

CR SERIES FOR REFLECTED COLOR

Minolta CR series Chroma Meters are compact, lightweight, portable tristimulus colorimeters for measuring reflected color and color difference in a wide range of industrial fields. Five different CR-300 series models are available to meet the needs of various applications. All CR-300 series models offer improved inter-instrument agreement to allow multiple units to be used for color control both within a company and between companies. In addition, the microscope-like CR-241 provides accurate measurements of small objects, such as pills or printed material. Finally, the CF-101/131, a non-contact colorimeter for on-line color control.

FEATURES OF CR-300 SERIES CHROMA METERS

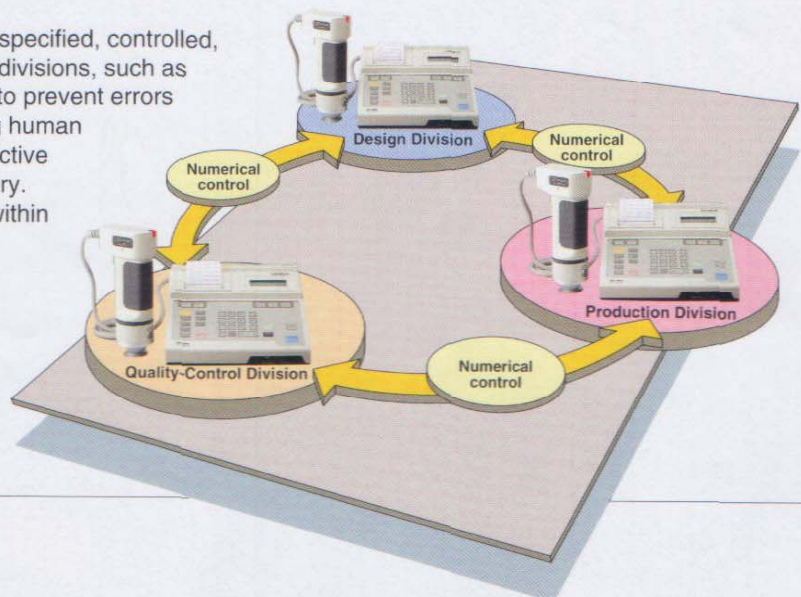
Improved Inter-Instrument Agreement for a Wider Range of Applications

For Consistent In-House Color Control

Within a company, the color of a product is specified, controlled, and inspected by a variety of people in different divisions, such as design, production, and quality-control. In order to prevent errors due to differences in the color perception among human observers, a color-control system based on objective measurements and numerical values is necessary.

With inter-instrument agreement of ΔE^*ab within 0.6^{**} (a value approaching that of many spectrophotometers), multiple CR-300 series Chroma Meters can be used throughout the company for color control, reducing costs by increasing efficiency and reducing errors.

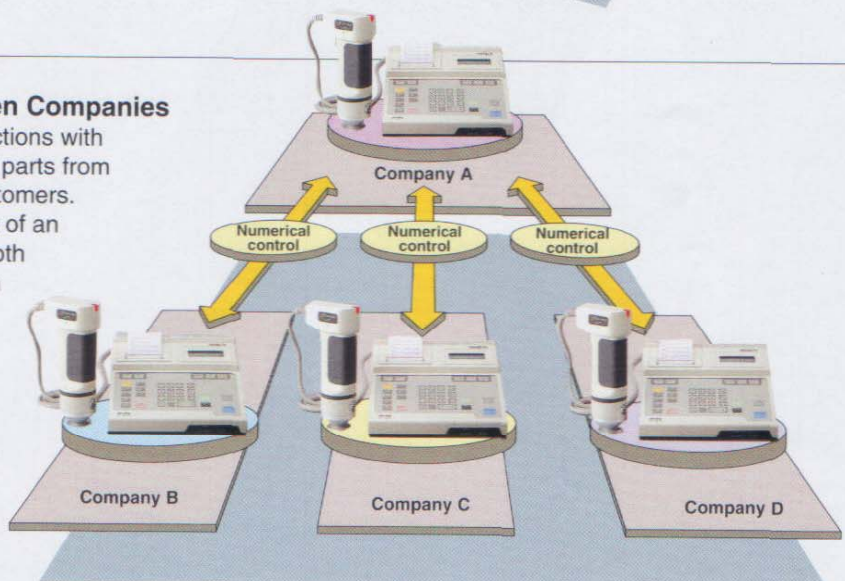
**1 For Chroma Meter CR-300 (based on measurements of 13 BCRA series-II tiles and comparison with a master unit)



For Consistent Color Control Between Companies

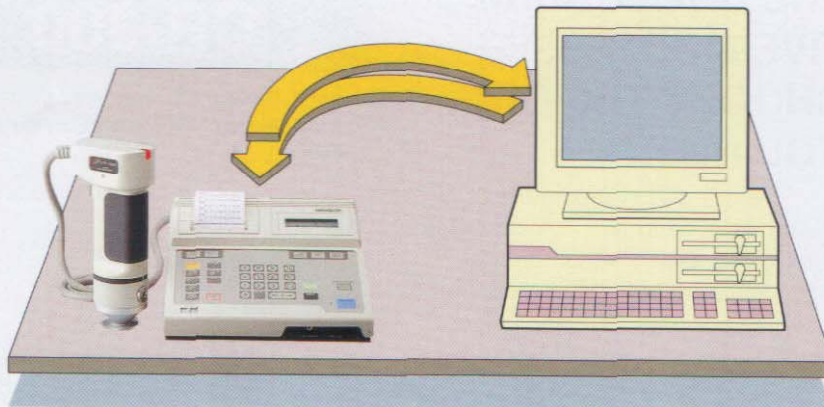
In many cases, a company has transactions with several other companies, either purchasing parts from outside suppliers or producing parts for customers. Precise communication regarding all details of an order is extremely important to ensure smooth relations between companies. Color is often one of these details.

By using CR-300 series Chroma Meters to specify the color numerically, control the color throughout the manufacturing process, and inspect the products upon receipt, optimum results can be expected, including reductions in manufacturing time, costs, and errors.



Data Communication Capabilities

CR-300 series Chroma Meters are equipped with an RS-232C terminal for communication with a separate computer. Using this terminal, all functions of the instruments can be controlled by the computer and data can be transferred to the computer. This allows data from the instrument to be used in a variety of ways, such as in specialized calculations or for creating data files, or data from multiple instruments can be combined.



Full Portability for On-the-Go Color Control

Each CR-300 series Chroma Meter consists of a lightweight, handheld measuring head and a compact, lightweight, battery-operable**2 data processor. The whole system is fully portable and can be used wherever the measurement subject is, indoors or outdoors, for on-the-spot color control.



**2 Operates on six AA-size batteries; exclusive AC adapter (standard accessory) can also be used.

A Variety of Data-Processing Functions

The data processor of CR-300 series Chroma Meters is an all-in-one unit with an LCD display, thermal printer, and RS-232C, remote-control, and ΔE^*ab alarm terminals.

Data can be displayed, printed out, or output in a variety of color systems: Yxy, L*a*b*, L*C*h, Hunter Lab, or tristimulus values XYZ for absolute data; $\Delta(Yxy)$, $\Delta(L^*a^*b^*) / \Delta E^*ab$, $\Delta(L^*C^*H^*) / \Delta E^*ab$, or Hunter $\Delta(Lab) / \Delta E$ for color difference data.

To provide the highest measurement accuracy, the data processor is equipped with a multicalibration function, which utilizes all calibration data in memory (calibration data can be stored in up to 20 memory channels) in calculating the measurement data. Users can also select a single calibration memory channel if desired.

Other features of the data processor include: Memory space for 300 sets of measurement data; 20 memory channels for target data for color-difference measurements; statistical calculations; an interval timer for automatic, timer-controlled measurements; and a ΔE^*ab alarm function.

Yxy

P00	11M200	15:30
001		
Y	63.71	x .3364 y .3040
002		
Y	63.72	x .3364 y .3040
003		
Y	63.72	x .3364 y .3040
004		
Y	63.71	x .3363 y .3040
005		
Y	63.69	x .3364 y .3040
006		
Y	63.71	x .3363 y .3040

L*a*b*

P00	11M200	15:39
001		
L	83.75	a+18.16 b +0.56
002		
L	83.75	a+18.15 b +0.56
003		
L	83.75	a+18.20 b +0.55
004		
L	83.75	a+18.14 b +0.57
005		
L	83.75	a+18.13 b +0.54
006		
L	83.76	a+18.15 b +0.55

L*C*h

P00	11M200	15:41
001		(RP)
L	83.75	C 18.16 h 1.6
002		(RP)
L	83.76	C 18.15 h 1.7
003		(RP)
L	83.76	C 18.11 h 1.7
004		(RP)
L	83.75	C 18.14 h 1.7
005		(RP)
L	83.75	C 18.13 h 1.6
006		(RP)
L	83.76	C 18.11 h 1.7

Hunter Lab

P00	11M200	15:50
001	Hunter	
L	79.73	a+18.60 b +0.48
002	Hunter	
L	79.78	a+18.58 b +0.48
003	Hunter	
L	79.77	a+18.60 b +0.47
004	Hunter	
L	79.77	a+18.61 b +0.46
005	Hunter	
L	79.78	a+18.57 b +0.49
006	Hunter	
L	79.78	a+18.56 b +0.48

XYZ

P00	11M200	15:45
001		
H	6.2RP	U 0.3 C 4.2
002		
H	6.2RP	U 0.3 C 4.2
003		
H	6.2RP	U 0.3 C 4.2
004		
H	6.2RP	U 0.3 C 4.2
005		
H	6.2RP	U 0.3 C 4.2
006		
H	6.2RP	U 0.3 C 4.2

Statistical Calculations

P00	11M200	15:52
001	(n=10)	11M200 15:53
MAX		
L	86.91	a+18.75 b +2.17
MIN		
L	86.77	a+18.69 b +2.12
MEAN		
L	86.80	a+18.72 b +2.14
SD		
L	0.01	a -0.02 b -0.01

THE CR-300 SERIES FIVE MODELS: CHOOSE THE ONE YOU NEED

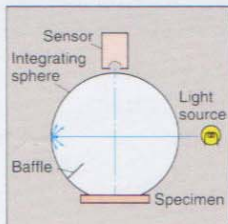
The CR-300 series consists of five models, each with its own unique illuminating and viewing conditions, allowing you to select the model most suitable your particular application.

ILLUMINATING / VIEWING SYSTEM

The color of an object will appear differently depending on the angle from which the object is illuminated and the angle from which it is viewed. This is especially true of materials with some degree of gloss. If the material has high gloss, most of the light will be specularly reflected, in the same way as a mirror reflects light. If the material has no gloss, no light will be specularly reflected. If the system accepts both specularly reflected light and diffusely reflected light, the degree of specularly reflected light will influence the measured value. The ratio of specularly reflected light to diffusely reflected light included in the measurement depends on the illuminating/viewing system of the instrument. Two general types of illuminating/viewing systems are shown below.

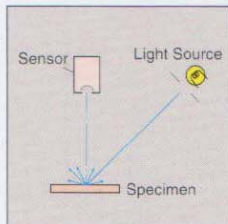
d/0 System

In the d/0 (diffuse illumination/0° viewing) system, the specimen is illuminated from all directions at an almost constant luminance, and only the light reflected perpendicular to the specimen surface is accepted for measurement. This system corresponds well to many conditions in daily life, such as a specimen illuminated by the open sky or a specimen illuminated by many lamps in a store. Because of this, this is the condition which most closely conforms to normal visual assessment, and can be used for measurements of most specimens.



45/0 System

In the 45/0 (45° illumination/0° viewing) system, the specimen surface is illuminated at an angle of 45° to the surface, and only the light reflected perpendicular to the specimen surface is accepted for measurement. With this system, if the specimen is glossy, most of the specularly reflected light will be reflected at a 45° angle, and thus will not be accepted for measurement. The measurement will be based only on the light diffusely reflected from the colored layer of the specimen. Because of this, this system is most suitable for measurements of glossy specimens, such as paints or printed materials.



CR-300

φ8mm measuring area and diffuse illumination/0° viewing geometry for applications



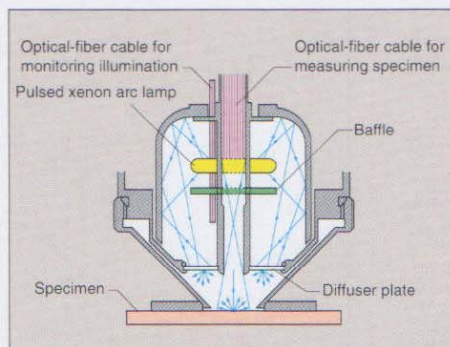
COLOR-CONTROL APPLICATIONS

Paint industry: Paints for houses, automobiles, ships, etc.; metal plating and coloring
Rubber/plastic industry: Raw materials, molded products
Printing industry: Printed materials, such as catalogs, posters, etc.
Textile/dyeing industry: Color of dyed cloth or fibers; Printed fabrics.
Food industry: Processed foods; determining maturity level of raw products.
Ceramic industry: Tiles, porcelain, pottery, glass, etc.



ILLUMINATING / VIEWING SYSTEM

The measuring head of the CR-300 uses diffuse illumination/0° viewing geometry (specular component included) to provide measurements of a wide variety of surfaces which correlate well with color as seen under diffuse lighting conditions. A pulsed xenon arc (PXA) lamp inside a mixing chamber provides diffuse, uniform lighting over the 8mm-diameter specimen area. Only the light reflected perpendicular to the specimen surface is collected by the optical-fiber cable for color analysis.



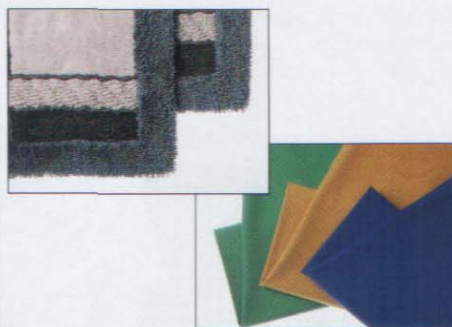
CR-310

φ50mm measuring area and wide-area illumination/0° viewing geometry for measurements of textured surfaces.



COLOR-CONTROL APPLICATIONS

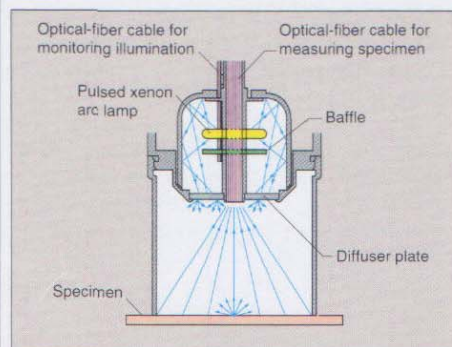
Textile/dyeing industry: Dyed cloth or fibers; rugs, carpets, drapes, etc.
Agriculture: Color analysis of soil
Food industry: Processed foods; determining maturity level of raw products.



ILLUMINATING / VIEWING SYSTEM

The measuring head of the CR-310 averages the measurement over a relatively large area. This is especially useful when measuring textured samples, such as cloth or carpet, which might result in measurement errors if a smaller specimen area were used. A pulsed xenon arc (PXA) lamp inside a mixing chamber provides diffuse, uniform lighting over the 50mm diameter area. Only the light reflected perpendicular to the specimen surface is collected by the optical-fiber cable for color analysis.

- Since measurements made with this system are greatly influenced by specular reflection, this system should not be used for measuring glossy surfaces.



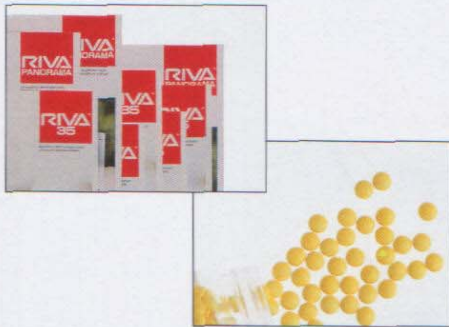
CR-321

φ3mm measuring area and 45° circumferential illumination/0° viewing geometry for measuring small areas of glossy subjects



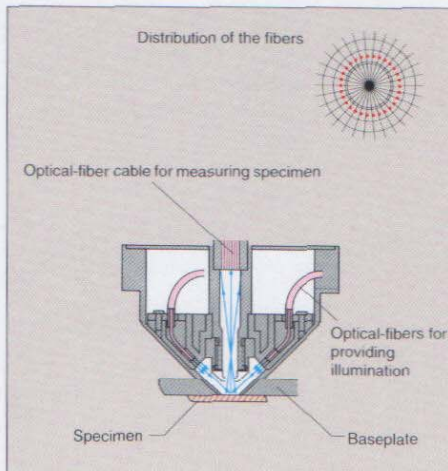
COLOR-CONTROL APPLICATIONS

Paint industry: Small painted areas
 Printing industry: Glossy printed materials, such as magazines, catalogs, etc.



ILLUMINATING /VIEWING SYSTEM

The measuring head of the CR-321 uses 45° circumferential illumination/0° viewing geometry (similar to the geometry of printing-industry densitometers) to provide accurate color measurements of printed materials and other glossy subjects. Light from the pulsed xenon arc lamp is projected onto the specimen surface by 30 optical fibers arranged in a circle around the measurements axis to provide diffuse, even lighting over the φ3mm measuring area. Only the light reflected perpendicular to the specimen surface is collected by an optical-fiber cable for color analysis.



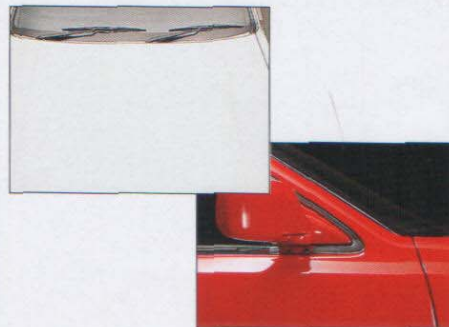
CR-331

φ25mm measuring area and 45° bidirectional illumination/0° viewing geometry for accurate measurements, even of glossy surfaces



COLOR-CONTROL APPLICATIONS

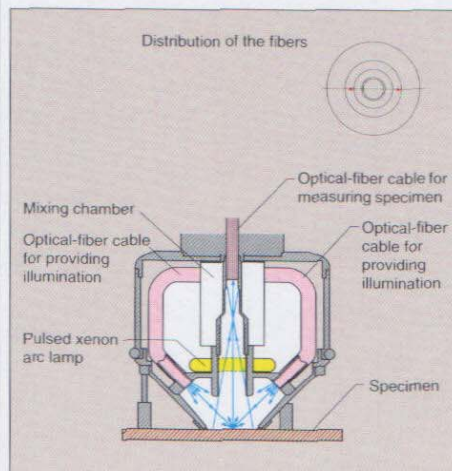
Paint industry: Large surfaces during production
 Textile industry: Silk, metallic-fiber textiles, metal-coated textiles, etc.



ILLUMINATING /VIEWING SYSTEM

The measuring head of the CR-331 enables accurate measurements without the effect of specular reflection. In addition, the reading is averaged over a relatively wide φ25mm area to provide a more uniform response. Light from a pulsed xenon arc (PXA) lamp is projected onto the specimen surface from opposite sides at an angle of 45°. Only the light reflected perpendicular to the specimen surface is collected by an optical-fiber cable for color analysis.

- Shiny metal specimens should not be measured with this instrument since most of the color of the metal (golds, aluminum, etc.) will be reflected at the specular angle (45°).



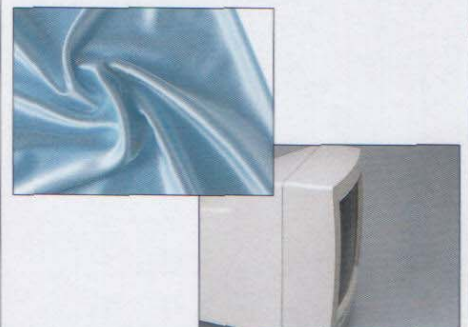
CR-331C

φ25mm measuring area and 45° circumferential illumination/0° viewing geometry for measuring glossy surfaces with directional characteristics



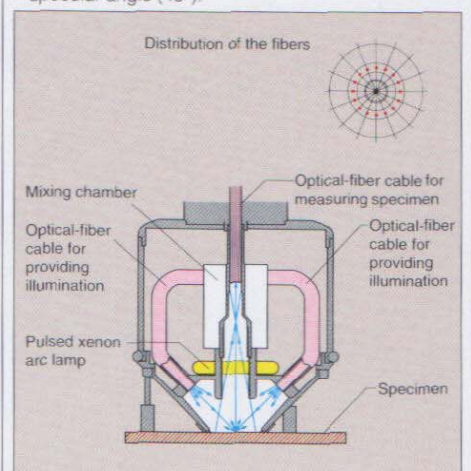
COLOR-CONTROL APPLICATIONS

Textile industry: Woven or knit metallic fibers, silk, etc. with directional characteristics
 Plastic industry: Finished product.

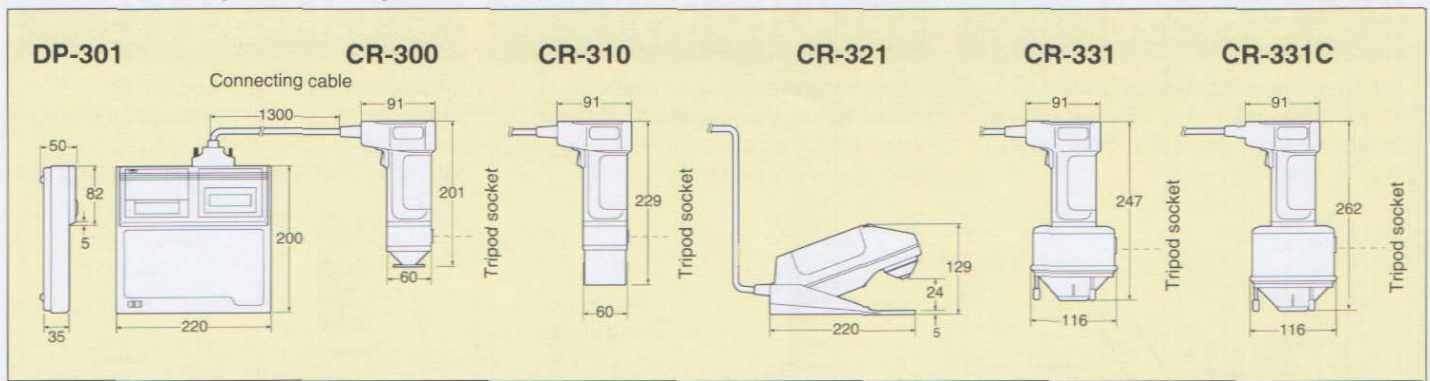


ILLUMINATING /VIEWING SYSTEM

The measuring head of the CR-331C uses 45° circumferential illumination/0° viewing angle geometry. Light from the pulsed xenon arc lamp is projected onto the specimen surface at an angle of 45° by 16 optical fibers arranged in a circle around the measurement axis. This provides uniform illumination over the φ25mm measuring area, and eliminates the problem of variation in measurement values according to the orientation of the specimen in relation to the optical fibers. Only the light reflected perpendicular to the specimen surface is collected by the optical-fiber cable for color analysis.



DIMENSIONS (Units: mm)



SPECIFICATIONS

Measuring Head

	CR-300	CR-310	CR-321	CR-331	CR-331C
Receptors	6 silicon photocells (3 to measure source illumination, 3 to measure reflected light) filtered to detect primary stimulus values for red, green and blue light				
Spectral response	Closely matches CIE 1931 Standard Observer curves (\bar{x}_λ , \bar{y}_λ , and \bar{z}_λ)				
Light source	Pulsed xenon lamp				
Illumination/ measurement system	Diffuse illumination/ 0° viewing angle (specular component included)	Wide-area illumination/ 0° viewing angle (specular component included)	45° circumferential illumination/ 0° viewing angle	45° bidirectional illumination/ 0° viewing angle	45° circumferential illumination/ 0° viewing angle
Measuring area	φ8mm	φ50mm	φ3mm	φ25mm	φ25mm
Short-term repeatability	Chromaticity (x, y): Within ±0.0002 Color difference (ΔE* ab): Standard deviation within 0.07 (Measurement conditions: White calibration plate measured 30 times at 10-second intervals; baseplate locked on CR-321)				
Inter-instrument agreement	ΔE* ab within 0.6	ΔE* ab within 0.8	ΔE* ab within 1.0	ΔE* ab within 0.8	ΔE* ab within 0.8
	(Measurement conditions: Comparison of average measured values of 13 BCRA Series II color tiles to values measured with master body)				
Temperature range	Operation: 0 to 40°C (32 to 104°F); Storage: -20 to 40°C (-4 to 104°F)				
Humidity range	Less than 85% relative humidity at 35°C/95°F with no condensation				
Dimensions	201 × 91 × 60mm (7 7/8 × 3 9/16 × 2 3/8 in.)	229 × 91 × 60mm (9 × 3 9/16 × 2 3/8 in.)	100 × 81 × 243mm* (3 15/16 × 3 3/16 × 9 9/16 in.)*	247 × 116 × 116mm (9 3/4 × 4 9/16 × 4 9/16 in.)	262 × 116 × 116mm (10 5/16 × 4 9/16 × 4 9/16 in.)
	Connecting cable: 1300 × φ8.5mm (51 3/16 × φ 5/16 in.)				
Weight	670g (23 7/8 oz.)	690g (24 3/8 oz.)	1225g (43 3/16 oz.)	1050g (37oz.)	1400g (49 3/8 oz.)
Accessories Included	Calibration Plate CR-A43; Case CR-A60	Calibration Plate CR-A44; Case CR-A64	Calibration Plate CR-A45; Case CR-A63	Calibration Plate CR-A46; Case CR-A61	Calibration Plate CR-A46; Case CR-A61

* With baseplate locked

Measuring Unit Data Processor DP-301

Measurement modes	Absolute and difference
Chromatic systems	Absolute: CIE Yxy, L*a*b*, L*C*h, and XYZ; Hunter Lab Difference: Δ(Yxy), Δ(L*a*b*) / ΔE*ab, Δ(L*C*H*) / ΔE*ab, and Hunter Δ(Lab) / ΔE
Illuminant conditions	CIE Illuminant C or D65
Calibration channels	20; calibration channel 00 for primary standard (white calibration plate), channels 01 to 19 for user-selected reference colors
Calibration functions	Multi-calibration: Data in all calibration channels utilized to determine measured values Manual: Data in a single calibration channel selected by user utilized to determine measured values
Target-color channels	20; set by measurement or keyboard input
Data memory	Space for 300 sets of measurement data; space divisible into 20 pages; data remains in memory even if POWER switch is set to OFF
Display range	0.01 to 160% reflectance
Display	16 characters × 2 lines; dot-matrix LCD with adjustable viewing angle
Printer	24-character thermal-dot
Statistical calculations	Maximum, minimum, mean, and standard deviation
Calendar/clock/timer	Data and time of first and last measurements on each memory page stored and printed out; timer intervals user-selectable from 3 sec. to 99 min.
Data input/output	RS-232C format, ASCII code; transmission rate: 4800 baud (selectable by service personnel: from 600 to 9600 baud for data output or from 600 to 4800 baud for data input); output voltage: CMOS ±5V; RS-232C terminal uses DIN 8-pin connector
Other	High-repeatability multiple-measurement-averaging mode; remote-control socket; ΔE ALARM output socket
Power source	6 AA-size alkaline-manganese or carbon-zinc (1.5V) or nickel-cadmium (1.2V) batteries, or included AC adapter connected to AC power source; memory equipped with built-in Ni-Cd battery
Battery performance	Alkaline-manganese: 690 measurements; Carbon-zinc: 280 measurements; Nickel-cadmium: 600 measurements (Measurement conditions: Primary standard measured in ABS. measuring mode at 10-second intervals with printout in one color space after each measurement)
Temperature range	Operation: 0 to 40°C (32 to 104°F); Storage: -20 to 40°C (-4 to 104°F)
Humidity range	Less than 85% relative humidity at 35°C/95°F with no condensation
Dimensions	50 × 220 × 200mm (2 × 8 11/16 × 7 7/8 in.)
Weight	1300g (45 7/8 oz.) without batteries
Accessories Included	AC Adapter (AC-A10 worldwide except N. America; AC-A10N in N. America); thermal paper (one roll); DIN 8-pin plug (1); 3.5mm (1/8 in.) subminiature plug (2)

INTERFACE I/O-300



Total computer control of color measurement

The Minolta Interface I/O-300 allows a CR-300 series measuring head or CT-310 measuring unit to become an integral part of a computerized production or quality-control system. Connected between the computer's RS-232C port and the measuring head or measuring unit, the I/O-300 acts as an interface between the two. Commands and calibration data are transmitted to the I/O-300 from the computer, which then controls the measuring head or measuring unit as directed. Measurement data from the measuring head or measuring unit are received by the I/O-300, converted into XYZ tristimulus values, adjusted using the calibration data, and then transmitted to the computer.

In addition to functioning as an interface, the I/O-300 also monitors itself and the measuring head or measuring unit. LED indicators provide basic information, such as power on, low battery power, I/O error, etc.; more detailed status information can also be requested by the computer. In addition, if an error occurs the I/O-300 transmits an error message indicating the type of problem.

Measurements can be taken by transmitting a command from the computer or (when the measuring button enable LED is lit) by pressing the measuring button of the CR-300 series measuring head or closing a switch connected to the CT-310's remote-control terminal.

OPTIONAL ACCESSORIES



Pivoting Base CR-A12 (For CR-300)

Attaching the Pivoting Base CR-A12 to the measuring head of the CR-300 ensures greater stability and accuracy in measurements. Light-Projection Tube CR-A33c is also included.



Glass Light-Projection Tube CR-A33f (For CR-300) and CR-A33e (For CR-310)

Glass Light-Projection Tube CR-A33f and CR-A33e have a glass plate at the tip and can be used for measuring wet surfaces or for ensuring that materials such as textiles are flat during measurements.



Granular-Materials Attachment CR-A50 (For CR-300 and CR-310)

With the Granular-Materials Attachment CR-A50, the color of powders, pastes, grains, and other granular substances can be easily and accurately measured.



Shoulder Case CR-A62 (For CR-300)

Shoulder Case CR-A62 makes it easy to carry the Data Processor DP-301 of the Chroma Meter CR-300 series when taking measurements in the field.

Color Tiles

14 color tiles are available: White, Pale grey, Middle grey, Difference grey, Deep grey, Deep pink, Red, Orange, Bright yellow, Green, Difference green, Cyan, Deep blue, Black. Original materials of these tiles are supplied by BCRA.

Adapter Cord MA-A10

Adapter Cord MA-A11

These Adapter Cords can be connected between the Data Processor DP-301 and the measuring head, enabling you to separate the two units by up to one meter (MA-A10) or up to three meters (MA-A11).