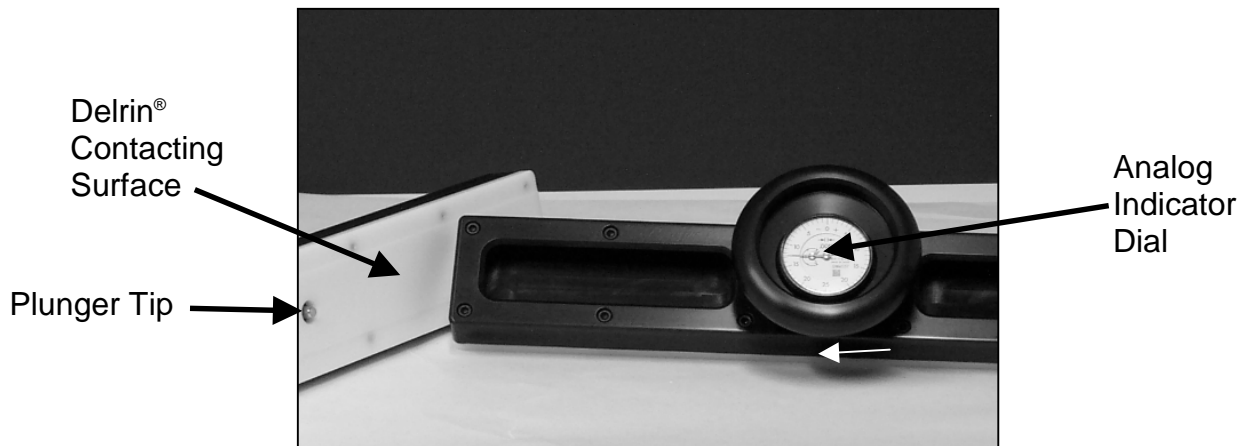


Strainoptics, Inc. Quick-Start Instructions

RWG-I/M Roller-Wave Gauges for Measuring Roller-Wave Distortion in Architectural Flat Glass

Note: These instructions are not meant to replace the full Strainoptics RWG-I/M instruction manual supplied with your instrument. If you are not yet familiar with the initial setup and general operation of your RWG-I (inch) or RWG-M (mm) gauge, or if questions arise, please refer to the complete manual for further details.

1. It is important to place the material to be inspected on a clean surface that has been verified as flat. The precision of the measurement is directly related to the flatness of the surface supporting the glass. The glass should also be free of debris and the contact surface of the instrument should be smooth and free of major cuts and excessive wear. The plunger tip should move freely up and down.



Components of RWG-I/M "Flat-Bottom" Roller-Wave Gages

2. Place the instrument on a known flat surface and rotate the indicator dial until the needle points to "zero".
3. Place a rule or measuring tape along the length of the glass to be inspected. This will be used to mark the relative positions of the peak and valley points, and to determine the average wavelength of the roller wave, which usually approximates the roller circumference (diameter x 3.14).
4. Place the gauge onto the glass sample at the approximate centerline of the glass, perpendicular to the roller wave (i.e., parallel to the direction of travel through the furnace). Position the gauge and start the measuring tape one roller circumference from the leading edge of the glass to eliminate normal edge droop from the measurements.
5. Without putting downward pressure on the gauge, push it along the surface of the glass and, with a washable marker pen, note the peaks where the dial reads zero (P) and the valleys where the dial reads maximum deviations from zero (V). Ignore minor deviations, which are not caused by roller wave. The distance between two consecutive zero readings (P-P) is one wavelength. Note this distance over at least two P-P wavelengths (three peaks) and two V-V wavelengths (three valleys). See Table 1 for an example using two P-P waves and two V-V waves (or a total of four waves).

Table 1. Calculating Average Wavelength (L)

Position on Tape	Peak 1 (Zero)	Maximum Valley 1	Peak 2 (Zero)	Maximum Valley 2	Peak 3 (Zero)	Maximum Valley 3
Inches	6	10-1/2	14-3/8	18-1/4	23	27-1/4
Millimeters	150	280	410	510	640	780

6. Using the example above, average wavelength (L) is calculated as follows:

Distance between Peak 1 (6) and Peak 3 (23) = 2 waves = 17 in (490 mm) = D_p

Distance between maximum Valley 1(10-1/2) and Valley 3 (27-1/4) = 2 waves = 16-3/4 in (500 mm) = D_v

$$\frac{D_p + D_v}{\text{No. of Peak and Valley Waves}} = \frac{17 \text{ in (490 mm)} + 16\text{-}3/4 \text{ in (500 mm)}}{4} = \frac{33\text{-}3/4 \text{ in (990 mm)}}{4} = 8.4 \text{ in (248 mm)}$$

Average wavelength, L = 8.4 inches (248 mm)

7. Measure the maximum Peak-to-Valley depth (W) as follows:

- Place the instrument in the proper position at the beginning of the wave being measured (see Step 4).
- Without putting pressure on the gauge, slowly move it over the glass surface, noting the deviations from zero indicated on the dial. With a washable marking pen, mark the maximum deviation position on the glass.
- On dials graduated in 0.001 inch units (25-0-25), this reading will be negative. Ignore the sign and record the absolute value, e.g., -3.5 = 3.5. Multiply this by 0.001 to arrive at “W” in inches.
- On dials graduated in 0.01 mm units (0-100), subtract the reading from 100 and multiply by 0.1 to arrive at “W” in millimeters, e.g., **Maximum P-V Depth (W) = 100-90 (10) x .01 mm = 0.1 mm.**

8. Calculating True Optical Distortion. While Roller-Wave distortion is often expressed as maximum Peak-to-Valley depth in inches or millimeters (W from Step 7), there is a trend toward using a measurement of lens power (millidiopters), which gives a representation of true distortion. This value, “D” in the equation below, can be calculated using the values of “W” and “L” previously measured.

$$D_{\text{mdpt}} = \left(\frac{1.6 \times W \text{ (inches)}}{L^2 \text{ (inches)}} \right) \times 10^6$$

-OR-

$$D_{\text{mdpt}} = \left(\frac{40 \times W \text{ (mm)}}{L^2 \text{ (mm)}} \right) \times 10^6$$

9. If you have any questions concerning the operation of the RWG-I/M roller-wave gauge, please consult the full instruction manual supplied with your instrument. If you still require assistance, contact Strainoptics.