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MINOLTA

SPECTROPHOTOMETER CM-2002



AN ALL-IN-ONE INSTRUMENT FOR FAST, ACCURATE MEASUREMENTS — PLUS BATTERY OPERATION FOR MEASUREMENTS IN THE FIELD

The Spectrophotometer CM-2002 combines measurement, data-processing, and display functions in one compact unit. This compact size is achieved by utilizing a miniature spectral sensor developed by Minolta and a 32-bit microcomputer to provide high-speed, high-accuracy measurements.

The CM-2002's d/8 (diffuse illumination/8° viewing angle) geometry conforms to ISO and DIN standards, and also meets the requirements for d/0 (diffuse illumination/0° viewing angle) geometry as stated by CIE. This d/8 geometry, combined with the CM-2002's ϕ 8mm measurement area, allows the CM-2002 to be used in a wide variety of industrial and research fields. In addition, the d/8 geometry also allows easy switching between SCI (specular component included) and SCE (specular component excluded) measurements, the first time such feature has been available on a portable, handheld spectrophotometer. The CM-2002 uses a 128KB RAM card for data storage, so a large number of measurements can be taken in the field and the results brought back to the laboratory for analysis. Direct connection with a computer is also possible, allowing the CM-2002 to function as part of a larger computerized system, such as a CCS (computerized color search) or CCM (computerized color matching) system. Color Data Software CM-1, optional software exclusively for use with the CM-2002, is also available to make control of color data even more convenient.

① Ultra-compact spectral sensor

This sensor provides simultaneous measurements over the CM-2002's entire wavelength range, eliminating problems caused by measuring different wavelengths at different times.

• Minolta developed this spectral sensor, combining a spectral filter array and a silicon photodiode array in a single IC package. Light incident on the sensor is separated according to wavelength by the spectral filter array and then strikes the appropriate segments of the silicon photodiode array, where the light is converted into electrical currents proportional to the light's intensity.



② Integrating sphere

The inner surface of the integrating sphere is coated with barium sulfate, which has superior diffusion and spectral characteristics and provides higher absolute measurement accuracy.

③ d/8 (diffuse illumination/8° viewing angle) geometry

④ Switchable between SCI (specular component included) and SCE (specular component excluded) measurements

⑤ High-stability, long-life pulsed xenon arc lamp

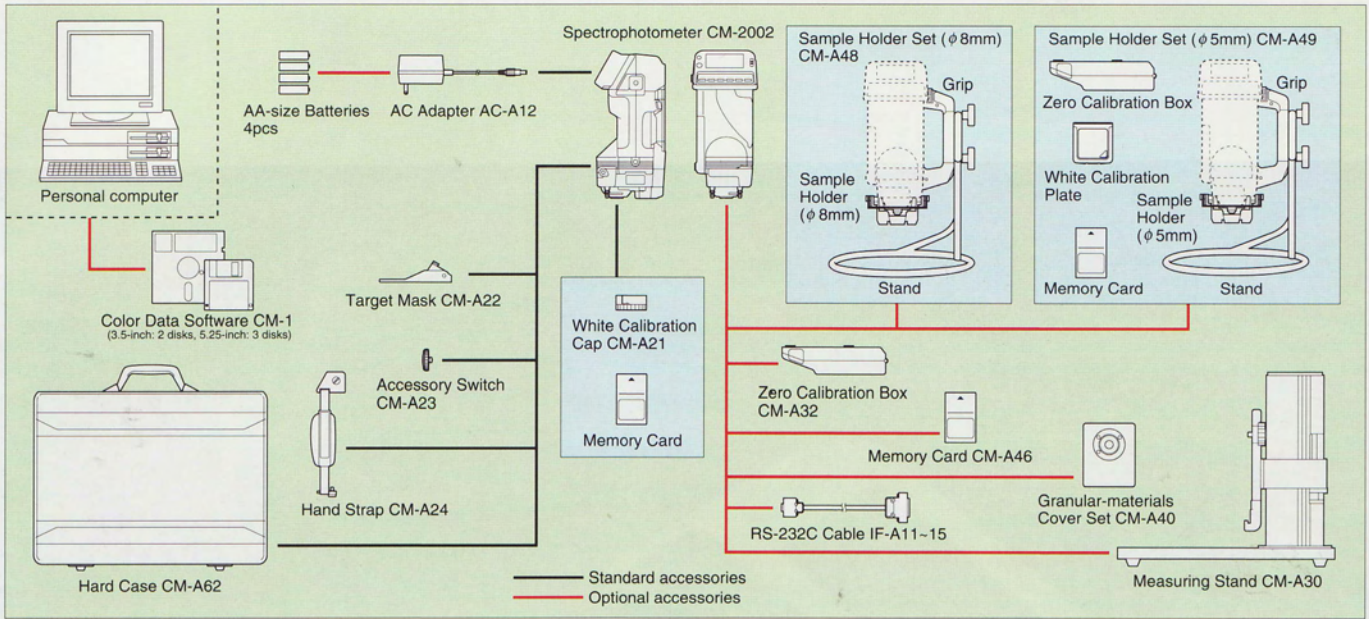
⑥ Analog control circuits

Hybrid LSI ICs provide high reliability in a compact package.

⑦ Dot-matrix LCD



SYSTEM DIAGRAM



SPECIFICATIONS

Model	CM-2002
Illuminating/viewing system	d/8 (diffuse illumination/8° viewing angle); switchable between specular component included and specular component excluded. Meets ISO 7724/1 and DIN 5033 teil 7 for d/8 geometry; also meets CIE recommendations and ASTM E1164 for d/0 geometry.
Detector	Silicon photodiode array with spectral filter array
Wavelength range	400 to 700nm
Wavelength pitch	10nm
Half bandwidth	15nm average
Photometric range	0 to 175% reflectance; resolution: 0.01%
Light source	Pulsed xenon arc lamp
Illumination/measurement area	Ø11mm illumination/Ø8mm measurement (Minimum specimen size is Ø11mm)
Microprocessor	32-bit 68332 MPU (16MHz max.)
Measurement and calculation time	0.3 to 0.5 seconds to display of results
Minimum interval between measurements	3 seconds *
Measuring modes	Manual/REMOTE (using computer connected to RS-232C terminal); single measurement/automatic averaging of multiple measurements
Measurement conditions	Illuminant: CIE Standard Illuminants A, C, D ₅₀ , and D ₆₅ ; Fluorescent Illuminants F2, F6, F7, F8, F10, F11(TL84), and F12(Ultralume 3000) Observer: CIE 2° and 10° Standard Observers Measurement conditions can be automatically loaded from installed memory card
Display	21-character x 7-line (128 x 56-dot) dot-matrix LCD with adjustable contrast
Displayed data	Spectral reflectance: Graph, numerical values; reflectance correction factor can also be set and used in calculating spectral reflectance Colorimetric values: Numerical absolute color and/or color difference values in the following notations: XYZ, Yxy, L*a*b*, L*C*H°, Hunter Lab, L*u*v*, MI (metamerism index), Munsell, CMC (2:1), CMC (1:1), FMC-2, WI (ASTM E 313), WI (CIE), YI (ASTM E 313), YI (ASTM D 1925) Color difference graph (ΔL*, Δa*, Δb*) Data or messages transmitted from a computer connected to the RS-232C terminal can also be displayed in REMOTE mode.
Measurement-data memory	Internal: Single measurement Memory card: Space for up to 1000 sets of measurement data
Target-data memory	Space for up to 50 target colors; set by measurement or by data input using computer connected to RS-232C terminal; target data can be temporarily deleted and later recovered; automatic target color selection function determines which target color is closest to measured color.
Tolerance data	Upper and lower limits of absolute color or color difference values in the following color spaces: XYZ, Yxy, L*a*b*, L*C*H°, Hunter Lab, L*u*v*, MI (metamerism index), CMC (2:1), CMC (1:1), FMC-2, WI (ASTM E 313), WI (CIE), YI (ASTM E 313), YI (ASTM D 1925)
Interface	RS-232C standard, 9-pin D-subminiature connector Communication parameters: Baud rate: 1200, 2400, 4800, 9600bps Character length: 7 or 8 bits Stop bits: 1 or 2 Parity: None, odd, even

Repeatability	Spectral reflectance: Standard deviation within 0.10% Colorimetric values: Standard deviation within ΔE*ab 0.03 (Measurement conditions: White calibration plate measured 30 times at 10-second intervals after white calibration was performed)
Temperature drift	Spectral reflectance: Within ±0.20%/°C Color difference: Within ΔE*ab 0.05/°C (When white calibration plate is measured)
Other	Displayed data can be inverted; built-in calendar/clock
Power source	Dedicated AC adapter (9V, 1.2A) or 4 AA-size batteries
Battery performance	Alkaline manganese: Up to 500 measurements at 10-second intervals
Temperature/humidity range	Operation: 0 to 40°C (32 to 104°F); less than 85% relative humidity at 35°C (95°F) with no condensation Storage: -20 to 55°C (-4 to 131°F); no condensation
Dimensions	W x H x D: 115 x 257 x 126mm (4-1/2 x 10-1/8 x 5 in.)
Weight	1.6kg (3-1/2 lb.) including batteries
Standard accessories	White Calibration Cap CM-A21 (with memory card and data sheet); Target Mask CM-A22; Accessory Switch CM-A23; Handstrap CM-A24; AC Adapter AC-A12; Hard Case CM-A62
Optional accessories	Measuring Stand CM-A30; Zero Calibration Box CM-A32; Granular-Materials Cover Set CM-A40; Memory Card CM-A46; Sample Holder Set (Ø8mm) CM-A48; Sample Holder Set (Ø5mm) CM-A49; RS-232C Cables IF-A11 through IF-A15; Color Data Software CM-1

DIMENSIONS DIAGRAM

(units: mm)

