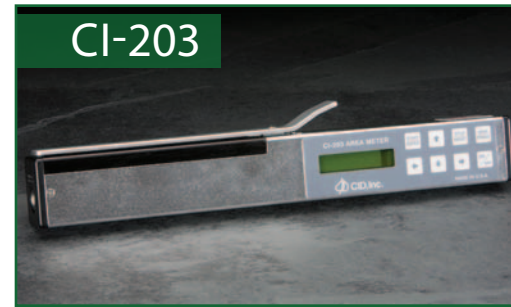
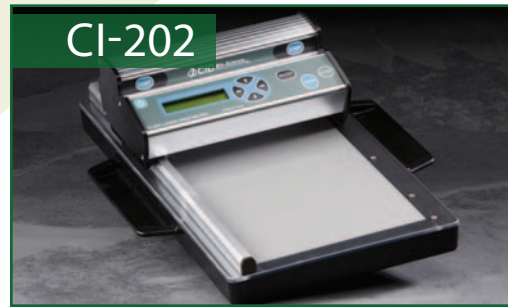


# CI-202/203 Comparison Chart



Specifications	CI-202	CI-203
Format	Palette	Wand
Scanning Technology	Laser	Laser
Measuring Thickness	15mm	25mm
Measuring Width	150mm	177mm
Measuring Length	36cm	3m
Scanner	675nm Laser Diode	675nm Laser Diode
Resolution	.025mm <sup>2</sup>	.01mm <sup>2</sup>
Accuracy	± 1% for samples > 10cm <sup>2</sup>	± 1% for samples > 10cm <sup>2</sup>
Interface	USB 2.0	RS 232
Memory Size	8,000 measurements	15,000 measurements
Display	LCD - 16 characters x 2 lines	LCD - 16 characters x 2 lines
Scanning Speed	127mm/sec	200mm/sec
Battery	7.2 volt rechargeable NiMH	7.2 volt rechargeable NiMH
Battery Capacity	15 hours	15 hours
Operating Temperature	0 - 50° C	0 - 50° C
Dimensions	Board - 38.5cm L x 21.5cm W x 3cm H Scanner - 11.5cm L x 20cm W x 8cm H	35.5cm L x 4.5cm W x 5cm H Self contained unit
Weight	1.8 Kg	910g
Accessories	No	CI-203CA Leaf Conveyor, CI-203RL Root Tray

The CI-202 and CI-203 employ similar technologies and both are world class instruments. The CI-203 is a stand alone, wand format instrument that is more convenient for non-destructive leaf area measurements. The CI-203 also works with the CI-203CA Conveyor Attachment for high speed measurements and the CI-203RL for Root measurements. Unlike the CI-203, the CI-202 requires the use of a scan board. The major benefit of using the scan board is the CI-202 enables the measurement of delicate leaves, very small leaves and needles.



4901 NW Camas Meadows Dr., Camas, WA 98607 USA | Phone: (360) 833-8835 | Fax: (360) 833-1914  
E-mail: cid@cid-inc.com | Web: www.cid-inc.com



## Laser Leaf Area Meters CI-202 and CI-203



Phone: (360) 833-8835 | Web: www.cid-inc.com | E-mail: cid@cid-inc.com

## CI-202 Portable Laser Leaf Area Meter

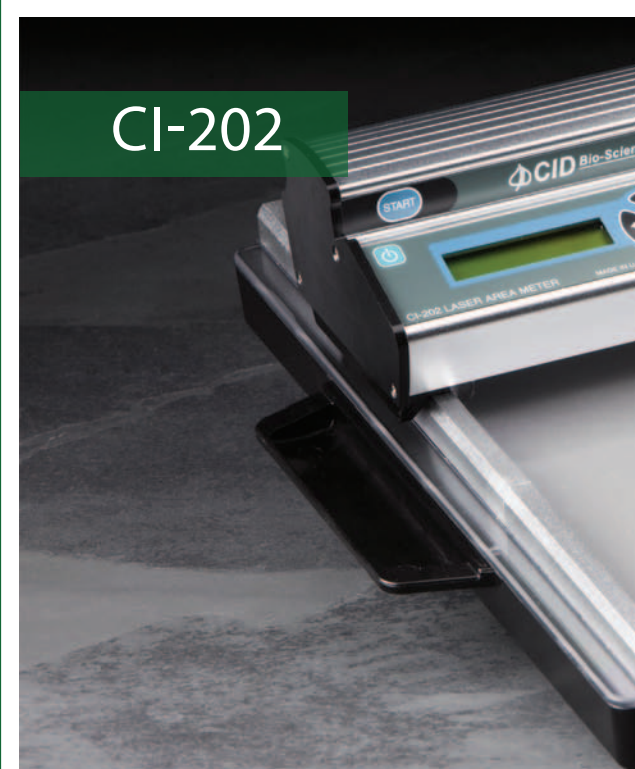
- ✓ Precise and accurate
- ✓ Fast, non-destructive measurements
- ✓ Durable and lightweight
- ✓ Ideal for field use
- ✓ Stores over 8000 data points
- ✓ Downloads data to computer via USB
- ✓ Rechargeable via USB

### HOW IT WORKS

The CI-202 Portable Laser Area Meter uses advanced laser technology to provide researchers with a precise and convenient method of measuring leaf area. The high-resolution laser scanner, data logger, and display are enclosed in a hand-held self-contained unit. Ideal for field use, the scanner head and palette format base weigh approximately 1.5Kg.

Researchers can perform non-destructive measurements on the leaves of living plants by simply sliding the scanner over the leaf, enabling collection of data from the same plant, or even the same leaf, throughout its life span.

Precise leaf area measurement of tender leaves is possible by using a transparent sheath for the leaf's protection.



#### The CI-202 includes:

- ✓ Palette style scan board
- ✓ Laser scanner with built-in control unit
- ✓ Internal batteries
- ✓ Battery charger
- ✓ Communication software
- ✓ One additional transparent film
- ✓ Operating manual

## CI-203 Specifications

Measuring Thickness	25mm maximum
Measuring Width	150mm maximum
Measuring Length	3m maximum
Resolution	0.1mm <sup>2</sup>
Accuracy	± 1% for samples >10cm <sup>2</sup>
Interface	USB serial interface
Measuring Units	cm <sup>2</sup> (area), cm (length, width, and perimeter)
Memory Size	32k bytes, 15,000 readings
Display	16 characters × 2 lines LCD
Scanning Speed	200mm/second
Battery	7.2 volt rechargeable NiMH
Battery Capacity	Over 15 hours of normal use
Operating Temperature	0 - 50° C
Dimensions	35.5L × 4.5W × 5Hcm
Weight	910g

### What's in the box?

#### The CI-202 includes:

- ✓ Palette style scan board
- ✓ Laser scanner with built-in control unit
- ✓ Internal batteries
- ✓ Battery charger
- ✓ Communication software
- ✓ One additional transparent film
- ✓ Operating manual
- ✓ Hard-shell instrument carrying case

#### The CI-203 includes:

- ✓ Laser leaf area meter main unit
- ✓ Internal battery
- ✓ Battery charger
- ✓ RS232 cable
- ✓ Communication software
- ✓ Operating manual
- ✓ Hard-shell instrument carrying case

## About CID, Inc.

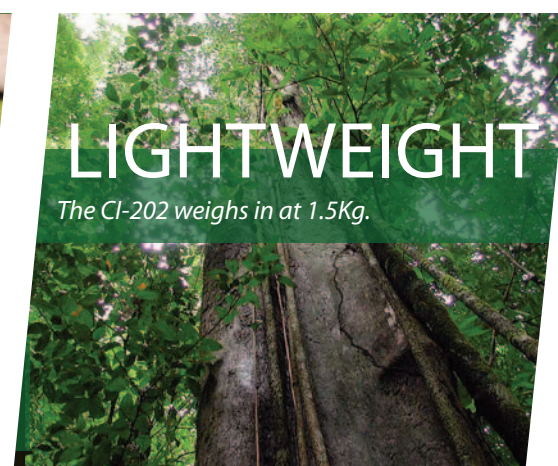
CID, Bio-Science Inc. is an industry leader in the design, manufacture, and marketing of scientific instruments for agricultural, environmental and biotechnological research. We pride ourselves on creating portable instruments for precision plant measurement.

It is our highest mission to identify and satisfy the needs of plant researchers by delivering the most innovative, efficient and portable instruments available.

For nearly 20 years, CID, Inc. instruments have been used in the field, in laboratories worldwide and even in the Spacelab for plant physiology research.

### HOW TO ORDER

CID Bio-Science, Inc. works with distributors world wide to provide technical training and resources that serve you and your needs. For local sales and service, please refer to our website [www.cid-inc.com](http://www.cid-inc.com) to find your local distributor, or you may contact us directly at 1-800-767-0119 or [cid@cid-inc.com](mailto:cid@cid-inc.com).



# CI-203 Handheld Laser Leaf Area Meter

- ✓ Ideal for field use
- ✓ Easy to use
- ✓ Non-destructive measurements
- ✓ Measures area, length, width, and perimeter and calculates shape factor and aspect ratio
- ✓ High resolution of 0.1 mm<sup>2</sup>
- ✓ No calibration required
- ✓ Stores up to 15,000 single measurements
- ✓ Light-weight and self-contained instrument with built-in data logger and Graphic display
- ✓ Rechargeable battery
- ✓ Measures objects up to 150mm wide, 25mm thick and of virtually unlimited length
- ✓ Conveyor Attachment (CI-203CA) is available for fast measurement in the field or lab
- ✓ Root Length Measurement Attachment (CI-203RL) is available
- ✓ RS232 port transfers data to computer

## HOW IT WORKS

The CI-203 Handheld Laser Area Meter uses advanced laser technology to enable researchers a precise and convenient way to measure leaf area (or the areas of leaf-like objects). The high-resolution laser scanner, data logger, and display are all enclosed in a single, handheld wand unit weighing 910g. Researchers can perform non-destructive measurements on leaves of living plants by simply pulling a leaf through the instrument, enabling collection of data from the same plant, or even the same leaf, throughout its life span. For rapid measurement of detached leaves, the CI-203CA, conveyor attachment makes a perfect complement to the CI-203.

In addition to the conveyor attachment, the CI-203 also has an optional attachment, CI-203RL for measuring the area of roots and other irregularly-shaped matter. All six measurement parameters (area, width, length, perimeter, shape factor, and aspect ratio) comprise a data set and are compiled at the same time, and over 15,000 data points can be stored and transferred to a computer.



CI-203

## HOW TO USE

This is as easy as data collection gets. To measure leaf area, simply sweep the leaf through the measuring wand, and the CI-203 instantly scans and calculates the leaf area, width, length, perimeter, shape factor and aspect ratio.

The CI-203 is flexible as well as fast: use in the field to measure living leaves on plants one-by-one, or add the conveyor attachment and measure hundreds of individual leaves in minutes. The CI-203 stores over 15,000 data points, and displays data on the LCD screen. Download measurements to a computer later at your leisure via the RS232 port.

## THEORY OF OPERATION

The CI-203 collects length, width, perimeter, and area measurements directly using a combination of a sweeping laser beam and a roller position encoder. After activating the device by opening the wand JAW, a low energy laser beam sweeps across the laser window 500 times per second at a rate of 150 m/s. As the user moves the CI-203 wand down the leaf, the roller encoder records the motion, and the onboard processing unit collects the data. Each laser sweep provides data that accurately accumulates the area and perimeter measurements. When the roller detects that motion has stopped, the laser subsystem stops taking measurements and the processing unit computes and posts the final results.

The perimeter increment is calculated and added to the perimeter accumulator. The perimeter increment is calculated using the function:

$$\Delta p = \sqrt{4\Delta l^2 + (W_o - W_i)^2}$$

Where  $\Delta p$  is the perimeter increment  
 $\Delta l$  is the length increment (always 1mm)  
 $W_o$  is the current width measurement  
 $W_i$  is the previous width measurement

### Computing Ratio and Shape Factor

Aspect ratio and shape factor information can be easily calculated from the other information gathered. These derived quantities are calculated for the purposes of display or data dumping. The calculations used are shown below.

Aspect ratio is the ratio of the leaf length to its maximum width. It can be calculated from the equation:

$$r = \frac{l}{W_m}$$

Where  $r$  is the aspect ratio,  
 $W_m$  is the maximum width,  
and  $l$  is the length

Shape factor is the ratio of the leaf area to the leaf perimeter, corrected so that the shape factor of a circle is equal to 1. It can be calculated from the equation:

$$f = 4\pi \frac{a}{p^2}$$

Where  $f$  is the shape factor,  
 $a$  is the area, and  
 $p$  is the perimeter

### FAST

Conveyor Attachment (CI-203CA) is available for fast measurement anywhere.



### PRECISE

Self-contained instrument with built-in data logger and Graphic display



### PORTABLE

Weighing only 910g...the CI-203 is ready for long hours in the field.



## Conveyor Attachment (CI-203CA)

Measure large numbers of detached leaves rapidly by inserting the CI-203 Handheld Laser Leaf Area Meter into the CI-203CA Conveyor Attachment, the combined unit will execute the leaf measurements and the data will be displayed and stored on the CI-203. Samples are fed between rubberized steel and glass rollers for scanning, eliminating the need for high-maintenance plastic belts.

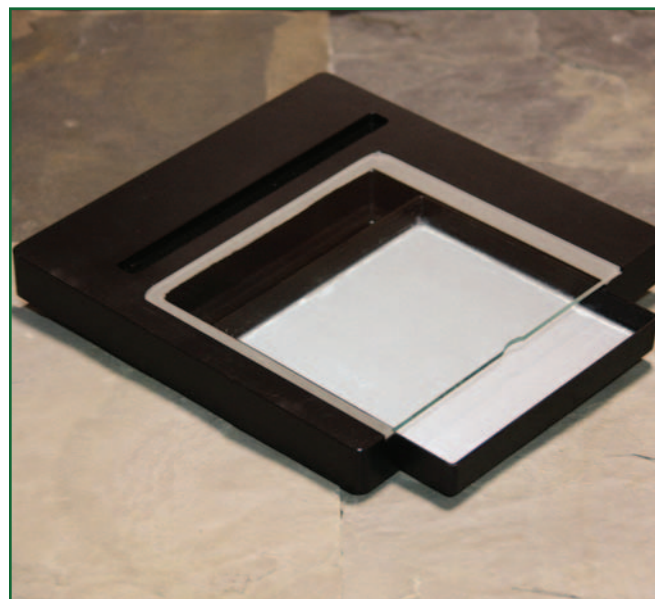
Max. Sample Thickness	15mm
Max. Sample Width	150mm
Max. Sample Length	3m
Resolution	0.01mm <sup>2</sup>
Accuracy	± 0.5% for samples >10cm <sup>2</sup>
Interface	RS232C serial interface
Scan Speed	10cm/second
Operating Temperature	0 - 50°C
Power Requirements	6 to 10 VDC at 100mA. We will provide an external AC adapter (110 VAC, 60 Hz or 220 VAC, 50 Hz) and an optimal 6V rechargeable battery (20 hours operation)
Dimensions	32L x 18W x 13Hcm
Weight	2.95kg



## Root Measurement Tray (CI-203RL)

Handheld Laser Area Meter attachment for determining root length and area. The CI-203RL consists of a carrier base, a removable guide that attaches to the CI-203 in place of the handle, and a CI-203RT root tray. To measure root length, simply slide the CI-203 Portable Laser Area Meter over the root tray. The total length of the roots in the tray will be displayed.

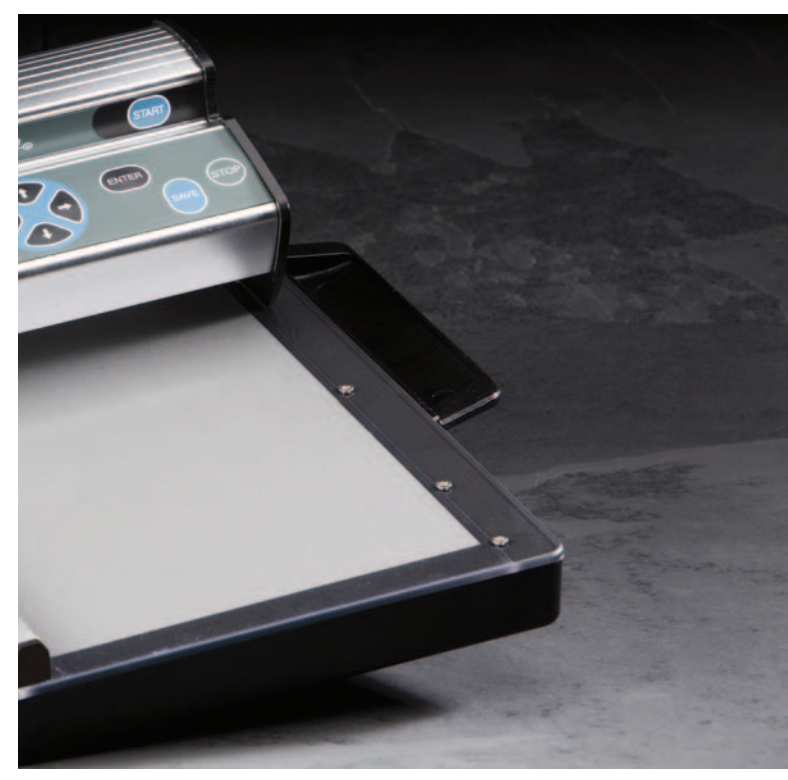
Resolution	0.1mm
Accuracy	± 5%
Scan Speed	Maximum 10cm/second
CI-203RL Dimensions	22.5L x 22W x 2.5Hcm
CI-203RT Tray Size	14 x 14cm
Weight	1.25kg
Operating Temperature	0 - 50°C.



## THEORY OF OPERATION

The CI-202 collects length, width, perimeter, and area measurements directly using a combination of a sweeping laser beam and an optical motion sensor. After activating the device by pressing the <start> key, a low energy laser beam sweeps across the laser window 500 times per second at a rate of 150 m/s. As the user moves the CI-202 control unit down the pallet, an optical sensor records the motion along the specially textured aluminum rail.

The onboard processing unit collects the data from each laser sweep and uses the optical sensor data to correctly accumulate the area and perimeter measurements.



## COMPUTING RATIO/SHAPE FACTOR

Aspect ratio and shape factor information can be easily calculated from the other information gathered. These derived quantities are calculated whenever necessary for the purposes of display or data dumping. The calculations used are shown below.

**Aspect ratio** is the ratio of the leaf length to its maximum width. It can be calculated from the equation:

$$r = \frac{l}{W_m}$$

Where  $r$  is the aspect ratio,  $W_m$  is the maximum width, and  $l$  is the length

**Shape factor** is the ratio of the leaf area to the leaf perimeter, corrected so that the shape factor of a circle is equal to 1. It can be calculated from the equation:

$$f = 4\pi \frac{a}{p^2}$$

Where  $f$  is the shape factor,  $a$  is the area, and  $p$  is the perimeter.

## SPECIFICATIONS

Measuring Thickness	15mm maximum
Measuring Width	150mm maximum
Measuring Length	36m maximum
Resolution	0.025mm <sup>2</sup>
Accuracy	± 1% for samples >10cm <sup>2</sup>
Interface	USB 2.0
Scanner	675nm Laser Diode
Memory Size	8,000 measurements
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