



# **TOUGH RAY 9030**

**PORTABLE VETERINARY X-RAY EQUIPMENT**

**INSTRUCTION MANUAL**

**DRAFT**

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Thank you for purchasing this portable veterinary x-ray unit. We are confident that you will be pleased with the radiographs you make with this model. This excellent unit will give you many years of reliable service. Please read this manual completely before using your unit. We always welcome your comments and suggestions.

### **NOTICE FOR SAFE OPERATION**

1. X-ray equipment should be operated only by individuals who have appropriate training and licenses.
2. Please take the following precautions during installation:
  - A. Keep equipment dry.
  - B. Do not subject equipment to excessive atmospheric pressure, temperature, humidity, direct sunlight, dust, or air containing salt and sulphur.
  - C. Do not subject equipment to excessive vibration and/or shock during transportation, etc.
  - D. Do not store equipment under any adverse gaseous conditions.
  - E. Insure that the input electrical voltage, amperage and hertz are correct and the unit is properly grounded.
3. During operation, consult and /or develop a technique chart for appropriate anatomy, distance, and screen/film combination.
4. After using the equipment:
  - A. Remove cords carefully, if necessary.
  - B. Keep equipment clean and dry.
  - C. Store inside carrying case in a cool, dry environment.
5. Maintenance
  - A. Equipment should be checked regularly to insure cleanliness and tightness of screws.
  - B. When equipment has not been used for a long interval, check operation completely before putting into service.
6. Operate the equipment correctly according to this instruction manual.

## **INTRODUCTION**

Your unit is a constant potential portable x-ray device utilizing the latest high frequency inverter. The unit has the following features:

1. A high frequency inverter with output greater than conventional models and constant x-ray tube voltage.
2. Compared with conventional generators, the wave form can be more than 2.5 times as effective.
3. kV and mA are corrected and stabilized by automatic feedback circuits.
4. X-ray tube focal spot size is 1.0 mm. Therefore, the quality of the resultant radiographs is equal to or better than x-ray taken by units with larger focal spots.
5. The unit is very easy to carry by hand because of its small size and lightweight.
6. The unit incorporates a Dual Laser Pointer in the light beam collimator to indicate the distance of SID.

As this unit uses high voltage, please read this manual carefully prior to operation.

## **NOTES TO USERS**

1. This unit has been developed specially for veterinary x-ray applications. It should not be used for other applications.
2. Wall outlet of 15A (minimum) is recommended.
3. Be sure to use a grounded circuit.
4. During operation, the operator should be fully protected from exposure to radiation and use a dosimeter badge.

## COMPONENTS

1.	X-ray Equipment (Model <i>TR9030</i> )	1 set
2.	Power Cord	1 pc.
3.	Hand-held Exposure Switch and Cord	1pc.
4.	Spare Fuse	2 pcs.
5.	Instruction Manual	1 pc.
6.	Carrying Case	1 pc.
7.	Warranty Sheet	1 pc.
8.	Technique Chart(s)	1 set

## OPERATING CONDITIONS

### A. Power Supply

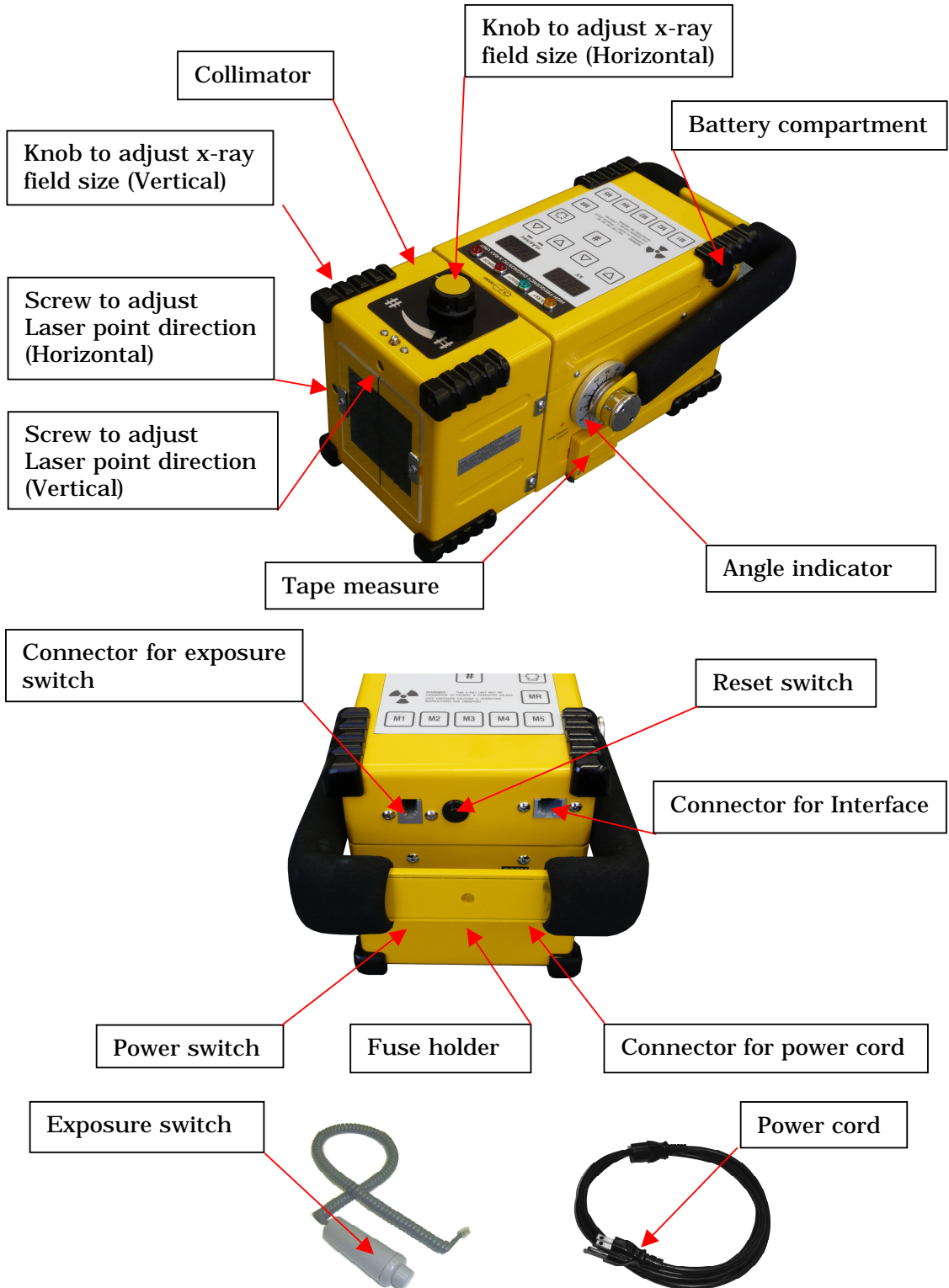
1. Nominal supply voltage	230VAC
2. Safe range of fluctuations in line voltage ( no load )	160-260VAC
3. Safe minimum line voltage (under load)	160VAC (230V model)
4. Rating of supply circuit	15A (230V model)
5. Phase and hertz	Single phase, 50 or 60Hz

**DO NOT OPERATE IF USING ELECTRICAL OUTLET WITHOUT PROPER GROUND.**

### B. Environmental Conditions for Use

1. Temperature	45 – 40°C 41 – 104°F
2. Humidity	30 – 85%
3. Atmospheric Pressure	70 – 106kPa (700-1060mbar)
4. Other	Avoid using where explosive or corrosive gases are present.

**MAIN PARTS OF TOUGH RAY 9030**



## CONTROL PANEL OF TOUGH RAY 9030



- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| 1. X-ray Indicator                    | 9. kV Adjustment Button (-)          |
| 2. Ready Indicator                    | 10. kV Adjustment Button (+)         |
| 3. Error Indicator                    | 11. sec/mAs Adjustment (-)           |
| 4. Low voltage indicator              | 12. sec/mAs Adjustment (+)           |
| 5. kV Indicator                       | 13. Shift Button                     |
| 6. Exposure time (sec)/ mAs Indicator | 14. Collimator light switch          |
| 7. mAs Indicator                      | 15. Memory Storage Button            |
| 8. sec Indicator                      | 16. Memory Recall Buttons (M1 to M5) |

## LASER ALIGNMENT INSTRUCTIONS

Before using the Dual Laser Pointer, you must adjust the position of the laser beam to be cross with the central ray of the x-ray unit at the source-to-image-distance (SID) you typically use. The adjustments can be made with a phillips (+) screwdriver.

Set up the x-ray unit indoors at the SID that you typically use, to a wall or x-ray cassette. The adjustment screws for the laser beam are on the top and side of collimator.

Turn on the collimator light and laser beam together by pressing the COLLIMATOR LIGHT ON BUTTON on the control panel, or the first stage of the EXPOSURE SWITCH. Make sure that the cross hair indicating the central ray is visible at this SID.

Use the screwdriver to turn the adjustment screws for the laser beam to place the laser beam close to be a cross on the wall or x-ray cassette by the collimator at your typical SID.

One adjustment screw adjusts the laser beam UP and DOWN. Turning this screw clockwise adjusts the laser beam DOWN. The other adjustment screw adjusts the laser beam RIGHT and LEFT. Turning this screw clockwise adjusts the laser beam LEFT.

When you have finished adjusting the position of the laser beam, a cross hair of laser beam indicating on the wall or x-ray cassette.

NOTE: Initially, the Laser Pointer has been adjusted to the central ray at a SID of 27.6"(70 cm).

The Laser Point's adjustable distance is 19.7" (50cm) – 39.4" (100cm).

One adjustment screw adjusts the laser beam UP and DOWN. Turning this screw clockwise adjusts the laser beam DOWN. (The adjustment Screw is locate the side of collimator)



The other adjustment screw adjusts the laser beam RIGHT and LEFT. Turning this screw clockwise adjusts the laser beam LEFT. (The adjustment Screw is locate the top of collimator)



When you have finished adjusting the position of the laser beam, a cross hair of laser beam indicating on the wall or x-ray cassette.

## OPERATING PROCEDURES

### Connection

Connect POWER CORD and EXPOSURE CORD to main body. Connect POWER CORD PLUG to grounded electrical outlet of proper voltage, amperage, and hertz. Check the rating label on your unit to confirm the proper input voltage.

### Operation

1. Press MAIN POWER SWITCH on the rear panel to the on position. Each digital display on the control panel will illuminate. The TR9030 is now ready to use.

### CAUTION

DO NOT SWITCH THE MAIN POWER ON AND OFF QUICKLY IN A SHORT TIME WHEN TURNING ON AGAIN AFTER TURNING OFF, WAIT FOR AT LEAST 1 MINUTE. OTHERWISE THE HIGH FREQUENCY INVERTER CANNOT WORK PROPERLY.

2. Select the kV output by pressing the arrows below the kV display to choose 50kV to 80kV.
3. Set the exposure time for the view to be taken, and the imaging medium used. Press the arrows below the sec. display to choose the exposure time between 0.01 and 2.00 second exposures. The display can be changed between mAs and sec. selected by pressing the shift button (#) and pressing the down arrow (▽) below the kV display.
4. Use the retractable tape measure to position the TR9030 at the proper source-image distance (SID) for the image to be taken.
5. Turn on the collimator light by pressing the button on the control panel. The light will remain on for approximately 30 seconds, and then automatically turn off. The shutters of the collimator can be adjusted at any time with the 2 knobs on the collimator. The size of radiation field will only be projected on the image receptor when the light is on.
6. Position the patient. Adjust the collimator position so the cross hair projected by the collimator light is aligned with the anatomical point of interest and the center of the image receptor. Collimate the size of the light field so that it stays within the dimensions of the image receptor.

## 7. Radiography

Make sure that ERROR INDICATOR is off.

The exposure switch has 2-stage button.

The first stage pre-heats the filament of the x-ray tube. When this stage alone is depressed and held, the "READY" indicator will light after 1.5 seconds, indicating the filament was heated and the unit is ready to generate x-rays.

The second stage initiates the x-ray exposure for the time set in the sec display. When the second stage is fully depressed, x-ray will be emitted, the X-RAY indicator will light, and an audible signal will be heard. PRESS AND HOLD THE FIRST AND SECOND STAGE BUTTONS TOGETHER UNTIL THE EXPOSURE HAS TERMINATED. This is a "dead man" exposure switch -- x-ray exposure will terminate immediately as a safety feature when the buttons are released.

It is possible to depress the two stage buttons simultaneously. When this is done, there is approximately a 1.5 second delay before the timed x-ray exposure begins.

8. After each exposure, release the exposure buttons. The TR9030 is now ready for the next exposure.

9. After exposure, if the Low voltage indicator is light on:

There are 2 reasons cause this case happen, one is capacity of power supply is not enough, the other is the power cord is too long.

Press the reset button, which is located on the back of unit, and check the Low voltage indicator is light off.

Press Shift key(#), and at the same time press mAs/ Sec. (△), switch mA program to be Low mA.

Reset up exposure time (same method as mAs setting method), and then exposure.

Low mA and Hi mA can be switched by pressing Shift key/(#) and at the same time pressing mAs/ Sec. (△).

When the unit under Low mA program, the indicator of sec setting is blinking, this is the signal that the unit is under Low mA program. mAs indicator indicates calculable mAs.

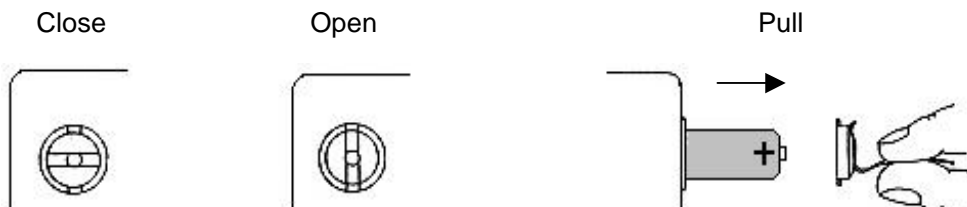
Low mA program helps when the supply power is not strong enough or if you have to use extension power cord. This new function outspread appliance area that current units don't have.

**Error lamp will blink if the exposure switch is released before the set exposure time. Turn off the MAIN POWER SWITCH, wait 1 minute, then start procedures over again.**

**Operation Note: To insure maximum life of x-ray tube and to avoid interruption of operation, do not exceed duty cycle of 1:60.**

10. When you are finished using the TR9030, turn off the main power switch. All of the indicators on the control panel will turn off after several seconds.
11. Five different technique settings can be stored in memory for quick recall on the TR9030. To store a technique setting, press the Memory Storage button MR then press Memory Recall button M1. This will store the technique setting displayed in memory position M1. Repeat this process for storing the different technique setting in M2-M5 as desired. Stored technique settings can be easily recalled by simply pressing M1-M5.
12. Memory Storage use two (2) size AA alkaline batteries inside Battery Compartment, located on the back side of equipment. Open the Battery Compartment using a coin, turning the compartment lid counterclockwise 90°. If there are no batteries in the Battery Compartment, use some adhesive tape to help you remove the compartment lid.

Insert two (2) size AA alkaline batteries in the Battery Compartment, with the + end toward the Battery Compartment lid. Reattach the Battery Compartment lid and lock it with a coin, turning it clockwise 90°.



## **ERROR INDICATOR**

Your **TR9030** has an ERROR INDICATOR. If the ERROR INDICATOR is on, stop exposing and follow the step below. The unit has malfunctioned and x-ray cannot be generated.

If ERROR INDICATOR is lit even after the EXPOSURE SWITCH is released, it means an unusual situation has occurred. Turn off the MAIN POWER SWITCH, wait 3 minutes, then start procedures over again.

If the ERROR INDICATOR remains on, contact your dealer.

## Specifications

### Rating

Power Requirement	AC, single phase, 230V
Maximum Output	90kVDC, 15mA, 2.00 sec.
Line Voltage Regulation	4.8%
Input Current	Stand by: 0.185A Momentary: 15.0A
Protection Against Electrical Shock	Type B, Class I
Fuse	15A @ 250V

### X-ray Generator

#### Output

Tube voltage : tolerance $\pm 10\%$		
Maximum tube voltage:		90 kV
Minimum tube voltage:		40 kV
kV switch:		2 kV step

Tube current : tolerance $\pm 20\%$			
90kV to 82kV	15mA(0.02 to 0.1sec)		9mA(0.11 to 1.0sec)
80kV to 72kV	20mA(0.02 to 0.1sec)		12mA(0.11 to 1.0sec)
70kV to 62kV	25mA(0.02 to 0.1sec)		15mA(0.11 to 1.0sec)
60kV to 40kV	30mA(0.02 to 0.1sec)		18mA(0.11 to 1.0sec)

Tube current : Low mA			
90kV to 82kV	9mA(0.02 to 0.1sec)		6.3mA(0.11 to 1.0sec)
80kV to 72kV	12mA(0.02 to 0.1sec)		8.4mA(0.11 to 1.0sec)
70kV to 62kV	15mA(0.02 to 0.1sec)		10.5mA(0.11 to 1.0sec)
60kV to 40kV	18mA(0.02 to 0.1sec)		12.6mA(0.11 to 1.0sec)

Exposure timer : tolerance $\pm 10\%+1\text{msec}$		
0.02	- 0.2 sec.	0.01sec step
0.2	- 0.5 sec.	0.02sec step
0.5	- 1.0 sec.	0.05sec step
1.0	- 2.0 sec.	0.1sec step

Internal Power Supply	Constant potential, 60kHz
Line Voltage Adjustment	Automatic
X-ray Tube	SNMI
Focal Spot	1.0 mm
Anode Heat Storage	7kHU
Total Filtration	2.7 mm Al equivalent (with collimator) 2.2 mm Al equivalent (without collimator)
Collimator	Mikasa R-200V continuously adjustable light beam type with central ray indicator, and size/distance scale to aid in correct positioning.
cassette	
Exposure Cord	2.5 meters
Exposure Switch	Two stage, deadman type
Power Cord	6.0 meters
Size	18.2cm W x 15.0cm H x 31.0cm L
Weight	6.56 kgs.
Applications	Equine and large animal veterinary radiography
Duty cycle	1:60

Specifications subject to revision without notice.