

2D Color Analyzer CA-2500 Series

Instruction Manual



Before using this instrument,
please read this 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 safety warning or precaution.
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 AC adapter from AC outlet.



Denotes a prohibited operation.
Never disassemble this instrument.



This symbol indicates A.C.



This symbol indicates D.C.

Trademarks












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Notes on this manual

- No part of this manual may be reprinted or reproduced in any form or by any means without the permission of Konica Minolta Optics, Inc.
- The contents of this manual are subject to change without notice.
- Every effort has been made to ensure the accuracy of the contents of this manual. However, should you have any questions or comments, or find an error or missing section, please contact a Konica Minolta-authorized service facility.
- Konica Minolta accepts no responsibility for consequences resulting from failure to follow the instructions outlined in this manual, the condition above notwithstanding.

Safety Warnings and Cautions

To ensure correct use of this instrument, 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 anytime a question arises.

	Warning (Failure to adhere to the following points may result in death or serious injury.)
	Do not use this instrument in places where flammable or combustible gases (gasoline etc.) are present. Doing so may cause fire.
	Always use the AC adapter and power cord supplied as a standard accessory or optional (AC-A312), and connect it to indoor AC outlet of rated voltage 100-240 V ~ 50/60 Hz. Failure to follow either of these may result in damage to instrument or AC adapter, fire or electric shock.
	Insert the power plug fully and securely. If the power plug is not pushed complete inserting may cause fire or electric shock.
	If this instrument is not used for a long time, disconnect AC adapter from AC outlet. Accumulated dirt or water on prongs of AC adapter plug may cause fire. Be sure to remove before use.
	Do not forcibly pull any part on power cord when unplugging since this may damage power cord, resulting in fire or electric shock. Gently disconnect by holding plug. Also, do not handle power plug with wet hands. Doing so may cause electric shock.
	Dust could enter inside this instrument from air duct. Do not leave such dust accumulated while using for this may cause fire. Contact with the nearest Konica Minolta-authorized service facility for periodical checkup.
	Do not forcibly bend, twist or pull power cord. Also, do not place heavy object on power cord, or damage or modify one. Any of these may cause fire or electric shock due to damage to power cord.
	Do not disassemble or modify this instrument or AC adapter. Doing so may cause fire or electric shock.
	Do not expose this instrument to liquid or metal object which may cause fire or electric shock. Should either of these happen, switch power off immediately, unplug AC adapter, and contact the nearest Konica Minolta-authorized service facility.
	Should this instrument or AC adapter be damaged or smoke or odd smell be generated, do not keep using one without correction. Doing so may cause fire. In such cases, switch power off immediately, unplug AC adapter from AC outlet, and then contact the nearest Konica Minolta-authorized service facility.

	Caution (Failure to adhere to following points may result in injury or damage to this instrument or other property.)
	Use this instrument near AC outlet for easy plugging or unplugging in using AC adapter.
	Do not place this instrument on unstable or sloping surface which may drop or overturn it. Dropping or overturning may injure someone around. Take care not to drop this instrument when carrying.
	When cleaning, disconnect the power plug. Connecting may cause electric shock.

Introduction

Thank you for purchasing our 2D Color Analyzer CA-2500 series. This instrument measures unevenness of luminance and color on various display unit or projector, backlight and car instrument panel in 2 dimension. Read this manual carefully before use.

"CA-2500" and CA-2500S are applied as representative examples for explanation and illustration respectively in this instruction manual. Only those with different specification are indicated model by model.

Packaging material

Retain accompanying packaging materials (carton, protector, and plastic bag) for future use.

This is delicate measurement instrument. Use packaging materials supplied in purchasing in case this instrument needs to be transferred for such purpose as maintenance in Konica Minolta-authorized service facility. These packaging materials are useful for minimizing shock or vibration to this instrument in such situation. Should any of these packaging materials be lost or broken, contact the nearest Konica Minolta-authorized service facility.

Note on use

Operating environment

- Do not use this instrument outdoor since standard accessory AC adapter (AC-A312) is designed for indoor use.
- Never disassemble this instrument for being composed of delicate electronic components.
- Use this instrument at rated voltage of 100-240 V \sim . Connect AC power cord to AC outlet with rated voltage 100-240 V \sim 50/60 Hz. Connected voltage should not be outside the range of $\pm 10\%$ of nominal.
- This instrument is classified into a Pollution Degree 2 as instrument used mainly in manufacturing plant, laboratory, warehouse or equivalents. Use this instrument in metal dust free and non condensing potential environment.
- This instrument is categorized into Overvoltage Category I as equipment which is powered by an AC adaptor connected to commercially available power.
- If protective earth terminal is equipped with the PC to control this instrument, connect the PC terminal to a protective earth outlet. If not, electric shock may occur due to earth leakage.
- Take care not to enter foreign substance like water or metal in this instrument. Operating in such state causes serious danger.
- Do not use this instrument under direct sunlight or near heater. The internal temperature of this instrument becomes much higher than ambient temperature which may break this instrument. Also, be sure to keep good ventilation in using this instrument. Never cover air duct of this instrument.
- Avoid rapid change in ambient temperature which may form dew condensation.
- Avoid using this instrument in extremely dusty or humid place.
- Use this instrument at ambient temperature between 10°C and 30°C and relative humidity 70% or less with no condensation. Operating this instrument outside specified temperature and humidity range may unsatisfy its original performance.
- Do not use this instrument at altitudes above 2000 meters (6560 ft).
- Even if the product is used within the specified operating temperature/humidity range, the displayed values may be affected by long-term conditions of use. If you have any question about specification, please contact the nearest Konica Minolta-authorized service facility.

This instrument

- Do not subject this instrument to strong impact or vibration.
- Do not forcibly pull, bend, or apply strong force to power cord for attached AC adapter or USB cable. This may result in snapping.
- Connect this unit to power source with minimal noise.
- Should breakage or abnormality be found during operation, switch power off immediately and unplug. Then, refer to "Error Check" on pages 29.
- Should this instrument break down, do not try to disassemble and repair it by yourself. Contact the nearest Konica Minolta-authorized service facility.

Lens and filter inside lens mount on body

- Be sure that there is no dirt on surface of lens and filter inside lens mount on body before measurement. Correct measurement result cannot be obtained if dirt, dust or handsoil is left or uncleaned.
- Do not touch surface of lens and filter inside lens mount on body with hand.
- Lens and filter inside lens mount on body could become fogged up if ambient temperature fluctuates under high humidity. Be careful not to generate such condition for correct measurement cannot be performed.

Storage

Body

- Cover lens mount with standard accessory mount cover in storing lens in removed state.
- Do not store this instrument under direct sunlight or near heater. The internal temperature of this instrument could become much higher than ambient temperature which may break this instrument.
- Store this instrument at ambient temperature between 0°C and 30°C and relative humidity 70% or less with no condensation or between 30°C and 35°C and relative humidity 55% or less with no condensation. Storage under high temperature and humidity may deteriorate performance of this instrument. For added safety, we recommend storage with a drying agent at room temperature.
- Even if the product is stored within the specified storage temperature/humidity range, the displayed values may be affected by long-term conditions of storage. If you have any question about specification, please contact the nearest Konica Minolta-authorized service facility.
- Take care not to form condensation. Avoid rapid change in ambient temperature when transferring body for storage.
- Put body in packaging box supplied when purchased or optional soft case (CA-A60) to store in safe place.

Lens

- Cover lens with lens cap, or lens hood with hood cap for storage.
- When you remove lens from body for storage, cover lens with lens cap and mount cap.

Temperature/Humidity conditions under which the instrument is used and stored

It is recommended that the instrument be used and stored under standard conditions (Temperature: 23°C; Relative humidity: 40%), and that areas subject to high temperature and/or humidity be avoided. In addition in order to maintain the measurement accuracy of this instrument, it is recommended that it be inspected regularly about once a year. For details on having the instrument inspected, please contact the nearest Konica Minolta-authorized service facility.

Even if the product is used within the specified operating temperature/humidity range or stored within the specified storage temperature/humidity range, the displayed values may be affected by long-term conditions of use or storage.

If the instrument is left under the following high-temperature conditions for a long period of time, the displayed values may change as follows:

Temperature: 30°C; Relative humidity: 70%; Period under these conditions: 720 hours (30 days)

Accuracy: Luminance: ± 0.4 %; Chromaticity: ± 0.003

Inter-point error: Luminance: ± 0.2 %; Chromaticity: ± 0.0003

Temperature: 35°C; Relative humidity: 55%; Period under these conditions: 336 hours (14 days)

Accuracy: Luminance: ± 1 %; Chromaticity: ± 0.006

Inter-point error: Luminance: ± 0.5 %; Chromaticity: ± 0.001

These differences in display values are due to the instrument materials and/or components being affected by the temperature and humidity conditions of long-term use or storage. In particular, optical filters are easily affected by temperature or humidity. Although measures have been taken to improve resistance to temperature/humidity changes, the accumulated effect of long-term use or storage may affect the displayed values.

Cleaning

Body

- If this unit becomes dirty, wipe with dry and soft cloth. Do not use organic solvent like benzine or thinner and other chemical agent for cleaning. Should none of these methods be helpful, contact the nearest Konica Minolta-authorized service facility.

Lens and filter inside lens mount on body

- Should it be gotten dirt or dust, wipe off with dry and soft cloth or lens cleaning paper. Do not use organic solvent like benzine or thinner and other chemical agent for cleaning. Should none of these methods be helpful, contact the nearest Konica Minolta-authorized service facility.

Notes on transfer

- Use the original packaging materials to minimize the shock and vibration to the product when transporting it.
- Pack the product and all of its accessories together in one package before sending them to us for repair, inspection and/or calibration.

Maintenance

- Periodical checkup is recommended annually to maintain measurement accuracy of instrument. For details on checkup, contact the nearest Konica Minolta-authorized service facility.

Disposal Method

- Make sure that the CA-2500, its accessories and the packing materials are either disposed of or recycled correctly in accordance with local laws and regulations.

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Others

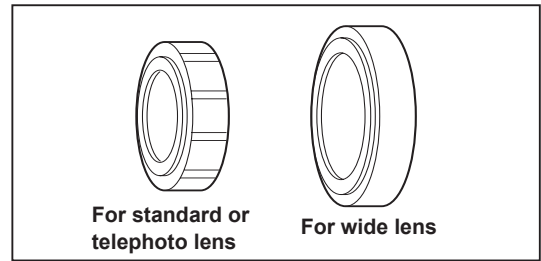
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Standard Accessory

Attached lens cap, mount cap, lens hood and hood cap corresponding with lens type for each model.

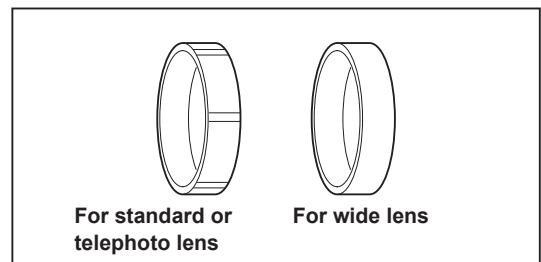
Lens Cap

- Place on lens for protection in not using this instrument.
For standard or telephoto lens
For wide lens



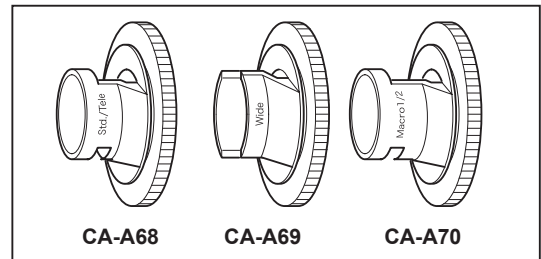
Mount Cap

- Place on lens mount for protection when lens is removed from body.
For standard or telephoto lens
For wide lens



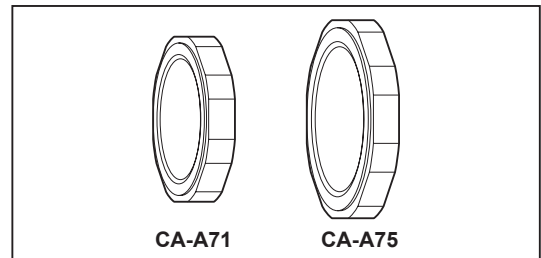
Lens Hood

- For standard or telephoto lens **CA-A68**
- For wide lens **CA-A69**
- For macro measurement **CA-A70**



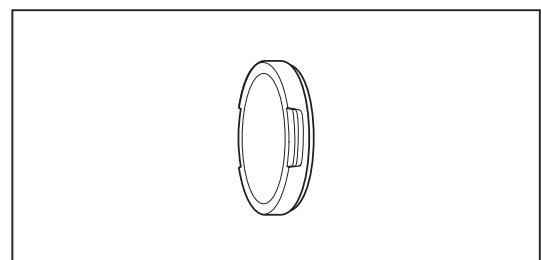
Hood Cap

- Place on lens for protection in not using this instrument.
For standard lens, telephoto lens, or macro measurement **CA-A71**
For wide lens **CA-A75**



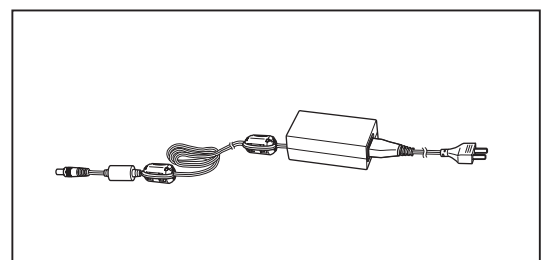
Mount Cover CA-A61

- Place for protection of lens mount of body when lens is removed.



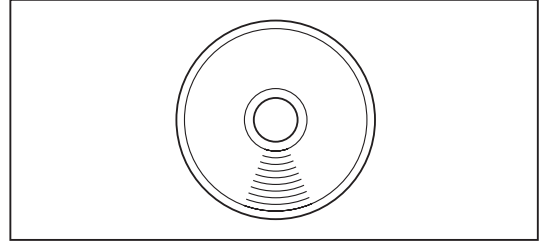
AC Adapter AC-A312

- Supplies power from AC outlet.
Input: 100-240 V ~ 0.75 A
50/60 Hz
Output: 12 V = 3.0 A

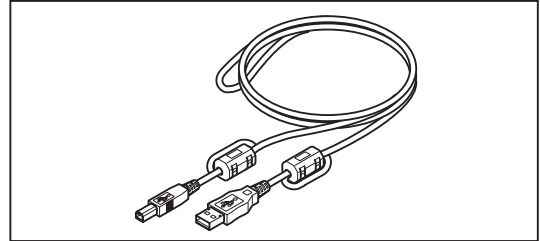


Data Management Software CA-S25w

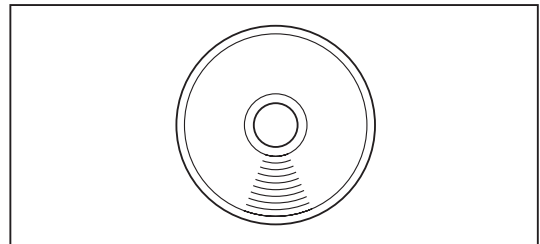
- For data management of this instrument from PC.

**USB Cable (3 m) IF-A18**

- Used for communication between this instrument and PC.

**Calibration Data DVD**

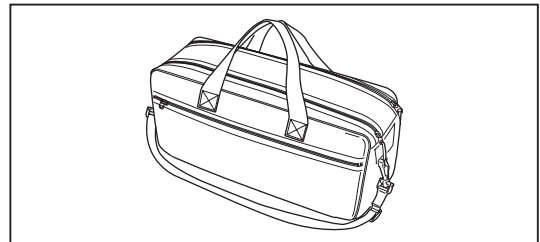
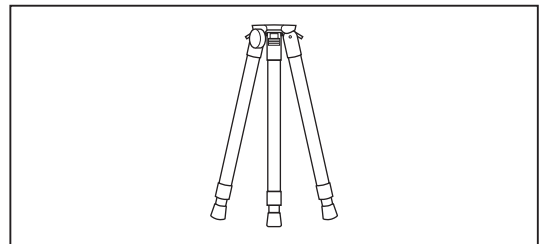
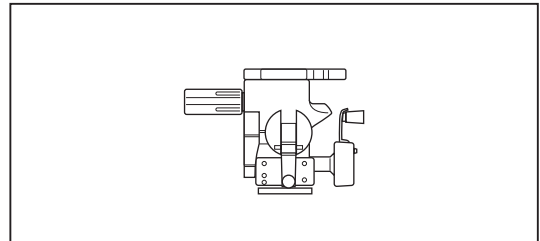
- Supplied with each lens.



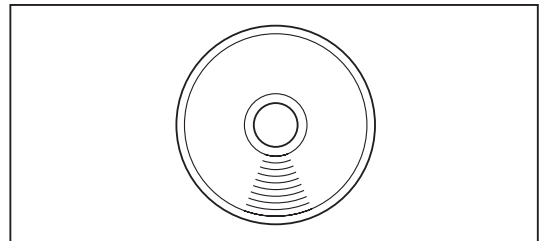
Optional Accessory

Soft Case CA-A60

- Used to keep this instrument and accessories or carry them with hand. Never use for transfer.

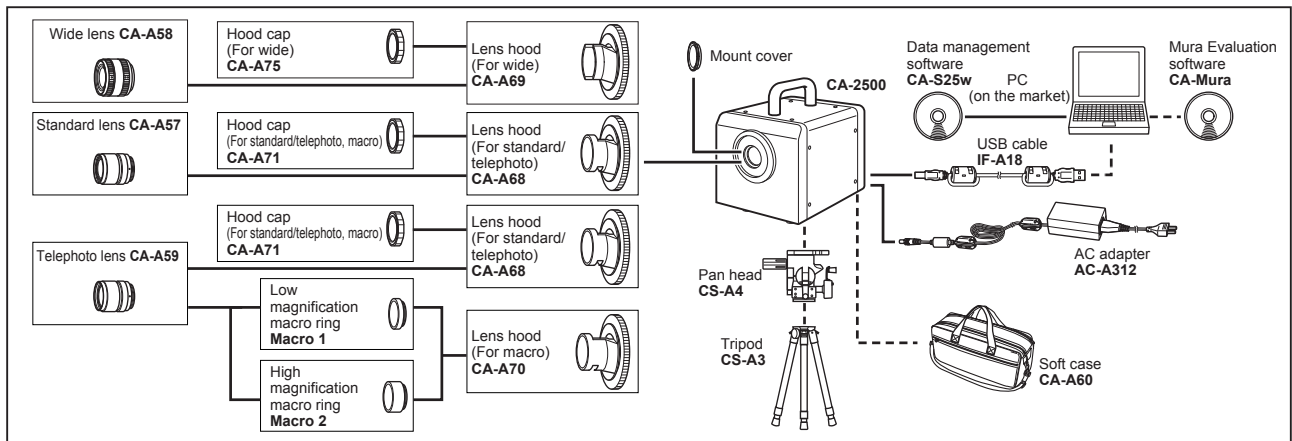
**Tripod CS-A3****Pan Head CS-A4****Mura Evaluation Software CA-Mura**

- This program is an add-on software for CA-S25w. It uses the "mura quantitative evaluation method" developed by Sony to provide the "mura indexes" and "mura index images" reflecting human sensitivity.

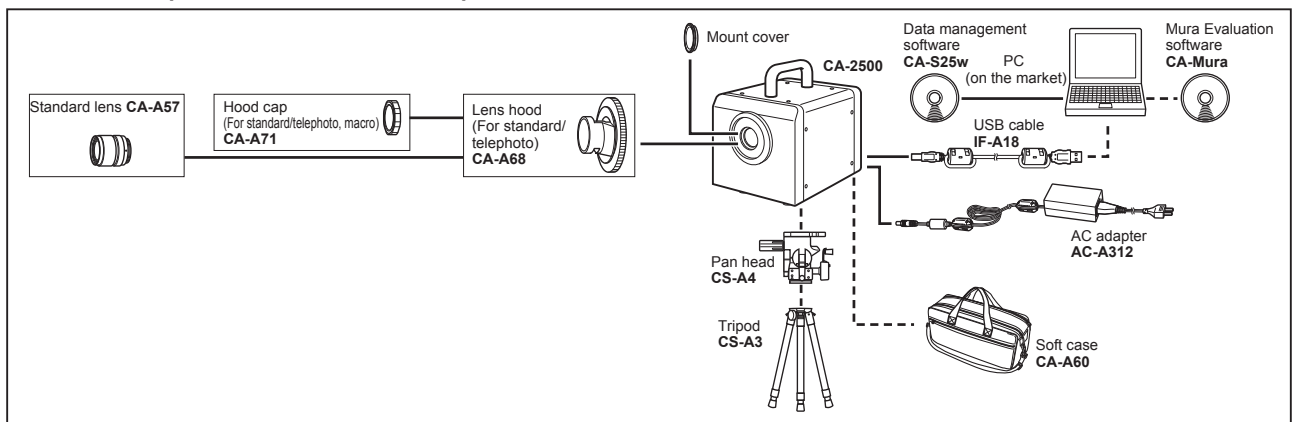


System Configuration

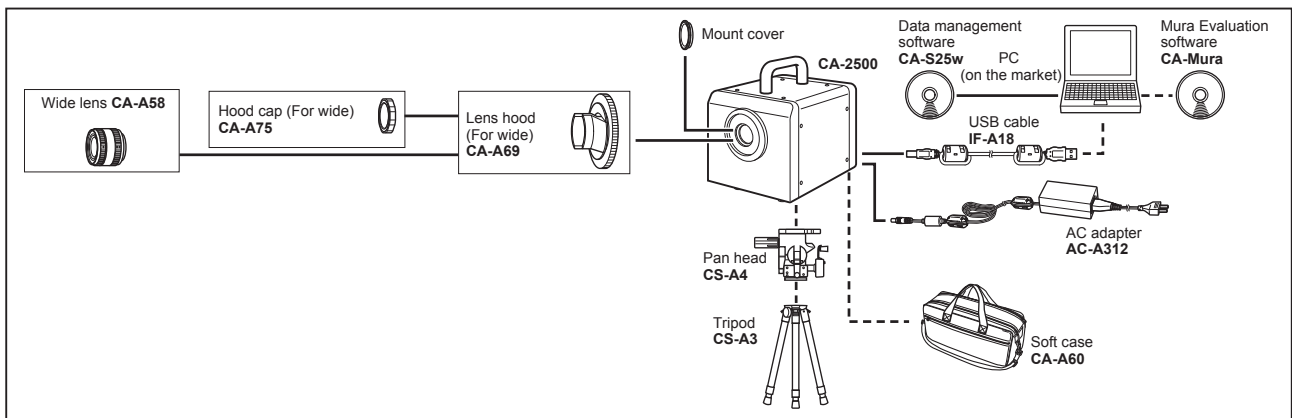
CA-2500A (With all lenses)



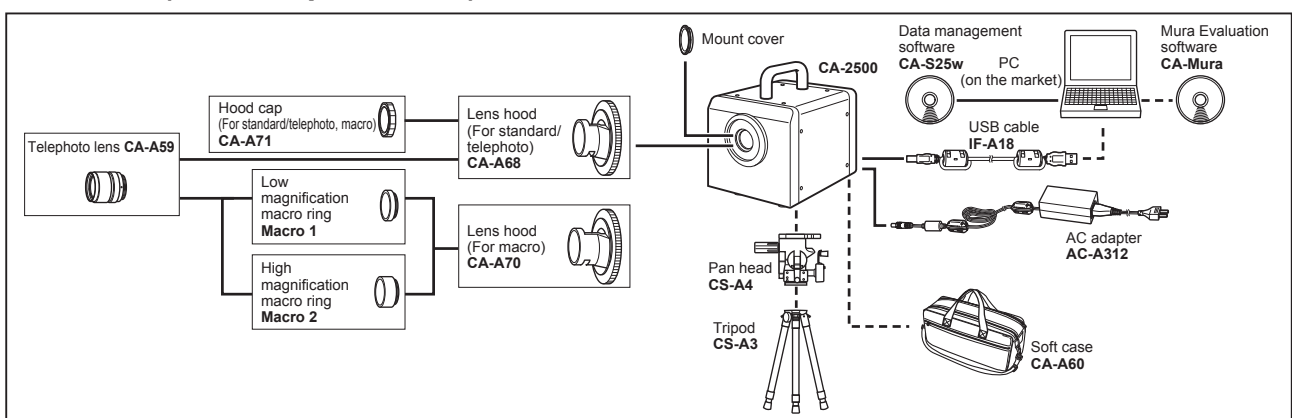
CA-2500S (With standard lens)



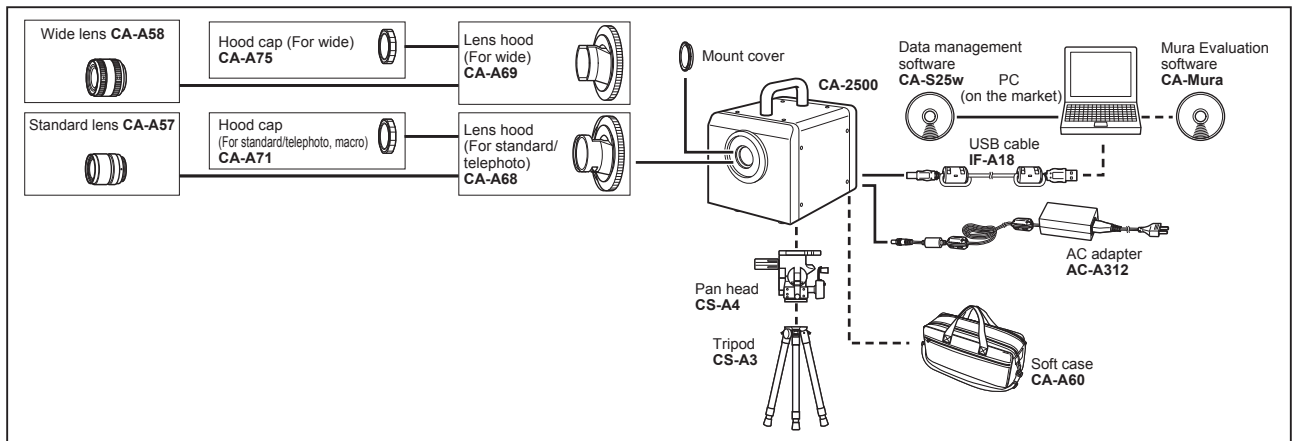
CA-2500W (With wide lens)



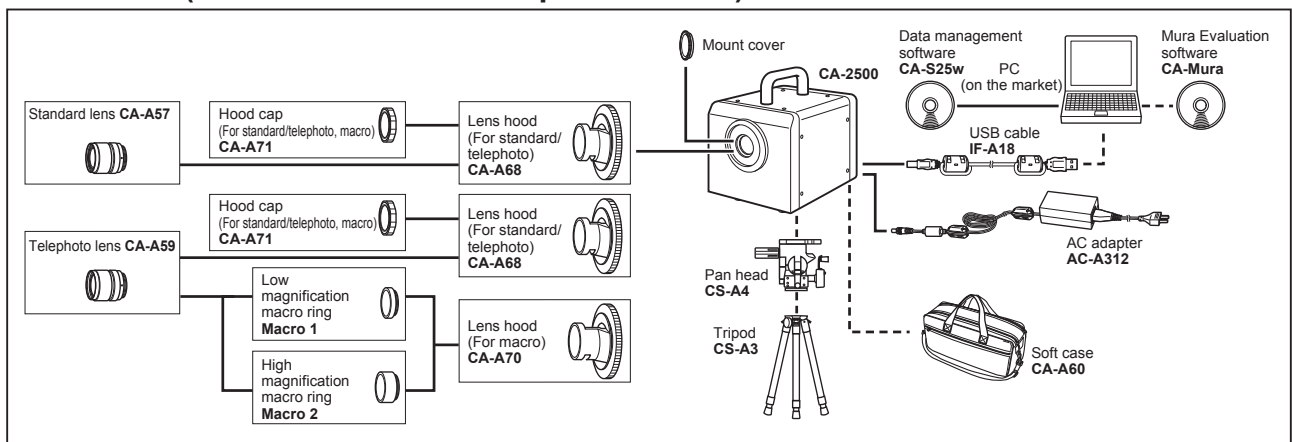
CA-2500T (With telephoto lens)



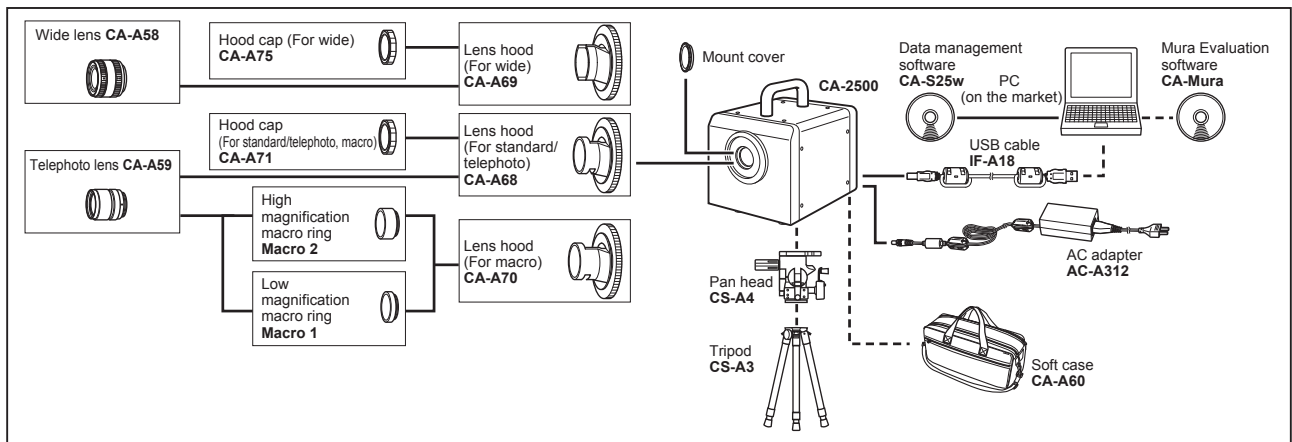
CA-2500SW (With standard and wide lenses)



CA-2500ST (With standard and telephoto lenses)



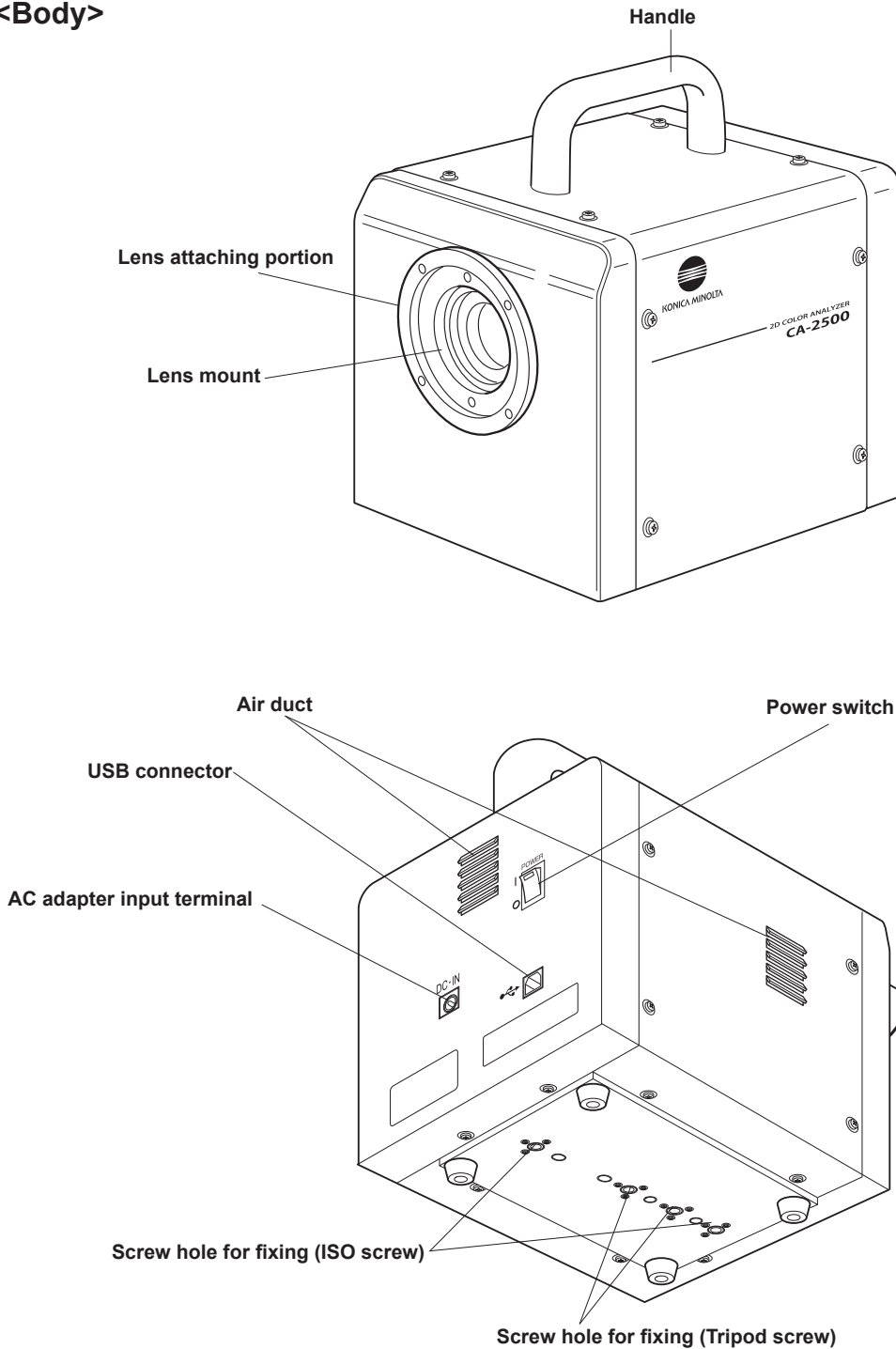
CA-2500WT (With wide and telephoto lenses)



———— Standard accessory
 - - - - - Optional accessory

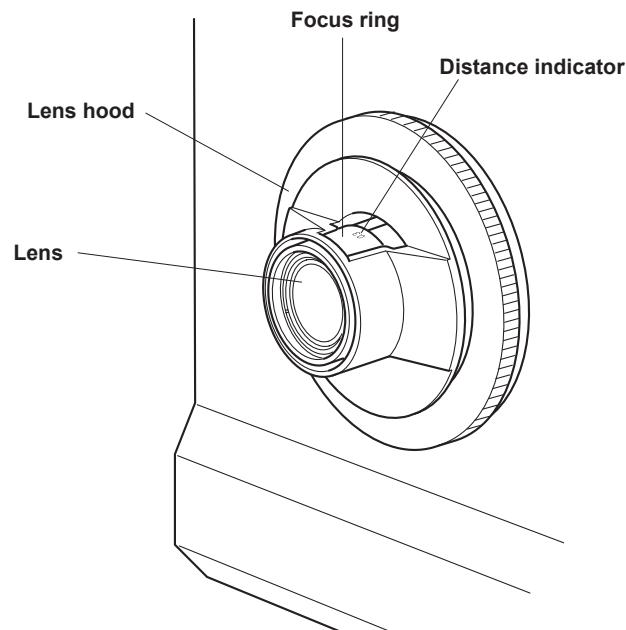
Names and Functions of Parts

<Body>



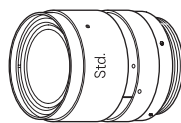
Power switch	Switches this instrument on/off. [] side for ON; [○] side for OFF. Green LED lights up while switched on. (p.19)
AC adapter input terminal	To which accessory AC adapter is connected. (p.18)
USB connector	To which USB cable is connected when used with PC. (p.19)
Air duct	Air duct to air-cool interior. Do not cover here. Air-cooling fan built in this instrument operates while switched on.
Lens mount	To install lens on.
Lens attaching portion	To which lens hood is attached.
Screw hole for fixing	Used to set this instrument on tripod or jig.

<Lens>



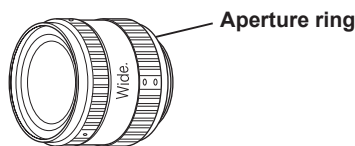
Body and lens arranged in a pair are calibrated. Pair those with identical numbers.

CA-2500A, CA-2500S, CA-2500SW, CA-2500ST



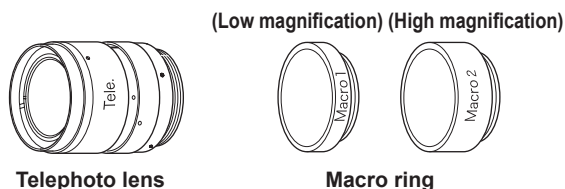
Standard lens

CA-2500A, CA-2500W, CA-2500SW, CA-2500WT



Wide lens

CA-2500A, CA-2500T, CA-2500ST, CA-2500WT



Lens hood

Protects lens. Remove this once when replacing lens.

Focus ring

Adjusts focus.

Aperture ring

Being fixed, this should not be used. Do not operate by removing or revolving screw for this would deteriorate the performance.

Macro ring

Placed between telephoto lens and body when utilizing telephoto lens for macro. You cannot place 2 types of macro ring simultaneously.

Installing

Goods/Environment to Prepare on Customer's Side

Get prepared for below goods/environment before using this instrument.

Controlling PC

OS	: Windows® XP Professional SP3, Windows® XP Professional x64 Edition SP2 Windows® 7 Professional 32bit (x86), Windows® 7 Professional 64bit (x64) Windows® 8 Pro 32bit (x86), Windows® 8 Pro 64bit (x64) (English, Japanese, or Chinese (simplified font) version of the above OS) The PC must meet the system requirements specified by the applicable OS or listed below, whichever is higher.
CPU	: Equivalent to Pentium® 4, 2.8 GHz or better
Memory	: 1024 MB or more
Hard disk drive	: At least 80 MB of available disk space is required on the system drive (drive where the OS is installed). To install the calibration data, the following disk space is required for each lens: <ul style="list-style-type: none"> • For a standard lens: approximately 540 MB • For a wide angle lens: approximately 470 MB • For a telephoto lens: approximately 1.3 GB To save measurement data on the hard disk, you need to reserve the following additional space on the hard disk: <ul style="list-style-type: none"> • For example, approximately 110 MB is required to save 10 pieces of measurement data with 980 × 980 resolution. • About 1 MB is required for configuration files such as the spot setting file and measurement condition file.
Display	: Display hardware capable of displaying 1280 × 768 pixels / 65,536 colors (High Color: 16-bit color) or better
Other	: CD-ROM drive Required for installation 1 DVD-ROM drive Required for installation of calibration data * In place of the above two drives, you can use a single drive that is capable of reading both CD-R and DVD-R media. A USB port is required for connection of the instrument.

In addition, following items are useful.

Mounting stage

Table on which this instrument is installed. Below are recommended conditions.

- Can change measurement distance according to measurement object.
- Painted with black to prevent the entrance of light diffusely reflecting.


Blackout curtain (quickly prepared darkroom) / Dark room

Needed to block this instrument and measurement object from outside light.


Get prepared for blackout curtain for quickly prepared dark room or dark room.

Installing

Warning for safety

-  Do not use this instrument in places where flammable or combustible gases (gasoline etc.) are present. Doing so may cause fire.

Caution for safety

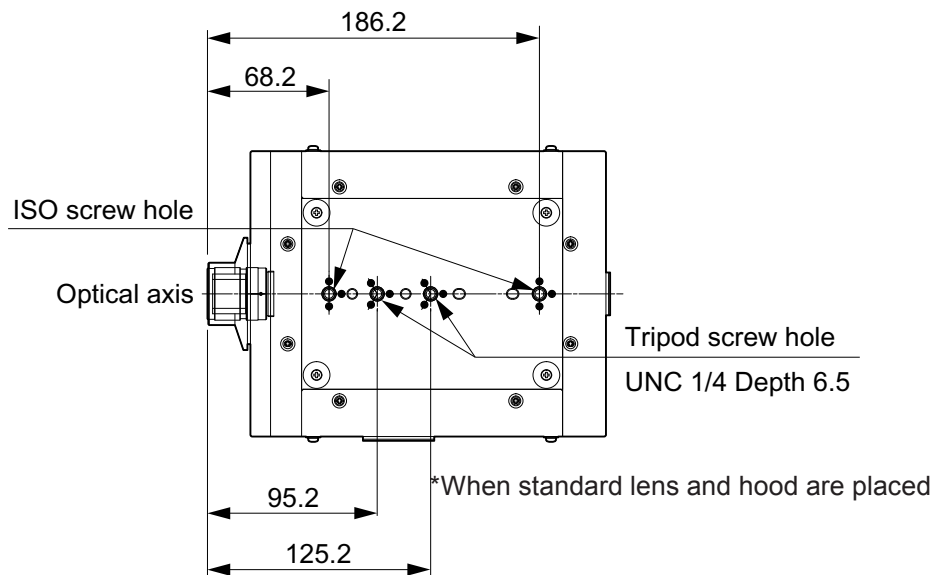
-  Do not place this instrument on unstable or sloping surface which may drop or overturn it. Dropping or overturning may injure someone around. Take care not to drop this instrument when carrying.

To set this instrument on tripod or jig, use screw hole for fixing at the bottom of this instrument.

2 type holes are available as follows;

Tripod screw hole: To set on tripod. Screw depth is 6.5 mm.

ISO screw hole: To set on jig. User ISO 5 mm screw and screw depth is 6.5 mm.



For further detail, see p.28.

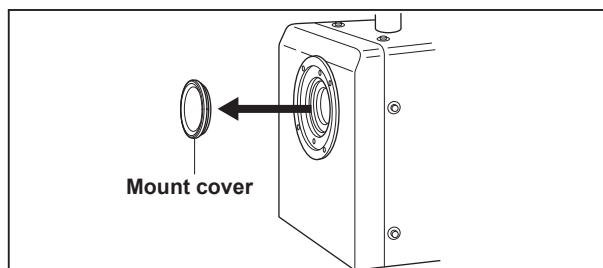
Placing Lens

Below shows lens type accompanying respective CA-2500 series. Lens hood is served as standard corresponding to lens type.

CA-2500A	Standard, wide and telephoto lenses, and 2 macro rings
CA-2500S	Standard lens
CA-2500W	Wide lens
CA-2500T	Telephoto lens and 2 macro rings
CA-2500SW	Standard and wide lenses
CA-2500ST	Standard and telephoto lenses, and 2 macro rings
CA-2500WT	Wide and telephoto lenses, and 2 macro rings

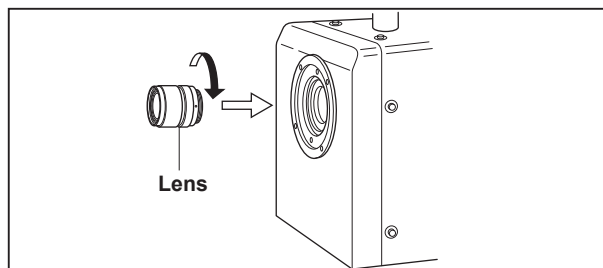
Operation procedure

1. Remove mount cover from lens mount on body.



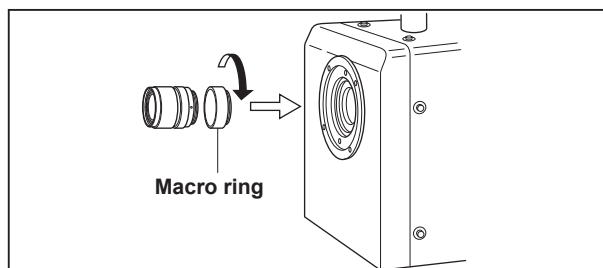
2. Place lens on lens mount before rotating clockwise.

- Be sure to insert lens straightly. If forcibly put aslant, lens mount could be broken.
- Revolve lens until fixed.



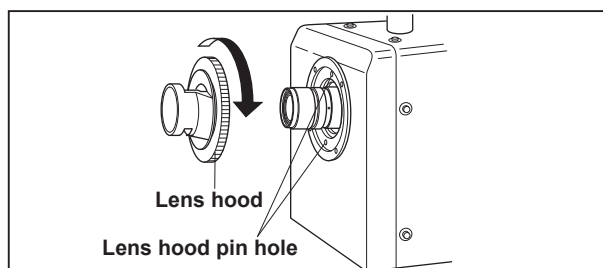
For CA-2500A, CA-2500T, CA-2500ST, or CA-2500WT

In using a macro ring for either of CA-2500A, CA-2500T, CA-2500ST, or CA-2500WT, sandwich it between lens and lens mount.



3. Align 2 pins of lens hood and 2 holes of body. Then, insert lens hood as if it covers lens. Finally, rotate screw portion of lens hood clockwise.

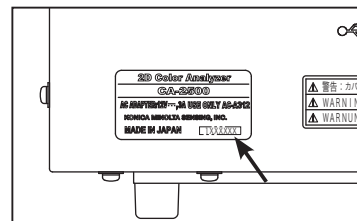
- Select appropriate lens hood depending on lens type. Inappropriate lens hood may cause the lens head to be positioned back from the lens hood, which leads to incorrect measurement.
- Hold the circumference of lens hood.
- Rotate screw portion of lens hood until fixed.



- Check whether body and lens have identical serial numbers.

Serial number can be found on label of body and lens side respectively.

To pursue high-accuracy measurement, calibration was done on maker's side for each unit before shipment combining with each accessory lens for CA-2500 series. This means that attached calibration coefficient data to each unit is valid exclusively for the packaged combination of unit and lens.



- Set lens type to use in software CA-S25w.

(For detail, see the instruction manual for data management software CA-S25w.)

This enables the application of appropriate calibration coefficient data depending on usage condition which would finally give correct measurement result.

Replacing lens

Follow reverse procedure to above to replace lens. First, remove lens hood and then lens.

Connecting AC Adapter

Use accessory AC adapter for power source.



Warning (Failure to adhere to the following points may result in death or serious injury.)



Always use the AC adapter and power cord supplied as a standard accessory or optional (AC-A312), and connect it to indoor AC outlet of rated voltage 100-240 V ~ 50/60 Hz. Failure to follow either of these may result in damage to unit, fire or electric shock.



If this instrument is not used for a long time, disconnect AC adapter from AC outlet. Accumulated dirt or water on prongs of AC adapter plug may cause fire and should be removed. Be sure to remove before use.



Do not forcibly pull any part on power cord when unplugging since this may cause fire or electric shock. Gently disconnect by holding plug. Also, do not handle power plug with wet hands. Doing so may cause electric shock.



Do not forcibly bend, twist or pull power cord. Also, do not place heavy object on power cord, or damage or modify one. Any of these may cause fire or electric shock due to damage to power cord.



Do not disassemble or modify this instrument or AC adapter. Doing so may cause fire or electric shock.



Should this instrument or AC adapter be damaged or smoke or odd smell be generated, do not keep using one without correction. Doing so may cause fire. Switch power off immediately, unplug AC adapter from AC outlet in such case. If operated on battery, remove battery and contact the nearest Konica Minolta-authorized service facility.



Caution (Failure to adhere to following points may result in injury or damage to instrument or other property.)

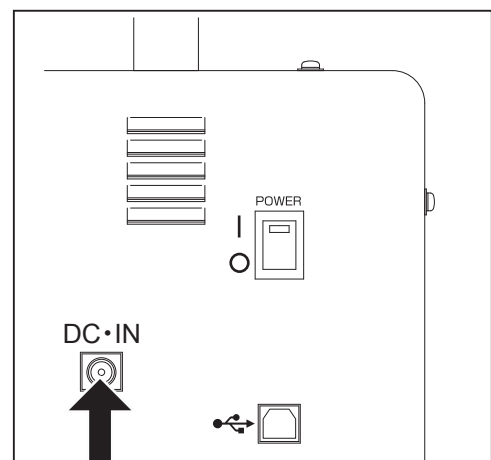


Use this instrument near AC outlet for easy plugging or unplugging in using AC adapter.

Connection procedure

1. Be sure that power switch is OFF ([O] mark pressed).

2. Connect AC adapter plug to AC adapter input terminal of body.



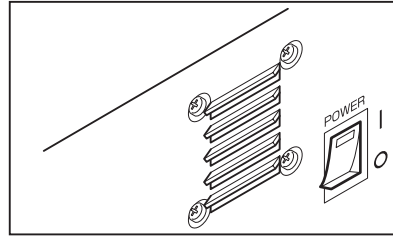
3. Plug AC adapter to outlet (AC 100-240 V ~, 50/60 Hz).

● Insert AC adapter plug all the way seated in AC outlet.

ON (|) / OFF (○) of Power Switch

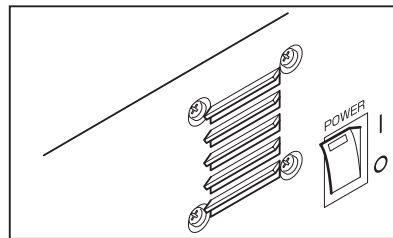
To ON

1. Press [|] side of power switch to ON.



To OFF

2. Press [○] side of power switch to OFF after completion of measurement.



Connecting with PC

Before connecting CA-2500 body with PC, install software CA-S25w in PC. (For detail, see the Installation Guide for data management software CA-S25w.)

Use accessory USB cable (3 m) IF-A18 for this purpose.

No problem would occur if USB cable is plugged or unplugged while power is on, but instruction here indicates the case when power is off.

Operation procedure

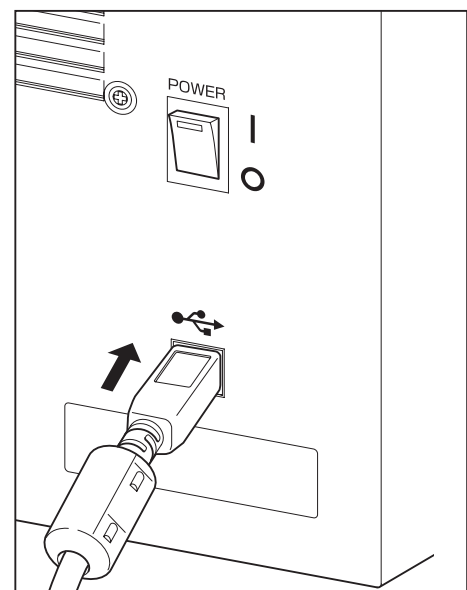
1. Switch power off [○].
2. Connect USB cable to USB connector on body.
3. Insert all the way to the end. Check whether the connection is secure.

Communication interface of this instrument complies with USB2.0.

Always hold plug portion of USB cable in unplugging. Never hold cord portion to unplug.

Match the USB cable plug shape with the slot of either body or PC before inserting.

Any USB port is usable on PC if it has multiple, but abnormal operation could be detected on PC in case that it is used together with other USB device than CA-2500.



Measurement

Starting Up and Ending System

Starting up

Switch power on as instructed. If not, erroneous operation could occur.

1. Switch power on for body. (Press [|] side.)

- Motor sounds indicating controller inside machine starts initialization.
- Fan inside body starts to run.
- 15-minute warm-up at least (to leave in this state after switching on.) is recommended for accurate measurement.

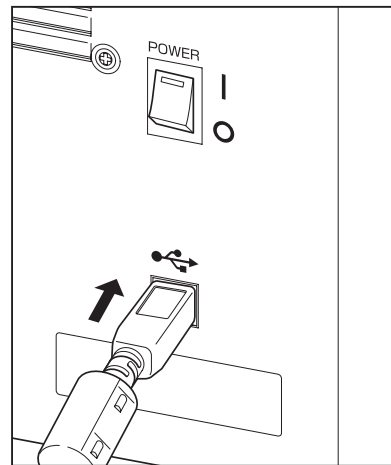
2. Start up Windows by turning on controlling PC.

3. Connect PC and CA-2500 with USB cable.

- PC recognizes that CA-2500 has been connected.

4. Select "CA-S25w" from Start → [Program].

- CA-S25w starts to run.



Connection recognition error

Sometimes, PC fails to recognize its connection with CA-2500 if CA-2500 was switched on after connected with USB cable to PC which had already started up. Such condition could not allow control of CA-2500 from software. Start up this instrument according to the procedure as above again.

- In case that PC has already started, unplug USB cable once and then connect after switching CA-2500 on.
- Switch CA-2500 on before PC if USB cable cannot be unplugged for some reason concerning setting. Should connection error occur, unplug USB cable once and connect again. Then, both can start up normally.

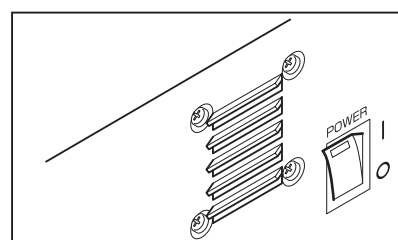
Ending

1. Select "End CA-S25w" from "File" of menu bar.

- CA-S25w ends.
- You can finish through standard application operation of OS.

2. Finish Windows and switch off PC.

3. Switch off body. (Press [○] side.)



Setting the measurement distance and the pint ring range index

Setting measurement distance

Five types of objective lenses are available for CA-2500 depending on the size of measuring objects. The relation between the size of measuring objects and the measurement distance for each lens is as follows:

CA-2500A, CA-2500S, CA-2500SW, CA-2500ST

Standard lens	
Size of measurement object (One-side length of square)	Measurement distance
98 mm approx.	250 mm
210 mm approx.	500 mm
440 mm approx.	1000 mm
890 mm approx.	2000 mm

CA-2500A, CA-2500W, CA-2500SW, CA-2500WT

Wide lens	
Size of measurement object (One-side length of square)	Measurement distance
145 mm approx.	200 mm
410 mm approx.	500 mm
850 mm approx.	1000 mm
1770 mm approx.	2000 mm

CA-2500A, CA-2500T, CA-2500ST, CA-2500WT

Telephoto lens		With low-magnification macro ring (Macro 1)	
Size of measurement object (One-side length of square)	Measurement distance	Size of measurement object (One-side length of square)	Measurement distance
115 mm approx.	900 mm approx.	57 mm approx.	500 mm
275 mm approx.	2000 mm approx.	With high-magnification macro ring (Macro 2)	
420 mm approx.	3000 mm approx.		
		Size of measurement object (One-side length of square)	Measurement distance
		27 mm approx.	300 mm

Optical lens features in varying light intensity and illuminance distribution of imaging surface if focus ring is rotated. Therefore, lens calibration has been done lens by lens according to the distance from lens to measurement object (distance indicator of focus ring). Each has its own calibration coefficient.

Correct calibration coefficient can be applied by selecting what kind of lens is used for which focusing distance, in software CA-S25w.

CA-2500A, CA-2500S, CA-2500SW, CA-2500ST

Standard lens		
Distance	With distance label	On indicator
0.25 m	○	Decimal point indicator position (See Figure 1-1.)
		Intermediate indicator between previous and next reference positions (Center) (See Figure 1-2.)
0.3 m	○	Decimal point indicator position
		Intermediate indicator between previous and next reference positions (Center)
0.5 m	○	Decimal point indicator position
		Intermediate indicator between previous and next reference positions (Center) (See Figure 1-3.)
1 m	○	Center of "1"
		Intermediate indicator between previous and next reference positions (Center)
∞	○	End of focus-ring travel ([∞] side)

CA-2500A, CA-2500S, CA-2500SW, CA-2500ST

Wide lens		
Distance	With distance label	On indicator
0.2 m	○	Indicator position (See Figure 3-1.)
0.24 m	○	Indicator position
0.3 m	○	Indicator position (See Figure 3-2.)
0.5 m	○	Indicator position
1 m	○	Indicator position
∞	○	Indicator position

CA-2500A, CA-2500S, CA-2500SW, CA-2500ST

Wide lens		
Distance	With distance label	On indicator
0.9 m	○	Decimal point indicator position (See Figure 2-1.)
		Intermediate indicator between previous and next reference positions (Center)
1 m	○	Center of "1"
		Intermediate indicator between previous and next reference positions in 1:2 (short-distance side) (See Figure 2-2.)
		Intermediate indicator between previous and next reference positions in 2:1 (long-distance side) (See Figure 2-3.)
1.5 m	○	Decimal point indicator position
		Intermediate indicator between previous and next reference positions in 1:2 (short-distance side)
		Intermediate indicator between previous and next reference positions in 2:1 (long-distance side)
3 m	○	Center of "3"
		Intermediate indicator between previous and next reference positions in 1:2 (short-distance side)
		Intermediate indicator between previous and next reference positions in 2:1 (long-distance side)
∞	○	End of focus-ring travel ([∞] side)
With low-magnification macro ring (Macro 1)		
Distance	With distance label	Precise position on focus ring
∞	○	End of focus-ring travel ([∞] side)
With high-magnification macro ring (Macro 2)		
Distance	With distance label	Precise position on focus ring
∞	○	End of focus-ring travel ([∞] side)

Caution

The CA-2500 has 28 calibration points as shown in the table above, at which the measuring accuracy is ensured. When using the instrument at a point other than the calibration points, use the calibration coefficient of the closest calibration point. Doing so may result in a decrease in measuring accuracy.

Example of reference position to read distance

How to read distance in case of standard lens or telephoto lens

The ring (focus ring) on which number values are written rotates in case of standard lens or telephoto lens. If the "distance indicator" includes decimal point, "." is determined as reference position; and if it does not include decimal point, the center of the number or $[\infty]$ is determined as reference position.

Standard lens

Figure 1-1
Example when setting to "0.25"

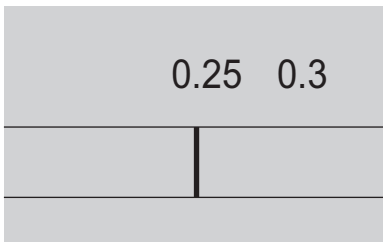
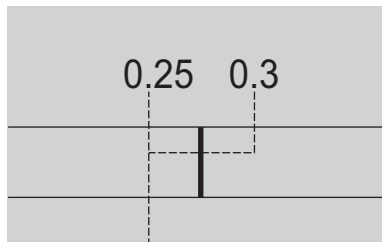


Figure 1-2
Example when setting to "diverting point between 0.25 and 0.3 in 1:1"



Set in reference of the 1/2 position between decimal points of 0.25 and 0.3.

Figure 1-3
Example when setting to "diverting point between 0.5 and 1 in 1:1"



Set in reference of the 1/2 position between decimal point of 0.5 and the center of 1.

Telephoto lens

Figure 2-1
Example when setting to "0.9"

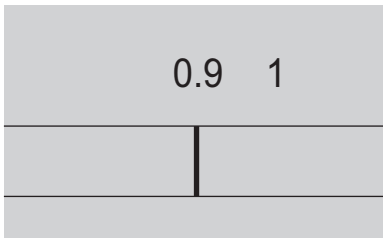
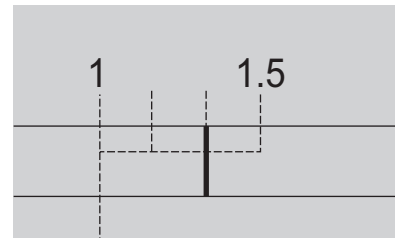


Figure 2-2
Example when setting to "diverting point between 1 and 1.5 in 1:2"



Set in reference of the 1/3 position between the center of 1 and decimal point of 1.5.

Figure 2-3
Example when setting to "diverting point between 1 and 1.5 in 2:1"



Set in reference of the 2/3 position between the center of 1 and decimal point of 1.5.

How to read distance in case of wide lens

The ring (focus ring) on which indicator position (the white circle in the figures below) is written rotates in case of wide lens. Set the indicator position to the line of number value.

Wide lens

Figure 3-1
Example when setting to "0.2"

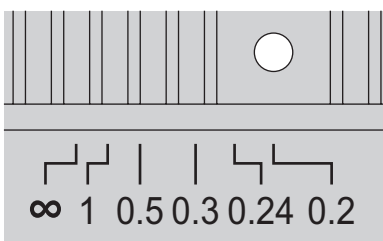
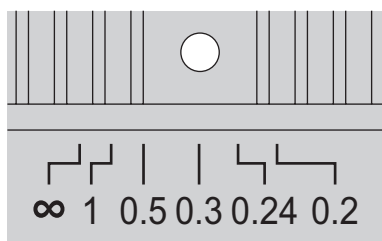


Figure 3-2
Example when setting to "0.3"



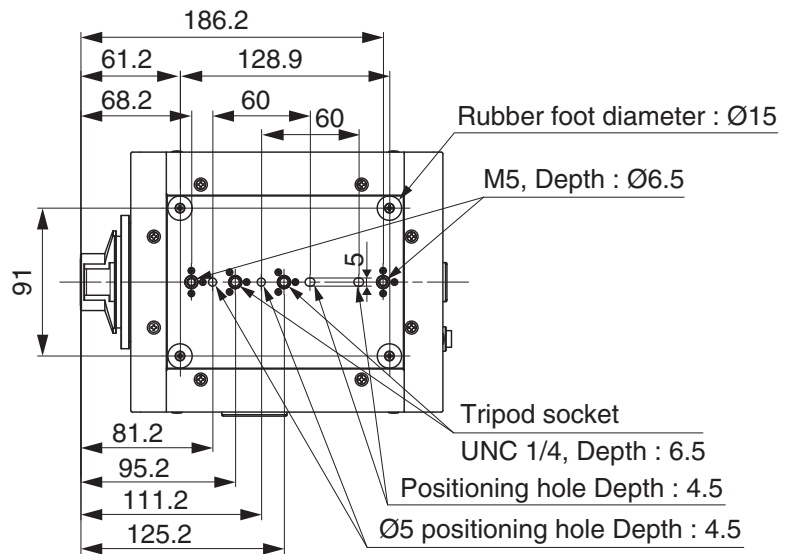
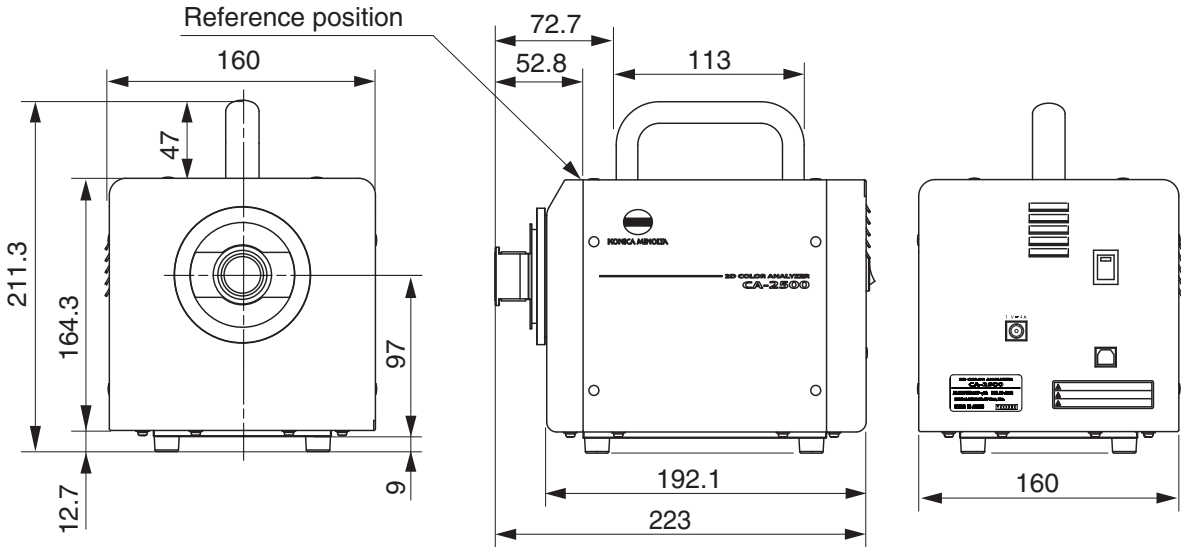


Others

Outer Dimensions

(Unit: mm)

*When standard lens and lens hood are placed



Error Check

Should error be found in this instrument, try corrective actions shown in the following table. If this does not help, this instrument has possibly been broken. Please contact the nearest Konica Minolta-authorized service facility with indicated error number.

Error No.	Symptom	Item to Check	Corrective Action
1	Power does not turn on. Does not normally start up.	Has AC adapter been plugged in outlet?	Connect AC adapter.
		Has AC adapter been connected with body?	Connect AC adapter.
		Have you connected correct AC adapter?	Use our specified standard accessory AC adapter and power cord or optionally offered AC adapter AC-A312. * When you disconnect a wrong adapter and reconnect an AC-A312 adapter, wait at least 5 minutes before turning the power switch on after turning it off.
		Is the AC power within rating?	Be sure the AC power is within $\pm 10\%$ of the nominal voltage.
2	Time for machine initialization after switched on varies.	It could vary depending on the machine position when switched on. It should not be regarded as failure if it takes only a few seconds.	If long time is needed, switch power off and contact the nearest Konica Minolta-authorized service facility.
3	PC cannot communicate with CA-2500.	Check whether PC correctly recognizes CA-2500.	PC could not properly recognize this instrument depending on PC type or how CA-2500 was started up. Restart PC, software, and CA-2500 according to each instruction.
		Check whether device driver normally operates with device driver manager.	If not, uninstall software once for reinstallation. See the instruction manual for CA-S25w.
		Has USB cable been connected securely?	Connect this instrument and PC securely.
		Check the standard for USB.	Cannot use with those supporting except for USB2.0. Use PC with which USB2.0 is usable.

Main Specification

Model		CA-2500S	CA-2500W	CA-2500T		
Light receptor		CCD image sensor (monochrome); 2/3-inch; Effective number of pixels: 1,000 x 1,000 pixels; Equipped with XYZ filter (closely matches CIE 1931 color-matching function) and ND filter				
Lens		Interchangeable Standard, wide, and telephoto lenses; low-magnification and high-magnification macro rings (for use with telephoto lens)				
Measurement points (Resolution)		980 x 980 (490 x 490 or 196 x 196 selectable by using Data Management Software CA-S25w)				
Color indication modes		XYZ, L _v x _y , L _v u'v', T _{Δuv} , Dominant wavelength, Excitation purity, L _v contrast				
Display modes		Pseudocolor, Chromaticity diagram, Spot, Cross section, Color difference				
Measurement sizes (length per side of square) (*1)		Standard lens	Wide lens	Telephoto lens	With low-magnification macro ring	With high-magnification macro ring
		Approx. 98 mm or more (depending on the distance)	Approx. 145 mm or more (depending on the distance)	Approx. 115 mm or more (depending on the distance)	Approx. 57mm (Fixed)	Approx. 27mm (Fixed)
Measurable size for typical measurement distances (size/distance)		98 mm / 250 mm Approx.	145 mm / 200 mm Approx.	115 mm / 900 mm Approx.	57 mm / 500 mm Approx. (Fixed)	27 mm / 300 mm Approx. (Fixed)
		210 mm / 500 mm Approx.	410 mm / 500 mm Approx.	275 mm / 2,000 mm Approx.		
		440 mm / 1,000 mm Approx.	850 mm / 1,000 mm Approx.	420 mm / 3,000 mm Approx.		
		890 mm / 2,000 mm Approx.	1,770 mm / 2,000 mm Approx.			
Measurement luminance range (including ND filter use)		0.05 - 100,000 cd/m ²	0.05 - 100,000 cd/m ²	0.25 - 100,000 cd/m ²	0.25 - 100,000 cd/m ²	0.5 - 100,000 cd/m ²
Measurement time (*2)		Single : Approx. 5 sec. or more; 4-time integration: Approx. 6 sec. or more; 16-time integration: Approx. 10 sec. or more; 64-time integration : Approx. 25 sec. or more; 256-time integration : Approx. 80 sec. or more				
Accuracy (*3)	Luminance	±3 %	±3 %	±3 %	±3 %	±3 %
	Chromaticity	±0.005	±0.005	±0.005	±0.005	±0.005
	Temperature/humidity drift (within the operating temperature/humidity range) Luminance: ±2% of change compared to reference temperature and relative humidity of 23°C and 40% Chromaticity: ±0.004 of change compared to reference temperature and relative humidity of 23°C and 40%					
Repeatability (*4)	Luminance	0.5 %	0.5 %	0.5 %	0.5 %	0.5 %
	Chromaticity	0.001	0.001	0.001	0.001	0.001
Inter-point error (*5)	Luminance (*6)	±2 %	±2 %	±2 %	±2 %	±2 %
	Chromaticity (*6)	±0.002	±0.002	±0.002	±0.002	±0.002
	Luminance (*7)	±3 %	±3 %	±3 %	±3 %	±3 %
	Chromaticity (*7)	±0.003	±0.003	±0.003	±0.003	±0.003
Other functions		Measurement sync (Synchronization frequency selectable), User calibration Integration function				
Interface		USB 2.0 or higher				
Operating temperature and humidity range (*8)		10-30°C, Relative humidity 70% or less/No condensation				
Storage temperature and humidity range (*8)		0-30°C, Relative humidity 70% or less/No condensation, 30-35°C, Relative humidity 55% or less/No condensation				
Size	Body only	160 (W) × 164 (H) × 192 (D) mm (Height including handle: 211 mm)				
	When lens and lens hood are attached	224 (D) mm	219 (D) mm	224 (D) mm	230 (D) mm	237 (D) mm
Weight		3.5 kg approx. (when standard lens and lens hood are attached)				
Power source		AC adapter 100-240 V ~ , 0.75 A, 50/60 Hz				
Standard accessories	Lens Hood	CA-A68	CA-A69	CA-A68	CA-A70	
	Hood Cap	CA-A71	CA-A75	CA-A71		
	Calibration data DVD	Included with each lens.				
	Other	Mount Cover, AC Adapter AC-A312, AC cable, USB Cable IF-A18, Data Management Software CA-S25w, SDK CA2D-SDK				
Optional accessories		Soft Case CA-A60, Tripod CS-A3, Pan Head CS-A4, Calibration certificate, Mura Evaluation Software CA-Mura				

*1: Error in angle of view: 7%

*2: Measurement time differs depending on brightness of measurement object, PC performance, and data processing contents.
The specifications above were obtained under Konica Minolta's measurement conditions shown below:

PC CPU : Intel® Core™ i7-3770 3.40 GHz
Memory : 8 GB
Data processing : Pseudocolor display of luminance data
Resolution : 980 x 980
Shutter speed : Y measurement : 1/64 sec., XZ measurement : 1/32 sec.

Measurement subject brightness:

Standard/wide lens: Approx. 80 cd/m², Telephoto lens: Approx. 300 cd/m²

Low-magnification macro ring and telephoto lens: Approx. 400 cd/m²,

High-magnification macro ring and telephoto lens: Approx. 600 cd/m²

* The measurement time becomes longer when the object is dark. The longest measurement time is approx. 14 seconds with 1-time integration, approx. 45 seconds with 4-time integration, approx. 3 minutes with 16-time integration, approx. 11 minutes with 64-time integration and approx. 44 minutes with 256-time integration

*3: The specifications above were obtained under Konica Minolta's measurement conditions shown below:

Measurement subject brightness:

Standard/wide lens: Approx. 35 cd/m², Telephoto lens: Approx. 140 cd/m²

Low-magnification macro ring and telephoto lens: Approx. 250 cd/m²,

High-magnification macro ring and telephoto lens: Approx. 250 cd/m²

Distance : Minimum distance of each lens
Evaluation : Based on the average obtained within 10% range at the center of the screen
Temperature : 23°C±2°C
Relative humidity : 40%±10%
Measuring light : White, reference light source
Integration : 64 times (Normal mode)

*4: The specifications above were obtained under Konica Minolta's measurement conditions shown below:

Resolution : 196 x 196
Shutter speed : Y measurement: 1/64 sec., XZ measurement: 1/32 sec.
Gain : Normal (x1),
Light intensity level: Midpoint of appropriate light intensity range
Evaluation : Based on the maximum repeatability (2 σ) of all pixels
Temperature : 23°C±2°C
Relative humidity : 40%±10%
Measurement subject: White, reference light source
Integration : 64 times (Normal mode)

*5: The specifications above were obtained under Konica Minolta's measurement conditions shown below:

Measurement subject brightness:

Standard/wide lens: Approx. 40 cd/m², Telephoto lens: Approx. 160 cd/m²

Low-magnification macro ring and telephoto lens: Approx. 200 cd/m²,

High-magnification macro ring and telephoto lens: Approx. 350 cd/m²

Distance : Calibration distance of each lens
Resolution : 196 x 196
Evaluation (*6) : Based on the maximum/minimum values obtained in a square at the center of the screen measuring 60% of the height and width of the entire screen
(*7) : Based on the maximum/minimum values obtained in the entire screen
Temperature : 23°C±2°C
Relative humidity : 40%±10%
Measurement subject : White, reference light source
Integration : 64 times (Normal mode)

*8: Even if the instrument is stored within the specified usage (or storage) temperature humidity range, the displayed value may change depending on long-period usage or storage conditions.

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