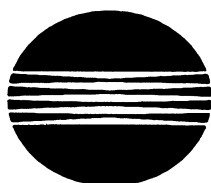


SPECTROPHOTOMETER CM-3630

INSTRUCTION MANUAL



KONICA MINOLTA

Safety Symbols

The following symbols are used in this manual to prevent accidents which may occur as a result of incorrect use of the instrument.



Denotes a sentence regarding a safety warning or caution.
Read the sentence carefully to ensure safe and correct use.



Denotes a prohibited operation.
The operation must never be performed.



Denotes an instruction.
The instruction must be strictly adhered to.












Denotes an instruction.
Disconnect the AC power cord from the AC outlet.








Denotes a prohibited operation.
Never disassemble the instrument.

SAFETY PRECAUTIONS

- To ensure correct use of this Spectrophotometer CM-3630, read the following points carefully and adhere to them. After you have read this manual, keep it in a safe place where it can be referred to any time a question arises.

 WARNING (Failure to adhere to the following points may result in death or serious injury.)	
<p> Do not use the CM-3630 in places where flammable or combustible gases (gasoline fumes, etc.) are present. Doing so may cause a fire.</p>	<p> Do not disassemble or modify the AC adapter. Doing so may cause a fire or electric shock.</p>
<p> Always use the AC adapter supplied as a standard accessory or specified replacement AC adapter with the CM-3630, and connect it to an AC outlet (100 Vac, 50-60 Hz). Failure to do so may damage the CM-3630 or the AC adapter, causing a fire or electric shock.</p>	<p> The CM-3630 should not be operated if the CM-3630 or AC adapter is damaged, or if smoke or strange odors occur. Doing so may result in a fire. In such situations, turn the power OFF immediately, disconnect the AC adapter from the AC outlet, and contact the nearest <u>Konica Minolta-authorized service facility</u>.</p>
<p> If the CM-3630 will not be used for a long time, disconnect the AC adapter from the AC outlet. Accumulated dirt or water on the prongs of the AC adapter's plug may cause a fire and should be removed.</p>	<p> Do not disassemble or modify the CM-3630. Doing so may cause a fire or electric shock.</p>
<p> Do not insert or disconnect the AC adapter with wet hands. Doing so may cause electric shock.</p>	<p> Take special care not to allow liquid or metal objects to enter the CM-3630. Doing so may cause a fire or electric shock. Should liquid or metal objects enter the CM-3630, turn the power OFF immediately, disconnect the AC adapter from the AC outlet, and contact the nearest <u>Konica Minolta-authorized service facility</u>.</p>

 CAUTION (Failing to adhere to the following points may result in injury or damage to the CM-3630 or other property.)	
<p> Do not perform measurement with the specimen measuring port directed towards your face. Doing so may cause damage to your eyes.</p>	<p> Be careful around openings in the CM-3630. Failure to do so may result in fingers being trapped causing injury.</p>
<p> Do not place the CM-3630 on an unstable or sloping surface. Doing so may result in its dropping or overturning, causing injury. Take care not to drop the CM-3630 when carrying it.</p>	<p> Do not connect or disconnect the AC adapter, when the power switch is set to ON ("I").</p>

Notes on Use

<OPERATING ENVIRONMENT>

- The CM-3630 should be used at ambient temperatures of between 13 and 33°C (55 and 91°F). Do not use it in areas of rapid temperature change.
- Do not leave the CM-3630 in direct sunlight or near sources of heat, such as stoves etc. The internal temperature of the instrument may become much higher than the ambient temperature in such cases.
- Do not use the CM-3630 in areas where dust, cigarette smoke or chemical gases are present. Doing so may cause deterioration in performance or breakdown.
- Do not use the CM-3630 near equipment which produces a strong magnetic field (such as speakers etc.)
- The CM-3630 belongs to installation category II products (equipment which is powered by AC adapter).
- The CM-3630 belongs to pollution degree 2 products (equipment which may cause temporary electrical hazards due to contamination or condensation or products which are used in such an environment).
- Do not use the CM-3630 at altitudes of 2000m or higher.
- The CM-3630 is designed for indoor use only, and should never be used outside.

<WHITE CALIBRATION PLATE>

- The calibration data for the white calibration plate was measured at 23°C. To achieve the highest accuracy when measuring absolute values (colorimetric values), calibration and measurement should be performed at 23°C.
- Do not allow the white calibration plate to get scratched or stained.
- If you are not going to use the white calibration plate, close the lid to prevent entry of ambient light.

<POWER SOURCE>

- Make sure that the power switch is set to OFF ("O") when the CM-3630 is not in use.
- Always use the AC adapter (AC-A12) supplied as a standard accessory and connect it to an AC outlet of the rated voltage and frequency.
- Use an AC power source which is within $\pm 10\%$ of the rated voltage.

<SYSTEM>

- Do not subject the CM-3630 to strong impact or vibration. Doing so may cause deterioration of performance or breakdown.
- The specimen measuring port and integrating sphere are extremely precise components, and great care should be taken to prevent them getting dirty or exposing them to impacts. When the CM-3630 is not in use, be sure to attach a target mask to the measuring port to prevent entry of foreign matter.
- The CM-3630 may cause interference if used near a television, radio, etc.
- Since the CM-3301d uses a microcomputer, external magnetic noise may cause malfunction. In this case, turn the power OFF, and wait 30 minutes, and then turn it ON again.

Notes on Storage

- The CM-3630 should be stored at temperatures of between 0 and 40°C. Do not store it in areas subject to high temperatures, high humidity, or rapid changes of temperature, or where condensation may occur. For added safety, it is recommended that it be stored with a drying agent (such as silica gel) at near room temperature.
- Do not leave or store the CM-3630 in direct sunlight, inside a closed vehicle, in the trunk of a vehicle, or in any area subject to extremely high temperatures. Doing so may cause breakdown.
- Do not store the CM-3630 in areas where dust, cigarette smoke or chemical gases are present. Doing so may cause deterioration in performance or breakdown.
- The white calibration plate may become discolored if left exposed to light. Therefore, make sure that the lid is closed to prevent entry of ambient light when it is not in use.
- Be sure to keep all packing materials (cardboard box, cushioning material, plastic bags, etc.). They can be used to protect the instrument during shipment to Konica Minolta for maintenance (recalibration. Etc.).

Notes on Cleaning

- If the CM-3630 becomes dirty, wipe it with a soft, clean dry cloth. Never use solvents such as thinner and benzene.
- If the white calibration becomes dirty, wipe it gently with a soft, clean dry cloth. If dirt is difficult to remove, dampen a cloth with commercially available lens cleaning liquid and wipe. Then wipe off the liquid with a cloth dampened with water, and leave it to dry.
- If the zero calibration box becomes dirty, wipe gently with a soft, clean dry cloth. If dirt is difficult to remove, dampen a cloth with commercially available lens cleaning liquid and wipe. Then wipe off the liquid with a cloth dampened with water, and leave it to dry.
- If the inside of the integrating sphere get dirty, contact the nearest Konica Minolta-authorized service facility.
- Should the CM-3630 breakdown, do not try to disassemble and repair it by yourself. Contact the nearest Konica Minolta-authorized service facility.

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INTRODUCTION

This spectrophotometer is designed for spectral measurement of color and color differences in paper industries. It can measure both reflected color with high accuracy.

Packing Materials

General Packing Materials

Keep all packing materials (cardboard box, cushioning material, plastic bags, etc.) in a safe place. Since the CM-3630 is a precision measuring instrument, they can be used to protect the instrument from impact and vibration during shipment to Konica Minolta for maintenance (recalibration. Etc.).

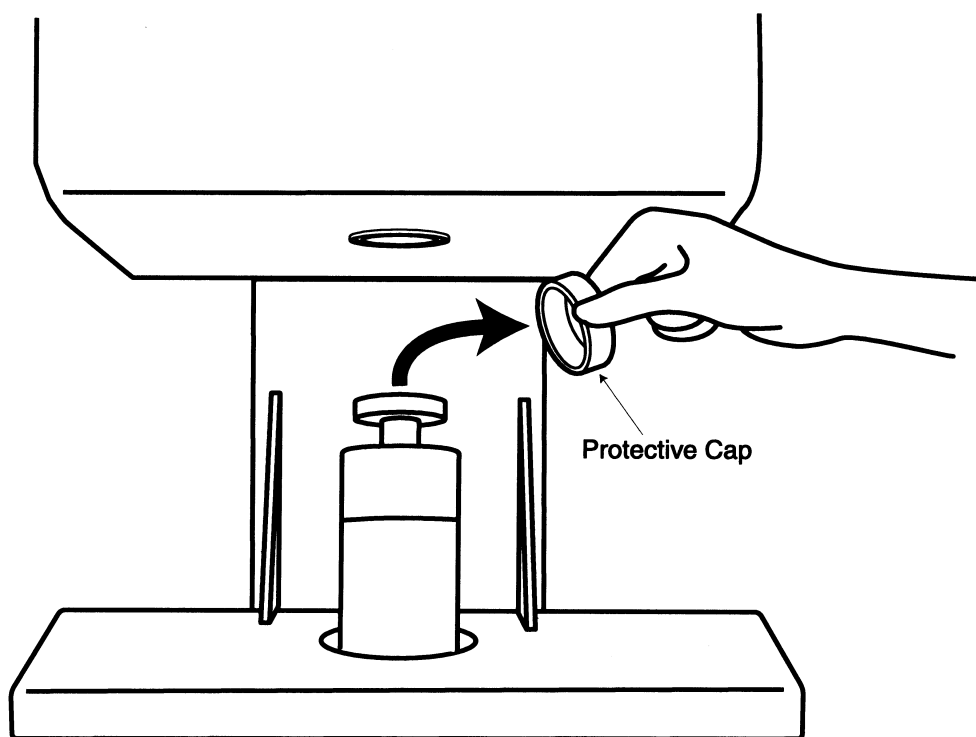
Should they be lost or damaged, contact the nearest Konica Minolta-authorized service facility.

Protective Cap for Sample Holder

The protective cap is attached to sample-holder when CM-3630 is delivered.

This protective cap must be removed before using the CM-3630.

When you transport the CM-3630 to another place, the protective cap must be attached. Keep the protective cap in a safe place.



Unit Driver Floppy Disk

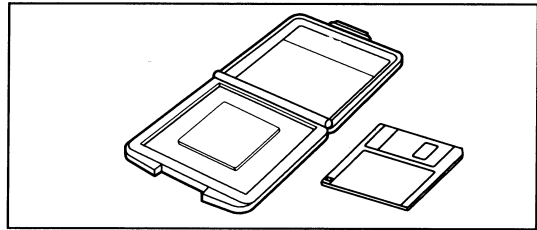
The unit driver floppy disk is supplied with the CM-3630 as a standard accessory.

- The unit driver disk contains data specific to your CM-3630. If you are going to use two or more CM-3630 units, make sure that the unit driver files for the correct CM-3630 unit are used.
- Keep the unit driver disk in a safe place. If the data is lost as a result of initialization or due to damage to the disk, contact the nearest Konica Minolta-authorized service facility.

Standard Accessories

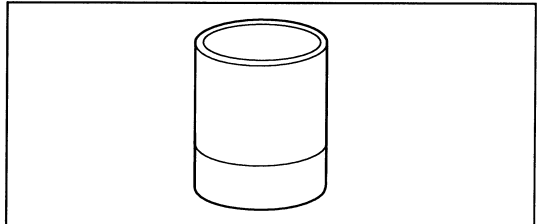
White Calibration Plate CM-A133

Used to perform white calibration for measurement of reflectance. A floppy disk containing white calibration data and a white calibration data sheet are supplied with this accessory.



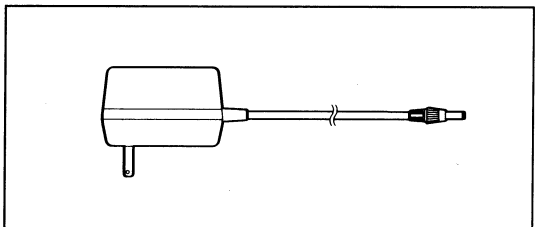
Zero Calibration Box CM-A119

Used to perform zero calibration for measurement of reflectance.



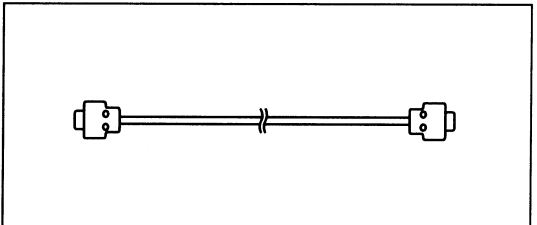
AC Adapter AC-A12

Used to supply power from an AC outlet to the CM-3630.



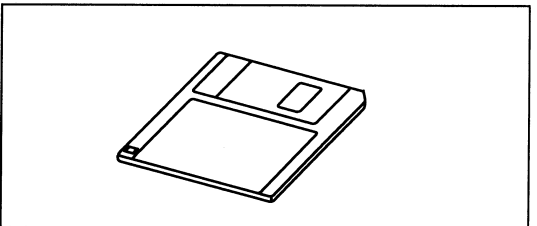
RS-232C Cable IF-A12

(for IBM PC/AT, Female 9-pin D-subminiature, 2m/6.6ft)
Used to connect the CM-3630 to a personal computer.



Unit Driver CM-A108

The unit driver contains instrument data.



Accessory Case CM-A117

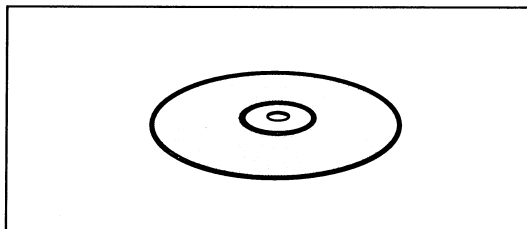
Dust Cover CM-A118

Optional Accessories

Software

PaperControl for CM-3630

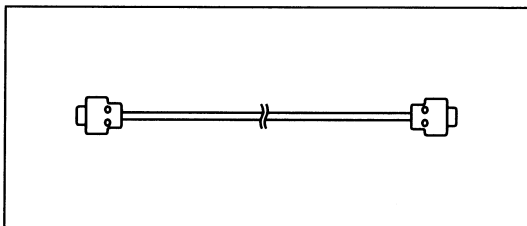
This software provides various functions (e.g., data processing and file management) and allows the user to operate the CM-3630 using a personal computer.



RS-232C Cable IF-A10, IF-A11, and IF-A13 through IF-A15

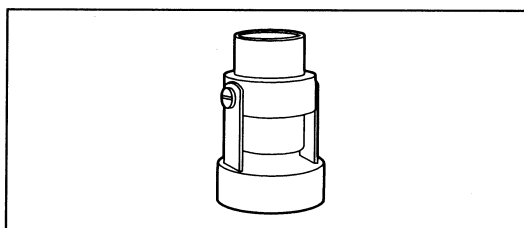
RS-232C Cables connect the Spectrophotometer to a computer. The following types are available:

Cable	Length	Connector
RS-232C Cable IF-A10	2m/6.6 ft.	Male 25-pin D-subminiature
RS-232C Cable IF-A11	5m/16.4 ft.	Male 25-pin D-subminiature
RS-232C Cable IF-A13	5m/16.4 ft.	Female 9-pin D-subminiature
RS-232C Cable IF-A14	2m/6.6 ft.	Female 25-pin D-subminiature
RS-232C Cable IF-A15	5m/16.4 ft.	Female 25-pin D-subminiature

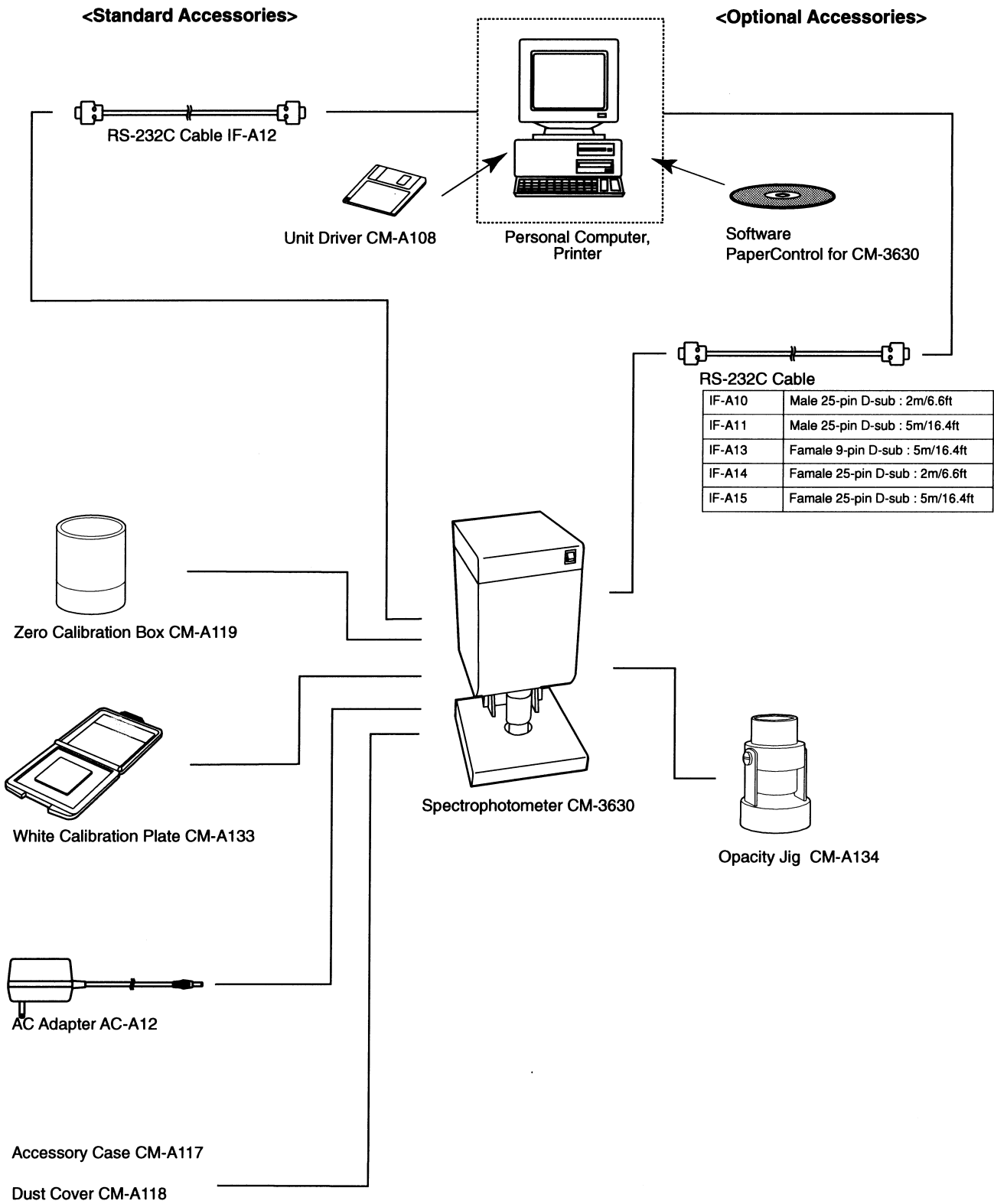


Opacity Jig CM-A134

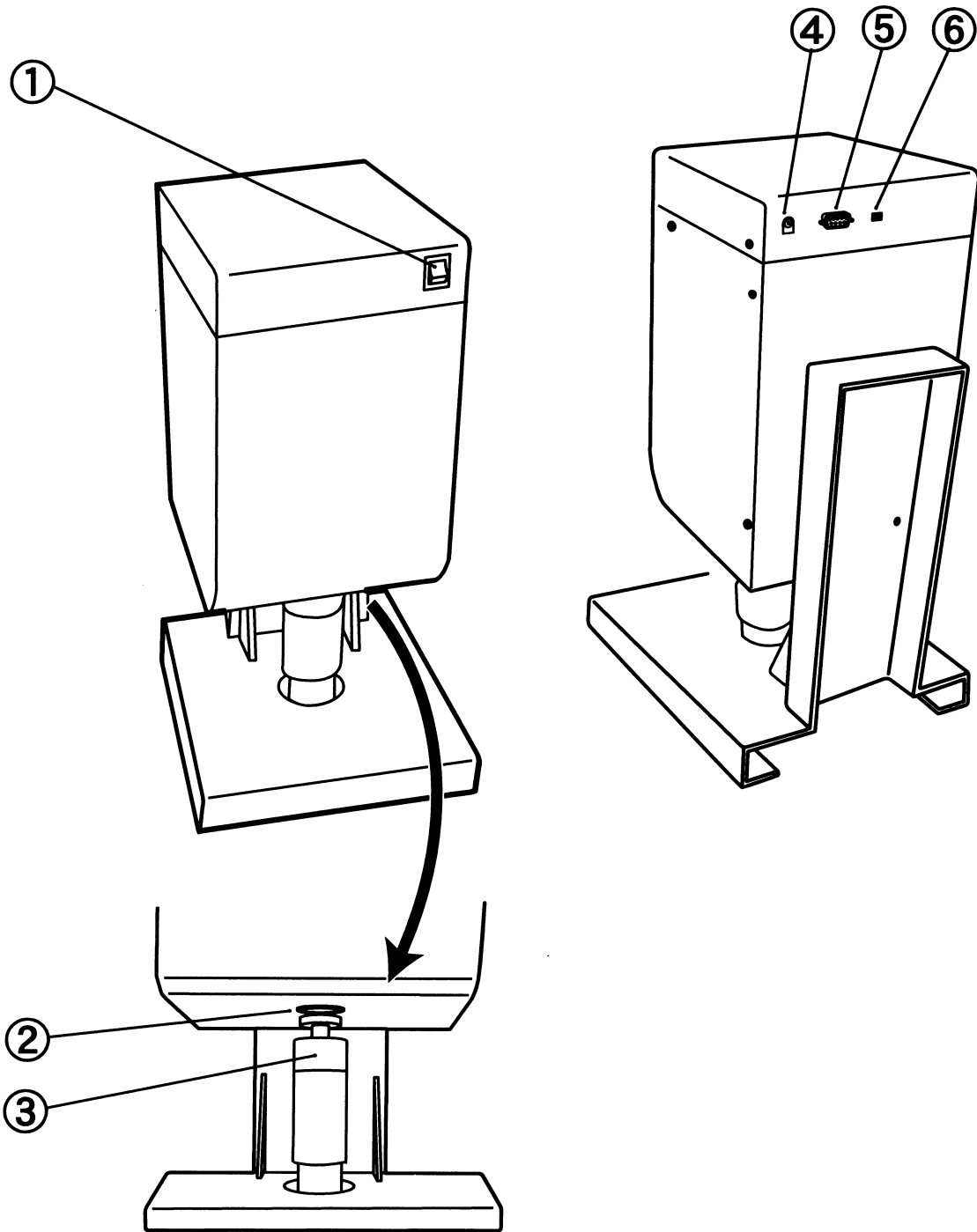
Opacity jig can be used for an opacity measurement with white backing or black backing.



System Block Diagram



Names and Functions of Parts



- ① Power switch Used to turn power ON and OFF.
- ② Measuring aperture
- ③ Sample holder Used to hold the specimen, white calibration plate or zero calibration box.
- ④ AC adapter input socket ... Used to connect the AC adapter supplied with the CM-3630.
- ⑤ RS-232C connect Used to connect the RS-232C cable supplied with the CM-3630.
- ⑥ DIP switch Used to set communication parameters.

Measurement Procedure

- This manual explains how to prepare the CM-3630 and how to set a specimen.
- The CM-3630 is controlled by a computer to perform measurements.
- For a description of measuring method using the PaperControl for CM3630 (optional), refer to the PaperControl for CM3630 manual.

<Flow of Preparation and Measurement>

Setting the baud rate :	Set the communication parameters to communicate with the computer. (Page 13)
↓	
Connecting the computer :	Connect the CM-3630 to the computer with the RS-232C cable. (Page 14)
↓	
Connecting the AC adapter (Page 15)	
↓	
Starting the computer : (starting Windows)	Turn on the computer to be used to control the CM-3630.
↓	
Turning the power ON (Page 16)	
↓	
Starting the software :	Starts the software set it for control of the CM-3630.
↓	
Performing zero calibration :	Attach the zero calibration box and perform zero calibration. (Page 17)
↓	
Performing white calibration :	Attach the white calibration plate and perform white calibration. (Page 18)
↓	
Setting a specimen in place :	Set a specimen in the CM-3630. (Page 19)
↓	
Performing measurement :	Perform measurements.
↓	
Turning the power OFF :	When measurements are complete, turn the power OFF. (Page 16)

Setting the Baud Rate

DIP switches are used to set the baud rate. Since the DIP switch settings in effect when the power is turned ON will be registered, the power must be turned OFF before setting the baud rate. If the DIP switch settings are changed while the power is ON, a malfunction may result.

	1200	2400	4800	9600	19200
Switch 1	OFF	OFF	OFF	OFF	ON
Switch 2	OFF	OFF	ON	ON	OFF
Switch 3	OFF	ON	OFF	ON	OFF

Switch 1 has been set to OFF and switches 2 and 3 to ON as the default settings before shipment of the CM-3630. If you are going to use the optional PaperControl for CM-3630 at the software's default settings for the CM-3630 make sure the DIP switches are set to the default settings.

The other communication parameters are fixed as follows.

Character bits : 8 bits

Stop bit : 1 bit

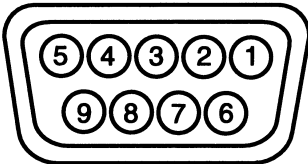
Parity check : None

Connecting to the Computer

<Notes on Connecting>

- When connecting the connectors, make sure that they are correctly oriented and secured tightly with screws.
- Before connecting, make sure that the power to the CM-3630 and host computer is turned OFF.
- When disconnecting the cable, be sure to grip the plug or connector when pulling on it. Do not pull on or forcibly bend the cable.
- Do not touch the connector terminals with your hands, allow them to get dirty or apply excessive force to them.
- Make sure that the cable has sufficient amount of slack. Stretching the cable tight may cause connection failure or wire breakage.
- When using a cable other than the one supplied as the standard accessory or one of the specified optional cables, make sure that the cable conforms to the table given below. If it does not conform, a malfunction may occur or incorrect data may be transferred between the CM-3630 and the computer.

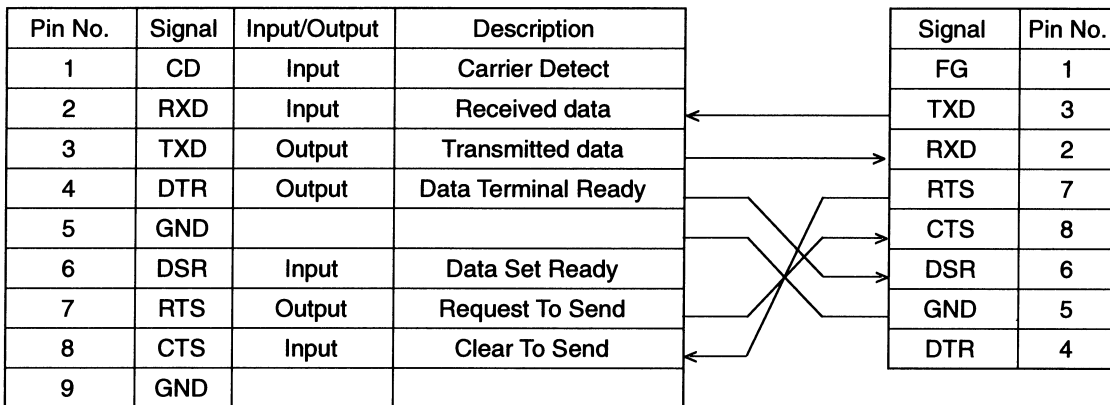
<Pin Assignment>



<Wiring Diagram>

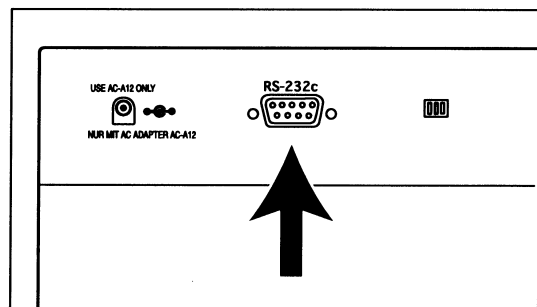
CM-3630

Personal computer
(D-sub 9-pin connector)



<Connecting Procedure>

1. Turn OFF the power to both the CM-3630 and the computer.
2. Connect the CM-3630 to the computer with the RS-232C cable.



Connecting the AC Adapter

⚠ WARNING

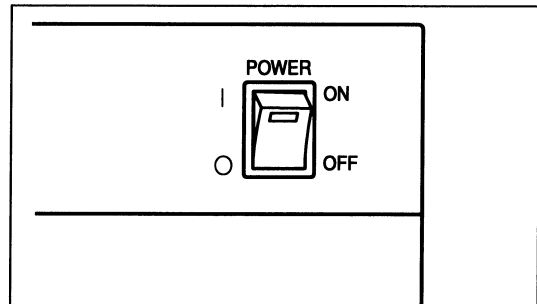
- Always use the AC adapter supplied as a standard accessory or specified replacement AC adapter with the CM-3630, and connect it to an AC outlet of the rated voltage and frequency. Failure to do so may damage the CM-3630 or the AC adapter, causing a fire or electric shock.
- ☞ If the CM-3630 will not be used for a long time, disconnect the AC adapter from the AC outlet. Accumulated dirt or water on the prongs of the AC adapter's plug may cause a fire and should be removed.
- ⊘ Do not insert or disconnect the AC adapter with wet hands. Doing so may cause electric shock.
- ⚡ Do not disassemble or modify the AC adapter. Doing so may cause a fire or electric shock.

⚠ CAUTION

- ⊘ Do not connect or disconnect the AC adapter, when the power switch is set to ON ("I").

<Connecting Procedure>

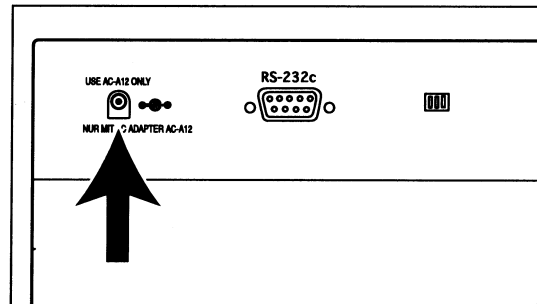
1. Make sure that the power switches of both CM-3630 and host computer are set to OFF ("O").



2. Insert the output plug of the AC adapter into the AC adapter input socket on the rear of the CM-3630.

3. Insert the input plug of the AC adapter into an AC wall outlet.

- The AC Adapter AC-A12 supplied as the standard accessory must be used.
- Before disconnecting the AC adapter, the power switch must be set to OFF ("O").

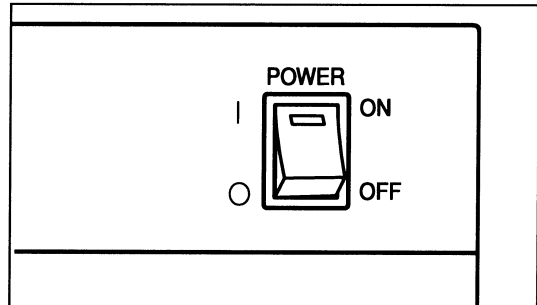


Turning Power ON and OFF

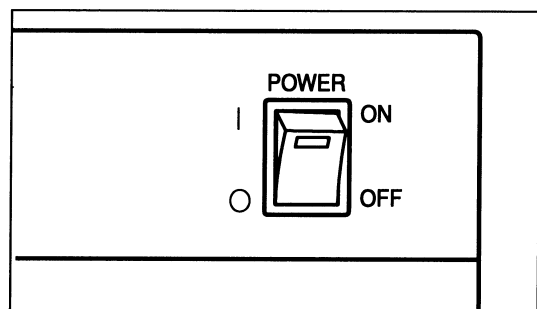
⚠ WARNING

⊘ The CM-3630 should not be operated if the CM-3630 or the AC adapter is damaged, or smoke or strange odors occur. Doing so may result in a fire. In such situations, turn the power OFF immediately, disconnect the AC adapter from the AC outlet, and contact the nearest Konica Minolta-authorized service facility.

1. To turn the power ON, set the power switch to ON ("I").



2. To turn the power OFF, set the power switch to OFF ("O").



Attaching the Zero Calibration Box

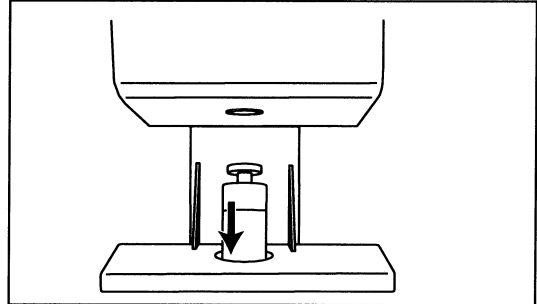
⚠ CAUTION

● Be careful around openings in the CM-3630. Failure to do so may result in fingers being trapped causing injury.

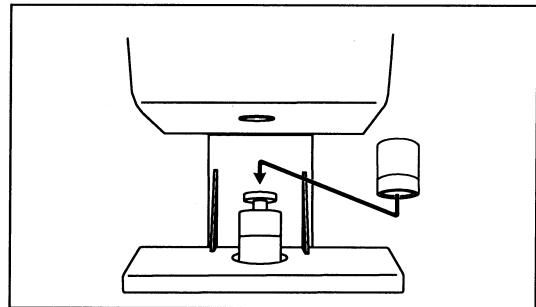
The zero calibration box is used to perform zero calibration for measurement of reflectance.

1. Pull down the specimen holder and hold it open.

- When it is turned right at the bottom position, specimen holder keeps that position.



2. Set the specimen holder to the groove of the zero calibration box and let the specimen holder pull up to hold the zero calibration box in right position.



- Take care not to scratch or make the inside of the zero calibration box dirty.
- If the inside of the zero calibration box gets dirty, wipe it with a soft, clean, dry cloth.
- If dirt is difficult to remove, dampen a cloth with commercially available lens cleaning liquid and wipe the zero calibration box. Then wipe off the liquid with a cloth dampened with water, and leave the box to dry.
- Should the inside of the zero calibration box get so dirty that it cannot be cleaned, replace the box with a new one.

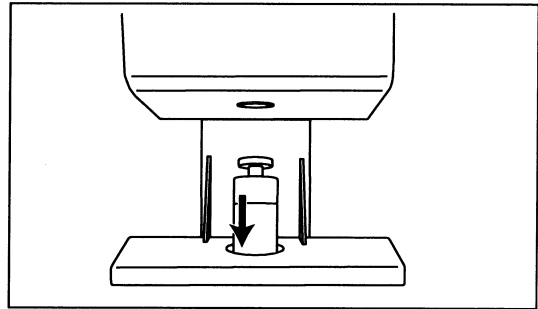
Attaching the White Calibration Plate

⚠ CAUTION

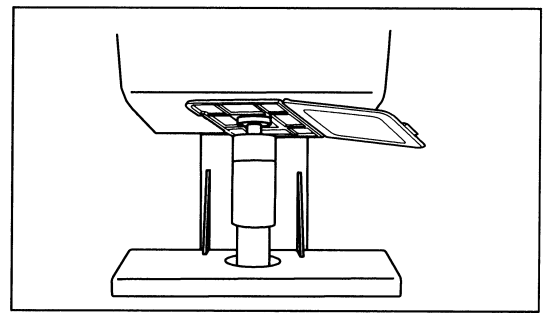
- ⊘ Do not perform measurement with the specimen measuring port directed towards your face. Doing so may cause damage to your eyes.
- ⚠ Be careful around openings in the CM-3630. Failure to do so may result in fingers being trapped causing injury.

The white calibration plate is used to perform white calibration for measurement of reflectance.

1. Pull down the specimen holder and hold it open.
 - When it is turned right at the bottom position, specimen holder keeps that position.



2. Set the specimen holder to the groove of the white calibration plate and let the specimen holder pull up to hold the white calibration plate in right position.



<Notes on Use of White Calibration Plate>

- The white calibration plate may become discolored if left exposed to light. Therefore, when not in use, make sure that the lid is closed to prevent exposure to light.
- Take care not to scratch or make the white calibration plate dirty.
- If the white calibration plate gets dirty, wipe it with a soft, clean, dry cloth.
- If dirt is difficult to remove, dampen a cloth with commercially available lens cleaning liquid and wipe the white calibration plate. Then wipe off the liquid with a cloth dampened with water, and leave the plate to dry.
- Should the white calibration plate get so dirty that it cannot be cleaned, replace the plate with a new one.

Setting a Specimen

⚠ WARNING

- ⊘ Do not use the CM-3630 in places where flammable or combustible gases (gasoline fumes etc.) are present. Doing so may cause a fire.
- ⚠ Do not disassemble or modify the CM-3630. Doing so may cause a fire or electric shock.
- ⊘ The CM-3630 should not be operated if it is damaged, or smoke or odd smells occur. Doing so may result in a fire. In such situations, turn the power OFF immediately, disconnect the AC adapter from the AC outlet, and contact the nearest Konica Minolta-authorized service facility.

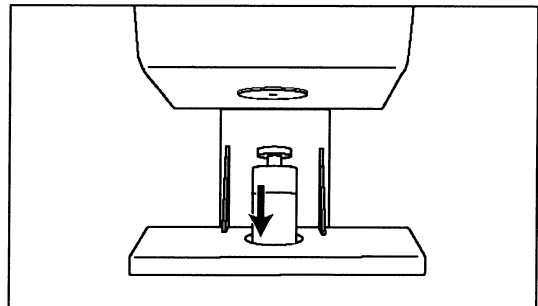
⚠ CAUTION

- ⊘ Do not perform measurement with the specimen measuring port directed towards your face. Doing so may cause damage to your eyes.
- ⚠ Be careful around openings in the CM-3630. Failure to do so may result in fingers being trapped causing injury.

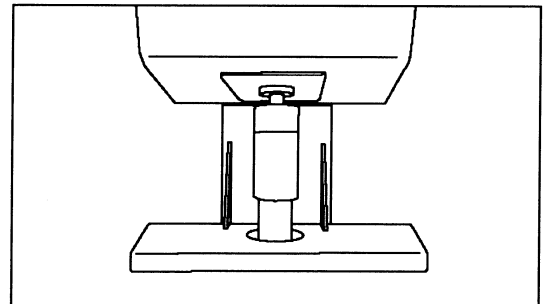
<Reflectance Measurements>

To measure the reflectance of a film- or plate-like specimen, the specimen needs to be secured with the sample holder.

1. Pull down the specimen holder and hold it open.
 - When it is turned right at the bottom position, specimen holder keeps that position.



2. Secure the specimen with the sample holder.
 - When adjusting the position of the specimen, the sample holder must be pulled down and kept open. This will prevent the sample holder scratching the surface of the specimen during adjustment.



Cleaning the CM-3630 and Accessories

⚠ WARNING

- ⚡ Do not disassemble or modify the CM-3630 or AC adapter. Doing so may cause a fire or electric shock.
- 🔥 The CM-3630 should not be operated if it is damaged, or if smoke or strange odors occur. Doing so may result in a fire. In such situations, turn the power OFF immediately, disconnect the AC adapter from the AC outlet, and contact the nearest Konica Minolta-authorized service facility.

⚠ CAUTION

- 👉 Be careful around openings in the CM-3630. Failure to do so may result in fingers being trapped causing injury.

<Zero Calibration Box and White Calibration Plate>

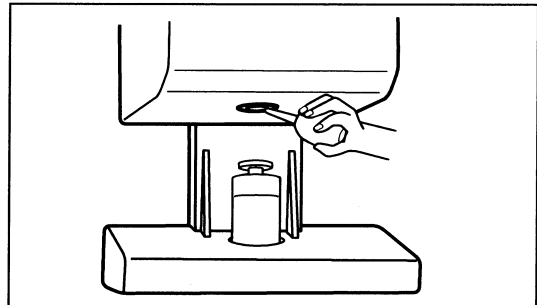
Wipe gently with a dry soft cloth. If dirt is difficult to remove, dampen a cloth with commercially available lens cleaning liquid and wipe. Then wipe off the liquid with a cloth dampened with water, and leave it to dry.

- When cleaning, take care not to scratch the zero calibration box or white calibration plate.

<Inside Integrating Sphere>

1. Open the sample holder and remove dust and dirt using a blower.

- Do not touch the white-coated inner surface of the integrating sphere, wipe it with a cloth or place any object against it. If the white-coated surface gets so dirty that dirt cannot be removed using a blower, contact the nearest Konica Minolta-authorized service facility.

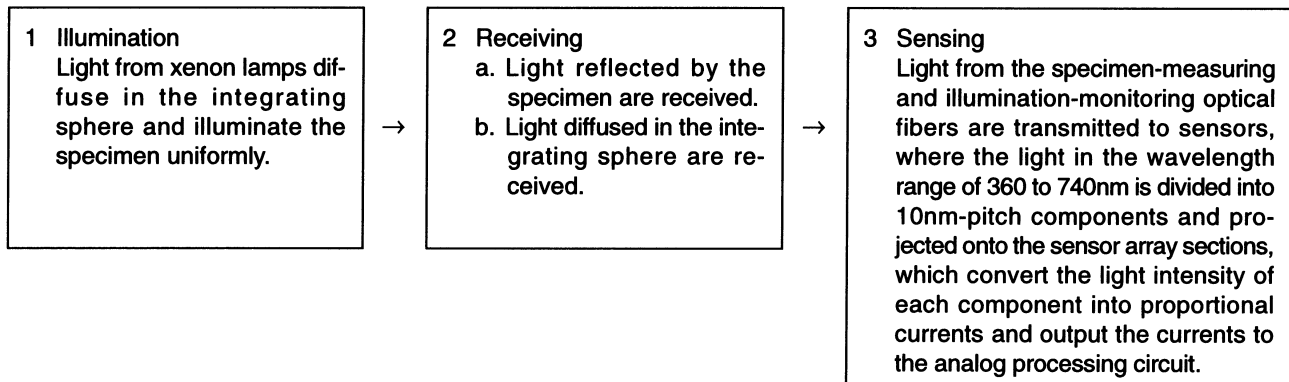


Explanation

Illumination/Viewing System

<Measuring Reflected Colors>

The flow of measurement is shown below.

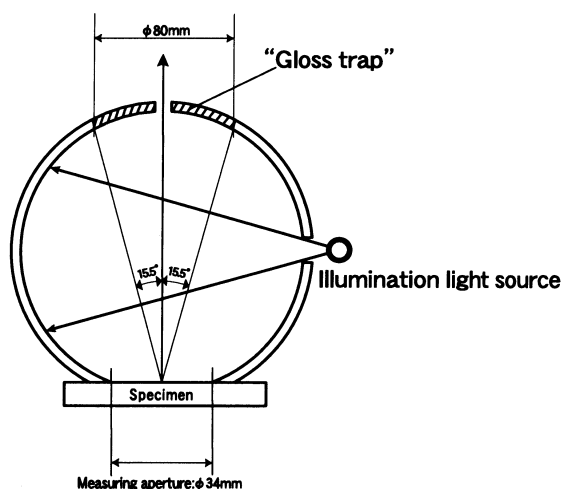


The d/0 geometry conforms to ISO 2469, DIN 53145 Part1•Part2, TAPPI T525 and JIS P8148 standards.
(Specular reflection is excluded with "gloss trap")

- 1 Light from the pulsed xenon lamps are diffused by reflection from the inner surface of the integrating sphere, and finally illuminate the specimen uniformly.
 - 2 a. The light reflected by the specimen surface at an angle of 0° to the normal to the surface passes through the viewing aperture and is then received by the specimen-measuring optical system and guided to the sensor (Specular reflection is excluded with "gloss trap").
b. The diffused light in the integrating chamber is received by the illumination-monitoring optical fiber and guided to the sensor.
 - 3 The light from the specimen-measuring optical fiber and from the illumination-monitoring optical fiber is divided into each wavelength component and projected onto the sensor array sections, which convert the light into proportional currents and output the currents to the analog processing circuit.
- By using the outputs from the specimen-measuring sensor and the illumination-monitoring sensor for calculations, compensation for slight differences in the spectral characteristics and intensity of the illumination light is performed (double-beam system).

"GLOSS TRAP"

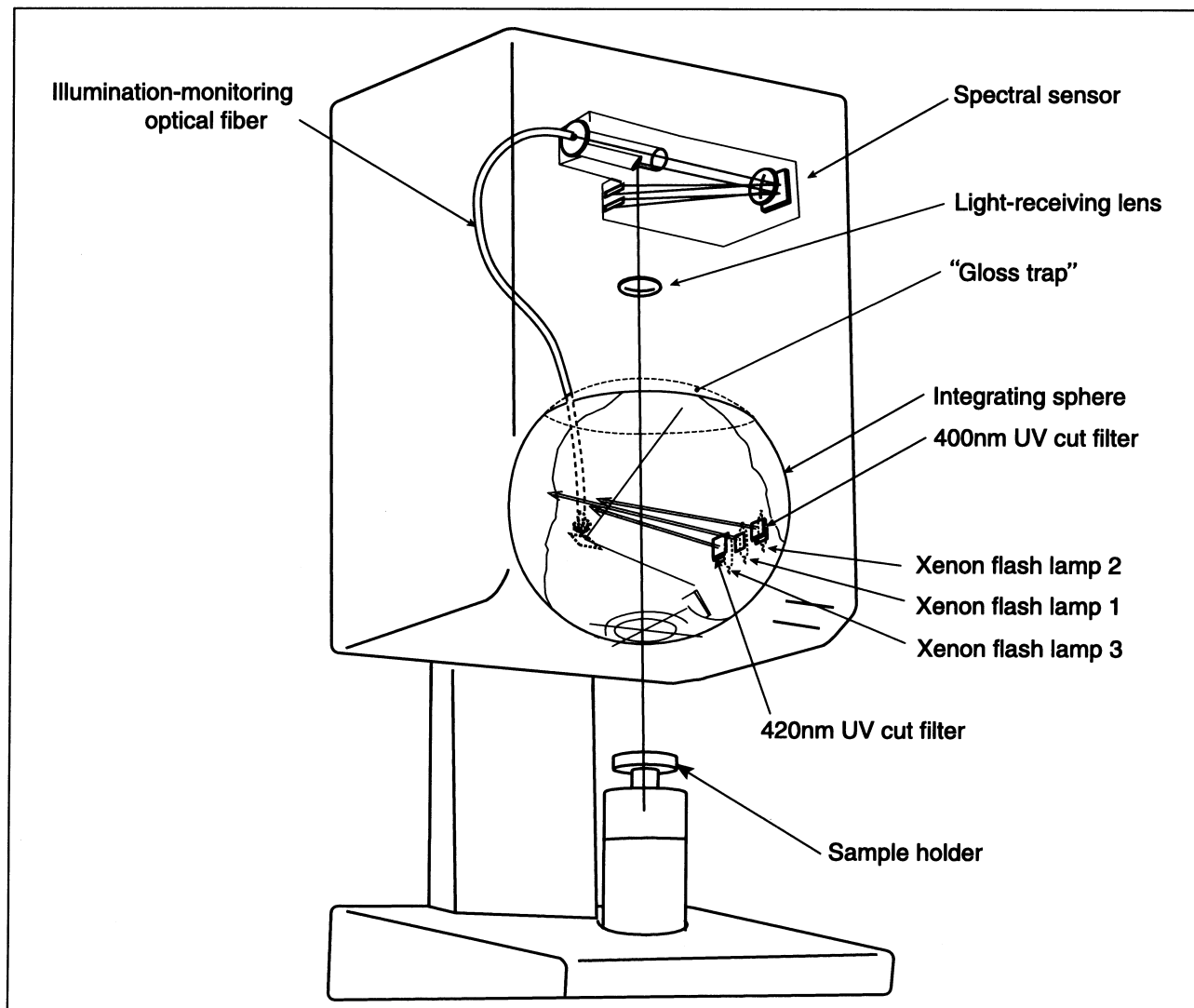
- The receptor aperture shall be surrounded in "black annulus".
(subtending a half-angle of 15.5° at the centre of sample aperture)
- This "black annulus" serves as a "gloss trap".
- Specular reflection is cancelled with "gloss trap".



Illumination and Measurement Areas

Specification of CM-3630 is 34 mm measurement area and 30 mm illumination area.

System Configuration



Fluorescent Measurement

The CM-3630 incorporates two types of xenon lamps as light sources for Fluorescent measurements (UV full light source and UV cut light source) and performs numeric calculation of the reflectance when the specimen is illuminated by these two light sources to obtain fluorescent reflectance.

WHEN FLUORESCENT CALIBRATION IS PERFORMED:

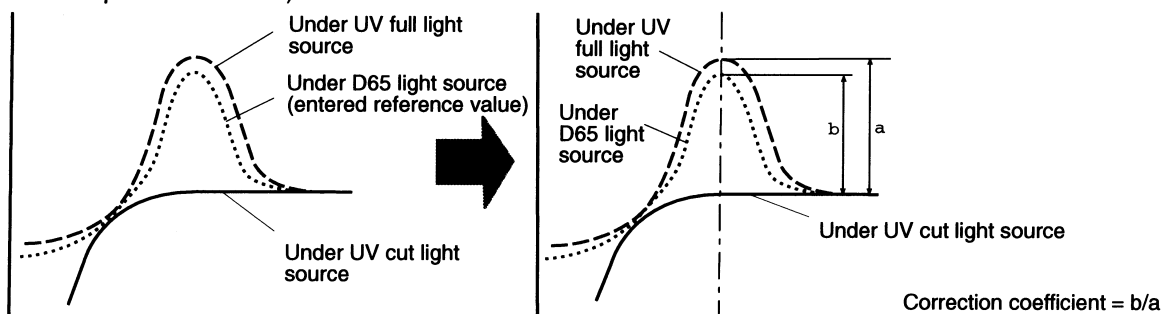
When PaperControl for CM-3630 is used, the following four fluorescent calibration methods are available to enable accurate measurement of fluorescent reflectance.

1. Profile mode
→ Correction coefficients for fluorescent measurement are obtained based on the calibrated reflectance profile of the fluorescent standard plate (the reflectance profile is created by entering reflectance for each wavelength).
2. Tint mode
→ Correction coefficients for fluorescent measurement are obtained so that the measured CIE Tint value for the fluorescent standard plate is within the specified range (Tint value for the fluorescent standard plate calibrated with a D65 light source is entered).
3. Whiteness [WI] mode
→ Correction coefficients for fluorescent measurement are obtained so that the measured CIE WI (whiteness index) value for the fluorescent standard plate is within the specified range (WI value for the fluorescent standard plate calibrated with a D65 light source is entered).
4. Tint and WI mode
→ Correction coefficients for fluorescent measurement are obtained so that the measured CIE Tint and WI values for the fluorescent standard plate are both within the specified range (Tint and WI values for the fluorescent standard plate calibrated with a D65 light source are entered).

CALCULATING FLUORESCENT REFLECTANCE

Based on the measured reflectances for the fluorescent standard plate obtained under the UV full light source and under the UV cut light source, the amount of fluorescence is obtained. The correction coefficients for fluorescent measurement are then determined so that the given reference values are satisfied.

(Calibration example: Profile mode)



These correction coefficients are then used to obtain the fluorescent reflectance by performing numeric calculations using the measured reflectances under the UV full light source and under the UV cut light source.

As a result, the CM-3630 can keep the fluorescent output quantity as close to the standard as possible, without the need for adjusting the quantity of ultraviolet light, which is required in the case of conventional models.

WHEN FLUORESCENT CALIBRATION IS NOT PERFORMED:

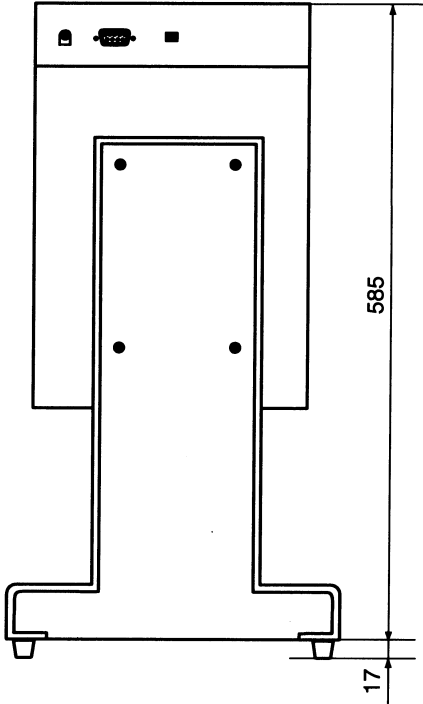
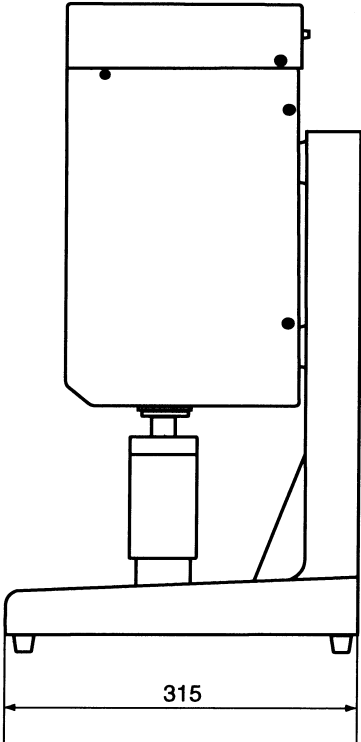
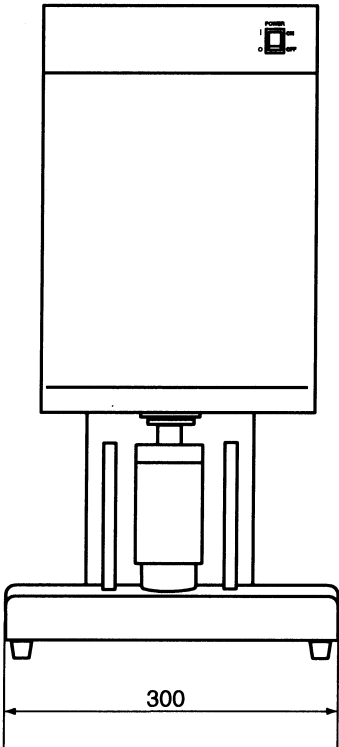
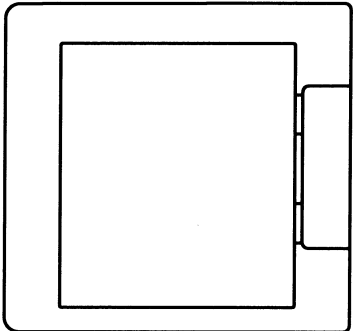
The UV full xenon lamp of the CM-3630 has a spectral distribution similar to that of the D65 light source. Therefore, when high accuracy fluorescent measurements are not required normal measurement of reflectance can be used to measure fluorescent reflectance.

UV CUT LIGHT SOURCES

With the CM-3630, UV400 cut light source (with radiation at wavelengths of 390nm or lower eliminated) and UV420 cut light source (with radiation at wavelengths of 410nm or lower eliminated) are provided.

Dimensions

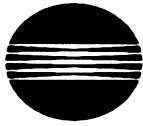
(mm)



Specifications

Model	CM-3630	
Illumination/viewing system	Reflectance: d/0 (diffused illumination, 0-degree viewing) Conforms to ISO 2469, DIN 53145 Part1•Part2, TAPPI T525 and JIS P8148 standards.	
Light-receiving element	Silicon photodiode array (dual 40 elements)	
Spectral separation device	Diffraction grating	
Wavelength range	360nm to 740nm	
Wavelength pitch	10nm	
Half bandwidth	Approx. 10nm	
Reflectance range	0 to 200%; resolution: 0.01%	
Light source	Pulsed xenon lamps (× 3)	
Measurement time	Approx. 1.5 seconds (for measurements of fluorescent colors, at 9600bps)	
Minimum interval between measurements	Approx. 4 seconds; when reflectance measured, approx. 5 seconds; when fluorescent color	
Measurement/illumination area	ø30mm/ø34mm(Fixed)	
Inter instrument agreement	Mean ΔE^*ab 0.2 based on 12 BCRA Series II color tiles compared to values measured with master body.	
Repeatability	Spectral reflectance: Standard deviation within 0.1% Colorimetric values: Standard deviation within ΔE^*ab 0.02 (when a white calibration plate is measured 30 times at 10-second intervals)	
Temperature drift	Spectral reflectance: Within $\pm 0.10\%/^{\circ}C$ Color difference: Within ΔE^*ab 0.05/ $^{\circ}C$	
UV adjustment	Instantaneous numerical adjustment	
Control method	Directly connected to a computer	
Interface	RS-232C Terminal : D-subminiature 9-pin (female) Baud rate : 1200, 2400, 4800, 9600, 19200bps Character bits : 8 bits Stop bit : 1 bit Parity check : None	
Output data	Count, conditions, status	
Other	Automatic delimiter code detection (during serial data communication)	
Power	100-240Vac, 50-60Hz 25W AC (with a dedicated AC adapter)	
Size (W × H × D)/weight	300 × 585 × 315mm / 15.5Kg	
Operation temperature/humidity range	13 to 33°C: less than 80% RH (at 33°C with no condensation)	
Storage temperature/humidity range	0 to 40°C, less than 80% RH (at 33°C with no condensation)	
Standard accessories	White calibration plate Zero calibration box AC adapter RS-232C cable Accessory Case Dust Cover Unit Driver	CM-A133 CM-A119 AC-A12 IF-A12 (Male 9-pin D-sub:2m/6.6ft) CM-A117 CM-A118 CM-A108
Optional accessories	Color Data Software Opacity jig RS-232C cable	PaperControl for CM-3630 CM-A134 IF-A10 (Male 25-pin D-sub:2m/6.6ft) IF-A11 (Male 25-pin D-sub:5m/16.4ft) IF-A13 (Female 9-pin D-sub:5m/16.4ft) IF-A14 (Female 25-pin D-sub:2m/6.6ft) IF-A15 (Female 25-pin D-sub:5m/6.6ft)

- Specifications subject to change without notice.



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