage levels. TURN POWER OFF WHEN CONNECTING MULTIMETER LEADS OR MOVING JUMPER. Use an insulated adjustment tool.

CAUTION: Wait 4 minutes for capacitors to discharge after power is OFF. Voltage at red and green wires must be below 2 VDC before connecting control panel.
Section VI  System Checks and Calibration

Remove control panel from mounting bracket. Unplug the 7-pin connector.
Remove wall plate cover.
Reconnect control cable to control panel.
Strap control panel to bottom of wall plate. See Temporary Connection of Control Panel, Page 14, for additional details.

Calibration

<table>
<thead>
<tr>
<th>CALIBRATION</th>
<th>J205</th>
<th>Adjust</th>
<th>Yellow</th>
<th>White</th>
<th>Brown</th>
<th>Power</th>
<th>Timer</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIL mA 7.4 VDC to 7.6 VDC</td>
<td>CAL</td>
<td>R203</td>
<td>-</td>
<td></td>
<td>GRND 1</td>
<td>(+)</td>
<td>Neg (-)</td>
<td>ON 2.00</td>
</tr>
<tr>
<td>Fine mA 6.8 VDC to 7.2 VDC</td>
<td>NOR</td>
<td>R201</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KVP 6.4 VDC to 6.6 VDC</td>
<td></td>
<td>R202</td>
<td>Black (-)</td>
<td></td>
<td>Pos</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: A nonconductive screwdriver is included inside the wall plate for adjustments. **DO NOT** use a metal screwdriver for the following steps.

Turn power OFF.
Place jumper J205 in the CAL (calibrate position).
Connect the meter to the contacts behind the yoke cover as follows: (-) lead to the white terminal and the (+) lead to the brown terminal.
Set the meter to read +8.00 VDC.
Turn the power switch ON.

**IMPORTANT:** Turn R201, R202, and R203 (FIL) counterclockwise until stopped. Then turn each potentiometer 1/8th of a turn (45°) clockwise.

Set the exposure time to 2.00 seconds.
Press and hold the exposure switch and read the meter.

Adjust R203 (FIL) until multimeter reads +7.40 to +7.60 VDC during exposures.
Turn the power switch OFF.
Place jumper J205 in NOR (normal) position.
Turn the power switch ON.
Using 2.00 second exposures, adjust R201 (mA) until meter reads between +6.80 and +7.20 VDC during exposures.
Move the (+) meter lead from brown to yellow terminal.
Using 2.00 second exposures, adjust R202 (kV) until meter reads between +6.40 and +6.60 VDC during exposures.
Calibration is complete; turn X-ray OFF. Assemble all covers carefully.

**CAUTION:** **DO NOT** overtighten top wall plate cover screws, to prevent damage to internal wiring.

Return to Page 14 for installation completion.

Installation, Operation and Maintenance Instructions 17
Section VII  Operation

Turning the System ON & Self Diagnostics

**RADIATION HAZARD:** Observe safe exposure factors and operating instructions as the X-ray may be dangerous to patient and operator.

⚠ **CAUTION:** If the following sequence does not occur, refer to **User Service Information**.

![Software Revision Level](image)

Software Revision Level

**Note:** The computer calculates the checksum, and if correct, displays CHS (a standard software signal) for one second. If checksum is not correct, the control panel displays error code E11, and disconnects. Turn power OFF, and replace control panel.

![Software Checksum](image)

Software Checksum

![Number of Unit Exposures](image)

Number of Unit Exposures (in thousands)

New installations display 000.

**Note:** When the exposure count reaches 149 thousand, the display flashes 4 times and a chime sounds 4 times. To continue exposure count, call for authorized service.

![Number Display](image)

Current Preferred Time

Note: The Preferred Time is the preset exposure time when the system is initially turned ON. It displays in seconds to two decimal places. For example:

- **0.33** is an exposure time of 0.33 seconds;
- **1.88** is an exposure time of 1.88 seconds.

The X-ray is now in standby, ready for one of five separate actions, A through E.

**A. Standby Condition**
The X-ray may be left in standby indefinitely.

**B. Adjusting the Exposure Time**
Note: If an exposure time other than the preferred time is selected and the system is turned OFF, when the system is turned ON, the preferred time will again be displayed.

![Exposed Time](image)

To change the exposure time, press the UP button to increase or the DOWN button to decrease.

![Exposure Time](image)

Minimum Exposure Time | Maximum Exposure Time
---|---
0.01 | 2.00

After reaching Maximum, the Exposure Time returns to Minimum

4 Steps Every Second

![Exposure Time Change Arrows](image)

To change the preferred time setting, simultaneously press and release both the UP and DOWN arrows.
Section VII Operation

HDX Intraoral X-ray

The control panel is now in the Preferred Time Adjust Mode, as indicated by the blinking decimal point and the chime sounding 2 times per second. Select the new Preferred Time by pressing the UP or DOWN arrow.

| 33 | ⌚ ⌚ ⌚ |

When the display shows the desired Preferred Time, turn the system OFF to store the new time in permanent memory.

Wait 5 seconds.

Turn the system ON. The new time displays.

D. Making an Exposure

⚠️ CAUTION: Always observe the system duty cycle. One 0.25 second X-ray exposure can be made every 15 seconds.

| .33 |

Select exposure time

Press and hold exposure switch until chime sounds.

Note: After pressing the exposure switch, power is applied to the X-ray tube filament, which takes 0.6 seconds to become fully operational. Then the exposure begins, as indicated by the amber X-ray light. At the end of the exposure, the X-ray light turns OFF, and the chime sounds.

Release switch.

| EO1 |

Error codes: Underexposed – Switch released too soon.

Note: Release switch within 15 seconds after chime sounds. If exposure switch is depressed too long, error code E02 appears. Refer to User Service Information for other error codes.

| E02 |

Switch held too long.

Replace the exposure switch in its holder (integrated version).

If an error code displays during an exposure, refer to User Service Information.

E. Turning the System OFF

|  |

Additional operating information:

Cones:

You have the choice of using any one of four (4) different cones:

1. 20 cm source-to-skin distance (SSD) round cone (supplied with the machine).
2. 30 cm round SSD cone.
3. 20 cm SSD rectangular cone.
4. 30 cm SSD rectangular cone.
Section VII Operation

While the use of any of the above cones will result in clear, sharp diagnostic radiographs, a few of the advantages of each cone are:

<table>
<thead>
<tr>
<th>Cone</th>
<th>Advantage(s)/Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 cm SSD round</td>
<td>• Most forgiving when aligning cone with the film (image receptor) in the mouth.</td>
</tr>
<tr>
<td></td>
<td>• Less cumbersome than long cone when used in a small operatory.</td>
</tr>
<tr>
<td></td>
<td>• Greater freedom to locate in operatory when installing.</td>
</tr>
<tr>
<td>30 cm SSD round</td>
<td>• Less image distortion with longer SSD.</td>
</tr>
<tr>
<td></td>
<td>• More cumbersome to maneuver tube head around patient’s head.</td>
</tr>
<tr>
<td></td>
<td>• The use of a film holder is recommended.</td>
</tr>
<tr>
<td>20 cm SSD rectangular</td>
<td>• Smaller X-ray field reduces patient tissue irradiation pattern.</td>
</tr>
<tr>
<td></td>
<td>• Must use intraoral film holder to precisely align cone with film (image receptor).</td>
</tr>
<tr>
<td>30 cm SSD rectangular</td>
<td>• Patient tissue irradiation pattern reduced to the minimum.</td>
</tr>
<tr>
<td></td>
<td>• Must use intraoral film holder to precisely align cone with film (image receptor).</td>
</tr>
<tr>
<td></td>
<td>• The time to take an intraoral series of images will increase.</td>
</tr>
</tbody>
</table>

When taking radiographs, move at least 2 meters away from the X-ray unit and protect yourself from radiation. Make sure that you are able to see and hear the patient during the exposure.

Automatic duty cycle control: If an operator inadvertently tries to initiate two consecutive exposures without waiting for the X-ray tube to cool down between the exposures, the microprocessor in the control panel is programmed to automatically protect the X-ray tube. After each exposure, an OFF interval equal to 60 times the last emission duration is provided. Any combinations of 1 second of exposure per minute can be made (e.g. four 0.25 second or two 0.50 second exposures).

System cleaning information:

1. Cones (BLDs): Use non-alcohol based disinfectant only (liquid or spray). Can be cleaned while assembled to tubehead.
2. All other parts: Use cloth dampened with mild soapy water.

The HDX X-ray system does not include any components which are between the X-ray source and the patient to attenuate the X-ray beam.

Note: While the use of either the short or long cone will produce clear, sharp X-ray images, there are certain inherent advantages in the use of the long cone technique such as less image distortion and the reduction of the patient’s absorbed dose to a level as low as reasonably achievable.
### Suggested Exposure Settings (In Seconds)

#### Using Flow Dental Film:

<table>
<thead>
<tr>
<th>Short Cone 8&quot; (20 cm) SSD* Technique</th>
<th>Incisors</th>
<th>Premolars</th>
<th>Molars</th>
<th>Bitewing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D SPEED FILM:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flow X-ray Silver D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.20</td>
<td>0.25</td>
<td>0.31</td>
<td>0.25</td>
</tr>
<tr>
<td>Child</td>
<td>0.13</td>
<td>0.17</td>
<td>0.21</td>
<td>0.17</td>
</tr>
<tr>
<td>Mandarin:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.16</td>
<td>0.20</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Child</td>
<td>0.11</td>
<td>0.13</td>
<td>0.17</td>
<td>0.17</td>
</tr>
</tbody>
</table>

| **F SPEED FILM:**                   |          |           |        |          |
| **Flow X-ray Xpress**               |          |           |        |          |
| Maxillary:                          |          |           |        |          |
| Adult                               | 0.12     | 0.14      | 0.18   | 0.14     |
| Child                               | 0.08     | 0.10      | 0.12   | 0.10     |
| Mandarin:                           |          |           |        |          |
| Adult                               | 0.09     | 0.12      | 0.14   | 0.14     |
| Child                               | 0.06     | 0.08      | 0.10   | 0.10     |

<table>
<thead>
<tr>
<th>Long Cone 12&quot; (30 cm) SSD* Technique</th>
<th>Incisors</th>
<th>Premolars</th>
<th>Molars</th>
<th>Bitewing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D SPEED FILM:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flow X-ray Silver D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.38</td>
<td>0.48</td>
<td>0.60</td>
<td>0.48</td>
</tr>
<tr>
<td>Child</td>
<td>0.25</td>
<td>0.32</td>
<td>0.40</td>
<td>0.32</td>
</tr>
<tr>
<td>Mandarin:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.29</td>
<td>0.38</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Child</td>
<td>0.19</td>
<td>0.25</td>
<td>0.32</td>
<td>0.32</td>
</tr>
</tbody>
</table>

| **F SPEED FILM:**                   |          |           |        |          |
| **Flow X-ray Xpress**               |          |           |        |          |
| Maxillary:                          |          |           |        |          |
| Adult                               | 0.22     | 0.27      | 0.34   | 0.27     |
| Child                               | 0.14     | 0.18      | 0.23   | 0.18     |
| Mandarin:                           |          |           |        |          |
| Adult                               | 0.16     | 0.22      | 0.27   | 0.27     |
| Child                               | 0.11     | 0.14      | 0.18   | 0.18     |

#### Using Kodak Film:

<table>
<thead>
<tr>
<th>Short Cone 8&quot; (20 cm) SSD* Technique</th>
<th>Incisors</th>
<th>Premolars</th>
<th>Molars</th>
<th>Bitewing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D SPEED FILM:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kodak Ultra-Speed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.20</td>
<td>0.25</td>
<td>0.31</td>
<td>0.25</td>
</tr>
<tr>
<td>Child</td>
<td>0.13</td>
<td>0.17</td>
<td>0.21</td>
<td>0.17</td>
</tr>
<tr>
<td>Mandarin:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.16</td>
<td>0.20</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Child</td>
<td>0.11</td>
<td>0.13</td>
<td>0.17</td>
<td>0.17</td>
</tr>
</tbody>
</table>

| **F SPEED FILM:**                   |          |           |        |          |
| **Kodak Insight**                   |          |           |        |          |
| Maxillary:                          |          |           |        |          |
| Adult                               | 0.12     | 0.14      | 0.18   | 0.14     |
| Child                               | 0.08     | 0.10      | 0.12   | 0.10     |
| Mandarin:                           |          |           |        |          |
| Adult                               | 0.09     | 0.12      | 0.14   | 0.14     |
| Child                               | 0.06     | 0.08      | 0.10   | 0.10     |

<table>
<thead>
<tr>
<th>Long Cone 12&quot; (30 cm) SSD* Technique</th>
<th>Incisors</th>
<th>Premolars</th>
<th>Molars</th>
<th>Bitewing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D SPEED FILM:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kodak Ultra-Speed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.38</td>
<td>0.48</td>
<td>0.60</td>
<td>0.48</td>
</tr>
<tr>
<td>Child</td>
<td>0.25</td>
<td>0.32</td>
<td>0.40</td>
<td>0.32</td>
</tr>
<tr>
<td>Mandarin:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>0.29</td>
<td>0.38</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Child</td>
<td>0.19</td>
<td>0.25</td>
<td>0.32</td>
<td>0.32</td>
</tr>
</tbody>
</table>

| **F SPEED FILM:**                   |          |           |        |          |
| **Kodak Insight**                   |          |           |        |          |
| Maxillary:                          |          |           |        |          |
| Adult                               | 0.22     | 0.27      | 0.34   | 0.27     |
| Child                               | 0.14     | 0.18      | 0.23   | 0.18     |
| Mandarin:                           |          |           |        |          |
| Adult                               | 0.16     | 0.22      | 0.27   | 0.27     |
| Child                               | 0.11     | 0.14      | 0.18   | 0.18     |

*SSD* is the abbreviation for Source-skin-distance. The above are suggested nominal exposure times. Adjust as needed to meet your density preference. Before changing exposure time, check developer solution for freshness and temperature. If available use the exposure settings of the dental film manufacturer.
Section IX Annual Maintenance Program

The calibration of the system must be checked on an annual basis to assure continued compliance with regulations that were applicable at the time of manufacture. Failure to have the following annual maintenance performed by an Authorized and qualified personnel relieves Flow Dental and its agent(s) of all regulatory responsibilities.

1. Perform the Preliminary System Checks on page 15 of this manual.
2. Check and verify the operation of the Switcher printed circuit board:

**RADIATION HAZARD:** While performing the checking and calibrating procedure, either block the end of the cone with lead or aim the cone in a safe direction away from any person.

**SHOCK HAZARD:** Dangerous voltages are present on circuit boards (including the IC’s or integrated circuits) inside wall plate. Use extreme caution whenever the wall plate cover is removed.

A. Check operation of LED lights located at top of board:

**LED System Operating Status**

<table>
<thead>
<tr>
<th>CR201</th>
<th>CR202</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>High voltage (kV) circuit enabled</td>
<td>Filament voltage circuit enabled</td>
</tr>
<tr>
<td>CR203</td>
<td>ON</td>
</tr>
<tr>
<td>mA and/or kV are absent</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** CR203 should be ON when X-ray system is in standby and OFF during an exposure.

3. Calibration check for kV and mA:

A. Remove yoke end cap and connect (place) meters as per chart below:

<table>
<thead>
<tr>
<th>Check</th>
<th>Meter Note</th>
<th>Power Switch</th>
<th>Exposure Setting</th>
<th>Exposure Switch</th>
<th>Meter Reads</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>Multimeter to Yoke: (+) lead to Yellow (-) to White</td>
<td>ON</td>
<td>2.00 seconds</td>
<td></td>
<td>+6.4 to +6.6 VDC</td>
</tr>
<tr>
<td>mA</td>
<td>Multimeter to Yoke: (+) lead to Brown (-) lead to White</td>
<td>Press &amp; Read Meter</td>
<td></td>
<td>+6.8 to +7.2 VDC</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Digital Impulse Counter (XR201): Place in front of cone</td>
<td></td>
<td></td>
<td>2.00 +/-0.02 sec.</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** If kV, mA and exposure time readings are within specified ranges, reinstall yoke end cap. Calibration check is complete.

B. If kV, mA or exposure time are out of specified range, the system must be calibrated.

4. Calibrate the system by following the calibration procedure detailed on page 17.

5. The annual maintenance program is now complete and normal operation can now be resumed.
Section X  User Service Information  

**Notes:** 1. All repairs should be performed by an authorized service representative to ensure that the system meets all of the radiation safety regulations applicable at the time of manufacturing.

2. Error codes E11 and above which are displayed are fault conditions which must be corrected only by an authorized dealer service representative.

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBLEM</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power ON light and digital display are not lit.</td>
<td>Primary power OFF.</td>
<td>Check building circuit breaker. If OK, call dealer for service.</td>
</tr>
<tr>
<td>Power ON light is not lit, but digital display is. System operates normally.</td>
<td>Light is inoperable or connector is disconnected.</td>
<td>OK to operate system, but have dealer service representative correct on next visit.</td>
</tr>
<tr>
<td>Digital display does not display all δ's during power ON sequence.</td>
<td>Problem with either digital display or display circuit.</td>
<td>Call authorized dealer for service. Do not attempt to use the X-ray because Exposure time cannot be set properly.</td>
</tr>
<tr>
<td>Film density too light.</td>
<td>Film is either under exposed or under developed.</td>
<td>Check to make sure that the correct exposure chart is being used. Check the developing procedure.</td>
</tr>
<tr>
<td>Film density too dark.</td>
<td>Film is either over exposed or over developed.</td>
<td>Check to make sure that the correct exposure chart is being used. Check the developing procedure.</td>
</tr>
</tbody>
</table>

*The following Error codes will be displayed on the digital display when they occur, and the chime will sound for the number of times indicated.*

**E01**

Exposure switch was prematurely released before the end of the exposure. Error code will clear after 5 seconds. Retake film using new film packet or digital sensor.
Section X User Service Information

E02 FF FF FF
Exposure switch or coiled cord shorted or switch pressed for more than 15 seconds after chime sounds.
Turn power OFF, wait a few seconds, and turn back ON. If problem persists, replace hand switch and coiled cord assembly.

E03 FF FF FF
The line voltage is below the specified minimum.
Turn power OFF, wait a few minutes. Try again. If problem persists, call authorized dealer to check incoming line voltage.

E04 FF FF FF
Duty cycle exceeded.
Wait until error message is turned OFF, then continue usage.

E18 FF FF FF
Low incoming line voltage when power switch turned ON.
Wait a few minutes and try again. If problem persists, call authorized dealer for service.

EEP
Faulty EEPROM
Call authorized dealer for service.

149 FF FF FF
(During Power On Sequence)
Exposure count has reached 149,000 (the EEPROM will be full at 150,000).
If continued counting of exposures is desired, call authorized dealer for service. Failure to replace the EEPROM will not affect the operation of the X-ray - the exposure count will simply stop at 150,000.

NOTE: For all other Error codes, note error code, turn system OFF, and call authorized dealer for service.
Section XI Dealer Service Information

To maintain system compatibility, use only HDX Intraoral X-ray system replacement components/subassemblies, if needed, that are manufactured and available from Flow.

**SHOCK HAZARD:** Dangerous voltages are present inside the wall plate. The owner or operator should never remove the wall plate cover.

**WARNING:** Error codes E11 and above are fault conditions that must be corrected or repaired by an authorized service technician. If error code E11 or above is displayed, turn the power switch OFF immediately. For other error codes refer to the troubleshooting tables for corrective action.

*Note:* If the corrective actions listed in this table do not provide a solution to the problem, contact Flow Dental Customer Service for technical assistance.

**E01-E04 error codes = User Service Information**

All other error codes = To be performed by authorized service personnel ONLY.

### Troubleshooting Table

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause(s)</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E01</strong></td>
<td>Exposure switch released before end of exposure.</td>
<td>Error code clears after 5 seconds. Take exposure using new film packet or digital sensor.</td>
</tr>
<tr>
<td><strong>E02</strong></td>
<td>Exposure switch pressed for more than 15 seconds after chime sounds.</td>
<td>Unit will reset in five seconds. Error code clears when exposure switch is released. If error code does not clear, turn power OFF.</td>
</tr>
<tr>
<td><strong>E03</strong></td>
<td>Exposure switch depressed while changing exposure time. Faulty exposure switch or cord.</td>
<td>If error code E17 occurs when power ON, exposure switch or the mating cord is damaged. Replace with Part No. 300071 (Integrated) &amp; Part No. 380455 (Remote).</td>
</tr>
<tr>
<td><strong>E04</strong></td>
<td>Line voltage below specified minimum range.</td>
<td>Power OFF; wait a few minutes. Power ON. Retry. If problem persists, call electrician to: Check power connection at TB1. Make sure power cable is not made of stranded wire. Measure line regulation. Contact local utility or have electrician install buck/boost transformer.</td>
</tr>
<tr>
<td></td>
<td>Duty cycle exceeded</td>
<td>Wait until the digital display indicates the preselected exposure time again.</td>
</tr>
</tbody>
</table>

*Note:* Error code E03 is normal and not a default condition, and may occur when power is disconnected to X-ray due to slow discharge of capacitors.

Error codes are prefixed by the letter *E*.

![Image of an error code](image-url)

**See Troubleshooting Table, Page 30, for details.**
### Section XI Dealer Service Information

**E01-E04 error codes = User Service Information**  
All other error codes = To be performed by authorized service personnel ONLY.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause(s)</th>
<th>Correction</th>
</tr>
</thead>
</table>
| E11     | Software malfunction. | Power OFF; wait a few seconds. Power ON.  
Retry. If this is an intermittent problem, noise may be present on the line. |
| E12     | Up switch ON when power ON. | Make sure unit is wired to an isolated line.  
If X-ray is remote, make sure the remote cable is not in contact with a 115 VAC or 230-240 VAC conduit. Check proper installation,  
*Pages 9-14.* |
| E13     | Down switch ON when power ON. | If problem persists, replace control panel,  
Part No. 380453 (Integrated) or 380455 (Remote). |
| E14     | Arm cable disconnected from I/O board.  
Head cable disconnected from arm cable.  
Control panel cable improperly connected. | Check connections at TB101 & TB102.  
Remove distal arm cover, & check arm cable connections.  
Check connection of black wire at control panel & at wall plate. |
| E15     | Hardware malfunction. REG signal OFF during exposure. | Refer to Troubleshooting Flow Chart,  
*Pages 31-36.* |
| E16     | Hardware malfunction. REG signal ON but not during exposure. | Refer to Troubleshooting Flow Chart,  
*Pages 31-36.* |
# Section XI  Dealer Service Information

## HDX Intraoral X-ray

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause(s)</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>E17</td>
<td>Exposure switch ON when power ON.</td>
<td>Replace exposure switch, Part No. 300071 (Integrated), or 380455 (Remote). Or check remote cable connection.</td>
</tr>
<tr>
<td>E18</td>
<td>Line voltage low when X-ray power ON.</td>
<td>Measure line regulation. Contact local utility to correct or electrician to install buck/booster transformer. Remeasure line regulation after installing transformer; or replace control panel, Part No. 380453 (Integrated) or 380455 (Remote).</td>
</tr>
<tr>
<td></td>
<td>System seems normal, but films are light.</td>
<td>Check Exposure Time Settings, Page 20. Increase or adjust exposure time, check processing technique.</td>
</tr>
<tr>
<td></td>
<td>Film is underexposed or underdeveloped.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>System seems normal, but films are dark.</td>
<td>Check Exposure Time Settings, Page 20. Decrease or adjust exposure time, check processing technique.</td>
</tr>
<tr>
<td></td>
<td>Film is overexposed or too dark.</td>
<td></td>
</tr>
<tr>
<td>EEP</td>
<td>Faulty EEPROM.</td>
<td>Replace control panel, Part No. 380453 (Integrated) or 380455 (Remote).</td>
</tr>
<tr>
<td></td>
<td>Number 149 flashes &amp; chime sounds 4 times during power ON sequence.</td>
<td>Replace (same as above). Note: Failure to replace control panel does not affect X-ray operation, but count stops at 150 thousand.</td>
</tr>
<tr>
<td></td>
<td>Exposure count at 149 thousand. (Non-volatile RAM stores exposure count; FULL at 150 thousand.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power light &amp; digits do not display.</td>
<td>Check building circuit breaker.</td>
</tr>
<tr>
<td></td>
<td>Primary power OFF.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No power light, red or green, but digits display. System operates normally.</td>
<td>Replace wall plate cover, Part No. 380411 (Integrated) or 380436 (Remote), at the next service call. Note: Operating the X-ray is safe.</td>
</tr>
<tr>
<td></td>
<td>Lamp burned out.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No chime during power ON sequence. System functions normally.</td>
<td>Replace control panel, Part No. 380453 (Integrated) or 380455 (Remote). Note: Regulations require X-ray exposure signal.</td>
</tr>
<tr>
<td></td>
<td>Faulty audio circuit.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exposure indicator: no display during power ON sequence. System functions normally.</td>
<td>Replace logic board, Part No. 300486 or control panel, Part No. 380453 (Integrated) or 380455 (Remote). Note: Regulations require X-ray exposure light.</td>
</tr>
<tr>
<td></td>
<td>Faulty exposure indicator circuit.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Faulty digit display or associated circuit.</td>
<td>Replace control panel, Part No. 380453 (Integrated) or 380455 (Remote). Note: Do not use X-ray, as time settings cannot be set properly.</td>
</tr>
</tbody>
</table>

*Installation, Operation and Maintenance Instructions 27*
Section XI  Dealer Service Information

When a problem is reported, verify the complaint. Consult troubleshooting tables and flow chart, wiring diagram, and repair procedures carefully. Repair obvious malfunctions such as burned out lamps and blown fuses first.
Do not attempt to disassemble the tube head. Always return it to the factory for repair or replacement.
Check the system calibration after replacing PC boards or the tube head.
All repairs should be performed by an authorized service technician to ensure that the system meets radiation safety specifications. Enter dates of adjustments and repairs in the Maintenance Record on page 4.

Fuse Replacement

⚠️ CAUTION: Always replace fuses with correct rating and type.

<table>
<thead>
<tr>
<th>FUSE</th>
<th>SYSTEM</th>
<th>FUSE</th>
<th>RATING</th>
<th>CIRCUIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1, F2</td>
<td>120v</td>
<td>5A, 250 vac</td>
<td>Main Power</td>
<td></td>
</tr>
<tr>
<td>F102</td>
<td>120v</td>
<td>.25A, 250 vac</td>
<td>I/O Board</td>
<td></td>
</tr>
<tr>
<td>F1, F2</td>
<td>230-240v</td>
<td>3A, 250 vac</td>
<td>Main Power</td>
<td></td>
</tr>
<tr>
<td>F102</td>
<td>230-240v</td>
<td>.125A, 250 vac</td>
<td>I/O Board</td>
<td></td>
</tr>
</tbody>
</table>

Fuses F1 and F2 are found behind the power switch on the bottom left of the wall plate.
Fuse F102 is found on the I/O board.

⚠️ SHOCK HAZARD: Dangerous voltages are present on the circuit boards inside the wall plate. Turn OFF power to system before removing cover.

⚠️ SHOCK HAZARD: Allow 4 minutes for large capacitors (C101 and C102) to safely discharge before removing fuses. Do NOT attempt to discharge capacitors by shorting screw terminals.

Control Panel Replacement

Unplug exposure switch with cord from control panel (integrated).
Gently press control panel in toward mounting bracket, and slide panel up and off.
Unplug 7-pin connector from the back of control panel. Install new control panel in reverse order.

Logic Board Replacement

Remove 3 screws securing heatsink to logic board.
Disconnect plug from J304 on logic board.
Section XI  Dealer Service Information

Remove heatsink and fishpaper insulator.
Disconnect control cover assembly from J302 on the logic board.
Install new logic board.
Verify that jumper J305 is installed in the correct position: integrated, remote, or external as marked.
Reassemble control panel in reverse order.

⚠️ CAUTION: Be sure to reinstall fishpaper insulator between logic board and heatsink.

Control Panel with Cover Replacement
Remove control cover assembly (see previous page).
Install new control cover.
Reassemble control cover in reverse order.

I/O Board Replacement

⚠️ SHOCK HAZARD: Dangerous voltages are present on the circuit boards inside the wall plate. Turn OFF power to system before removing cover.

Turn power OFF at circuit breaker.

Remove wall plate cover.

⚠️ SHOCK HAZARD: Allow 4 minutes for large capacitors (C101 and C102) to safely discharge before removing fuses. Do NOT attempt to discharge capacitors by shorting screw terminals.

Unplug 5 connectors of the I/O board.

Disconnect arm cable from terminal blocks TB101 and TB102.
Remove 4 screw terminals securing C101 and C102 to I/O board OR loosen clamps retaining C101 and C102.

⚠️ Remove 3 fasteners securing I/O board. Move board to the left to remove from chassis.

⚠️ CAUTION: Be sure to reinstall fishpaper insulator between I/O board and wall plate.
Install new I/O board in reverse order.

⚠️ CAUTION: Be sure all connectors are properly seated, and arm cable is connected correctly before turning X-ray ON.

Note: Check system calibration after replacing I/O Board.

Switcher Board Replacement

⚠️ SHOCK HAZARD: Dangerous voltages are present on the circuit boards inside the wall plate. Turn OFF power to system before removing cover.

Turn OFF power at circuit breaker.

Remove wall plate cover.

⚠️ SHOCK HAZARD: Allow 4 minutes for large capacitors (C101 and C102) to discharge safely. Do NOT attempt to discharge capacitors by shorting terminals.

Unplug 4 connectors.

Installation, Operation and Maintenance Instructions 29
Section XI  Dealer Service Information

⚠️ Remove 4 screws securing switcher board. Move board to the right to remove from chassis.

CAUTION: Be sure to reinstall fishpaper insulator between switcher board and wall plate. Install new switcher board in reverse order.

CAUTION: Make sure all connectors are properly seated.

Check system calibration after replacing switcher board. Calibrate if necessary.

Note: Call Flow Dental for return authorization before packing the tube head.

Tube Head Replacement

Strapping the Scissor Arm
Turn OFF power to system.

Remove Allen screw and install in yoke stem.

Install new tube head in reverse order.

⚠️ SHOCK HAZARD: Dangerous voltages are present on circuit boards, including integrated Note: Call Flow Dental for return authorization before packing the arm assembly.

Turn OFF power to system.

Remove wall plate cover. Disconnect cables to control panel and power-ON light.

Disconnect arm cable from TB101 and TB102 on the I/O board.

Strap the scissor arm. See previous column, Tube Head Replacement.

Remove tube head.

Lift arm assembly UP to remove from wall plate.

Reinstall wall plate cover.

Arm Counterbalance Adjustment
The scissor arm (see previous illustration) consists of two individually counterbalanced arms: spring arm, close to the horizontal arm, and distal arm, closest to the head. Adjust arms to position the head at various heights, without drift up or down.

Move head up and down, as well as forward and back. The head should move smoothly with a minimum of force.

Determine whether spring or distal arm, or both, require adjustment.

Move scissor arm perpendicular to horizontal arm, and secure with tie wrap to prevent it from swinging open.

Remove distal arm cover.

Unplug connectors from arm cable.

Remove Allen screw on the white bearing in distal arm.

Remove tube head.

30  Flow Dental HDX Intraoral X-ray
Section XI  Dealer Service Information

**Note:** A step ladder is needed to adjust the spring arm.
To adjust spring arm, remove covers from the center pivot.
Orient arm so threaded rod is in view.

**CAUTION:** Use caution when inserting screwdriver into arm. Arm cable may be damaged if struck or pinched by a tool.

Using a large slotted screwdriver, adjust threaded rod 1/4 to 1/2 turn. Turn counterclockwise to increase spring tension; clockwise to decrease.
Check arm movement, and readjust if necessary.

**Note:** The arm assembly is factory adjusted and should not require adjustment at time of installation.
To adjust distal arm, remove its cover.
Orient arm so threaded rod is in view.

---

**E01-E04 error codes** = User Service Information
All other error codes = To be performed by authorized service personnel ONLY.

---

**HDX Intraoral X-ray**
**Troubleshooting Flow Chart**

1. Check power connections at TR1. Make sure power cable not made of stranded wire.
2. Measure line regulation. Contact local utility or electrician to install a buck/booster transformer.
3. Refer to your Service Dealer.

---

Determine a connector's board position by the 1st digit in the identification number:
- 100 Series = I/O Board
- 200 Series = Switcher Board
- 300 Series = Control Panel, Logic Board

---

Installation, Operation and Maintenance Instructions  31
Section XI Dealer Service Information

HDX Intraoral X-ray Troubleshooting Flow Chart

1. Turn power OFF, wait a few seconds. Retry, if problem persists, noise on line. Make sure unit is on a dedicated circuit. Problem persists, replace control panel, see page 22.
2. REMOTE UNITS ONLY: Verify remote cable not contacting conduit for a 115 VAC line. Also check installation; see pages 9-14.
3. Verify shielded ground connected to stud in wall plate and disconnected at remote control panel.
4. Inspect ALL I/O & switcher board connections & wires.
5. Disconnect arm cable from I/O board. Check continuity from I/O board to tube head:
   - Blue to blue - short
   - Red to red - short
   - Green to black - short
   - Any red to any blue - open
   - Green to any blue - open
   - Any red - open
   - Black to any blue - open
   - Any red - open.
7. Head cable not connected to arm cable.
8. Control panel cable not properly connected.
9. 1. Remove distal arm cover and check arm cable connections.
   2. Check for loose and recessed connector pins and crimps.
10. Reseat 7-pin connector at the rear of control panel and wall plate. Power OFF. Replace control panel.
11. Repair arm cable or connections.
12. Yes: Reseat all I/O board and head connections. Take an exposure. Is E15 still displaying?
13. No: Check calibration.
14. Yes: Does K101 click during an exposure?
15. No: Replace I/O board.
16. Yes: Does CR202 light during an exposure?
17. Short P301 pin 3 to pin 8. Does CR202 light?
18. No: Replace control panel.
20. Yes: Replace switcher board.
21. No: Recalibrate unit.
22. Yes: Is 300 VDC - 340 VDC measured between P201 Pin 5 (+) orange wire & Pin 8 (-) yellow wire?
23. No: Replace I/O board.
24. Yes: Turn potentiometers R201, R202, & R203 counterclockwise & take exposure. Does error code E15 displayed during exposure?
25. Yes: Replace switcher board & recalibrate unit.
27. Replace HDX tube head.

Replace control panel which includes membrane switch. See page 22.

Power OFF: Replace control panel.

YES

Power OFF: Does P301 pin 5 to pin 8 measure less than 1000?

YES

Check resistance between P301 pin 8 to head cable Black wire. P301 pin 8 to head cable Green wire.

NO

Repair wiring or connections.

Flow Dental HDX Intraoral X-ray
HDX Intraoral X-ray
Troubleshooting
Flow Chart

E01-E04 error codes = User Service Information
All other error codes = To be performed by authorized service personnel ONLY.

- E16
  - REG signal ON not during an exposure.
  - Turn power OFF. Unplug exposure switch. Turn power ON. Does E16 still appear?
    - YES
      - Replace exposure switch.
    - NO
      - Replace switcher board.
  - Is CR203 lit with power ON?
    - NO
      - Replace I/O board.
    - YES
      - Does K101 click during an exposure?
        - NO
          - Replace I/O board.
        - YES
          - Does P301 pin 5 (+) to Pin 8 (-) measure -8 to -15 VDC?
            - NO
              - Replace switcher board.
            - YES
              - Does J301 pin 2 (+) to pin 5 (-) measure +0.0V to 0.5 VDC?
                - NO
                  - Repair open between J102 & J301.
                - YES
                  - Replace switcher board.
      - Does J102 pin 5 (+) to pin 2 (-) measure -8 to -15 VDC?
        - YES
          - Replace I/O board.
        - NO
          - Replace I/O board.

- E17
  - Exposure switch ON during power ON.
  - Remote
    - Integrated
      - Disconnect exposure switch cord, and turn power ON?
  - Check remote cable wiring for continuity, breaks or frays.
  - Reseat 7-pin connector to remote control panel.
  - Is E17 still displaying?
    - YES
      - Replace control panel.
    - NO
      - Replace exposure switch.
  - Is E17 still displaying?
    - YES
      - Replace control panel.
    - NO
      - Replace control panel.
  - Check calibration.
Section XI Dealer Service Information

HDX Intraoral X-ray
Wiring Diagram

Notes: (Unless otherwise specified)
1. Wire Gage: 22 AWG.
2. Wiring shown for remote control panel. For integrated control panel, P301 plugs into J301.
3. W301 jumper plug selects either integrated, remote or external exposure switch source.
4. All wiring within this area (*phantom line box) to be 18 AWG.
Section XI Dealer Service Information

E01-E04 error codes = User Service Information
All other error codes = To be performed by authorized service personnel ONLY.

HDX Intraoral X-ray
Troubleshooting Flow Chart

Determine a connector's board position by the 1st digit in the identification number:
100 Series = I/O Board
200 Series = Switcher Board
300 Series = Control Panel, Logic Board

- **E18**
  - Low line voltage during power ON.
  - On the logic board, turn R302 clockwise no more than ¼ turn. If problem still occurs, replace control panel.

- **EEP**
  - EEPROM faulty.
  - Replace control panel.

- **149**
  - Exposure count has reached "149" thousand. (EEPROM is full at 150,000.)
  - Replace control panel if desired.

Wall frame fuses blown.

- YES
  - Inspect all I/O board connections, switcher board connections & all wall plate wiring. Replace wall plate fuse: 5A, 120V, 3A, 230-240V.
  - Refer to your Service Dealer.

- NO
  - Check unit calibration.

Fuse F102 blown.

- YES
  - Inspect all I/O board connections, switcher board connections & all wall plate wiring. Replace wall plate fuse: F102, 120V, 25A, 230-240V, 125A
  - Refer to your Service Dealer.

- NO
  - Check unit calibration.

Put X-ray in safe direction. Turn power ON.

- YES
  - Does system perform self diagnostics correctly.
  - Can display be set to 0.02 seconds?
    - YES
      - Press exposure switch. Any error codes appear?
        - YES
          - Refer to Troubleshooting Chart.
        - NO
          - Replace control panel.
    - NO
      - Replace control panel.

- NO
  - Refer to Troubleshooting Chart.

Unit tests OK.
### Section XII Parts List

<table>
<thead>
<tr>
<th>Item</th>
<th>Part#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>382953</td>
<td>Arm Assembly, 1.5 m</td>
</tr>
<tr>
<td>1</td>
<td>380100</td>
<td>Arm Assembly, 1.9 m</td>
</tr>
<tr>
<td>2</td>
<td>381256</td>
<td>Bearing, White, Kit</td>
</tr>
<tr>
<td>3</td>
<td>380356</td>
<td>Bearing, Counting, Kit</td>
</tr>
<tr>
<td></td>
<td>380729</td>
<td>Bearing, Bronze, Kit</td>
</tr>
<tr>
<td>4</td>
<td>380444</td>
<td>Board, I/O, 120V</td>
</tr>
<tr>
<td>4</td>
<td>380447</td>
<td>Board, I/O, 230-240V</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>380448</td>
<td>Board, Switcher, 120V</td>
</tr>
<tr>
<td>6</td>
<td>380450</td>
<td>Board, Switcher, 230-240V</td>
</tr>
<tr>
<td>7</td>
<td>301308</td>
<td>Box, Packing, for HDX Intraoral X-ray</td>
</tr>
<tr>
<td>7</td>
<td>300481</td>
<td>Bracket, Control Panel Mounting</td>
</tr>
<tr>
<td>8</td>
<td>301277</td>
<td>Brake, Scissor Arm</td>
</tr>
<tr>
<td>9</td>
<td>301278</td>
<td>Brake, Horizontal Arm Pivot</td>
</tr>
<tr>
<td></td>
<td>302959</td>
<td>Cable, Arm, Kit</td>
</tr>
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<td>300070</td>
<td>Cable, Remote, 10.6 m, Kit</td>
</tr>
<tr>
<td>10</td>
<td>302971</td>
<td>Cone, Rectangular, 20 cm</td>
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<td>10</td>
<td>302972</td>
<td>Cone, Rectangular, 30 cm</td>
</tr>
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<td>10</td>
<td>301218</td>
<td>Cone, Round, 20 cm</td>
</tr>
<tr>
<td>10</td>
<td>300061</td>
<td>Cone, Round, 30 cm</td>
</tr>
<tr>
<td>11</td>
<td>300926</td>
<td>Control Cover, Integrated</td>
</tr>
<tr>
<td>11</td>
<td>300927</td>
<td>Control Cover, Remote</td>
</tr>
<tr>
<td>12</td>
<td>380453</td>
<td>Control Panel, Integrated</td>
</tr>
<tr>
<td>12</td>
<td>380455</td>
<td>Control Panel, Remote</td>
</tr>
<tr>
<td>13</td>
<td>380411</td>
<td>Cover, Wall Plate, Integrated with indicator light</td>
</tr>
<tr>
<td>13</td>
<td>380436</td>
<td>Cover, Wall Plate, Remote with indicator light</td>
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<tr>
<td>13</td>
<td>300433</td>
<td>Power Switch</td>
</tr>
<tr>
<td>14</td>
<td>300337</td>
<td>Cover Set, Plastic Head</td>
</tr>
<tr>
<td>15</td>
<td>380114</td>
<td>Covers, Replacement, Kit</td>
</tr>
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<td>15</td>
<td></td>
<td>6 covers, foam back tape, &amp; fasteners:</td>
</tr>
<tr>
<td>16</td>
<td>380115</td>
<td>Center Pivot</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>Distal Arm</td>
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<tr>
<td>18</td>
<td>380116</td>
<td>Lower Casting</td>
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<tr>
<td>19</td>
<td></td>
<td>Horizontal Arm End Cap - qty. 2</td>
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<tr>
<td>20</td>
<td>380117</td>
<td>Yoke End Cap</td>
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<tr>
<td>21</td>
<td>300524</td>
<td>Filter, Line</td>
</tr>
<tr>
<td>22</td>
<td>300564</td>
<td>Fuse, 5 Amp, 120V</td>
</tr>
<tr>
<td>23</td>
<td>300565</td>
<td>Fuse, 3 Amp, 230-240V</td>
</tr>
<tr>
<td>24</td>
<td>300558</td>
<td>Fuse, 125 Amp, 230-240V</td>
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<td>25</td>
<td>300571</td>
<td>Fuse, 25 Amp, 120V</td>
</tr>
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<td>26</td>
<td>300412</td>
<td>Holder, Exposure Switch</td>
</tr>
<tr>
<td>27</td>
<td>300747</td>
<td>O-Ring, Cone</td>
</tr>
<tr>
<td>28</td>
<td>300752</td>
<td>Pin, Roll</td>
</tr>
<tr>
<td>28</td>
<td>300019</td>
<td>Plate, Back, Assembly</td>
</tr>
<tr>
<td>28</td>
<td>300018</td>
<td>Plate, Mounting, 40.6 cm Center-to-Center</td>
</tr>
<tr>
<td>28</td>
<td>300825</td>
<td>Screw, Hex Socket Cap</td>
</tr>
<tr>
<td>28</td>
<td>301771</td>
<td>Screw, Half Dog Set</td>
</tr>
<tr>
<td>30</td>
<td>380439</td>
<td>Support, Arm Pivot</td>
</tr>
<tr>
<td>31</td>
<td>300071</td>
<td>Switch, Integrated Exposure</td>
</tr>
<tr>
<td>32</td>
<td>302990</td>
<td>Template Layout Sheet</td>
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<tr>
<td>32</td>
<td>380300</td>
<td>Tube Head Assembly</td>
</tr>
<tr>
<td>33</td>
<td>380400</td>
<td>Wall Plate Assembly, Integrated, 120V</td>
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<td>33</td>
<td>380401</td>
<td>Wall Plate Assembly, Remote, 120V</td>
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<td>33</td>
<td>380402</td>
<td>Wall Plate Assembly, Integrated, 230-240V</td>
</tr>
<tr>
<td>33</td>
<td>380403</td>
<td>Wall Plate Assembly, Remote, 230-240V</td>
</tr>
</tbody>
</table>

---

**Integrated Model**

![Diagram](image)
Section XII Parts List

Remote Model

Wall Plate Assembly Detail

38 Flow Dental HDX Intraoral X-ray
**Section XIII Technical Specifications**

**Classification:**
- Complies with DHHS Radiation Performance Standard, 21 CFR Subchapter J.
- Safety according with IEC60601-1 standard.
- Protection against electrical shock: Class I.
- Degree of protection: Type B.
- Protection against ingress of liquids: Ordinary.

**Disinfection methods:**
- Mild soapy water
- Non-alcohol based disinfectant for cone (B.LD).

For use in environments where no flammable anaesthetics and/or flammable cleaning agents are present.

**Mode of operation:** Stand-by with intermittent loading. Applied part with no conductive connection to patient.

**Description:**
The Flow Dental HDX X-ray is a intraoral x-ray system with a high frequency switching mode X-ray generator and tube housing assembly, and is designed for dental use only and must be operated by a dentist or by the authorized staff.

**Tube Housing Assembly:**

**X-ray tube:**
- Model number: D-081B (stationary anode).
- Manufacturer: Toshiba Corporation, Tokyo, Japan.
- Focal spot: 0.8 mm x 0.8 mm.
- X-ray tube target angle: 20 degrees with respect to the central ray.
- Target material: Tungsten.
- Operating tube potential:
  - Maximum voltage: 65 kV fixed.
  - Maximum tube current: See rating charts.
- Operating tube current: 7 mA fixed.
- X-ray tube inherent filtration: At least 0.8 mm AL equivalent at 50 kV.
- Tube rating chart: See tube rating chart.
- Anode Cooling curve: See Anode cooling curve.
- Thermal Characteristics: Anode heat storage capacity: 6.0 kJ (8.5 kHU).
  - Max. anode heat dissipation rate: 128 W (180 HU/s).

**Generator:**
- Maximum output power: 455 W nominal at 65 kV, 7 mA.
- kV wave form: Constant potential (DC).
- Duty cycle: 1.60 (one 0.25 second exposure every 15 seconds).
- Leakage technique factors:
  - Maximum: 65 kV / 0.12 mA.
- Minimum filtration permanently in useful beam: 1.5 mm AL equivalent at 65 kV.
- Tube housing cooling curve: See Tube housing cooling curve.
- Primary protective shielding: Minimum 0.37 mm Pb or equivalent.
- Outer shell temperature: 50°C maximum.
- 0.12 mA is the maximum rated continuous tube current equivalent to 7 mA with a duty cycle of 1:60.

**Cones (Beam Limiting device):**
The following Flow cones (B.LD) are compatible with the HDX system:

<table>
<thead>
<tr>
<th>P/N</th>
<th>Minimum Source-skin distance</th>
<th>Cone tip configuration &amp; field size</th>
</tr>
</thead>
<tbody>
<tr>
<td>381218*</td>
<td>20 cm</td>
<td>Round - 6 cm</td>
</tr>
<tr>
<td>300061</td>
<td>30 cm</td>
<td>Round - 6 cm</td>
</tr>
<tr>
<td>302971</td>
<td>20 cm</td>
<td>Rectangular - 3.3 cm x 4.4 cm</td>
</tr>
<tr>
<td>302972</td>
<td>30 cm</td>
<td>Rectangular - 3.3 cm x 4.4 cm</td>
</tr>
</tbody>
</table>

*Supplied with the system.

**HDX Intraoral X-ray**

The small circles on the top and bottom of the tube housing assembly indicate the location, along the central ray axis, of the focal spot (tube target). Measure the minimum source-skin distance (SSD) from the focal spot as shown.

**Tube Housing Assembly:**
- Nominal dose output at cone tip:
  - 20 cm cone - 1.5 R/second.
  - 30 cm cone - 0.80 R/second.
- Cooling curves: See Cooling curve.

The HDX X-ray source assembly complies with radiation protection in accordance with IEC 60601-1-3: 1995

**X-ray Controls and Generator:**

<table>
<thead>
<tr>
<th>Rated nominal line voltage</th>
<th>120V</th>
<th>230-240V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Frequency</td>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Phase</td>
<td>Single</td>
<td>Single</td>
</tr>
<tr>
<td>Permissible maximum line voltage regulation</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Maximum line current</td>
<td>11A</td>
<td>5.5A</td>
</tr>
<tr>
<td>Technique factors at maximum line current</td>
<td>65 kV/7mA</td>
<td>65 kV/7mA</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>1.60 (one 0.25 second exposure every 15 seconds)</td>
<td></td>
</tr>
<tr>
<td>Time range</td>
<td>0.01 - 2.00 seconds in 0.01 second increments</td>
<td></td>
</tr>
</tbody>
</table>

Maximum deviation from indicated values:

- kV: +/-5 kV
- mA: +/-25% for T=0.01 seconds
- +/-10% for T > 0.01
- Time: 0.01 seconds or +/-1% (whichever is greater).

**Measurement Base of Technique Factors:**

The kV is measured by using a built-in voltage divider with an accuracy of +/-2%, and a digital multimeter. Tube current is measured using a sampling resistor with an accuracy of +/-1%, and a digital multimeter. Exposure time is measured by a crystal controlled counter with a base accuracy of better than 0.1%. Exposure time begins when the X-ray light on the control panel illuminates, and ends upon activation of the audible chime.

**Electrical Specifications:**

<table>
<thead>
<tr>
<th>Input voltage</th>
<th>120VAC</th>
<th>230-240 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line frequency</td>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Phase</td>
<td>Single</td>
<td>Single</td>
</tr>
<tr>
<td>Permissible maximum line voltage regulation</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Maximum apparent resistance of supply mains</td>
<td>0.650ohms</td>
<td></td>
</tr>
<tr>
<td>Maximum line current</td>
<td>11A</td>
<td>5.5A</td>
</tr>
<tr>
<td>Line Circuit breaker</td>
<td>15A</td>
<td>10A</td>
</tr>
<tr>
<td>Maximum stand-by current</td>
<td>0.2 Amps</td>
<td>0.1 Amps</td>
</tr>
<tr>
<td>Maximum line fusing (F1 and F2): 120V: 5 Amp., 250V: 3 Amp., 250V.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remote cable specification:**
A 10.7 m long, 7-wire, shielded, 22 AWG cable is supplied with each remote system. If needed, a maximum 15.2 m long cable is available upon request from Flow Dental.

**A "deadman" type exposure switch on a coiled cord which stretches 3.66 m long is provided for Integrated models only.**

**Environmental Specifications:**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Temperature: 10°C to 45°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Humidity</td>
<td>5 to 90% non-condensing</td>
</tr>
<tr>
<td>Altitude: Sea level to 3,000 m</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shipment &amp; Storage</th>
<th>Temperature: -43°C to 60°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude:</td>
<td>Sea level to 3,700 m</td>
</tr>
<tr>
<td>Relative Humidity:</td>
<td>5 to 90% non-condensing</td>
</tr>
</tbody>
</table>

**Installation, Operation and Maintenance Instructions**
Section XIII Technical Specifications

ELECTROMAGNETIC INTERERENCE:
The HDX Intraoral x-ray is designed to meet the following standards as they relate to Electromagnetic Interference (EMI): EN 60601-1-2, IEC 801-2: 1991, IEC 801-3: Draft, IEC 801-4: 1988, and IEC-801-5: Draft. In order to assure continued system operation to EMI performance levels within allowable limits, do not remove or modify any of the EMI control devices.

SYSTEM DISPOSAL AT END OF USEFUL LIFE ADVICE:
The HDX Intraoral x-ray, with exception of the transformer oil inside of the tubehead, can be disposed of in the same way as any electronic product. In regard to disposing the oil, puncture the aluminum window in the front center of the tubehead (where the cone is attached). Drain the oil into a clean container, then dispose of it in accordance to local requirements.

MAXIMUM RATING CHARTS
(ABSOLUTE MAXIMUM RATING CHARTS)

SELF-RECTIFIED

FOCAL SPOT: 0.8 mm

TUBE CURRENT (mA)

HEAT STORAGE x 10^6 HU

EXPOSURE TIME(s)

MINUTES

ANODE THERMAL CHARACTERISTICS

HEATING

COOLING

MINIMUM TIME BETWEEN EXPOSURES

Seconds

Housing Cooling Curve

Duty Cycle Chart

Flow Dental HDX Intraoral X-ray
Section XIII Limited Warranty

Flow Dental warrants the HDX Intraoral X-ray to be free of defects in material and workmanship, under normal usage for a period of two (2) years from the date of installation.

Please note the following additional terms of our warranty and return policy:

- Warranties cover manufacturing defects only and do not cover costs resulting from abuse, improper handling, cleaning, care or maintenance, normal wear and tear on non-observance of operating, maintenance or installation instructions.

- Liability is limited to repair or replacement of the defective product at our sole discretion. All other liabilities, in particular liability for damages, including, without limitation, consequential or incidental damages are excluded.

- THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO EMPLOYEE, REPRESENTATIVE OR DEALER IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR TO GRANT ANY OTHER WARRANTY.

If product return is required, we will provide you with a Return Authorization number and shipping instructions to return the product to the proper facility. If the product is under warranty we will ask you to provide proof of purchase such as a copy of your invoice. Please be sure to include the Return Authorization number on the package you are returning. Products returned without a return authorization number cannot be repaired or given credit consideration.

Freight costs for product returns are the responsibility of the customer. Products under warranty will be repaired or replaced, at our sole discretion, and returned at our expense. Products outside the warranty limits will be repaired and returned with costs invoiced to the customer. We are not responsible for shipping damages. We will, however, help you file a claim with the freight carrier. Written repair estimates are available. Out of warranty repaired products are protected by a six-month warranty. In warranty repairs or replaced products are covered for the duration of the original warranty.