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PHOTOMETRY BY PHILIPS VARI-LITE

How we measure our luminaires

For over 25 years, Philips Vari-Lite has set the standards by which all automated luminaires have been judged. From the pioneering VL1 automated luminaire, which debuted on the 1981 Genesis *Abacab* tour, to the much-anticipated VL3500 wash luminaire, Philips Vari-Lite, has always taken pride in its transcending optical technologies. Today, Philips Vari-Lite will walk you through our prescribed method of calculating the lumen output of our industry-leading luminaires.

In examining Photometry, we will embark on four areas of discussion. Our first will be “What is Photometry?” Our second area encompasses “What are the biggest challenges in measuring Photometry?” Our third discussion explains “What is the Philips Vari-Lite method of measuring Photometry?” And our final discussion covers “What are the various methods used in measuring Photometry.”

Together, we will break down the essentials of Photometry. And at the end of our discussion, we will have hopefully achieved a greater understanding of how lights are measured and how those measurements are reported in the entertainment industry today.

WHAT IS PHOTOMETRY?

Photometry is technically-defined as the measurement of the effectiveness of radiation (in the spectrum of visible light) in stimulating normal human vision. Or, more simply put, photometry measures how bright the normal human eye sees a light, given in the basic photometric unit of the “lumen”.

In defining Photometry, the terminology “normal human eye” is referenced as a definable standard. But exact quantitative numbers cannot be reached as each independent human eye will never view the same light in exactly the same manner. Therefore, the measurement is defined in a general quantitative estimate based upon the scientific standard of a median measuring point.

Photometry is not an absolute, exact measurement, but by using consistent methodology, photometric measurements can be made repeatable.

WHAT ARE THE BIGGEST CHALLENGES IN MEASURING PHOTOMETRY?

Photometry presents its own unique challenges, with different variable and different engineers performing the tests affecting the results; a uniform outcome is simply not a reality.

A major challenge is variation within the luminaires and the sources. The manufacturing of the luminaires can be considered very accurate, but the sources used vary significantly from lamp to lamp. For example, the exact position of the lamp within the luminaire, particularly with a short-arc lamp, makes a tremendous difference in a luminaire’s light output.

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Another challenge is often simply confusion over the collected data or calculated results. Confusion often results from the presentation of the data, with some referring to 'brightness', rather than illuminance, luminance, or total lumens while confusing different measurement types and units with one another.

In addition, one manufacturer may use a certain lamp type, while one may use another. One manufacturer may use a certain measurement method; one may use a different one. One manufacturer may report their results one way; another will report theirs in a slightly-different way. This lack of consistency in measurement style and consistency in the products being measured leads to many varying results in the measurement of automated luminaires, which presents problems for both the manufacturer and the consumer.

WHAT IS THE PHILIPS VARI-LITE METHOD OF MEASURING PHOTOMETRY?

Implemented in November 2005, Philips Vari-Lite employs the Dubinovsky method of measuring Photometry in its automated luminaires. Created by Michael Dubinovsky PhD., this proven method involves the measuring of lumen output from a fixed luminaire shining on a wall, and is currently used by a number of manufacturers in the automated luminaire market. The Dubinovsky method has garnered respect throughout the industry for a number of reasons.

The Dubinovsky method was chosen because it is inexpensive, quick, and repeatable. The test set-up is straight-forward, with data recorded and then used in automatic calculations in an Excel spreadsheet.

When measuring an inexact calculation, repeatability is critical to accuracy. By completing a defined number of tests, and using the testing methods as laid out by Dubinovsky, an optical engineer may now perform tests with consistent, repeatable, and more reliable and accurate results.

Philips Vari-Lite prides itself on the award-winning optics of its automated luminaires. Holding itself to a higher standard, Philips Vari-Lite will always utilize the latest and most accurate measuring standards in the testing of its products. All of this is accomplished through the Dubinovsky method. While other manufacturers may employ a different testing procedure, Philips Vari-Lite believes it was Dubinovsky who set the standard by which all should be judged.

THE DUBINOVSKY METHOD IN GREATER DETAIL

On a piece of board approximately 4 feet in diameter, make three circles with diameters 1', 2' and 3' concentrically revolving around a common center point. Then, divide the circles with lines at 45 degrees (see Fig. 1).

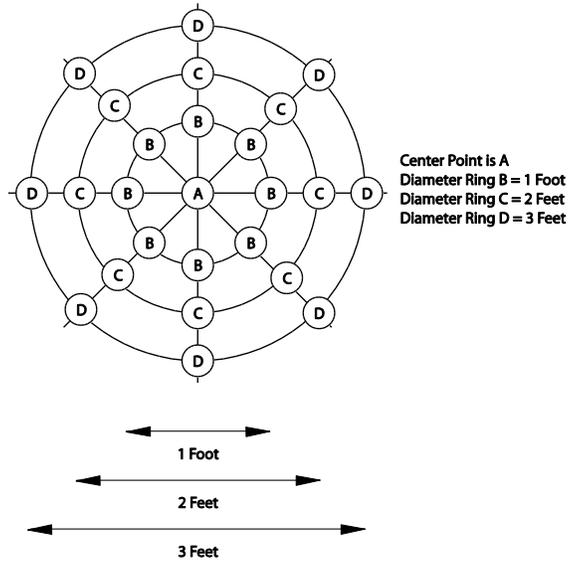
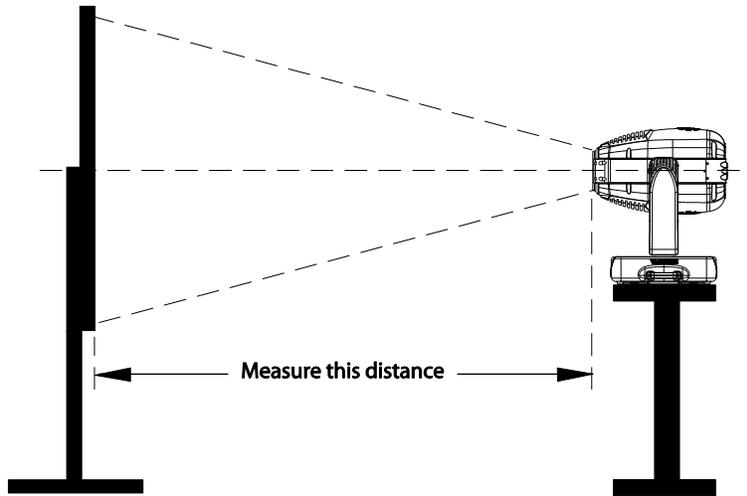


Fig. 1 – The Dubinovsky Method Explained

Draw small targets upon each point that the lines intersect the circles. Then draw one target in the center point. Mount the board on a stand so that the center point of the circle is at the same height as the center of the light fixture to be measured (see Fig. 2). Also, ensure that the board is as perpendicular to the beam as possible, for accurate results.



NOTE: To get the result in lumens, you should use proper units. If you use foot-candles, then the radius must be in feet. If you use lux, then the radius must be in meters.

Fig. 2 – Example of Measuring Setup

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For Spot fixtures, or a hard-edge beam, point the light fixture output at the board and adjust the distance of the fixture from the board so that the outer edge of the beam is the same diameter as the outside circle of the target on the board. Measure the distance from the front of the fixture output lens to the board and record on the auto calculating spreadsheet. Record the light level readings (in foot-candles or lux, as appropriate) at each of the 25 points and record into the auto calculating spreadsheet.

For Wash fixtures, or a soft-edge beam, point the light fixture output at the board and adjust the distance of the fixture from the board so that the illumination at all targets on the outer edge is 10% of the center point illumination. Measure the distance from the front of the fixture output lens to the board and record on the auto calculating spreadsheet. Record the light level readings (in foot-candles or lux, as appropriate) at each of the 25 points and record into the auto calculating spreadsheet.

When all the values have been entered into the spreadsheet, the total lumen output will be calculated and displayed along with the field angle.

WHAT ARE THE VARIOUS METHODS USED IN MEASURING PHOTOMETRY?

So what are the different techniques being employed by manufacturers to calculate lumen output in automated luminaires? How does one know which technique is the most valid? And is there a standard by which all manufacturers should complete testing for more uniform results in the industry?

There are a multiple ways to measure useful luminaire output. In addition to the Dubinovsky method, there are also methods that use an integrating sphere with an attached detector to measure total output. However, this type of measurement, while calculating a higher output, can be misleading, because it captures all light, independent of direction or usefulness, and some light detected (particularly from very extreme output angles from the luminaire) doesn't truly contribute to the total number of lumens output by the beam as seen when projected onto a surface. Because of this, this method is typically avoided.

There are other ways that manufacturers calculate photometric data for their luminaires, however. For measuring luminaire output, as opposed to source output, the methods can be divided into two large groups: one group is based on the use of Goniophotometers, which consist of a detector on a long rotating arm, with either the detector or luminaire being rotated. The other method involves shining the light from a luminaire at a wall and measuring the illumination produced. This is usually called 'flat-wall photometry'. Standards from the American National Standards Institute (ANSI) are constantly revising various technical standards for photometric measurements in the entertainment lighting industry, constantly reducing the interaction and influence of hundreds of different variables that can affect the accuracy and repeatability of photometric measurements. But until the day when all manufacturers are required to test and report the resultant data in the exact same manner, it is the responsibility of the market to understand just how each manufacturer goes about this process. The Dubinovsky method of measuring Photometry is a field tested and proven approach for the accurate gathering of this data, and therefore it is the method of choice for Philips Vari-Lite.