FLUKE ®

— Biomedical

Nuclear Associates 07-453

Digital X-Ray Pulse Counter/Timer

Operators Manual

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Section 1
General Information

1.1 Introduction

The Model 07-453 Digital Pulse Counter measures exposure time for a wide variety of x-ray generators. For half-wave x-rays such as dental machines, the instrument is always used in Pulse mode. The instrument will display the number of pulses. For DC or 3-phase x-rays, the 07-453 is always used in Millisec mode. After an exposure, the instrument will indicate the exposure time in milliseconds. For full-wave x-rays, the operator may need to try both modes. For most full-wave x-rays, especially at low power settings, the 07-453 should be used in Pulse mode. The unit will indicate the number of x-ray pulses. Many full-wave x-ray waveforms have a DC component. In other words, the x-ray output does not drop to zero between pulses. When this occurs, the 07-453 will read 1(one) when used in Pulse mode. The output of a DC x-ray is actually one pulse, so the instrument is reading correctly. To measure the exposure time, simply switch the instrument to Millisec and the instrument will time the x-ray in milliseconds.

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> NOTE
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> It is important that the user be thoroughly familiar with the contents of this manual before performing any tests on radiation-generating equipment. It is also imperative that the user be thoroughly qualified, and familiar with safety precautions and other practices relating to radiation generators.

1.2 Description

The Digital X-Ray Pulse Counter/Timer is used to measure the duration of radiation output produced by x-ray generators. This solid-state, digital instrument is designed specifically to aid service personnel in assessing the performance of radiation generator timing controls. The instrument is a noninvasive instrument, which samples the radiation beam of x-rays.

The Digital X-Ray Pulse Counter/Timer can be used as follows:

1. To count the number of x-ray pulses produced by half-wave and full-wave rectified machines; typically 60 pulses per second for half-wave rectified machines or 120 pulses per second for full-wave. Dental x-ray machines are typically half-wave rectified.

2. To measure the length of radiation output when the x-ray output is steady-state such that "pulsing" does not exist. X-rays that generate steady outputs include 3-phase AC medical x-ray machines, capacitor discharge x-ray machines and DC operated x-rays.

3. To measure the "on time" or relay contact closure time by counting the number of pulses of AC line voltage (65 to 130 VAC) via the front panel input jacks and test leads.

The Digital X-Ray Pulse Counter/Timer replaces not only mechanical impulse counters, but also other electronic counters. Its small hand-held size allows it to conveniently fit in a small tool box/jacket pocket.

There is no "Reset" button. The Digital X-Ray Pulse Counter/Timer automatically resets at the beginning of each exposure, holding the reading until the next exposure.

The most convenient way of using the Digital X-Ray Pulse Counter/Timer is to place it directly under the x-ray head. Step back, take the exposure and then read the exposure time in pulses or milliseconds. An optional remote sensor is also available to allow use of the instrument at distances of up to 12 ft away from the x-ray.

1.3 Specifications

Accuracy	AC Input: +/- 1 count
	DC Input: 2% or +/- 1 count
	X-ray Detection: +/- 1 count
Sensitivity	AC Input: 65 VAC minimum
	X-ray Input: 50 kVp, 5 mA at 2.0 in from top surface of case, pointed to target on case
Range	9999 pulses
	9999 milliseconds
Display	0.4 in liquid crystal
Power	9 V battery; alkaline or equivalent
Battery Life	24 hours continuous; typically 6 months of normal use
AC Input Jacks	130 V AC maximum
	65 V AC minimum
	Input circuit not affected by reversed polarity
Controls/Indicators	3-position switch: Pulse, Off, Milliseconds
	4-digit liquid crystal display: 0.4 character
	Low battery indicator: "Low Batt" appears in display when battery voltage reaches 4.8 V ± 0.5 V
	Power-On: LED (green)
	Oscilloscope output
Connections	None required for direct exposure measurement
Dimensions	3.15 x 5.8 x 1.6 in (80 x 147 x 40 mm)
Weight	0.5 lbs/0.21 kg
Accessories	AC test leads with pluggable alligator clips
Optional Accessories	Remote X-Ray Sensor (Model 07-453-2000)
	Carrying Case (Model 89-453)
	Oscilloscope Leads (Model 88-453)

1.4 Battery Replacement

The Digital X-Ray Pulse Counter/Timer is supplied with one 9 V alkaline battery. Replace the battery when the "Lo Batt" indicator shows in the display. Long life alkaline batteries are available from Fluke Biomedical. Any standard 9 V alkaline battery can be used in the Digital X-Ray Pulse Counter/Timer.

To replace the battery, slide open the battery compartment on the bottom of the case. Remove the old battery, and install the new battery.

Section 2
Operation

2.1 General Instructions

Switch Settings

The front panel selector/toggle switch on the Digital X-Ray Pulse Counter/Timer has three positions: "OFF", "PULSE" and "MILLISEC". The switch is OFF when in the center position.

OFF

All power to the instrument is disconnected in the "OFF" position. Set the switch to "OFF" when not in use, to conserve battery life. The center position is OFF.

PULSE

When the switch is moved to the "PULSE" position, the instrument will be used for measuring output pulses from half-wave or full-wave rectified machines as well as AC line voltage pulses. Normally, each full second of exposure will produce 60 pulses. An exposure of 2/10 second will read 12, for example.

MILLISEC

With the switch in the "MILLISEC" position, the instrument will measure the length of time that a DC or 3-phase AC x-ray is on. The display reading will be in milliseconds; i.e., an exposure of 1 second will read 1000; an exposure of 2/10 second will read 200.

Connections

When reading directly from an x-ray head, no connections are made to the instrument. Point the x-ray head at the "target" area of the instrument (near the lower left side of the instrument). Take an exposure and read the time on the display in pulses or milliseconds.

Oscilloscope Output

A jack labeled "scope" located on the left side of the instrument is the oscilloscope output. It allows the user to connect the instrument to an oscilloscope, so that x-ray waveform can be observed. This connector takes a standard 2.5 mm mono phone plug.

Remote Sensor

To use the Remote Sensor (optional), connect the plug at the end of the remote sensor cable into the jack labeled "remote" located on the left side of the Digital X-Ray Pulse Counter/Timer. Point the x-ray head at the target on the Remote Sensor. Stretch the cable out and use as described above.

AC Input

Connect the two test leads to the two input jacks on the front of the instrument. Since the instrument counts AC pulses, the AC line must be switched by the relay that is in the timer under test.

The circuit for AC inputs is completely isolated from the rest of the instrument. No damage to the instrument will occur if the probes are reversed. However, to obtain the best accuracy, the "+" (red) should be connected to the high side of the line, and the black or "-" probe should be connected to the low side of the line.

2.2 Oscilloscope Output

The Digital X-Ray Pulse Counter/Timer can be, and usually is, used without an oscilloscope, but the scope output feature enables technical analysis of the x-ray output.

X-ray generators often have characteristics such as gradual rise times, variations in amplitude, noise, capacitive filtering, and extended decay times. Problems with x-rays can often be diagnosed by observing the output waveform of an x-ray with an oscilloscope. Plug in a standard 2.5 mm mono phone plug into the jack and attach the leads of the scope probe to the phone plug terminals. Set the vertical sensitivity of the scope to 1 V per cm. The scope waveform will be an amplified version of the actual output of the x-ray detector.

A cable with a phone plug and a BNC connector for a scope is available from Fluke Biomedical (Model 88-453). The 2.5 mm mono phone plug is available from many vendors including Mouser Electronics, (P/N 177PP053). The Remote Sensor available from Fluke Biomedical (Model 07-453-2000) is particularly useful when observing the x-ray output using an oscilloscope.

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