



## **ELECTRONIC CONTROL CONCEPTS**

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# **INSTRUCTION MANUAL**

**MODEL 815 / 815L**

**X-RAY kVp Meter / Exposure Time Meter**

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**INSTRUCTION MANUAL**

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## DESCRIPTION

The ECC Model 815 X-ray kVp Meter / Exposure Time Meter is used to measure the maximum or peak accelerating voltage output produced by tungsten X-ray generators. The ECC Model 815 is a solid-state, digital instrument designed specifically for service personnel in assessing the performance of radiation generators. This instrument not only samples the acceleration voltage of x-rays, but measures the length of an exposure. Having both functions in an instrument simplifies regular constancy checks of kV. The instrument is used for dental x-ray units, radiographic and fluoroscopic x-rays.

The Model 815 is available with a low range option (Model 815L). See specifications section for actual range of both models.

The Model 815 can be used to measure the peak acceleration voltage produced by half-wave, full-wave rectified x-ray machines as well as DC or multiphase x-rays. It will accurately use ratios produced by different differentially filtered x-ray detectors to observe kV levels. When the instrument is being used to measure the length of an exposure, the operator can also determine the characteristics of an x-ray. After a reading is obtained, pushing the 'Mode' button will give the operator a message indicating if the x-ray is:

1. half-wave, or
2. full-wave, or
3. DC / 3 Phase (constant potential, also for x-rays with more than 3 phase) and, the exposure time.

When a measurement is being made, the Model 815 has the capability of automatically determining the type of x-ray that is being measured. It is not necessary for the user to program correction factors for different types of x-ray waveforms.

The Model 815 automatically resets at the beginning of each exposure, holding the reading until the next exposure.

The most convenient way of using the 815 is to place it directly under the x-ray head. Step back, take the exposure and then observe the reading. Refer to the section on Operation for information on how to obtain the most accurate measurements.

Note: With high energy (above 70 kVp) disregard first reading after power on.

**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.**

# GENERAL INSTRUCTIONS

## SWITCH SETTINGS

In order to keep operation easy and straightforward there are only two switches on the front panel.

### ON/OFF SWITCH

The ON/OFF Switch is used to turn on the instrument. The switch is illuminated, and the green light will be **on** when the power is turned **on**. Remember to turn the instrument off when not in use to conserve the batteries.

### MODE SWITCH

The MODE SWITCH has two functions.

1. When initially turned on, the instrument can be switched to the “High Resolution” mode.
2. After a kVp reading is obtained, pushing the Mode Switch will provide additional information.

#### 1. High Resolution / High Speed Modes

When the instrument is first powered on, it is in “Normal” or “High Speed Mode” which is used for most measurements. When used in Normal Mode the Model 815 measures the x-ray for almost 100 ms (0.1 second). Pushing the button once will put the instrument into “High Resolution Mode”. In High Resolution Mode, the x-ray exposure is sampled or measured for a little less than 200 ms (0.2 second). **When using the instrument in High Speed Mode, the x-ray exposure time must set to at least 100 ms (1/10 sec). When using the instrument in High Resolution Mode, the exposure must be at least 200 ms (2/10 sec).**

When the instrument is put into High Resolution Mode, it will stay in High Resolution Mode until it is turned off. To get the instrument into High Speed or Normal mode, turn the power off and then on. There is additional information about using High Resolution Mode in the Operation section.

#### 2. Additional Information Display

After a measurement, the kVp value will be displayed. Additional information can be displayed by pushing the mode button momentarily. The instrument will then sequence through the following information:

- Waveform Type
- Exposure Time in milliseconds

And back to kVp.

Waveform type and exposure time will each be displayed for about 1.2 seconds, and then the display will revert back to kVp. After the Additional Information is displayed and display returns to kVp, the meter is ready for another reading. If the battery is low, a ‘Batt Low’ message will also appear for 1.2 seconds.

# OPERATION

## kVp Measurements

To use the Model 815 X-ray kVp Meter for a kVp measurement, in most instances it is only necessary to turn on the instrument, and then center the meter's target in the light field and make an exposure.

In order to ensure more accurate readings, the following points should be kept in mind.

### 1. Current (mA)

The Model 815 will operate down to approximately 7 mA if the x-ray is focused properly on the x-ray target. The best accuracy is obtained at 10 to 50 mA.

### 2. Height

For half wave x-rays (Most dental x-rays) with 7 to 15 mA output, the cone should be ½ to 2 inches above the instrument.

For x-rays with 25 to 100 mA output, position the x-ray head 8 to 16 inches above the instrument.

### 3. Collimation

Collimate the x-ray to approximately 2" by 2" centered on the target on top of the instrument.

### 4. Exposure Time

There are two modes requiring different exposure times.

*In the Normal or "High Speed Mode", the exposure time must be at least 0.1 sec (100 ms).* The instrument takes slightly less than 100 ms exposure to make the entire kVp measurement. Exposure times longer than 100 ms are not necessary or desirable in order to minimize wear and tear on the head and exposure to the operator. When the instrument is used to measure exposure time, longer exposures are necessary.

*In "High Resolution Mode", the x-ray exposure time must be at least 0.2 sec (200 ms).* The instrument makes the entire kVp measurement during the first 200 ms of an exposure. Exposure times longer than 200 ms are not necessary or desirable in order to minimize wear and tear on the head and exposure to the operator. When the instrument is used to measure exposure time, longer exposures are necessary.

### 5. Waveform

This instrument measures the maximum or peak accelerating voltage that occurs during any part of the x-ray exposure except for the first 30 ms which we use as a delay to make sure the x-ray waveform is stable. The instrument will read and display the maximum value of the accelerating voltage during the rest of the x-ray exposure.

## 6. Initial Reading

The x-ray detectors accumulate charge when the unit is not used. When initially powered on, the instrument will need one x-ray exposure to work correctly. Disregard the first reading, especially at higher energies i.e. above about 80 kVp.

### **Exposure Time Measurements**

The Model 815 measures the Exposure Time each time a kVp measurement is made. To display the Exposure Time after an exposure, momentarily push the white Mode pushbutton switch. The exposure time will be displayed in milliseconds (ms). In normal or High Speed mode, exposure times less than 100 ms cannot be measured. The x-ray exposure time must be at least 100 ms. If it is necessary to measure exposure times less than 100 ms, please contact ECC to purchase our Model 8700 Digital X-ray Time Exposure Meter.

When the instrument is in High Resolution Mode, exposure times less than 200 ms cannot be measured. The x-ray exposure time must be at least 200 ms. We recommend using normal mode for all exposure time measurements.

More accurate reading of exposure times are obtained at lower kVp / mA settings. Many high-energy x-ray exposures have a noticeable decay at the trailing edge (end) that will be added to the exposure time. We recommend making exposure time readings at 50 to 80 kV and 25 to 50 mA. Also, the accuracy specifications apply for measurements greater than 120 milliseconds.

### **High Resolution**

The Model 815 was specifically designed to accurately make measurements with a short exposure time in order to minimize wear on the x-ray head and exposure to service personnel. However, there are three conditions where more accurate readings can be obtained by sampling the x-ray waveform for a longer period of time.

**Low Energy** - When the expected kVp is below approximately 60 kVp, the accuracy of the reading can be improved by setting the x-ray exposure time to 200 ms (0.2 sec) and putting the instrument in High Resolution Mode.

**Slow X-rays** - Some x-rays, particularly older models take a relatively long time to reach peak exposure. In the normal or High Speed mode the instrument waits 30 ms before starting the x-ray measurement. The wait time is doubled in the High Resolution mode, and the actual measurement time is also doubled.

Some DC and multiphase units come on quickly but have a large overshoot. If the overshoot lasts more than 30 ms, High Resolution Mode will give a more accurate reading of the true maximum kVp.

## CONNECTIONS

No external connections are made to the instrument.

## STATUS MESSAGES

The alphanumeric display on the Model 815 is capable of displaying messages along with the output readings that give the user additional information. Each message is described below:

Rdy Fast - Unit is ready for a reading in Fast mode (100 millisecond minimum exposure).

RdyHiRes - Unit is ready for a reading in Hi Resolution mode (200 millisecond minimum exposure).

AlignErr - Alignment Error. Position the Model 815 in the center of the x-ray beam.

Over Rng - Over Range. The x-ray output is too high. Use a lower mA setting or increase the distance from the x-ray head to the Model 815.

OvrScale - Over Scale. The output of the x-ray exceeds the measurable range of the Model 815.

Low Batt - Battery is low. The unit may still be operated for several hours, but accuracy may suffer. Replace the batteries as soon as possible.

## FILTRATION CORRECTION

The Model 815 kVp Meter is calibrated for tungsten tube x-rays with 1.5 mm of Al filtering. When the x-ray has different filtration, refer to the table below and make the appropriate correction to the kVp reading.

<u>Added filtration</u>	<u>60 kVp</u>	<u>80 kVp</u>	<u>100 kVp</u>	<u>120 kVp</u>
0.5 mm	-0.2	-0.5		
1.0 mm	-0.4	-0.9	-1.1	-0.6

For example, if your x-ray has 2.5 mm Al, that is equivalent to 1.0 mm of added filtration. A reading at approximately 60 kVp will be 0.8 kV high. Subtract 0.8 kVp to get the correct reading.

The values can also be interpolated. For example, when taking a reading at 70 kVp, with 0.5 mm additional filtration (2.0 mm total), use a correction factor mid

way between -0.3 and -0.5, which is -0.4. Therefore, when taking a measurement at about 70 kVp with 2 mm of Al filtration, subtract 0.4 kVp.

For values below about 55 kVp, the correction factor is minimal and can be ignored.

## **BATTERY REPLACEMENT**

The Model 815 is supplied with 4 AA batteries. Replace the battery when the "Low Batt" indication shows in the display. Long life alkaline batteries are available from ECC. We also carry extra long life Lithium batteries. Any standard AA batteries can be used in the 815. To prolong battery life, turn the instrument off when not in use.

To replace the battery, slide open the battery compartment on the bottom of the case. Remove the old batteries, and install the new batteries. Observe the correct polarity of the batteries as shown on the bottom of the battery compartment.

## **WARRANTY**

Electronic Control Concepts warrants the Model 815 X-ray kVp Meter / Exposure Time Meter from defects in materials and workmanship for a period of 2 years. There is no warranty on the battery. ECC will replace or repair any Model 815 during the first year after shipment that does not show obvious signs of abuse. Contact the factory as described below.

## **SERVICE INFORMATION**

If a unit should need calibration or service, please contact the factory by phone or fax to obtain a Return Materials Repair authorization.

(800)VIP-XRAY or (800)847-9729 Phone  
(845)247-9028 Fax

After obtaining an RMR number, ship the unit to:  
Electronic Control Concepts  
160 Partition Street  
Saugerties, NY 12477

# SPECIFICATIONS

## RANGE

45 to 125 kV – Model 815  
40 to 115 kV – Model 815L

## KVP ACCURACY

2% +/- 1 kV, at 25 to 100 mA,  
18 to 42 cm from head,  
Tungsten target x-ray tube with 1.5 mm  
Al equivalent filtration

## EXPOSURE TIME ACCURACY

1% +/- 2 millisecond - 120 mS and  
longer at 50 to 80 kV, 25 to 50 mA  
Minimum exposure time is 100  
millisecond for measurement

## MINIMUM EXPOSURE TIME

100 millisecond - High Speed Mode  
200 millisecond - High Resolution Mode

## MINIMUM CURRENT (mA)

7 mA at 65 kV, 10 cm from x-ray (815)  
5 mA at 50 kV, 10 cm from x-ray (815L)  
Also depends on focus

## DISPLAY

0.4" (10.2mm) Liquid Crystal  
8 Character Alphanumeric

## CONTROLS/INDICATORS

ON/OFF Switch – Illuminated  
MODE Switch – momentary push-button

## OUTPUTS

8 Character Liquid Crystal Display

## POWER

4 AA batteries accessible from  
bottom of case  
Low battery indicator

## BATTERY LIFE

48 hours continuous  
Typically 9 months of normal use

## ENVIRONMENTAL

Temperature  
Operating +10°C to 40°C  
Storage 0°C to 50°C  
Humidity  
Up to 75% relative humidity

## PHYSICAL SIZE

150 X 120 X 58.5 mm  
5.9 X 4.7 X 2.3 inches

## WEIGHT

0.7 kg, (1.5 lb)

## CONNECTIONS

None

## OPTIONAL ACCESSORIES

Carrying Case 815CC  
Custom designed case for ECC kVp Meter