



Victoreen Model 8000 NERO TM mAx



100 kHz sampling speed captures data from the most difficult machines
0.5 kV or 1% accuracy from 22 to 160 kV
Measures kVp average, kV effective, kV peak, time, exposure or rate, mA or mAs, HVL, exposure/frame, and mAs/frame Displays R or Gy

Convenient Excel Add-in with templates for Reproducibility, Accuracy, mAs Linearity, Beam Quality and Summary Reports RS-232 computer interface
Enhanced dental capabilities.

INTRODUCTION

The Victoreen NERO TM mAx, Non-invasive Evaluator of Radiation Outputs, evaluates the widest range of X-ray machines on the market today. Evaluation of pulsed fluoro, cine, computed tomography (CT), portable, mammographic, dental, radiographic, fluoroscopic, low, medium, and high frequency machines is finally made possible with a single instrument. This fifth generation instrument features 100 kHz sampling speed and direct mA/mAs measurements. The NERO TM mAx's innovative Easy Flow Menu (EFM) system and flexible softkeys provide an intuitive, user friendly operating environment for quick, accurate, and easy measurements. All measurement modes and functions are displayed on the NERO TM mAx's super bright LCD and are controlled by the five softkeys directly below the display and three hard keys to the right.

Seven user selectable measurement modes and three system control modes are

available and clearly displayed on the control console screen for easy access and selection.

APPLICATIONS

The NERO™ mAx consists of the control console, detector, detector cable, two filter cards, mAs leads, Excel Add-in, AC adapter, HVL plates, manual and carrying case.

The compact control console houses the rechargeable battery, super bright easy to read backlit display, eight control buttons, and the sophisticated electronics necessary for accurate, reproducible measurements. Connectors for power input, RS-232, printer, scope output and the NERO™ mAx detector are located on the control console's rear panel.

The NERO™ mAx detector contains sensors for simultaneously measuring kV, exposure or rate and mA or mAs. Solid state detectors are used to measure kV. An ion chamber, located in the top of the detector, is used for exposure/rate measurements. Connectors for external ion chambers and the NERO™ mAx detector interface are located on the rear panel of the detector. The front panel has a keyed opening for the NERO™ mAx filter cards and a connector for mAs leads. The filter cards contain the various filters needed to accurately measure kilovoltage. Each filter card is coded so that the NERO™ mAx "knows" which filter is in use and its position. The NERO™ mAx also verifies that the filter card is valid for the selected measurement mode. The two filter cards are keyed so that they may only be inserted properly. The W/AI filter card and the Mammo filter card are clearly labeled as to the X-ray tube targets for which they are calibrated.

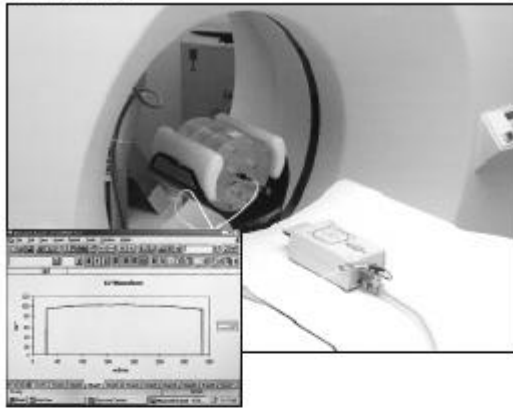
External Chambers

External ion chambers for CT, mammographic, image intensifier tube, and special radiographic applications are available.

Chamber calibration factors can be stored in the NERO™ mAx for direct readout of measurements.

The NERO™ mAx Excel Add-in acquires measured data and waveforms directly into an Excel spread sheet to maximize flexibility for report generation.

Real-time CT



UNIT ID	SETUP	CAL	HVL
EXP	CT EXP	10 PULSE	
	AMSE	ZERO	
	FLUORO	75%	
	MAMMO	80%	LOW
	RADIO	90%	HIGH 10 mS
MODE	%kV	SENS	DELAY

Easy Flow Menu, Mode Select Screen

80.0	kVp Avg	100	msec
79.2	kV Eff	392	mR
81.1	kV Peak	0.0	mAs
RADIO	75%	LOW	10 mS
MODE	%kV	SENS	DELAY

Easy Flow Menu, Radio Screen

24.8	kVp Avg	226.1	msec
24.3	kV Eff	240	mR
27.3	kV Peak	19.9	mAs
MAMMO	HIGH	MOLY	Mo 30µ
MODE	SENS	TARGET	FILTER

Easy Flow Menu, Mammo Screen

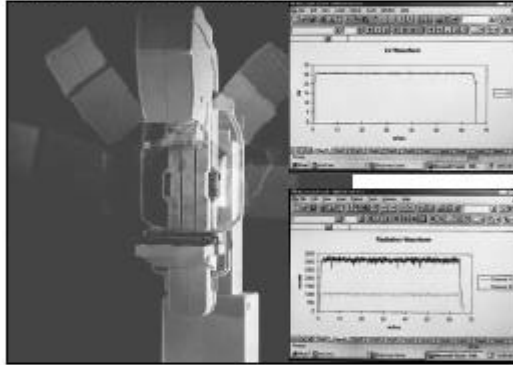
75.4	kVp Avg	0.159	R/min
71.1	kV Eff	0	mAs/pulse
80.8	kV Peak	177	µR/pulse
FLUORO	PULSED	LOW	
MODE	TYPE	SENS	

Easy Flow Menu, Pulsed Fluoro Display

74.1	kVp Avg	102.1	mSec/frame
72.7	kV Eff	359.3	mR/frame
74.8	kV Peak	30.5	mAs/frame
AMSE	LOW		
MODE	SENS		

Easy Flow Menu, AMSE Screen

High Frequency Mammography



3.65 R			
CT EXP	LOW	10 mm	
MODE	SENS	BEAM	RESET

Easy Flow Menu, CT EXP Screen

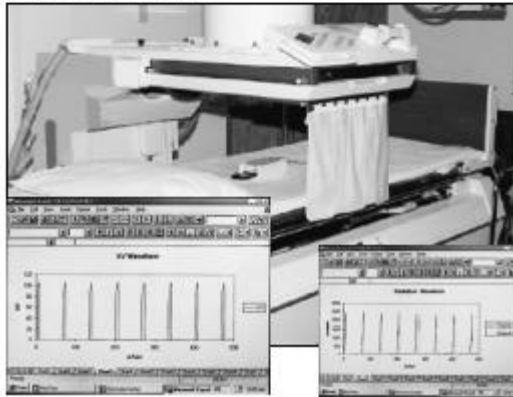
1.23 mR			
EXP	FLUORO	INTEG	HIGH
MODE	CHAMBER	MODE	SENS

Easy Flow Menu, EXP Screen

6.2 R	HVL	3.76	mmAl
	r = 1.000		
Please wait...			
HVL	CT	LOW	10 mm
MODE	CHAMBER	SENS	BEAM

Easy Flow Menu, HVL Screen

Pulsed Fluoro/AMSE



SPECIFICATIONS

Kilovoltage

Measured during the first 480 ms of exposure

Measured Quantity kVp Avg, kV Eff, kV Peak

Accuracy 0.5 kV or ± 1%

Reproducibility 0.5 kV or ± 1%

Range

Target/Filter Range Filtration

W/Al 30 - 60 kV

50 - 100 kV

80 - 160 kV 1.2 mm of Al

Mo/Mo 22 - 35 kV 30 µ of Mo

Mo/Rh 22 - 40 kV 25 µ of Rh

Mo/Al 22 - 49 kV 1 mm of Al

Rh/Rh 25 - 49 kV 25 μ of Rh
Rh/Al 25 - 49 kV 1 mm of Al
All calibrations performed with NIST
traceable calibration beam

Analyze/Display Cycle Time

Radio & Mammo

3 seconds for 0.1 second exposure, 1 second for
each 32 ms of exposure time

Fluoro & AMSE

15 seconds for all exposures

Time

Radio Mode

Measured during entire exposure at 90, 80, 75%
rise/fall of waveform, zero crossing, or pulse
count

Mammo Mode

Measured during entire exposure at 90% rise/
fall of waveform

Accuracy 0.1 ms

Resolution 0.1 ms

Range All diagnostic exposures from 0.1 ms to 60
seconds

Exposure & Rate

Measured during entire exposure with automatic
energy, temperature, and pressure correction

Measured Quantity Roentgens or Grays

Accuracy $\pm 5\%$

Reproducibility

Radio and mammo modes: $\pm 2\%$ or 2 mR

Resolution 0.1 mR

Range All diagnostic exposure and rate measurements
from 1 mR to 9999 R

Fluoro Rate 0.1 R/min to 999 R/min

mAs and mA

Measured invasively during entire exposure

Accuracy 2%

Reproducibility $\pm 1\%$ or 0.2 mAs

Range 0.1 mAs to 9999 mAs, 0 to 1000 mA

HVL

Accuracy $\pm 5\%$

Range 0.1 - 99.9 mmAl

Physical

Display Super bright 240 x 60 pixel, super twist LCD
with cold cathode fluorescent backlight

Detectors Ion chamber and solid state (kV Detectors)

Ion Chamber Volume 45 cc nominal

Window Area/Density 38 mg/cm² Polycarbonate

HVL Set 2.30 mm, 1.0 mm, 0.3 mm Al

Power 12 VDC 1A External Supply

Rechargeable internal batteries supply more than
4 hours of continuous service with overnight

charge

Size Volume is 3960 in³ (0.065 m³)

Console

9.00 in x 9.12 in x 3.25 in
(22.86 x 23.17 x 8.26 cm)

Detector

6.56 in x 3.70 in x 2.58 in
(16.66 x 9.4 x 6.55 cm)

Filter Cards

2.4 in x 6.25 in x 0.31 in
(6.1 x 15.88 x 0.8 cm)

Weight

Shipping 23 lb (10.43 kg)

Console 4 lb 9.0 oz (2.067 kg)

Detector (with card) 1 lb 10.4 oz (.747 kg)

Filter Cards 2.9 oz & 3.2 oz (.090 kg & .094 kg)

Regulatory Compliance

Certified to meet European EMC directive 89/336/EEC and
FCC Part 15 Class B

This includes EN55011 Class B, EN50082-1. Meets safety
standards EN61010-1 and CSA 22.2 No. 950

NERO™ MAX OPERATING MODES

Radio Mode

Radio mode is used to make measurements on tungsten target, aluminum filtered
radiographic X-ray generators

Selections are available for % kV peak for the type of generator being tested. For
example, Zero

Crossing, Single Phase Pulse, 75%, 80%, or 90% of kVp modes are available for
accurate exposure

measurements on difficult X-ray machines Radio mode simultaneously measures:

- kVp Avg
- kV Eff
- kV Peak
- exposure
- exposure time
- mAs

Mammo Mode

Mammo mode is used to make measurements
on mammographic X-ray generators

Mammo mode simultaneously measures:

- kVp Avg
- kV Eff
- kV Peak
- exposure
- exposure time
- mAs

Fluoro Mode

Fluoro mode is used to make measurements on fluoroscopic X-ray generators.

Fluoro mode

supports both continuous fluoro and pulsed fluoro measurements

In the continuous fluoro mode, the NERO™ mAx measures:

- kVp Avg
- kV Eff
- kV Peak
- exposure rate (R/min)
- mA

In the pulsed fluoro mode, the NERO™mAx measures:

- kVp Avg
- kV Eff
- kV Peak
- exposure rate (R/min and mR/pulse)
- mAs/pulse

AMSE Mode

AMSE mode is used for Automated

Measurement of Sequential Exposures. This

mode is used to measure the output of CINE generators

In AMSE mode, the NERO™ mAx measures:

- kVp Avg
- kV Eff
- kV Peak
- exposure rate (mR/frame)
- mAs/frame
- time/frame (ms/frame)

CT Exposure Mode

CT Exposure mode is used to make CT exposure measurements using the Victoreen 6000-100 CT

ion chamber. The CT probe must be connected to the NERO™ mAx detector's external ion

chamber input in this mode

Exposure Mode

Exposure mode is used to make exposure and rate measurements using the NERO™ mAx's

internal ion chamber or an external ion chamber

HVL Mode In the HVL mode, the NERO™ mAx calculates half value layer based upon a series of exposure

or rate measurements made with varying thicknesses of aluminum absorbers placed in the

X-ray beam. A minimum of two exposures are required and up to ten exposures may be used

Calibrate Mode

Calibrate mode is used to enter and store calibration factors for ion chambers used with the NERO TM mAx

Setup Mode

Setup mode is used to setup various features of the NERO TM mAx. From the setup screen the user can set the instrument's parameters such as the real time clock, temperature and pressure

Unit ID Displays the NERO TM mAx's serial number, firmware part number and level

Available AC Adapters (Specify with Order)

Number Description Typical Geo.Region

14-328 110 VAC 12 VDC 1000 mA U. S. A., Japan

14-401 230 VAC 12 VDC 1000 mA Europe

14-414 230 VAC 12 VDC 1000 mA U. K.

14-414* 230 VAC 12 VDC 1000 mA Australia

External ion chambers are available for CT, Mammo, Fluoro, R/F, and Scatter. Please contact Inovision for additional information

** w 14-416 adaptor*

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