PHOTEK Application Note

Ultra Violet Corona Detection

Corona is an electrical discharge that can occur around objects that have high electric fields, resulting in ionization of the surrounding material. This is a common occurrence in electric power transmission systems where it can occur around transmission lines, transformers, and insulators. Corona has a number of adverse effects including:

- A loss of power in the transmission lines
- Radio Frequency (RF) noise generation that can interfere with consumer and industrial electronics
- The generation of ozone and NO_X gases that have adverse effect on people living near transmission lines
- Damage to the lines, transformers or insulators that can exacerbate the problem, leading to more power loss and eventual arcing conditions

If components of a transmission line system are experiencing corona and the problem is not fixed, the resulting damage can lead to electrical discharge, or arcing, to a nearby conductor. Arcing causes significant damage to the power transmission system and leads to excessive heating, resulting in potential failure.

There are several techniques used to detect and minimize the impact of corona. Acoustic and RF sensors can detect the noise generated by corona, but precise location of the corona is difficult. Thermal images can be used to locate “hot spots” on transmission wires or transformers, however by the time thermal imagers detect a problem significant damage has already occurred due to arcing. The most reliable and precise way to detect and locate corona is using Ultra Violet (UV) Imaging which can detect very low levels of deep UV emission associated with the recombination of electrons and ions in the region of the corona event. While visible light is also created in this process, the amount of ambient visible light due to the sun is many orders of magnitude larger than that produced by corona. Solar light at wavelengths less than 300nm, the deep UV, is absorbed in the earth’s ozone layer. Very sensitive ***solar blind image intensifiers*** are sensitive only to this deep UV light and can operate in full daylight while still detecting and locating weak UV corona emissions. These solar blind image intensifiers are the only way to precisely detect and locate corona before it becomes a more serious problem, saving electric utilities power and money.

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Instrumentation

A diagram of a typical Ultra Violet Corona Imager is shown in Figure 1. The Ultra Violet imaging channel consists of a UV transparent lens, a Solar Blind Image Intensifier, a CCD coupled to the image intensifier, and image processing electronics. A visible imaging channel is often co-aligned with the Ultra Violet channel to provide identification of the component which is experiencing corona and consists of a visible lens, a CCD visible image sensor, and image processing electronics. The two co-aligned images are fused in the processing electronics and shown on an integral video display, allowing the inspector to detect corona in the field of view and determine its precise location by comparison of the scene with the displayed image. Some imaging systems can include a thermal imager which can help determine the severity of damage.

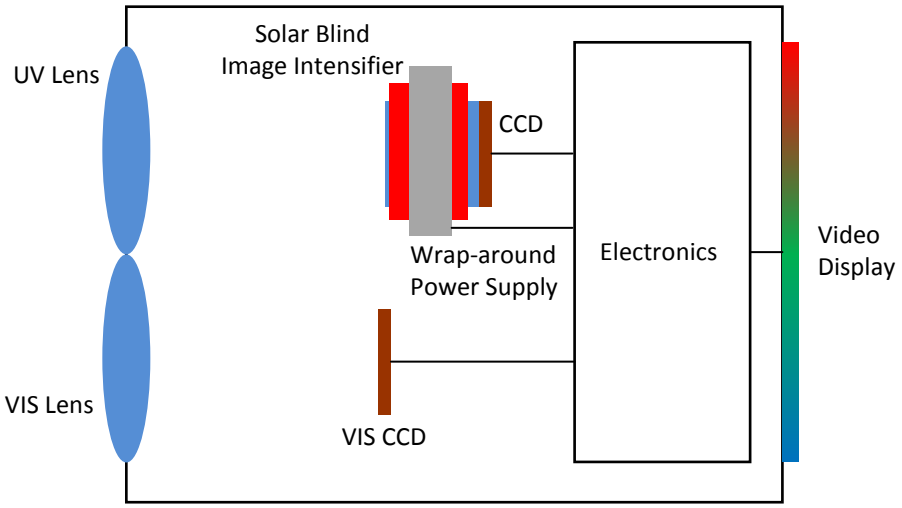

Figure 1: Typical Ultra Violet Corona Imager configuration.

PHOTEK Recommendations

Image Intensifier - MCP218/Q/SB/P43/FO

Or

Image Intensified CCD - ICCD218

Wrap Around Power Supply - WP620