

## Measurement Method

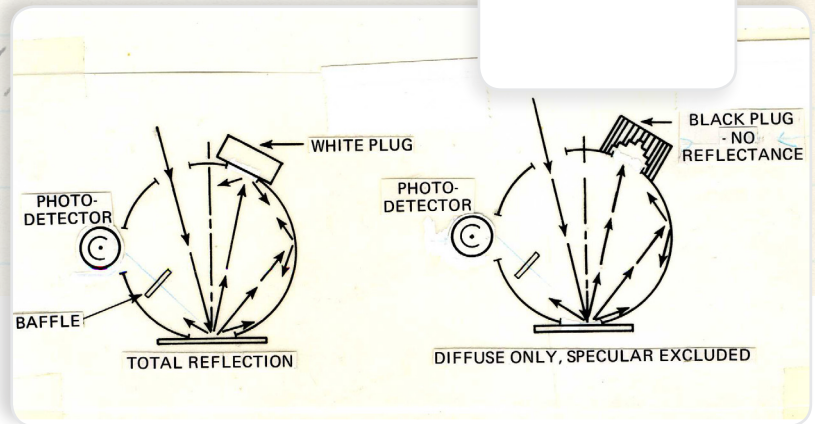
Change of phase of  
 $\Delta = 2t + \frac{\lambda}{2}$  (must equal a whole number of  $\lambda$  for a bright fringe or

$$n\lambda = 2t + \frac{\lambda}{2}$$
$$t = \frac{n\lambda - \frac{\lambda}{2}}{2} = \frac{\lambda}{2} \left( n - \frac{1}{2} \right)$$

substituting

$$D^2 = 2r \left[ \frac{\lambda}{2} \left( n - \frac{1}{2} \right) \right]$$

MM 5027.00



## Measuring Transparent Bottles

with UltraScan® VIS

The final color of plastic and glass bottles is often measured to ensure lot-to-lot consistency. Bottles that are transparent may be measured in regular transmittance (RTRAN) or total transmittance (TTRAN) mode using a benchtop instrument such as the ColorQuest® XE.

A HunterLab UltraScan® VIS Diffuse/8° spectrophotometer can be used to measure the transmittance of transparent bottles. A special transmission sample holder is required to hold bottle cut-outs or the whole bottles at the transmission port. This is the method advocated by HunterLab for the measurement of transparent bottles of various sizes.

### THE APPLICATION

Bottles have several non-uniform characteristics that require compensating preparation and presentation techniques in order to ensure a repeatable sample measurement.

The samples are rounded, and so consistent placement using a special handling device is required in order to make the samples appear as flat as possible to the instrument.

The samples are transparent and will look different when backed with different backgrounds. Using a special handling device that provides a constant background will minimize this effect.

The bottles may contain bubbles or hazy areas that alter the color measurement, and there may be variation in the color uniformity and wall thickness, requiring the averaging of several readings with rotation.

Recommended Color Scale

**CIE L\*a\*b\* as a full color descriptor**

Recommended Single-Number Indices

**YI D1925 (2/C), YI E313 when samples are near colorless, Haze**

Recommended Illuminant/Observer

**D65/10°.**



UltraScan® VIS



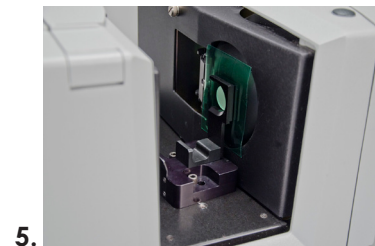
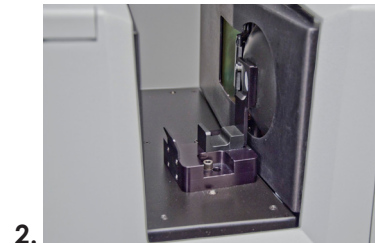
## MEASUREMENT METHOD

### Method #1:

#### Measuring Bottle Cut-outs.

This method is preferred as the most repeatable and reproducible method of measuring transparent bottles.

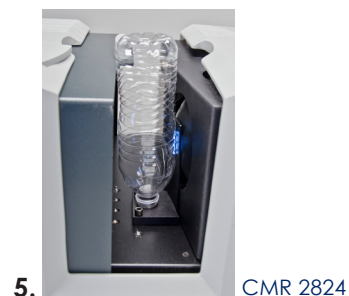
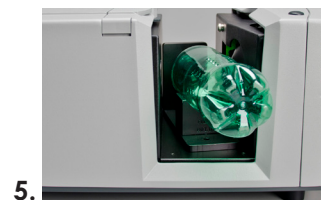
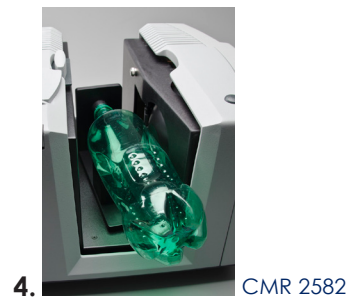
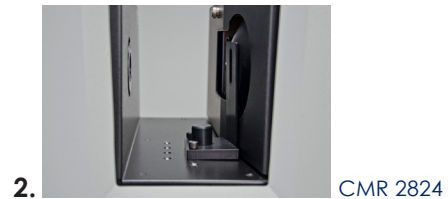
1. Configure your software to read using the desired color scale, illuminant, and observer.
2. Install the transmission sample clamp (HunterLab Part Number C02-1005-444) into the transmission compartment in the TTRAN orientation (next to the sphere).
3. Standardize the instrument in TTRAN mode on air, using large as the area view and 1-inch as the port size.
4. Cut out a segment of the bottle sample that is at least two inches square. This area should be as flat and smooth as possible with no labels or markings.
5. Install the cut-out onto the transmission sample clamp.
6. Close the transmission compartment door as far as it will go and measure the cut-out.
7. Measure the cut-out once more, rotating it 90° between readings.
8. Average the multiple color readings for a single color measurement representing its color. Averaging multiple readings with rotation between readings minimizes measurement variation associated with directionality.
9. Record the average color values.



**Method #2:****Measuring Whole Bottles.**

This method should be used only when time constraints or other factors prohibit measuring bottle cut-outs.

1. Configure your software to read using the desired color scale, illuminant, and observer.
2. Install a transmission bottle holder (HunterLab Part Number CMR-2582 for measuring bottles horizontally, CMR-2824 for measuring bottles vertically) in the transmission compartment as described in the CMR addendum.
3. Standardize the instrument in RTRAN mode (for CMR 2582) or TTRAN mode (for CMR 2824) on air, using large as the area view and 1-inch as the port size.
4. Install the bottle onto the holder as described in your CMR addendum. The instrument should not be viewing any labels or markings.
5. Close the transmission compartment door as far as it will go and measure the bottle.
6. Measure the bottle twice more, rotating the bottle 120° about its central axis between readings.
7. Average the multiple color readings for a single color measurement representing its color. Averaging multiple readings with rotation between readings minimizes measurement variation associated with directionality.
8. Record the average color values.



## ABOUT HUNTERLAB

HunterLab, the first name in color measurement, provides ruggedly dependable, consistently accurate, and cost effective color measurement solutions. With over 6 decades of experience in more than 65 countries, HunterLab applies leading edge technology to measure and communicate color simply and effectively. The company offers both diffuse/8° and a complete line of true 45°/0° optical geometry instruments in portable, bench-top and production in-line configurations. HunterLab, the world's true measure of color.

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**More Information about  
Measurement Methods at**

*[hunterlab.com](http://hunterlab.com)*

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