ARIBEX™

NOMAD™ eXaminer

Portable X-Ray System for Small Area Radiographic Imaging

USER MANUAL

A Radiation Safety Abbreviated Report has been submitted in order to register NOMAD eXaminer in accordance with DHHS Manufacturer Reporting Requirements, 21 CFR 1002.12. See accompanying Certificate of Conformance.

Disclaimer: NOMAD eXaminer is sold with the understanding that the user assumes sole responsibility for radiation safety (as well as any state, provincial, or local regulatory compliance) and that ARIBEX, Inc., its agents or representatives, do not accept responsibility for:

a) injury or danger to personnel from x-ray exposure,
b) image overexposure due to poor operating techniques or procedures,
c) equipment not properly serviced or maintained in accordance with instructions contained in this publication, and
d) equipment which has been modified or tampered with in any way.

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Table of Contents

1.0 Getting Started

We value your business. For feedback or suggestions, please send e-mail to NOMADexaminer@aribex.com – we like to hear from our customers. Thank you very much for choosing ARIBEX, Inc. as your x-ray vendor!

Introducing *X-Portability* from ARIBEX
▲ True Portability – optimal cordless use for confined spaces or remote locations.

Other NOMAD™ eXaminer Features
▲ Charged for Performance – battery power source delivers dependable high voltage (60kV, true DC) and direct current (2.3mA).

▲ Constant Emission Radiation – high-frequency, constant-potential x-ray generator provides high quality images, with a relatively lower radiation *dosage* than other AC x-ray systems.

▲ Radiation Protection – operator shielded from source and backscatter radiation.

▲ Simple Operation – exposure time is the only setting requiring operator input, digitally displayed on the user-friendly control panel along with indicators for machine and battery status.

▲ Lightweight and Ergonomic – design provides complete flexibility and convenience.

▲ Engineered for Compatibility – works with both film and digital imaging systems.

▲ Authorized Service – complete support and maintenance from an authorized distributor and ARIBEX.

1.1 Intended Use

NOMAD™ eXaminer is intended for general, non-medical use – materials imaging, industrial inspection, pathology/forensics, and veterinary care that requires small-area radiographic imaging. The use of NOMAD eXaminer on live humans is expressly prohibited by regulation.

This publication, applicable to NOMAD eXaminer and NOMAD CE eXaminer, covers instructions for a cordless, handheld x-ray system. Symbols used in this publication and used to mark the equipment have the following meanings:

 Ionizing Radiation

 Double Insulation

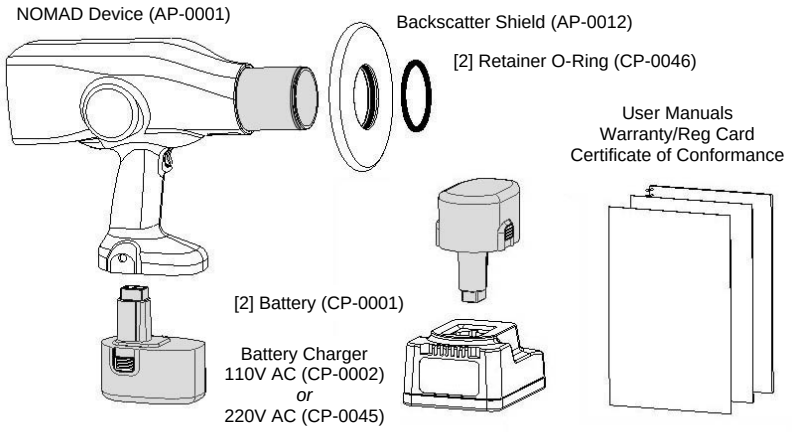
 Warning *or* Danger

 Electrical Shock Hazard

 Type BF Equipment (providing a degree of protection against electric shock, pertaining particularly to allowable leakage currents)

1.2 Unpacking and Registering NOMAD eXaminer

❶ Unwrap individual components from the protective plastic and double-check for any noticeable signs of damage. The battery charger should be appropriate for local AC line voltage. The standard package system includes the following items.



❷ Compare the serial number of NOMAD eXaminer (see underside) with the number affixed to the registration card (MP-0008) to ensure they are the same.

❸ Complete this product registration card and mail it with proper postage to ARIBEX today. Registration fills a condition of warranty coverage (see last page for warranty info) and enables you to receive valuable product news and updates.

1.3 Charging the Battery

❶ Unwrap the power cord of the battery charger and connect it to an AC electrical outlet (110V or 220V, dictated by the locale). A plug adapter may be used as needed; use only the supplied battery charger (for manufacturer and model info, see section 6.3, *Repair and Maintenance by an Authorized Distributor*).

❷ Invert one of the batteries and plug it into the charger. The red indicator light on the top of the charger will flash at a steady rate while the battery is charging. The required charge time varies (as much as 30 to 45 minutes). Battery and charger may become warm to the touch while charging, which is a normal condition.

When the battery is fully charged and ready to use, the indicator light will stop flashing and remain on continuously (for more info, see section 5.0, *Battery Replacement*, or the battery charger user manual).

2.0 Important Safety Precautions

Do not pull apart the apparatus housing (enclosure). Do not undertake disassembly of the main apparatus, or the warranty shall be invalidated.

Repairs can only be undertaken by trained service personnel at an authorized distributor. Direct all questions to an authorized distributor.

2.1 Cleaning

Ensure the battery charger is unplugged before attempting to clean. To make sure that power is off for NOMAD eXaminer while cleaning, detach the battery. Use a non-alcohol based disinfectant only – wipes, or a cloth dampened with liquid or spray.

NOMAD eXaminer and the accompanying battery charger are not designed to be subjected to any kind of sterilization procedure. NOMAD eXaminer is not designed to be used to sterilize anything else.

2.2 Usage

NOMAD eXaminer should not be used in environments where flammable cleaning agents are present.

NOMAD eXaminer is rated for IP0; do not operate it or battery charger if either was immersed in liquid or subjected to an undue amount of moisture.

As a safety feature, NOMAD eXaminer cannot be enabled for exposure with insufficient voltage (low battery). The proper voltage rating for NOMAD eXaminer batteries is 14.4V.

NOMAD eXaminer is also designed to avoid damage from overheating. The maximum duty cycle rating (the relationship between duration and frequency of exposures) is 1:60. Examples of optimal use:

Duration	0.25 sec	0.46 sec	0.50 sec	0.99 sec
Cycle	every 15 sec	every 28 sec	Every 30 sec	every 60 sec

NOMAD eXaminer may generate and radiate radio frequency energy that causes interference to other devices in the vicinity, if not used in accordance with the instructions (though there is no guarantee that interference will not occur in a particular instance). If interference occurs, the user is encouraged to try the following corrective measures: reorient or relocate the receiving device; increase the separation between the equipment; consult the device manufacturer or field service technician for help.

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

Follow all guidelines dictated by the radiation protection program of your organization in regard to operators who are pregnant or expect to become pregnant. In implementing a radiation protection program, please consult any state, provincial, and local regulations governing radiation protection and the use of x-ray equipment. Ensure proper registration and compliance with any such regulation.

Standard exposure procedure consists of three basic steps, regardless of whether film or a digital imaging sensor is used:

- Determining proper time setting
- Enabling the x-ray device (which ensures a state of readiness)
- Starting the timed exposure

Do not enable NOMAD eXaminer until relevant materials and personnel are positioned and ready for the exposure, diminishing the likelihood of interruption and preventing inadvertent exposure of anyone to x-rays. Do not attempt an exposure if anyone else is positioned immediately behind the object or material being examined (in line with the direction of x-ray emission).

An exposure can be prematurely terminated for any reason by abruptly releasing the depressed trigger (for more info, see section 4.0, *Operation*).

2.3 Storage and Transportation

Make sure NOMAD eXaminer will not be knocked to the ground when not in use. Lay it on its side if necessary. Power should automatically shut off.

Some charge is lost during extended inactivity (leading to fewer exposures between battery chargings). For long-term storage, please detach the battery.

Under conditions that are cool and dry, away from direct sunlight, battery and charger can actually be stored for up to five years. Do not store or carry batteries so that metal objects can contact exposed battery terminals.

NOMAD eXaminer, battery charger, and batteries should not be subjected during storage or transportation to extreme conditions that are below –40°C (–40°F) or above +60°C (+140°F), or beyond 10% and 100% relative humidity (non-condensing).

3.0 Setup and Power Check

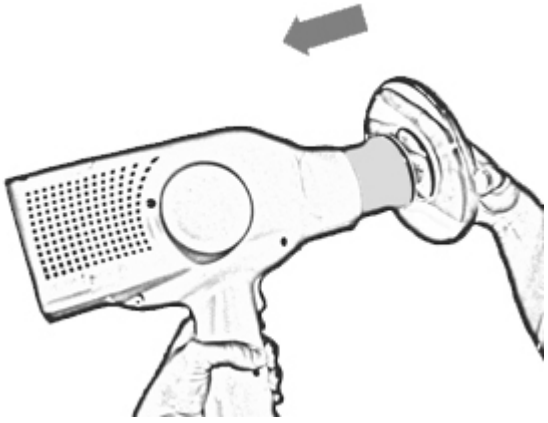
Please follow these additional pre-operational steps.

3.1 Attaching the Backscatter Shield

In addition to the lead-lined cone, the backscatter shield provides additional protection to you, the operator, and features an adjustable position to permit exposures made at various angles.

❶ First locate the rubber, retainer o-ring in the groove around the end of the collimator cone. Roll it out of the groove. Remove it and set aside.

❷ Hold the backscatter shield perpendicular to the collimator cone and align the end of the tube-shaped cone with the hole in the center of the shield.



❸ Attach it by pressing firmly on the shield, guiding it past the groove on the end. The inner o-ring of the shield allows it to slide along the collimator cone for adjustment as needed.

❹ In order to keep the shield on the cone, the retainer o-ring must now be placed back into the groove on the cone end. Make sure it is seated all the way around.

3.2 Attaching a Charged Battery

Once the red indicator light of the battery charger has changed from steady flashing to continuous (which could be up to 30 or 45 minutes), the battery is fully charged and can be removed from the charger.

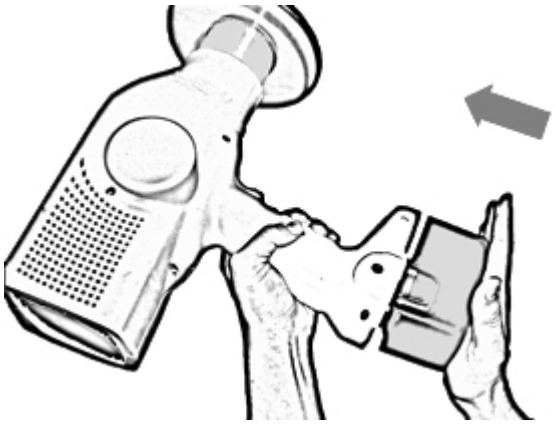
❶ Properly orient and insert the newly charged battery into the base of the NOMAD eXaminer handle with a firm push.

The clicking sound ensures the snaps on both sides of the handle bottom are fastened.

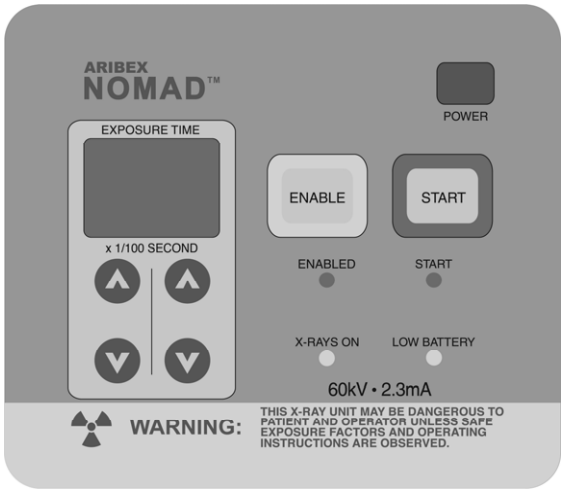
❷ Make sure the battery is secure by giving it a tug.

That's all it takes!

NOMAD eXaminer can be immediately placed into service, pending the following check for power.



3.3 Checking for Power



The control panel provides interaction and functionality necessary for operating NOMAD eXaminer.

❶ Press/release POWER. A single, long audible signal and the illuminated numeric (LED) display for exposure time are evidence of proper battery operation.

❷ For either scenario below, see section 5.0, *Battery Replacement*, for more info.

If for some reason the battery is too low, the yellow indicator at the lower right of the control panel will flash (accompanied by an intermittent audible signal).

The second battery should be charged in advance of the need to replace the battery currently in use. So, start charging it now.

4.0 Operation

Follow these steps for powering NOMAD eXaminer on/off and producing basic exposures.

For an explanation of the relationship between duration and frequency of exposures (duty cycle), see section 2.2, *Usage*.

4.1 Powering Up

After about two and a half minutes of inactivity, NOMAD eXaminer shuts off automatically. Press/release POWER to turn NOMAD eXaminer on, if needed.

A single, long audible signal and an illuminated numeric (LED) display for exposure time confirm that the control panel has power.

example

4.2 Ensuring Battery Charge Is Adequate

If the Low Battery indicator slowly flashes, accompanied by an intermittent audible signal, see section 5.0, *Battery Replacement* or section 6.2, *Troubleshooting*.

For other error conditions, please see section 6.1, *Alarms and Alerts*.

4.3 Ensuring the Right Exposure Time Is Set


increase

When power is turned off, the most recent setting for exposure time is stored in memory and redisplays when power is turned back on (unless the battery was replaced, in which case it is reset to the default value of 00, meaning 0.00 seconds).

example


decrease

If needed, press the Up and Down arrow buttons to change time (by tenths / hundredths of a second). A single, short audible signal confirms input when a panel button is pressed/released. (For example, **08** LED setting = 0.08 seconds; **35** LED setting = 0.35 seconds.)

4.4 Situating Object and Enabling the Device

Properly position the material or object to be examined *before* enabling NOMAD eXaminer (to prevent accidental exposure). Make sure the object remains stationary during the exposure.

Press/release ENABLE to ready the device; be sure to re-enable NOMAD eXaminer if any subsequent changes are made to the time setting prior to exposure.

The slowly flashing, green Enabled indicator and audible signal (intermittent, double beep) confirm that NOMAD eXaminer is enabled. This continues for 30 seconds or until an exposure is initiated.

4.5 Initiating and Completing a X-Ray Exposure

Note: An exposure can be prematurely terminated for any reason by abruptly releasing the depressed trigger. See section 6.1, *Alarms and Alerts*.

To begin the exposure, squeeze the handle trigger (or press/release START). The Enabled indicator stops flashing, and the green Start and yellow X-Rays On indicators illuminate.

To ensure complete exposure, keep the trigger depressed until the audible, continuous-tone signal ends and both indicators extinguish.

4.6 Powering Down

Press/release POWER to turn NOMAD eXaminer off, if needed.

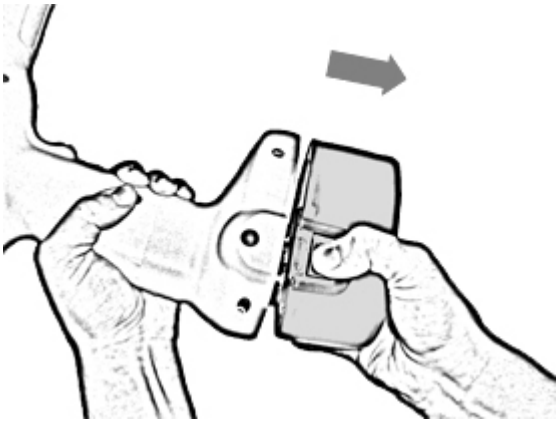
As previously noted, NOMAD eXaminer automatically shuts off after about three minutes of inactivity.

5.0 Battery Replacement

Having at least two batteries makes it possible to charge one while another is still in use. The red indicator light on the battery charger may stay on momentarily after a battery is removed from the charger. Always wait for the indicator light to extinguish before inserting another battery.

A flashing, yellow Low Battery indicator (control panel) and intermittent audible signal indicate the need for a freshly charged battery. NOMAD eXaminer cannot be enabled for an exposure with a low, depleted battery (insufficient voltage).

Follow these steps to clear the Low Battery alert.



❶ Press/release POWER on the control panel in order to turn NOMAD eXaminer off.

❷ Grasp the depleted battery and depress the buttons on both sides to unsnap it from the handle. You may have to put pressure at the very top of the buttons (nearest the handle).

❸ Then pull the battery away from the handle.

❹ Insert a newly charged battery into the base of the NOMAD eXaminer handle with a firm push. A clicking sound ensures that the snaps on both sides of the handle bottom are fastened. Make sure the battery is secure by giving it a tug.

Note: When a battery is detached, any stored exposure time is erased from memory and has to be reset when the unit is turned on again.

Each battery can go through the discharge/charge cycle approximately 100 times. When the battery charger senses a bad battery, it is spent and must be taken out of service. Do not attempt to charge damaged batteries. An authorized distributor, ARIBEX, and your local recycling center will accept spent or damaged batteries. Order new 14.4V batteries from ARIBEX or your authorized distributor. Do not use 18V (or other incorrect voltage) batteries from other sources, which invalidates the warranty.

Risk of Shock - There is 120V AC present at the battery charger terminals. Do not probe with fingers or conductive objects.

Always unplug the charger from the power supply when it is not in service.
For additional information, specifically about the charger, please see the accompanying user manual for the battery charger.

6.0 Keeping NOMAD eXaminer Up and Running

6.1 Alarms and Alerts

The visual/audible alarm signals a programmed action designed to prevent harm to operator, bystanders, and/or NOMAD eXaminer.

The visual/audible alerts confirm normal conditions or draw the operator's attention to a required action.

Condition	Visual Indicator	Audible Signal	Function / Resolution
Overheating ***Alarm***	LED display begins flashing	series of long beeps	operation suspends if the device overheats; after cooling down, it must be manually powered off/on (duty cycle – see section 2.2, *Usage*)
Low Battery ***Alert***	yellow *Low Battery* indicator flashes slowly 	slow series of short beeps	replace the battery and reset exposure time (for info see section 5.0, *Battery Replacement*)
X-Ray Exposure ***Alert***	green *Start* and yellow *X-Rays On* indicators illuminate 	continuous tone (for the duration of the timed exposure)	at the end of the successful exposure, audible signal and indicators extinguish
Incomplete Exposure ***Alert***	green *Start* and yellow *X-Rays On* indicators flash 	series of long beeps	activates if trigger is released before the timed x-ray exposure actually completes; ends automatically after 15 seconds or if power is manually turned off/on

Condition	Visual Indicator	Audible Signal	Function / Resolution
System Readiness ***Alert***	green *Enabled* indicator flashes slowly 	slow series of short, double beeps	activates when ENABLE is pressed/ released; ends automatically after 30 seconds or when an exposure starts (trigger is depressed or START is pressed/ released)
Invalid Input Error ***Alert***	N/A	two short beeps	invalid input (for example, triggering prior to enabling) activates alert, which then ends automatically
Valid Input ***Alert***	for numeric LED display, time setting increments or decrements	single short beep	valid when panel button is pressed/ released
System Alert ***Alert***	LED display extinguishes	two short beeps	battery is not low and x-ray emissions are not detected during timed exposure
	followed by a system shutdown		
Power OFF ***Alert***	LED display extinguishes	two short beeps	POWER is pressed/ released (while power is on)
	followed by a system shutdown		
Power ON ***Alert***	LED display illuminates	single long beep	POWER is pressed/ released (while power is off)

6.2 Troubleshooting

If you encounter results and/or errors in the operation of NOMAD eXaminer that are not explained in the previous sections, check the following table on user troubleshooting in an effort to determine the need for authorized service.

Device Symptom	Potential Problem	Corrective Action
6.2.1 Image from x-ray exposure does not have sufficient contrast	Underexposure (too light).	Increase the exposure time setting; or see Incomplete Exposure below.
	Overexposure (too dark).	Decrease the exposure time setting.
	Chemical developer (for film-based imaging).	Ensure chemical freshness and proper temperature.
6.2.2 Image from x-ray exposure is blurred	Combined movements of operator and object during exposure produced too much distortion.	Double-check the exposure time setting and re-enable when operator and object are again properly situated.
6.2.3 Green *Enabled* indicator stops flashing (and corresponding, short double beeps end) before an exposure is started	NOMAD eXaminer is no longer enabled. If an x-ray exposure is not initiated within 30 seconds of enabling, the System Ready condition will terminate.	Double-check the exposure time setting and re-enable when operator and object are again properly situated.
6.2.4 Green *Start* and yellow *X-Rays On* indicators flash (with corresponding series of long beeps)	Incomplete exposure – the depressed trigger was released before the timed exposure was able to complete.	This condition is cleared automatically within 15 seconds or by manually turning NOMAD eXaminer off and back on. The exposure will probably have to be repeated.
6.2.5 Yellow *X-Rays On* indicator does not illuminate	No exposure – a subsequent *Low Battery* alert will signal whether a low battery is the source of the problem.	Follow proper procedures for replacing the battery; see section 5.0, *Battery Replacement*.
	If within a few seconds, two short beeps are emitted and the system automatically shuts down, a different problem exists (see section 6.1, *Alarms and Alerts*).	NOMAD eXaminer will require authorized service; see section 6.3, *Repair and Maintenance by an Authorized Distributor*.

Device Symptom	Potential Problem	Corrective Action
6.2.6 NOMAD eXaminer automatically shuts down	After about three minutes of inactivity, NOMAD eXaminer emits two short beeps and shuts off automatically – the system has timed out.	Manually turn on NOMAD eXaminer when you are ready to use the device.
	However, if while attempting a x-ray exposure two short beeps were emitted and shutdown occurred, a different problem exists (see section 6.1, *Alarms and Alerts*).	If this condition persists, NOMAD eXaminer will require authorized service; see section 6.3, *Repair and Maintenance by an Authorized Distributor*.
6.2.7 There is no power to the NOMAD eXaminer control panel	If pressing POWER several times does not cause the numeric (LED) display to illuminate, the attached battery is the likely problem.	Ensure battery is securely attached.
		Replace with a newly charged battery before continuing. Use the battery charger to determine if the first battery is spent and must be taken out of service, or if it can be recharged.
	However, if while attempting an x-ray exposure two short beeps were emitted and shutdown occurred, a different problem exists (see section 6.1, *Alarms and Alerts*).	NOMAD eXaminer will require authorized service; see section 6.3, *Repair and Maintenance by an Authorized Distributor*.

6.3 Repair and Maintenance by an Authorized Distributor

NOMAD eXaminer is a maintenance-free product, except for routine cleaning. To make sure the power is off while cleaning, detach the battery. It is unnecessary to detach anything else in order to clean the unit. Use a non-alcohol based disinfectant only – wipes, or a cloth dampened with liquid or spray.

The battery charger and NOMAD eXaminer are not designed to be user service-able.

Do not pull apart the apparatus housing (enclosure). Do not undertake disassembly of the main apparatus, or the warranty shall be invalidated.

Repairs can only be undertaken by trained service personnel at an authorized distributor. Direct all questions to an authorized distributor.

The following are factory serviceable parts and components:

- NOMAD eXaminer, main apparatus assembly – part AP-0001
- Retainer o-rings – part CP-0046
- Backscatter shield / inner o-ring assembly – part AP-0012
- Batteries – part CP-0001
- 110V AC battery charger w/ manual (DeWalt, model DW9116) – part CP-0002
- 220V AC battery charger w/ manual (DeWalt, model DE9107) – part CP-0045
- Plastic carrying case (accessory) – part MP-0018

Damaged or suspect NOMAD eXaminer materials and components must be returned to an authorized distributor or ARIBEX, Inc. Please protect the environment, and do not throw away or improperly dispose of any part of the system or the battery charger.

If product return is required, contact ARIBEX for a Return Authorization number and shipping instructions to return the product to the proper facility. If the product is under warranty, you will be required to provide the serial number from the label affixed on the underside of the main apparatus.

Please be sure to include the Return Authorization number on the package you are returning. Products without a Return Authorization number cannot be repaired or given credit consideration.

Freight costs for product returns to the company are the responsibility of the customer. Though ARIBEX will not assume responsibility for shipping damages, it will help you file a claim with the freight carrier. Please see warranty information at the end of this manual.

7.0 Basic Technical Specifications

Maximum deviation from fixed factors	±5% (unless otherwise noted)
Total weight	4kg

Environmental

Operation	
Temperature	+4.5°C (+40°F) to +40.5°C (+105°F)
Relative humidity	10 to 90%, non-condensing
Storage and transportation	
Temperature	–40°C (–40°F) to +60°C (+140°F)
Temperature *w/ plastic carrying case*	–20°C (–4°F) to +60°C (+140°F)
Relative humidity	10 to 100%, non-condensing

Classification

Electrical specification	Double insulation 
	Class II, Type BF 
IPX specification	IP0; do not operate under wet conditions
Mode of operation	Intermittent operation

For use in environments where no flammable anesthetics and/or flammable cleaning agents are present; non-alcohol based disinfectant only – wipes or cloth dampened with liquid / spray.

Electrical

Rechargeable NiCd battery	14.4V, 2 Ahr
Minimum battery charge	11.6V
Battery current at 2.3mA, 60kVp output	16A

X-Ray Controls and Generator

Exposure time range	0.01–0.99 sec.
Maximum duty cycle	1:60 (one 0.25 sec. exposure / 15 sec.)
Minimum inherent filtration	1.5mm Al
Maximum output power	140W nominal at 60kV, 2.3mA
Generator rating	2.3mA at 60kVp ±5%
Leakage technique factors	60kV, 2.3mA, 0.99 sec.

Collimator Cone

Nominal dose output at cone tip (20cm)	600mR / sec.
X-ray field size and configuration	6cm diameter circle
Shielding	Lead-lined

Tube Assembly

Maximum peak tube potential	60kV ±5%
Anode voltage	60kV, DC
Anode current	2.3mA

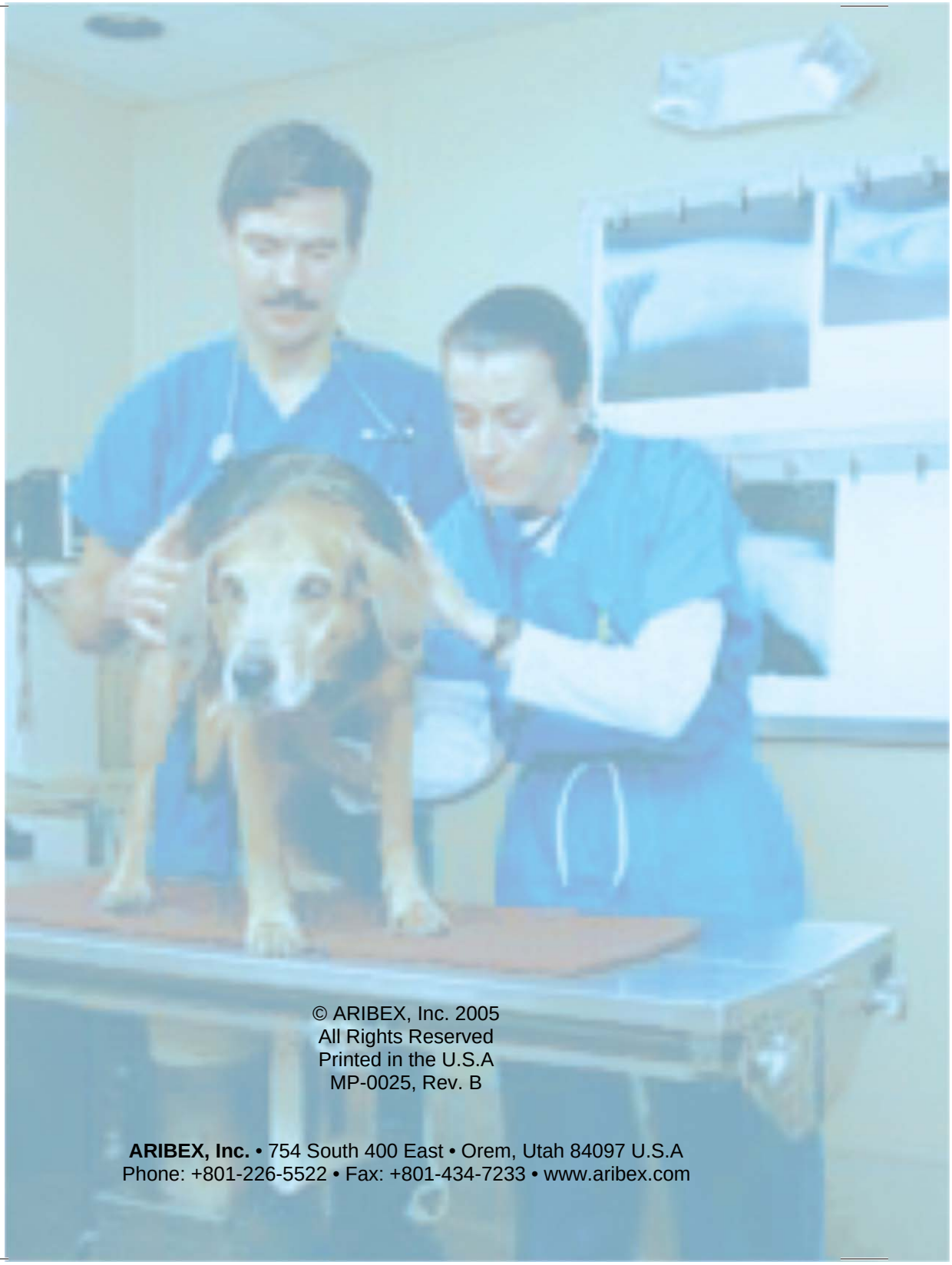
ARIBEX, Inc.
X-Ray Products Limited Warranty

ARIBEX, Inc. warrants its x-ray equipment to be free from any defects in material or workmanship for a period of one (1) year from the date of purchase. ARIBEX, Inc. also warrants carrying case, and any accessories purchased from ARIBEX, to be free from any defects in material or workmanship for the period of one (1) year from the date of purchase.

The liability of ARIBEX, Inc. is limited to repair or replacement of any parts that ARIBEX or its authorized resellers determine to be defective. Parts proving defective will be repaired or replaced free of charge, F.O.B. Orem, Utah, U.S.A. (or the location of the authorized reseller), if defective equipment is returned to such location for inspection, freight charges prepaid. All warranty claims must be made not later than ten (10) business days following the expiration of the applicable warranty period. Equipment repaired or replaced under warranty will continue to be warranted for the balance of the original warranty term.

This warranty does not apply to equipment that is or has been abused, misused, or altered (including opening enclosure or tampering), improperly maintained, subjected to use beyond rated conditions, or damaged as a result of any carelessness or accidents. This warranty does not cover ordinary wear and tear or maintenance.

ARIBEX, Inc. makes no other warranty, either express or implied, with respect to any equipment purchased from ARIBEX, including without limitation any implied warranties of merchantability or fitness for a particular purpose, whether or not ARIBEX may have been informed of the actual uses to which any of such equipment may be put. ARIBEX, Inc. shall not under any circumstance be liable for incidental, indirect, consequential, punitive or exemplary damages, including without limitation damages for delay or lost profits, and in no event shall liability of ARIBEX arising from the purchase, sale or use of the equipment, or breach of any warranty made above, exceed in the aggregate the purchase price paid therefore.



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