

2018

# Components of the X-Ray Circuit

Savannah Burkhalter  
*Parkland College*

---

## Recommended Citation

Burkhalter, Savannah, "Components of the X-Ray Circuit" (2018). *A with Honors Projects*. 247.  
<https://spark.parkland.edu/ah/247>

Open access to this Presentation is brought to you by Parkland College's institutional repository, [SPARK: Scholarship at Parkland](#). For more information, please contact [spark@parkland.edu](mailto:spark@parkland.edu).

Savannah Burkhalter  
Honors Project  
XRA 213-101H Radiographer's Physics  
Tammy Cox

## SCRIPT

Hello my name is Savannah and today we'll be going over the components of the X-Ray Circuit. The X-Ray Circuit is divided a couple different ways. The circuit can be divided into the main circuit and filament circuit. The main circuit creates the x-rays by modifying the power from the source. The filament circuit, on the other hand, ensures the filament has the most suitable thermionically emitted electron cloud by using the incoming power. Another way the x-ray circuit can be divided is into the primary and secondary side of the x-ray circuit. The primary side consists of the line compensator, autotransformer (variable transformer), ammeter (mA selector), and the exposure switch (timing circuit). The secondary side contains the step up and step down transformer, the rectifier diodes, the ground, and the x-ray tube. The last way the circuit is divided is in three parts: the control console, the high voltage selection, and the x-ray tube. This is where each of the components of the tube can be found.

Now let's start with the line compensator. This is where the voltage from the wall plug-in is measured and then stabilized to 220 Volts for the x-ray circuit. Once that voltage is stabilized to 220, it moves to the autotransformer, or the kVp selector. The autotransformer has a single winding and sends voltage to the filament and high voltage circuit. The autotransformer, also called the variable transformer, works using alternating current, is self-inducting, and has only one wire and one core. The autotransformer selects the major or minor kVp and steps the voltage up to kilovolts.

Next is the kVp meter, or the pre-reading voltmeter, which measures the electrical potential of the x-ray tube, or the kilovoltage that will be flowing through the tube once the exposure is made. Next is the exposure switch, or the timing circuit, which is used to complete the x-ray exposure. It regulates the length of the exposure, and it's where the tech starts and the

timer stops the exposure. It is also the wire between the auto and step-up transformer, and is separate from the other main circuits of the x-ray imaging system. Now onto the filament circuit where we have the ammeter, or the mA selector, which selects the tube current to heat the filament.

Now that we're finished with what's in the control console, let's move on to the high voltage circuit. In the main circuit we have the step-up transformer, which increases the voltage to kilovoltage for x-ray production, and still operates on alternating current like the autotransformer, but is not a variable transformer. It operates on the principle of mutual induction, with two coils and two cores, one primary and one secondary. The step-up transformer links to a rectifier diode, which changed the alternating current that was provided into direct current for the x-ray tube to use. Attached to these four rectifier diodes is an electrical ground, which collects remnant electric charges. Many times these rectifiers are made of silicon just for their compact size, good current ratings, and their durability over time. The last thing in the high voltage circuit of the main circuit is the mA meter, which measures the current going to the x-ray tube.

Back to the filament circuit, we have instead of a step-up transformer, we have a step-down transformer (also called the filament circuit transformer), which decreases the voltage and in turn increases the amperes going to the filament. Connected to the step-down transformer is the focal spot selector, in where the focal spot is the area of the target that the x-ray is emitted from. Lastly, everything connects finally to the x-ray tube which holds the cathode and the anode. The anode is the positive side of the x-ray tube and serves as a target surface for high-voltage electrons from the filament and conducts the high voltage from the cathode back into the x-ray generator circuitry as well as serving as the primary thermal conductor. The cathode is the negative side of the x-ray tube and produces a thermionic cloud, conducts high voltage to the gap between the cathode and anode, and focuses the electron stream as it heads for the anode.

All of these components make up the x-ray circuit. Thank you so much for watching!

### References

Bushong, Stewart C. *Radiologic Science for Technologists: Physics, Biology, and Protection*.

Mosby, 2017.

Carlton, Richard R., and Arlene McKenna Adler. *Principles of Radiographic Imaging: An Art and*

*a Science*. Fifth edition. Clifton Park, New York: Delmar/Cengage Learning, 2013. Print



