

# **Display Color Analyzer**

# **CA-410**

## **Probe + Software**

### **Instruction Manual**



Please read before  
using the instrument.



**KONICA MINOLTA**



**Display Color Analyzer**  
**CA-410**

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**Probe**

## ■ Safety Symbols

The following symbols are used in this manual to prevent accidents that may occur because of incorrect use of the instrument.



**Denotes an instruction regarding a safety warning or note.**  
**Read the instruction carefully to ensure safe and correct use.**



**Denotes an instruction regarding the risk of electric shock.**  
**Read the instruction carefully to ensure safe and correct use.**



**Denotes an instruction regarding the risk of fire.**  
**Read the instruction carefully to ensure safe and correct use.**



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



**Denotes an instruction.**  
**This instruction must be strictly adhered to.**



**Denotes a prohibited operation.**  
**Never disassemble the instrument.**



**This symbol indicates direct current (DC).**



**This symbol indicates class II protection against electric shock.**

### Notes on this Manual

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- The contents of this manual are subject to change without prior notice.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your retailer or a KONICA MINOLTA-authorized service facility.
- KONICA MINOLTA will not accept any responsibility for consequences arising from the use of the instrument.
- The latest instruction manual can be downloaded from the following URL:  
[http://www.konicaminolta.com/instruments/download/instruction\\_manual/index.html](http://www.konicaminolta.com/instruments/download/instruction_manual/index.html)

### Formal designations of application software used in this manual

(Designation in this manual) (Formal designation)

Bluetooth

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# Safety Precautions

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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 the instrument in places where flammable or combustible gases (gasoline, etc.) are present. Doing so may cause a fire.



Firmly push the cable plug completely into the outlet. Incomplete insertion may cause fire or electric shock.



Always hold the plug itself when disconnecting the cable from an outlet. Pulling on the cable may damage it and cause a fire or electric shock. Also, do not insert or disconnect the plug with wet hands. Doing so may cause electric shock.



Do not forcibly bend, twist, or pull the cords or cables. Also, do not scratch, or place heavy objects on the cables. Doing so may damage the cable and cause a fire or electric shock.



Do not disassemble or modify the instrument. Doing so may cause a fire or electric shock.



Take special care not to allow liquid or metal objects to enter the instrument. Doing so may cause a fire or electric shock. Should liquid or metal objects enter the instrument, turn the power OFF immediately, and contact the nearest KONICA MINOLTA-authorized service facility.



The instrument should not be operated if it is damaged, or if smoke or odd smells occur. Doing so may cause a fire. In such situations, turn the power OFF immediately, and contact the nearest KONICA MINOLTA-authorized service facility.



Do not insert or disconnect the plug with wet hands. Doing so may cause electric shock.



## CAUTION

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



When cleaning the instrument, disconnect the cable. Failure to do so may result in electric shock.



Do not place the instrument on an unstable or sloping surface. Doing so may result in the instrument dropping or overturning, causing injury. Be careful not to drop the instrument when carrying it as well.

# Introduction

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The CA-410 series is an instrument designed to measure the color, luminance, and flicker of various color displays. Please read this manual carefully before using the instrument.

## Packing materials of the product

Be sure to keep all packing materials used for shipping the instrument (cardboard box, cushioning material, plastic bags, etc.). This instrument is a precision measuring instrument. When transporting the instrument to a service facility for maintenance or for other reasons, be sure to use the packing materials to minimize shock or vibration. If the packing materials are lost or damaged, contact a KONICA MINOLTA-authorized service facility.

## Notes on Use

- This instrument has been designed exclusively for indoor use. Outdoor use is prohibited.
- This instrument is composed of precision electronic components. Never disassemble the instrument.
- This instrument is a pollution level 2 product (equipment to be used primarily in manufacturing environments, laboratories, warehouses, and similar locations). This instrument should be used in environments where exposure to metallic dust or condensation is not a concern.
- This instrument is an overvoltage category I product (equipment for connection to circuits in which measures are taken to limit transient overvoltage to an appropriately low level).
- Do not use the instrument at altitudes higher than 2,000 m.
- Take care to prevent foreign matter from entering the instrument. Using the instrument while subjected to intrusion of water or metals is extremely dangerous.
- Using the instrument near heating equipment can cause the internal temperature of the instrument to become much higher than the ambient temperature, resulting in malfunction. Do not use the instrument in such areas. Also, use the instrument in a well-ventilated environment.
- Avoid subjecting the instrument to sudden temperature changes and condensation.
- Using the instrument in direct sunlight or near heating equipment can cause the internal temperature of the instrument to become much higher than the ambient temperature, resulting in malfunction. Do not use the instrument in such areas.
- Avoid using the instrument in extremely dusty environments or in humid areas.
- Do not use the instrument in areas where dust, smoke, or chemical gases are present, or in extremely humid environments.
- This instrument should be used in an environment with an ambient temperature between 10 and 35°C and a relative humidity of 85% or less. Use of the instrument outside this range will result in unsatisfactory performance.
- Do not subject the instrument to strong vibrations or impacts.
- Do not pull, forcibly bend, or apply excessive force to the connected cables and cords. Doing so may cause the cable or cord to break.
- The instrument should be connected to a power source with as little noise as possible.
- Should the instrument break down, do not try to disassemble and repair the instrument. Consult with your nearest KONICA MINOLTA-authorized service facility.
- The instrument may cause interference if used near a television, radio, transceivers, etc.
- When restarting the instrument, wait several seconds after turning the power OFF before turning the power ON again.
- Do not turn the power off during writing to the memory such as calibration and measurement.
- The instrument may not operate properly due to the compatibility with the equipment connected to it such as a PC. Please check whether the instrument operates properly by yourself.
- Make sure that the power is turned OFF when the instrument is not in use.
- Periodic backup of important data and settings to another storage medium is recommended.
- Before measurement, make sure that the lens surface is not dirty. You may not be able to perform correct measurement if there is dirt, dust, or finger mark on it, or if stain remains after cleaning.
- Do not touch the lens surface with hands.
- Avoid subjecting the instrument to sudden temperature changes under a high-humidity environment. It may fog the lens and hinder correct measurement.

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## Storing the Instrument

- This instrument should be stored at a temperature between 0 and 45°C with a relative humidity of 85% or less and no condensation. Storing the instrument in an environment with high temperatures and high humidity will result in unsatisfactory performance. Storing the instrument at or near room temperature and humidity is recommended.
- Make sure that the instrument is not subjected to condensation when stored. In addition, take care to prevent rapid temperature changes to prevent condensation from occurring when transporting the instrument to the storage location.
- Storing the instrument in direct sunlight or near heating equipment can cause the internal temperature of the instrument to become much higher than the ambient temperature, resulting in malfunction. Do not store the instrument in such areas.
- Do not store the instrument in areas where dust, smoke, or chemical gases are present. Doing so may cause deterioration in performance or a malfunction.
- Do not leave the instrument inside the cab or trunk of a vehicle. Otherwise, the temperature and/or humidity during midsummer or midwinter may exceed the allowable range for storage, resulting in a malfunction.
- Before storing, make sure that the lens is attached with the cap supplied as a standard accessory.

## Notes on Cleaning

- If the instrument becomes dirty, wipe it with a soft, dry cloth. Never use organic solvents (such as benzene or thinner) or other chemicals for cleaning.
- If there is dust or dirt on the optical system of a probe, use a blower to blow it off and then gently wipe it with a soft, dry cloth or with a lens-cleaning cloth. Never use organic solvents (such as benzene or thinner) or other chemicals for cleaning.
- If you are unable to remove dirt from the instrument or if the instrument becomes scratched, contact a KONICA MINOLTA-authorized service facility.

## Notes on Transporting

- When transporting the instrument, be sure to use the packing materials to minimize shock or vibration.
- When sending the instrument in for service, package and send the instrument and all accessories.

## Maintenance and Inspection

- To maintain measurement accuracy, the instrument should be inspected once a year. For information on inspection, contact the nearest KONICA MINOLTA-authorized service facility.

## Disposal Method

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

## About This Manual

This manual is designed for those who possess basic knowledge of displays and relevant equipment.

Please read this manual carefully before using the instrument.

In the descriptions about probes in this manual, probes are described as "probe" where the type of probe is not specified.

## For Those Who Want to Purchase Optional Accessories for This Instrument

This manual also explains how to use optional accessories available for this instrument.

If an explanation of how to use an optional accessory is given in this manual, its product name is also given.

Please read the explanation together with the manual supplied with the accessory.





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# Configuration of the CA-410 Series

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The CA-410 series consists of the following three systems:

## ● Probes

Sensor units for measuring displays.

Can be connected to a PC to perform measurement (using PC software).

Can be connected to a data processor to perform measurement.

## ● Data Processor CA-DP40

Can connect up to ten probes simultaneously to perform measurement.

Can be connected to a PC so that it can be controlled from the PC (using PC software).

## ● PC software CA-S40

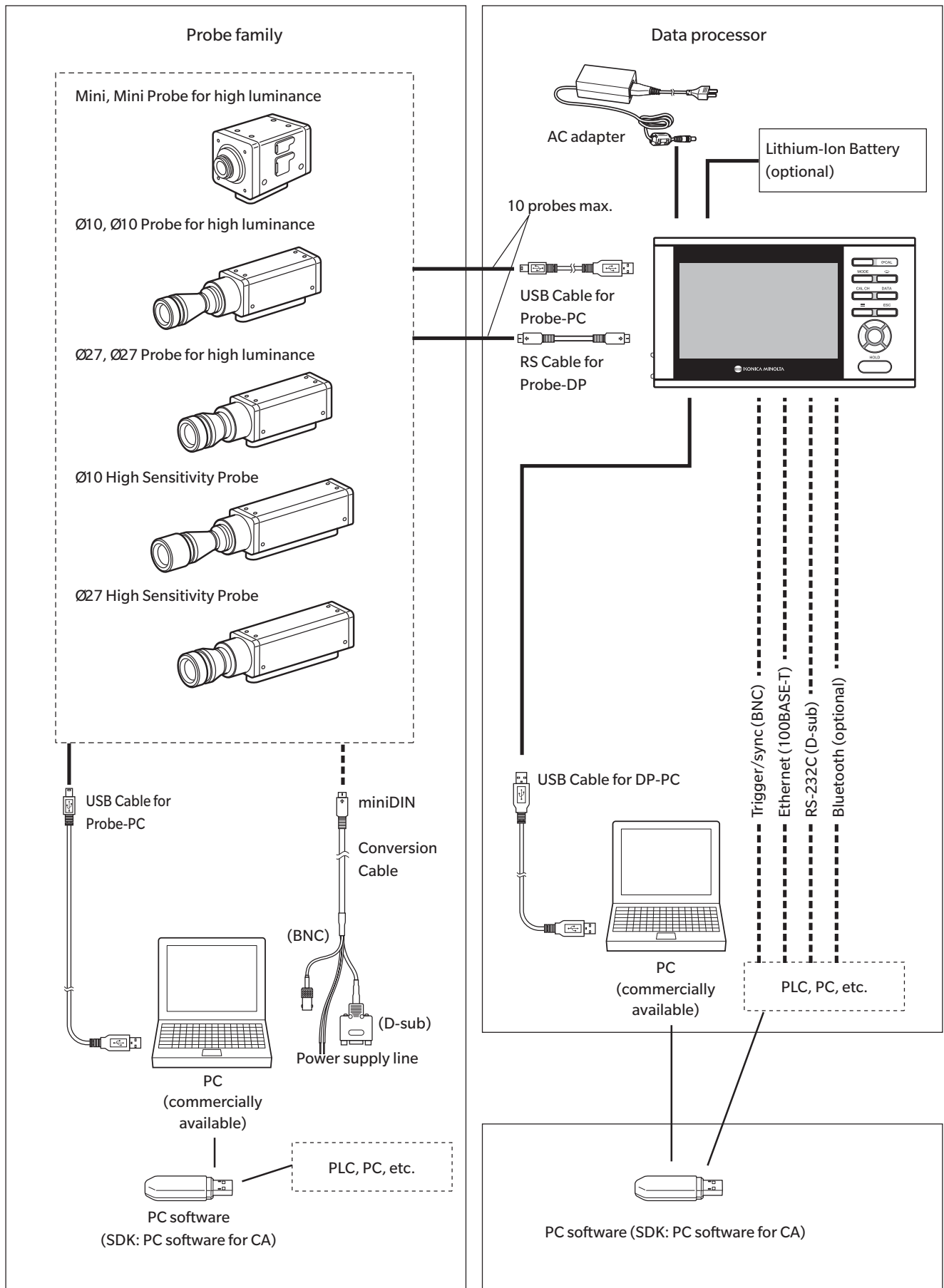
Can control a probe connected to a PC to perform measurement.

Can control a data processor connected to a PC to perform measurement.

The instruction manual for probes and PC software contains the following descriptions about probes and the standard PC software, PC Software for Color Analyzer CA-S40:

- Handling procedure and specifications of probes
- How to install the PC software
- How to measure when probe and PC are connected

# System Configuration Diagram



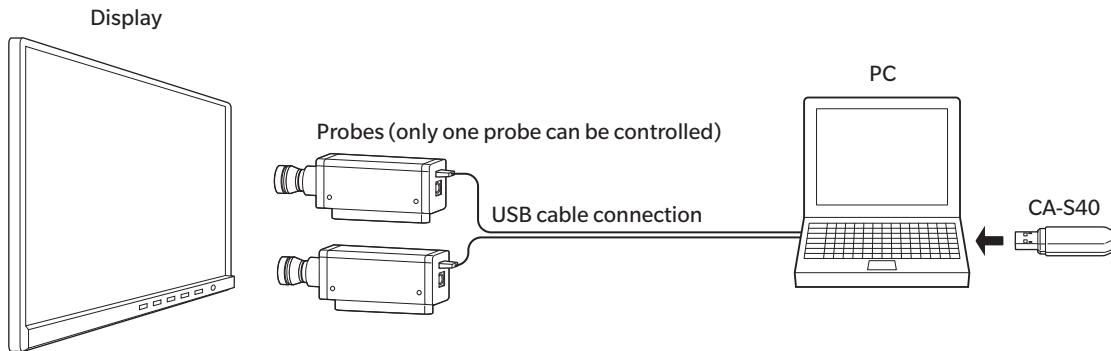
# Probes

## About Probes

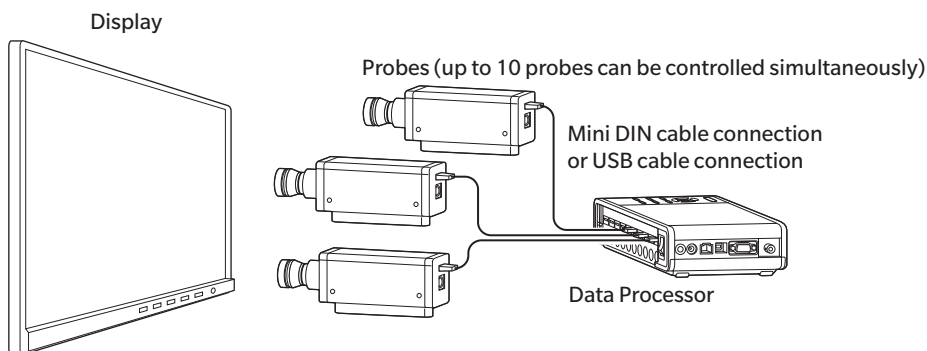
A CA-410 series probe can be used to measure the luminance, chromaticity, and flicker values of displays.

A probe can be controlled in the following three ways:

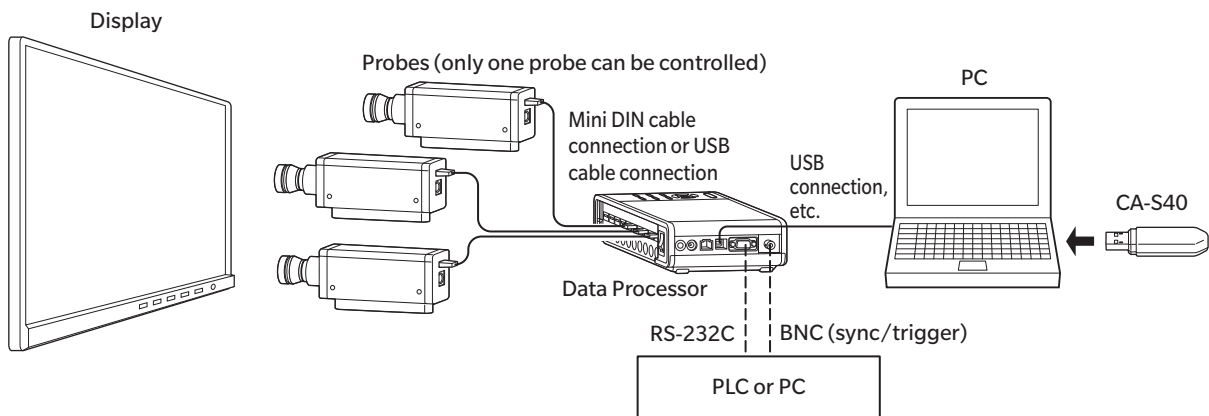
- You can connect a probe to a PC and control it from PC software to perform measurement. By using the standard software, PC Software for Color Analyzer CA-S40, you can select one of the probes connected to a PC via USB and control it to perform measurement.



- You can connect a probe to a data processor and control it from the data processor to perform measurement. Multiple probes can be controlled simultaneously to perform measurement.



- You can connect a probe to a data processor, connect the data processor to a PC, and control it from PC software to perform measurement. By using the standard software, PC Software for Color Analyzer CA-S40, you can select one of the probes connected to the data processor and control it to perform measurement.



## Probe Lineup (All Probes are Provided with Lens Caps)

Eight types of probes are available according to your application:

Model	Name	Description	Dimensions
CA-P427	Ø27 Probe	Measuring probe with a measurement area of 27 mm	P.12
CA-P427H	Ø27 Probe for high luminance	High-luminance measuring probe with a measurement area of 27 mm	P.12
CA-P410	Ø10 Probe	Measuring probe with a measurement area of 10 mm	P.13
CA-P410H	Ø10 Probe for high luminance	High-luminance measuring probe with a measurement area of 10 mm	P.13
CA-MP410	Ø10 mini Probe	Compact measuring probe with a measurement area of 10 mm	P.16
CA-MP410H	Ø10 mini Probe for high luminance	Compact high-luminance measuring probe with a measurement area of 10 mm	P.16
CA-VP427	Ø27 High Sensitivity Probe	High-sensitivity measuring probe with a measurement area of 27 mm	P.14
CA-VP410	Ø10 High Sensitivity Probe	High-sensitivity measuring probe with a measurement area of 10 mm	P.15

Note:

- High-sensitivity probes CA-VP427 and CA-VP410 cannot measure er.
- Use of a high-luminance probe is recommended for measuring a display that instantaneously shows high luminance, such as CRTs.

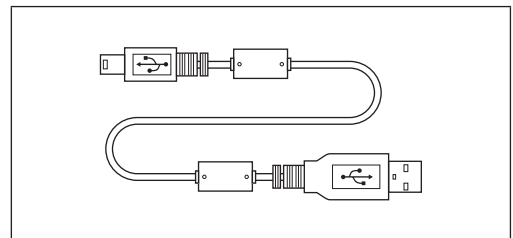
## Standard Accessories

### ● Light-shielding cylinders and lens caps

Use	Light-shielding cylinder		Lens cap	
	Model	Name	Model	Name
For a Ø27 probe	CA-H12	Hood for Ø27 Probe	CA-H13	Lens Cap for Ø27 Probe
For a Ø10 probe	CA-H14	Hood for Ø10 Probe	CA-H15	Lens Cap for Ø10 Probe
For a Ø10 mini probe	CA-H16	Hood for Ø10 Mini Probe	CA-H17	Lens Cap for Ø10 Mini Probe
For a Ø27 high-sensitivity probe	CA-H18	Hood for Ø27 High Sensitivity Probe	CA-H19	Lens Cap for Ø27 High Sensitivity Probe
For a Ø10 high-sensitivity probe	CA-H20	Hood for Ø10 High Sensitivity Probe	CA-H21	Lens Cap for Ø10 High Sensitivity Probe

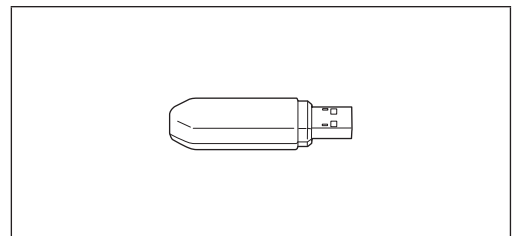
### ● USB Cable for Probe-PC IF-A28

Connects a probe to a data processor or a PC via USB.  
How to connect: Refer to page 17.



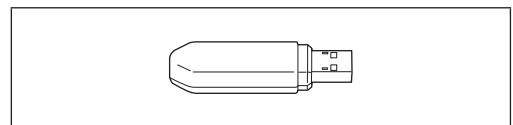
### ● PC Software for Color Analyzer CA-S40

Controls a probe or data processor connected to a PC via USB to perform measurement.  
This is stored on the USB flash drive supplied with the product.  
For how to use it, refer to the instruction manual for the PC software on the USB flash drive.



### ● SDK for Color Analyzer CA-SDK2

A library for users to create programs on their own. This is stored on the USB flash drive supplied with the product.



### ● Instruction Manual (this manual)

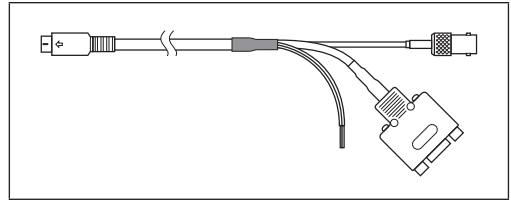
Please read before using the instrument.

## Optional Accessories

### ● Conversion Cable IF-A29

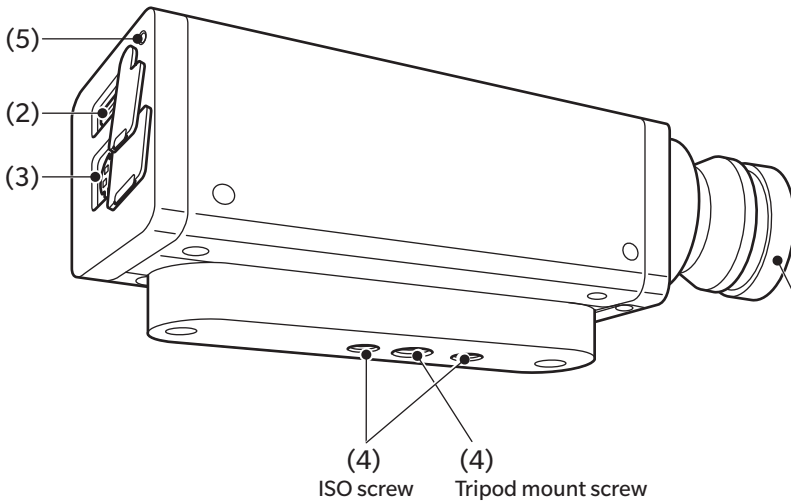
Connects a probe to a PC or a sequencer via RS-232C and inputs synchronization signals to the probe.

How to connect: page 18



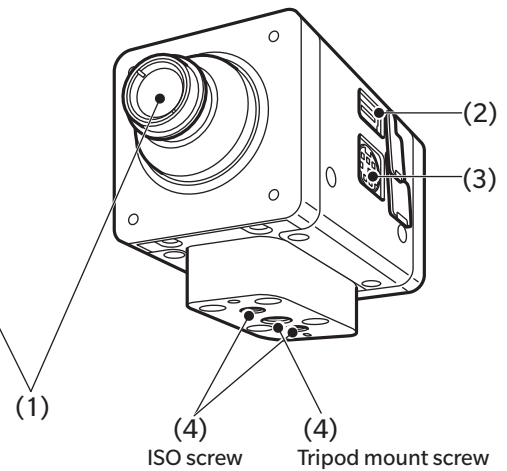
## Description of Each Part of Probes

### ● Probe other than mini



Note: CA-P427, P427H, P410, and P410H have another tripod mount screw on the front side of the ISO screw. For details, refer to the dimensions.

### ● Mini probe



Note: Mini probes have screws for jigs and cable clamps. For details, refer to the dimensions.

#### (1) Receptor

Make this part face perpendicular to a display to perform measurement.

#### (2) USB connector

For USB connection with a data processor or a PC, connect the USB cable IF-A28 supplied as a standard accessory.

#### (3) RS-232C connector

For RS-232C connection to a data processor, connect the mini DIN cable IF-A30/31/32 for the data processor to the RS-232C connector.

For RS-232C connection with a PLC or PC, connect an optional conversion cable IF-A29.

Use a conversion cable IF-A29 to input display's vertical synchronization signals, which are used for measurement in "EXT" measurement synchronization mode.

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#### **(4) Screw holes**

There are two types of screws for securing a probe:

Tripod mount screw: Used for mounting the probe on a tripod. The depth is 6 mm.

ISO screw: Used for securing the probe to jigs. Use an ISO 5 mm screw and the depth is 6 mm.

This is used for securing the probe to jigs or other components.

- The distance from each screw to the end of the optical column is the same as that for a CA-310 series probe.
- The position of the optical axis (in the height direction) is the same as that for a CA-310 series probe. (Excluding mini probes)

#### **(5) Status indicator**

Located on the rear of all probes to indicate the status of the probe.

No power supply: Off

During measurement or zero calibration: Off

Memory error: Blinking (On for 0.2 sec, then Off for 0.2 sec)

Zero calibration not performed: Blinking (On for 1 sec, then Off for 0.2 sec)

Measurement possible: On (even when measurement is not possible due to the setting of an invalid synchronization frequency or integration time in INT, EXT, or MANUAL sync mode, without displaying that state)

# Probe Dimensions

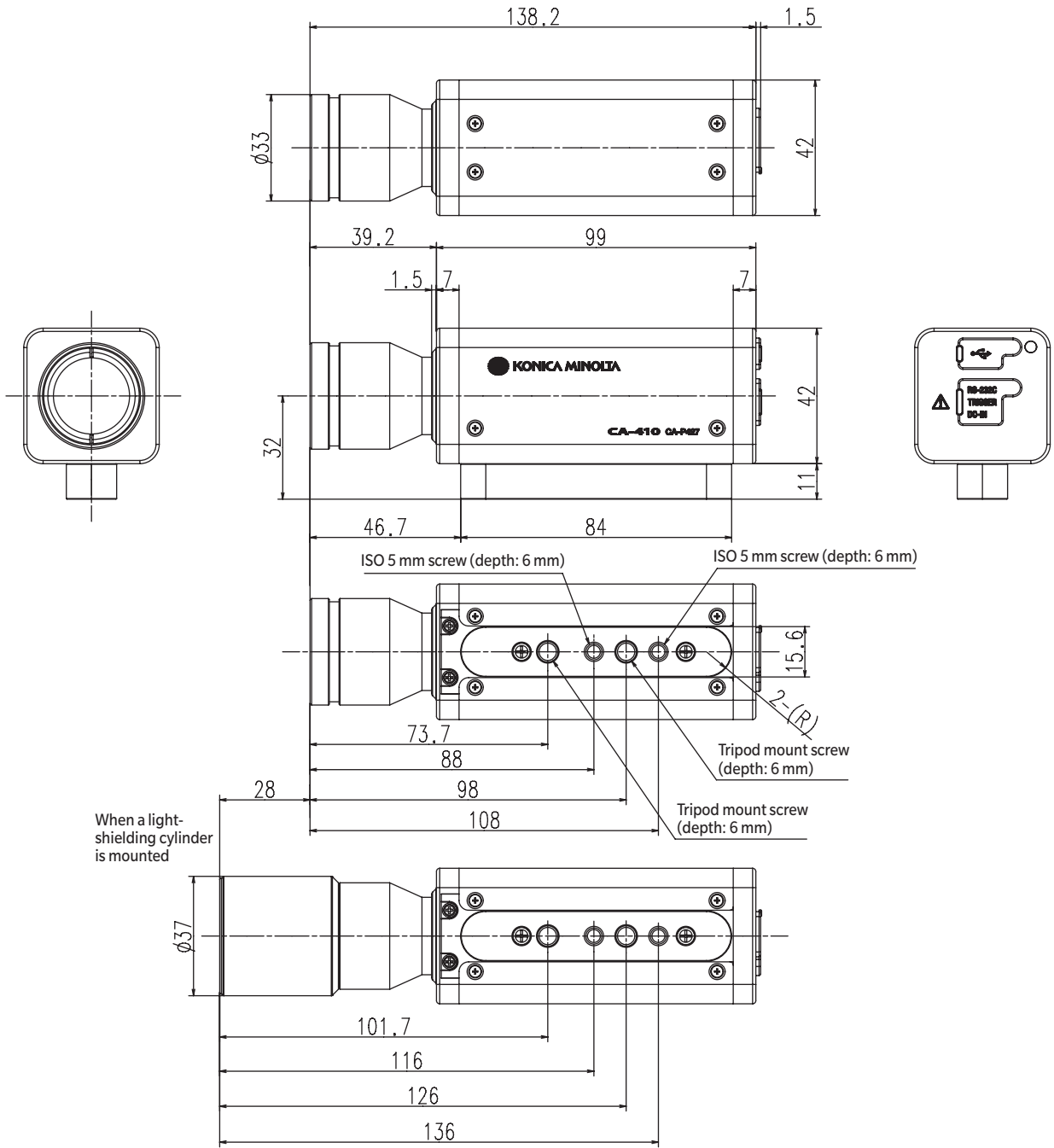
CA-P427 Ø27 Probe

Measuring probe with a measurement area of 27 mm

CA-P427H Ø27 Probe for High Luminance

High-luminance measuring probe with a measurement area of 27 mm

(unit: mm)



Probe



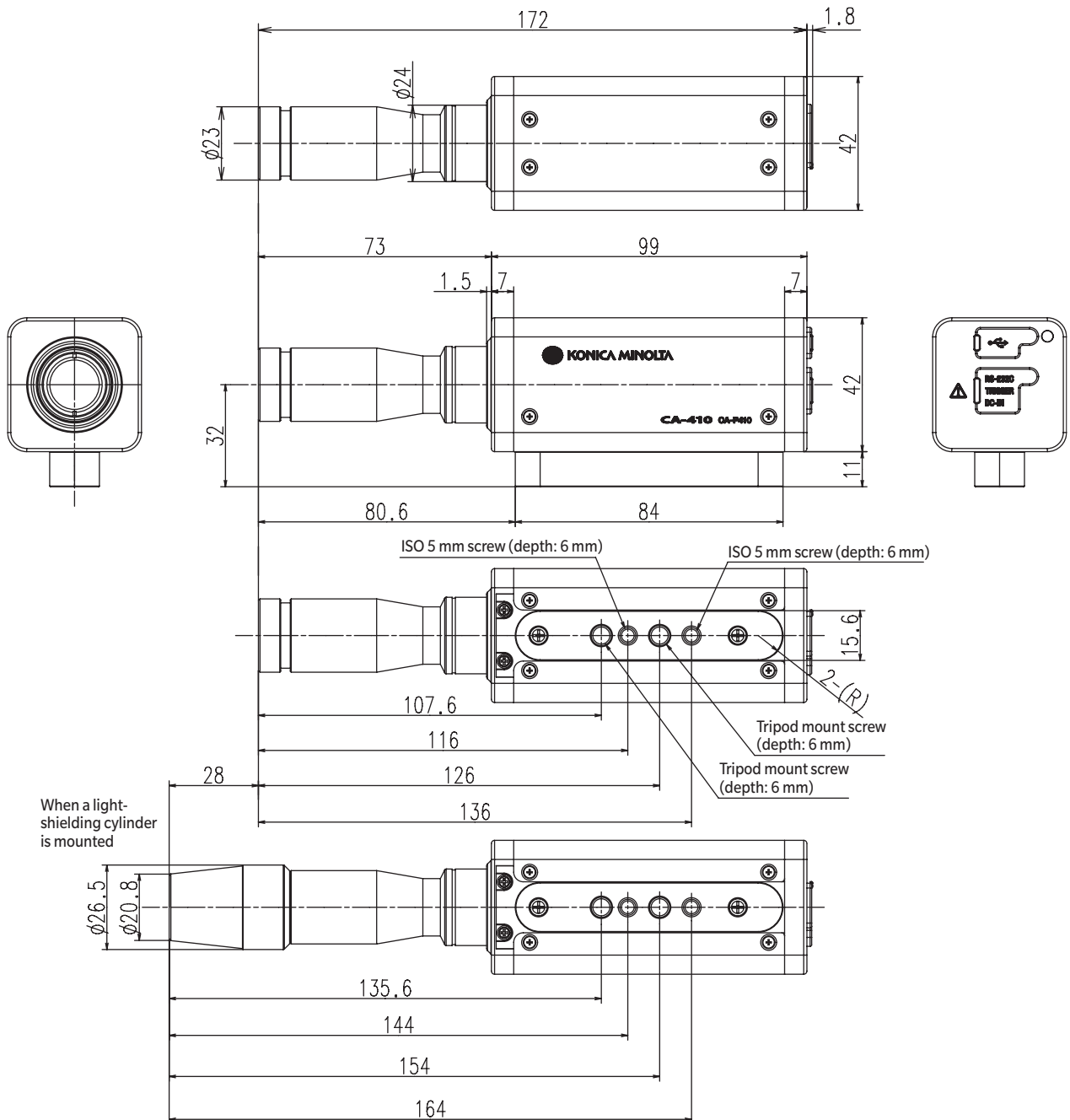
CA-P410 Ø10 Probe

Measuring probe with a measurement area of 10 mm

CA-P410H Ø10 Probe for High Luminance

High-luminance measuring probe with a measurement area of 10 mm

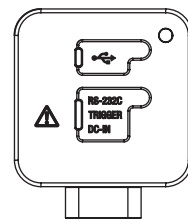
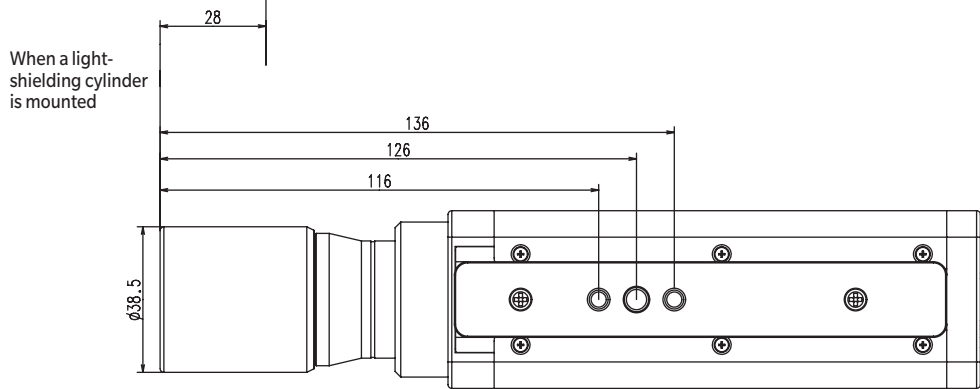
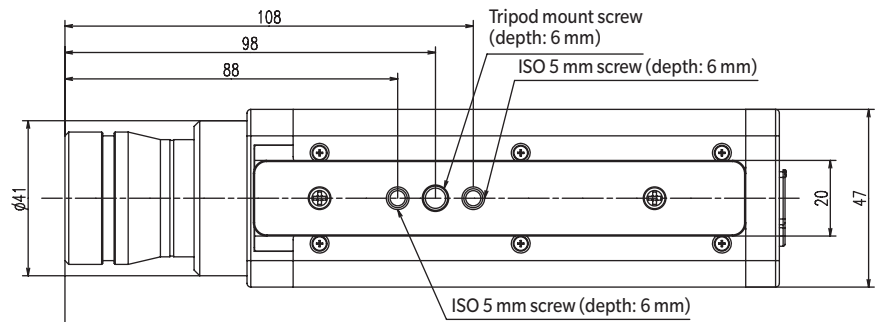
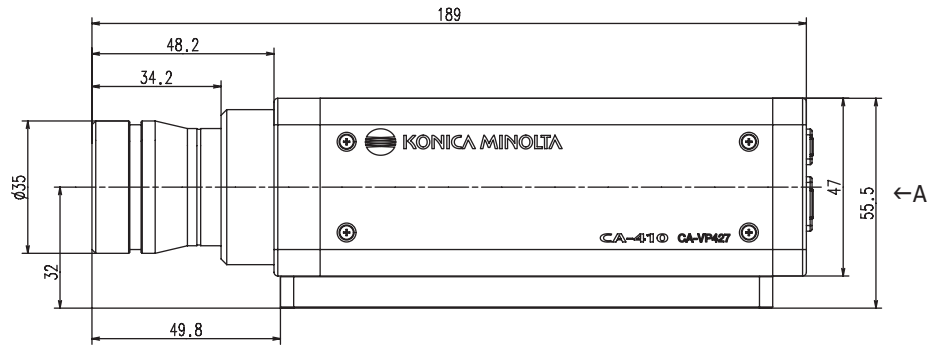
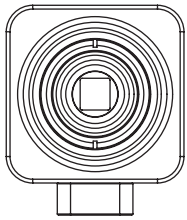
(unit: mm)



# Probes

CA-VP427 Ø27 High Sensitivity Probe High sensitivity measuring probe with a measurement area of 27 mm

(unit: mm)

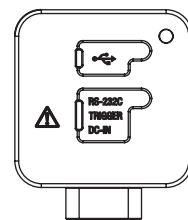
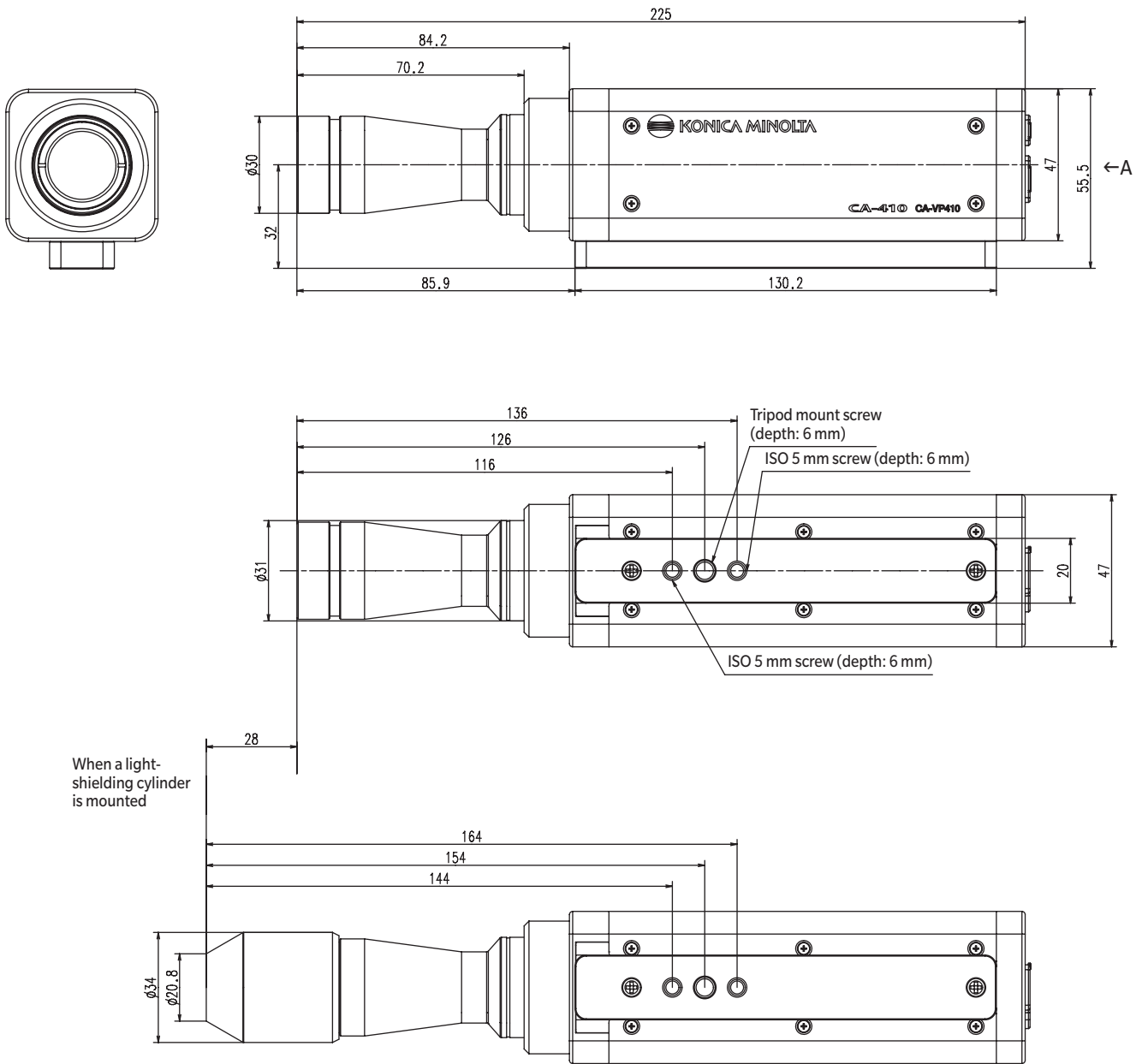


Viewed from A

Probe

**CA-VP410 Ø10 High Sensitivity Probe High sensitivity measuring probe with a measurement area of 10 mm**

(unit: mm)



Viewed from A



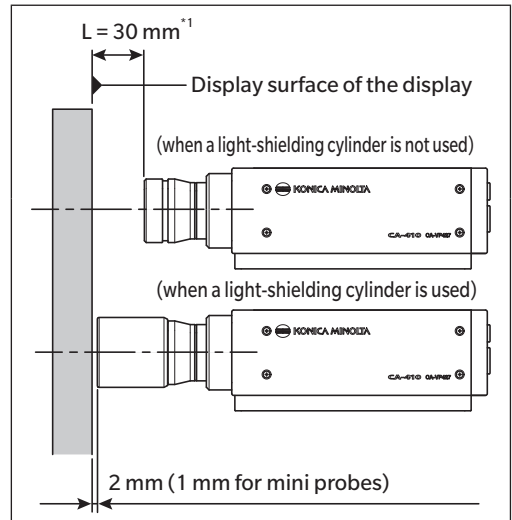
# How to Set a Probe

**1 Secure the display.**

**2 Secure the probe in a way to place its end 30 mm\*<sup>1</sup> away from the display surface.**

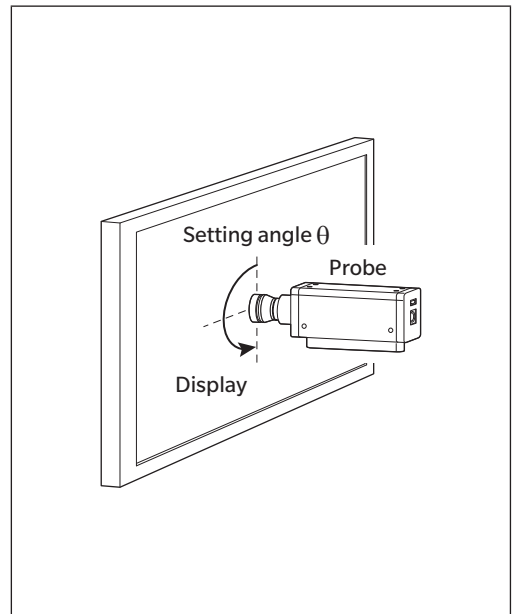
Be sure to set it perpendicular to the display.

\*1: L = 10 mm for mini probes.



## Notes on setting

- When measuring displays with high view angle dependence, you can obtain a higher measurement reproducibility by not changing the setting angle  $\theta$  for every measurement. In particular, the CA-VP410 high-sensitivity probe has a large aperture angle, which creates a higher dependence on panel directivity. When measuring panels with high directivity, run user calibration and use the probe without rotating it from the calibrated position.
- Use of the light-shielding cylinder supplied as a standard accessory not only blocks ambient light but also makes it easier to achieve a proper measurement distance and an angle of 90°.
  - For a  $\varnothing 27$  probe, the specification range of the length is 30 mm $\pm$ 10 mm.
  - For a  $\varnothing 10$  probe, the specification range of the length is 30 mm $\pm$ 5 mm.
  - For a mini probe, the specification range of the length is 10 mm $\pm$ 5 mm.
- When a light-shielding cylinder is used in situations where the intensity of light emitted obliquely is strong, such as with LCD monitors with a black display, the obliquely reflected light on the inner wall of the light-shielding cylinder becomes stray light and may affect measured values. In such cases, measuring in a dark room with the light-shielding cylinder removed is recommended.



# How to Connect Cables

A probe has a USB connector for connecting a USB mini B plug and a connector for connecting an RS-232C mini DIN plug. Before connection, make sure that power is not supplied to the probe and the external device. Be sure to connect a cable plug to the specified connector.

- For USB connection with a PC, connect the USB mini B plug of the supplied USB cable IF-A28 to the USB connector of the probe. Connect the USB plug on the other side of the cable to the USB connector of the PC.

### ●USB connection (using IF-A28)

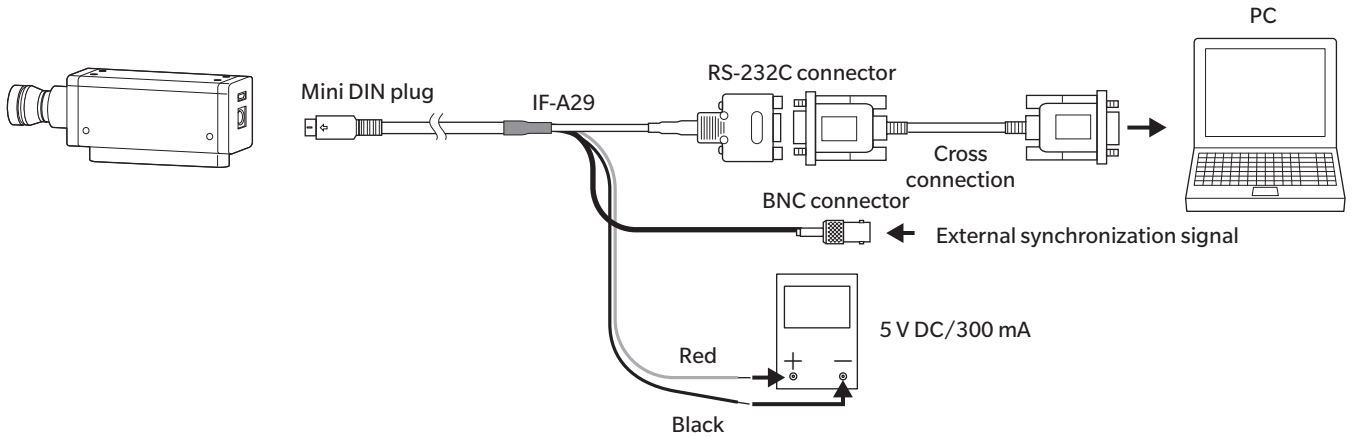


## Probes

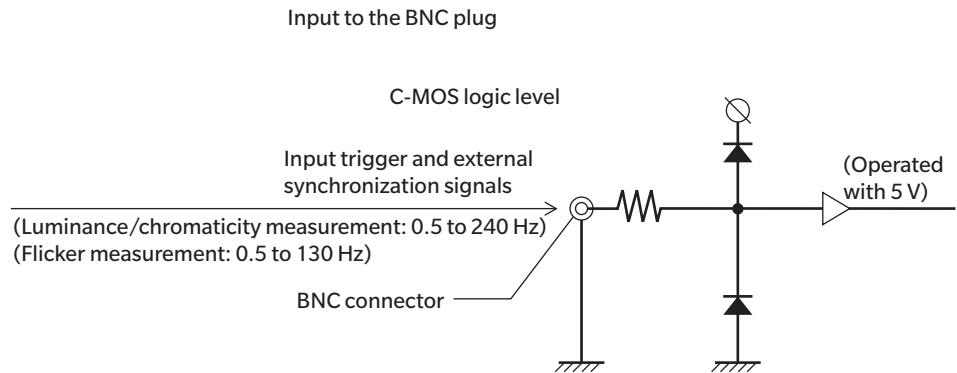
- For RS-232C connection with a PC or PLC, connect the mini DIN plug of an optional conversion cable IF-A29 to the RS-232C connector of the probe, and the D-sub plug to the RS-232C connector of the PC or PLC via a cross cable. In this case, it is also necessary to use the cable's power supply line to supply power to the probe. As a power source, 5 V/300 mA is required.

To control a probe from a PC via RS-232C, use the supplied SDK (CA-SDK2). For the specifications of the SDK and how to use it, refer to the instruction manual for CA-SDK2.

### ● RS-232C connection (using IF-A29)



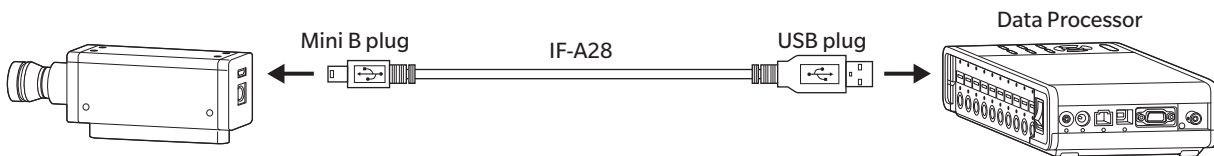
- To input trigger signals or external synchronization signals to the probe, input the signals to the BNC plug of an optional conversion cable IF-A29.



For connection with a CA-DP40 data processor, you can use a mini DIN cable or a USB cable.

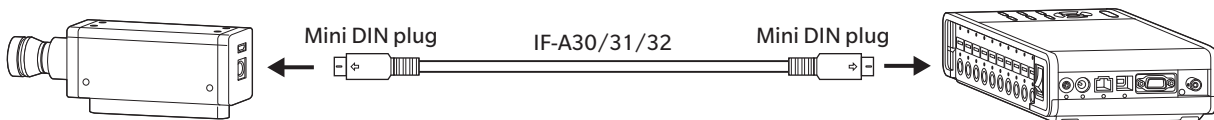
- For USB connection, connect the USB mini B plug of the supplied USB cable IF-A28 to the USB connector of the probe. Connect the USB plug on the other side of the cable to the probe USB connector of the CA-DP40 data processor.

### ● Connection via a USB cable (using IF-A28)



- For RS-232C connection, connect the mini DIN plug of the RS mini DIN cable IF-A30 (or IF-A31 or IF-A32) for the data processor to the RS-232C connector of the probe and the probe RS-232C connector of the CA-DP40 data processor.

### ● Connection via a mini DIN cable (using IF-A30/31/32)



# About Zero Calibration

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Zero calibration performs zero point adjustment while blocking entry of light into the probe's receptor. Be sure to perform zero calibration whenever the instrument is started.

## Notes on zero calibration

- Perform zero calibration if the ambient temperature has changed.
- During zero calibration, the shutter inside the probe automatically closes, but just in case, do not direct the end of the probe toward an illuminant with luminance exceeding the upper limit of the measurement range.

## How to Check Zero Calibration

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To check whether zero calibration has been performed correctly, block entry of light into the end of the probe using a blackout curtain, etc. so that the receptor is not exposed to light.

- Zero calibration has been performed correctly if zero is displayed for the Lv section on the controller's measured value display. If a value other than zero is displayed, perform zero calibration again.

Note: Even in case of a zero calibration error, measurement will start if the probe's receptor is exposed to light.

# Measurement Functions of Probes

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## 1. Measurement Speeds

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A probe has the following four modes (measurement speeds), which are available according to the purpose. A probe outputs every measured value and a PC or data processor connected to it can retrieve all of them through communication. Generally, however, not all measured values are displayed but values are displayed at an appropriate interval.

### **FAST mode**

Requires short measurement time, but may compromise measurement repeatability for low-luminance measurements.

### **SLOW mode**

Repeats FAST mode measurements several times. Use this mode when you want to perform measurement with high repeatability.

### **AUTO mode**

Switches FAST, SLOW, and setting with a further longer integration time automatically depending on the luminance level. Normally, this is the recommended setting.

### **LTD.AUTO mode**

Switches between FAST and SLOW settings automatically depending on the luminance level.

### **Notes on selecting the measurement speed**

- The currently selected measurement speed setting is stored in the probe. The set measurement speed will be used at the next start-up.



## 2. Measurement Synchronization Modes

Measurement synchronization modes are designed to select a measurement time (integration time) according to the vertical scanning frequency of a display. A probe has the following six types of measurement synchronization modes. Select a mode suitable for the type of the display to be measured.

Measurement synchronization mode	Description of mode	Measurement time (Integration time)	Vertical scanning frequency	Display's vertical synchronization signal input
NTSC	Mode for measuring NTSC displays	33.3 ms	59.94 Hz	Not required
PAL	Mode for measuring PAL and SECAM displays	40.0 ms	50 Hz	Not required
EXT	Mode for measuring while synchronizing with the display's vertical synchronization signal input (refer to page 20 for how to input vertical synchronization signals)	(1 vertical scanning period) ×2	0.50 to 240.00 Hz (For FMA: 0.50 to 130.00 Hz)	Required
UNIV.	Mode used when the display's vertical scanning frequency is unknown or cannot be input; a mode that can measure any display	100 ms	—	Not required
INT	When the display's vertical synchronization signal is known, set that information so that it can be used for measurement.	(1 vertical scanning period) ×2	Settable range 0.50 to 240.00 Hz (For FMA: 0.50 to 130.00 Hz)	Not required
MANUAL	Mode that allows you to specify the integration time	Settable range 4.0 to 4000.0 ms (For FMA: 7.7 to 4000.0 ms)	—	Not required

**Memo** / On a flickering LCD, the screen is fluctuating at half the frequency of the vertical scanning frequency. When you measure a display in this state, the luminance and the chromaticity vary if you set the same integration time as the vertical scanning frequency.

For stable LCD measurement, it is recommended that you set the measurement synchronization mode to MANUAL and set the integration time double (or another even multiple of) the vertical scanning frequency.

### Relationship between measurement speed and measurement synchronization mode

The measurement time (sampling time) is determined by the selected measurement synchronization mode.

Also, the measurement speed (number of measurements/outputs possible per second) is determined by the measurement synchronization mode and the following conditions:

- Luminance of the display to be measured
- Measurement mode
- Data output method (RS-232C or USB)
- Baud rate (for RS-232C)
- Number of probe to be used

Typical measurement speeds are described in the specifications.

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### 3. Measurement Modes

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A probe has the following measurement modes:

Measurement mode	Description of mode
xyLv mode	Mode for displaying and outputting chromaticity coordinates x, y and luminance Lv
TduvLv mode	Mode for displaying and outputting correlated color temperature T, color difference from blackbody locus duv, and luminance Lv
u'v'Lv mode	Mode for displaying and outputting u'v' chromaticity diagram coordinates (CIE 1976 UCS chromaticity diagram) and luminance Lv
Flicker mode	Displays the flicker amount in the contrast method (AC/DC). The unit is "%".
	Displays the flicker amount in the JEITA method. The unit is "dB".
XYZ mode	Mode for displaying and outputting tristimulus values XYZ
$\lambda$ dPeLv mode	Mode for displaying and outputting dominant wavelength $\lambda$ d, excitation purity Pe, and luminance Lv

\* Under the initial settings, the mode is set to xyLv mode at the start-up.

# User Memory

## 1. About Memory Channels

A probe has memory channels from CH00 to CH99 (100 channels in total).

The following can be set for each of CH00 to CH99:

- (1) Correction coefficient for user calibration
- (2) Target
- (3) ID

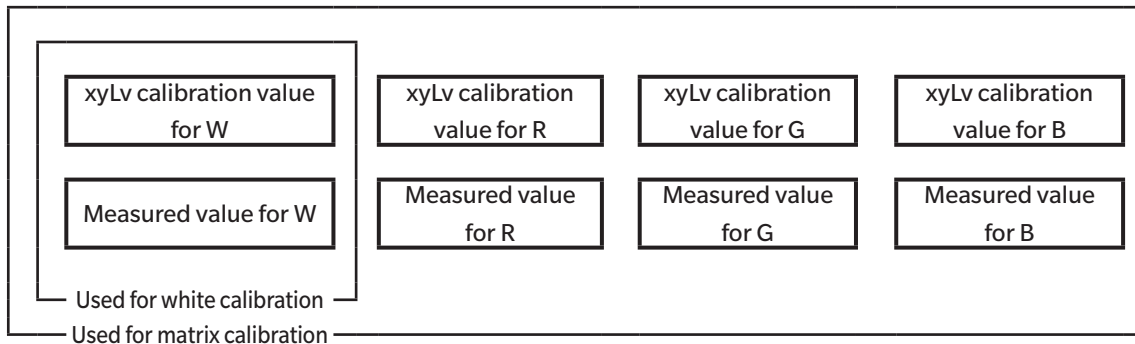
CH00 is a channel for calibration in accordance with the Konica Minolta calibration standard. It can only be used for setting targets or IDs.

Users can use CH01 to CH99 for calibration or saving targets.

Under the initial settings, CH01 to CH99 are also provided with the same Konica Minolta calibration value as with CH00.

Each channel can also be assigned with an ID.

### How the memory is used during user calibration



## 2. About Targets

Targets become the base color for measuring how different another measurable color is, which is required for color difference display. Targets can be set for each probe of each memory channel.

Targets are set after the following operations:

- (1) User calibration: After user calibration, the calibration value is set as a target at the same time.
- (2) Setting/changing a target: To be performed in the following cases:
  - To set a target in memory channel CH00
  - To set a different color from user calibration as a target in a user-calibrated memory channel
  - To perform measurement without performing user calibration but in accordance with the Konica Minolta calibration standard and to use color difference display

- If a correction coefficient for user calibration is input, a target is set at the same time, which erases the previously set target.
- To change a set target, set/change a target. Changing a target does not change the correction coefficient set for user calibration.

In a same channel, the target is saved to common memory, irrespective of measurement mode.

As a result, the target set last is saved, irrespective of measurement mode.

For one memory channel and one probe number:

- The correction coefficient for user calibration is common to xyLv mode, TduvLv mode, u'v'Lv mode, and XYZ mode.
- The target is common to all measurement modes.

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## 3. About User Calibration

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- User calibration allows users to set their own correction coefficients to the memory channel of the probe by measuring any display colors and setting calibration values ( $x$ ,  $y$ ,  $L_v$ ) to the instrument. Afterward, the value corrected with the specified correction coefficients will be displayed/output for every measurement.
- Two types of user calibration can be performed for a CA-410 series probe: white calibration and matrix calibration.
- Matrix calibration has been performed when the instrument is shipped from the factory.
- User calibration is performed independently for each probe.
- User calibration can be performed for every memory channel (except for CH00).
- When a probe is used for the first time after being shipped from the factory, measurement is performed in accordance with the Konica Minolta calibration standard in all memory channels. You can use user calibration to apply the following corrections to measurements based on the specified correction coefficients.
  - (1) Corrects the difference in the reading due to the deviation of spectral response from the CIE 1931 color-matching function.
  - (2) Corrects the difference in the readings between probes when multiple probes are used for measurement.
- When user calibration is performed, the color is set to the same memory channel as its target at the same time. Targets become the base color for displaying how different another measurable color is, which is used as the base for color difference display.

### **When multiple probes are used**

When using multiple probes for measurement, you can correct the difference in the readings by performing user calibration as follows:

### **When the target color value for the display to be measured is known**

Make a standardized color display on a standard display and perform user calibration for all probes.

### **When the target color value for the display to be measured is not known**

- (1) Determine one master probe.
- (2) Set the measurement mode to  $xyL_v$  mode, make the master probe face perpendicular to the display on which the target color is displayed, and perform measurement.
- (3) Record the measured value.
- (4) Using the display on which the target color is displayed and the value displayed in (3), perform user calibration for other probes.

# Specifications of Each Probe

## Specifications of Each Probe (1)

			CA-P427	CA-P427H	
Measurement area			Ø27 mm	Ø27 mm	
Aperture angle			±2.5°	±2.5°	
Accuracy guaranteed measurement distance			30±10 mm	30±10 mm	
Display range	Luminance		0.0001 to 5000 cd/m <sup>2</sup>	0.0001 to 30000 cd/m <sup>2</sup>	
	Chromaticity		Displayed in 4 digits	Displayed in 4 digits	
Luminance	Accuracy guaranteed range		0.001 to 5000 cd/m <sup>2</sup>	0.01 to 30000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1, *3</sup>	0.001 - cd/m <sup>2</sup>	±9%	---	
		0.01 - cd/m <sup>2</sup>	±2%	±9%	
		0.1 - cd/m <sup>2</sup>	±1.5%	±2%	
		1 - cd/m <sup>2</sup>	±1.5%	±1.5%	
		10 - cd/m <sup>2</sup>	±1.5%	±1.5%	
		100 - cd/m <sup>2</sup>	±1.5%	±1.5%	
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.001 - cd/m <sup>2</sup>	10%	---
			0.01 - cd/m <sup>2</sup>	1%	10%
			0.1 - cd/m <sup>2</sup>	0.40%	1%
			1 - cd/m <sup>2</sup>	0.10%	0.40%
10 - cd/m <sup>2</sup>			0.10%	0.10%	
100 - cd/m <sup>2</sup>			0.10%	0.10%	
Chromaticity	Accuracy guaranteed range		0.01 to 5000 cd/m <sup>2</sup>	0.1 to 30000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1, *3</sup>	0.01 - cd/m <sup>2</sup>	±0.003	---	
		0.1 - cd/m <sup>2</sup>	±0.002	±0.003	
		1 - cd/m <sup>2</sup>	±0.002	±0.002	
		10 - cd/m <sup>2</sup>	±0.002	±0.002	
		100 - cd/m <sup>2</sup>	±0.002	±0.002	
	In 100 cd/m <sup>2</sup> (for monochrome) <sup>*2</sup>		100 cd/m <sup>2</sup>	±0.003	±0.003
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.01 - cd/m <sup>2</sup>	0.0035	---
			0.1 - cd/m <sup>2</sup>	0.0015	0.0035
			1 - cd/m <sup>2</sup>	0.0004	0.0015
			10 - cd/m <sup>2</sup>	0.0003	0.0004
100 - cd/m <sup>2</sup>			0.0002	0.0003	
Flicker (Contrast)	Measurement range		5 cd/m <sup>2</sup> or higher	30 cd/m <sup>2</sup> or higher	
	Accuracy	30 Hz, AC/DC 10% sine wave	±0.4%	±0.4%	
		60 Hz, AC/DC 10% sine wave	±0.7%	±0.7%	
	Repeatability (2σ)	20 to 65 Hz, AC/DC 10% sine wave	0.3%	0.3%	
Flicker (JEITA)	Measurement range		5 cd/m <sup>2</sup> or higher	30 cd/m <sup>2</sup> or higher	
	Accuracy	30 Hz, AC/DC 4% sine wave	±0.35 dB	±0.35 dB	
		30 Hz, AC/DC 1.2% sine wave	±0.35 dB	---	
	Repeatability (2σ)	30 Hz, AC/DC 4% sine wave	0.1 dB	0.1 dB	
		30 Hz, AC/DC 1.2% sine wave	0.3 dB	---	

## Specifications of Each Probe (1)

				CA-P427	CA-P427H
Accuracy guaranteed measurement speed <sup>*4</sup>	xyL	AUTO	0.001 - cd/m <sup>2</sup>	1 time/sec	1 time/sec (0.01 - cd/m <sup>2</sup> )
			0.15 - cd/m <sup>2</sup>	5 times/sec	5 times/sec (0.9 - cd/m <sup>2</sup> )
			2 - cd/m <sup>2</sup>	20 times/sec	20 times/sec (12 - cd/m <sup>2</sup> )
	Flicker (Contrast)			20 times/sec	20 times/sec
Flicker (JEITA)			0.5 times/sec (at 1 Hz pitch) 2.5 times/sec (at 10 Hz pitch)	0.5 times/sec (at 1 Hz pitch) 2.5 times/sec (at 10 Hz pitch)	
Measurement synchronization mode				NTSC, PAL, EXT, UNIV, INT, MANU (4 ms to 4 s)	NTSC, PAL, EXT, UNIV, INT, MANU (4 ms to 4 s)
Measurement speed mode				AUTO, LTD. AUTO, SLOW, FAST	AUTO, LTD. AUTO, SLOW, FAST
Supported range to be measured (frequency)				0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)	0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)
User calibration memory channel				99 channels	99 channels
Interface	Communication			USB2.0, RS-232C	USB2.0, RS-232C
	Trigger			In & Out (5 V)	In & Out (5 V)
Size				<input type="checkbox"/> 42 x 140	<input type="checkbox"/> 42 x 140
Weight				270 g (including the mount)	270 g (including the mount)
Power supply				5 V DC (input from a USB bus power line or an RS communication connector)	5 V DC (input from a USB bus power line or an RS communication connector)
Operating temperature/humidity range				Temperature: 10 to 35°C, Relative humidity: 85% or less with no condensation With reference to 23°C, 40%: Luminance change: ±2% of reading for white; Chromaticity change: ±0.002 for white/±0.003 for monochrome, Measurement luminance: 100 cd/m <sup>2</sup>	
Storage temperature/humidity range				0 to 45°C, relative humidity 85% or less (at 35°C) with no condensation	

\*1: Measured under Konica Minolta's standard illuminant (6,500 K).

\*2: The luminance for monochrome is measured when reading of luminance for white is 100 cd/m<sup>2</sup>.

\*3: Temperature 23°C/±2°C, relative humidity 40%±10%

\*4: In NTSC sync mode, using USB, with one probe

Measured by Konica Minolta (with PC and probe directly connected, using the supplied measurement software)

## Specifications of Each Probe (2)

			CA-P410	CA-P410H	
Measurement area			Ø10 mm	Ø10 mm	
Aperture angle			±5°	±5°	
Accuracy guaranteed measurement distance			30±5 mm	30±5 mm	
Display range	Luminance		0.0001 to 5000 cd/m <sup>2</sup>	0.0001 to 30000 cd/m <sup>2</sup>	
	Chromaticity		Displayed in 4 digits	Displayed in 4 digits	
Luminance	Accuracy guaranteed range		0.01 to 5000 cd/m <sup>2</sup>	0.1 to 30000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1,*3</sup>	0.001 - cd/m <sup>2</sup>	---	---	
		0.01 - cd/m <sup>2</sup>	±2.5%	---	
		0.1 - cd/m <sup>2</sup>	±2%	±2.5%	
		1 - cd/m <sup>2</sup>	±2%	±2%	
		10 - cd/m <sup>2</sup>	±1.5%	±2%	
	100 - cd/m <sup>2</sup>	±1.5%	±1.5%		
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.001 - cd/m <sup>2</sup>	---	---
			0.01 - cd/m <sup>2</sup>	2%	---
			0.1 - cd/m <sup>2</sup>	0.60%	2%
1 - cd/m <sup>2</sup>			0.20%	0.60%	
10 - cd/m <sup>2</sup>			0.10%	0.20%	
100 - cd/m <sup>2</sup>	0.10%	0.10%			
Chromaticity	Accuracy guaranteed range		0.01 to 5000 cd/m <sup>2</sup>	0.1 to 30000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1,*3</sup>	0.01 - cd/m <sup>2</sup>	±0.006	---	
		0.1 - cd/m <sup>2</sup>	±0.002	±0.006	
		1 - cd/m <sup>2</sup>	±0.002	±0.002	
		10 - cd/m <sup>2</sup>	±0.002	±0.002	
		100 - cd/m <sup>2</sup>	±0.002	±0.002	
	In 100 cd/m <sup>2</sup> (for monochrome) <sup>*2</sup>		100 cd/m <sup>2</sup>	±0.003	±0.003
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.01 - cd/m <sup>2</sup>	0.0070	---
			0.1 - cd/m <sup>2</sup>	0.0020	0.0070
			1 - cd/m <sup>2</sup>	0.0008	0.0020
10 - cd/m <sup>2</sup>			0.0005	0.0008	
100 - cd/m <sup>2</sup>			0.0003	0.0005	
Flicker (Contrast)	Measurement range		15 cd/m <sup>2</sup> or higher	90 cd/m <sup>2</sup> or higher	
	Accuracy	30 Hz, AC/DC 10% sine wave	±0.4%	±0.4%	
		60 Hz, AC/DC 10% sine wave	±0.7%	±0.7%	
	Repeatability (2σ)	20 to 65 Hz, AC/DC 10% sine wave	0.3%	0.3%	
Flicker (JEITA)	Measurement range		15 cd/m <sup>2</sup> or higher	90 cd/m <sup>2</sup> or higher	
	Accuracy	30 Hz, AC/DC 4% sine wave	±0.35 dB	±0.35 dB	
		30 Hz, AC/DC 1.2% sine wave	±0.35 dB	---	
	Repeatability (2σ)	30 Hz, AC/DC 4% sine wave	0.1 dB	0.1 dB	
		30 Hz, AC/DC 1.2% sine wave	0.3 dB	---	



## Specifications of Each Probe (2)

				CA-P410	CA-P410H
Accuracy guaranteed measurement speed <sup>*4</sup>	xyL	AUTO	0.01 - cd/m <sup>2</sup>	1 time/sec	1 time/sec (0.1 - cd/m <sup>2</sup> )
			0.15 - cd/m <sup>2</sup>	5 times/sec	5 times/sec (0.9 - cd/m <sup>2</sup> )
			2 - cd/m <sup>2</sup>	20 times/sec	20 times/sec (12 - cd/m <sup>2</sup> )
	Flicker (Contrast)			20 times/sec	20 times/sec
Flicker (JEITA)			0.5 times/sec (at 1 Hz pitch) 2.5 times/sec (at 10 Hz pitch)	0.5 times/sec (at 1 Hz pitch) 2.5 times/sec (at 10 Hz pitch)	
Measurement synchronization mode				NTSC, PAL, EXT, UNIV, INT, MANU (4 ms to 4 s)	NTSC, PAL, EXT, UNIV, INT, MANU (4 ms to 4 s)
Measurement speed mode				AUTO, LTD. AUTO, SLOW, FAST	AUTO, LTD. AUTO, SLOW, FAST
Supported range to be measured (frequency)				0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)	0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)
User calibration memory channel				99 channels	99 channels
Interface	Communication			USB2.0, RS-232C	USB2.0, RS-232C
	Trigger			In & Out (5 V)	In & Out (5 V)
Size				<input type="checkbox"/> 42 x 77	<input type="checkbox"/> 42 x 174
Weight				200 g (including the mount)	280 g (including the mount)
Power supply				5 V DC (input from a USB bus power line or an RS communication connector)	5 V DC (input from a USB bus power line or an RS communication connector)
Operating temperature/humidity range				Temperature: 10 to 35°C, Relative humidity: 85% or less with no condensation With reference to 23°C, 40%: Luminance change: ±2% of reading for white; Chromaticity change: ±0.002 for white/±0.003 for monochrome, Measurement luminance: 100 cd/m <sup>2</sup>	
Storage temperature/humidity range				0 to 45°C, relative humidity 85% or less (at 35°C) with no condensation	

\*1: Measured under Konica Minolta's standard illuminant (6,500 K).

\*2: The luminance for monochrome is measured when reading of luminance for white is 100 cd/m<sup>2</sup>.

\*3: Temperature 23°C/±2°C, relative humidity 40%±10%

\*4: In NTSC sync mode, using USB, with one probe

Measured by Konica Minolta (with PC and probe directly connected, using the supplied measurement software)

## Specifications of Each Probe (3)

			CA-MP410	CA-MP410H	
Measurement area			Ø10 mm	Ø10 mm	
Aperture angle			±5°	±5°	
Accuracy guaranteed measurement distance			10±5 mm	10±5 mm	
Display range	Luminance		0.0001 to 5000 cd/m <sup>2</sup>	0.0001 to 30000 cd/m <sup>2</sup>	
	Chromaticity		Displayed in 4 digits	Displayed in 4 digits	
Luminance	Accuracy guaranteed range		0.01 to 5000 cd/m <sup>2</sup>	0.1 to 30000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1,*3</sup>	0.001 - cd/m <sup>2</sup>	---	---	
		0.01 - cd/m <sup>2</sup>	±2.5%	---	
		0.1 - cd/m <sup>2</sup>	±2%	±2.5%	
		1 - cd/m <sup>2</sup>	±2%	±2%	
		10 - cd/m <sup>2</sup>	±1.5%	±2%	
		100 - cd/m <sup>2</sup>	±1.5%	±1.5%	
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.001 - cd/m <sup>2</sup>	---	---
			0.01 - cd/m <sup>2</sup>	2.40%	---
			0.1 - cd/m <sup>2</sup>	0.70%	2.40%
1 - cd/m <sup>2</sup>			0.25%	0.70%	
10 - cd/m <sup>2</sup>			0.12%	0.25%	
100 - cd/m <sup>2</sup>	0.10%	0.12%			
Chromaticity	Accuracy guaranteed range		0.01 to 5000 cd/m <sup>2</sup>	0.1 to 30000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1,*3</sup>	0.01 - cd/m <sup>2</sup>	±0.006	---	
		0.1 - cd/m <sup>2</sup>	±0.002	±0.006	
		1 - cd/m <sup>2</sup>	±0.002	±0.002	
		10 - cd/m <sup>2</sup>	±0.002	±0.002	
		100 - cd/m <sup>2</sup>	±0.002	±0.002	
	In 100 cd/m <sup>2</sup> (for monochrome) <sup>*2</sup>		100 cd/m <sup>2</sup>	±0.003	±0.003
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.01 - cd/m <sup>2</sup>	0.0085	---
			0.1 - cd/m <sup>2</sup>	0.0025	0.0085
			1 - cd/m <sup>2</sup>	0.0010	0.0025
10 - cd/m <sup>2</sup>			0.0006	0.0010	
100 - cd/m <sup>2</sup>			0.0004	0.0006	
Flicker (Contrast)	Measurement range		15 cd/m <sup>2</sup> or higher	90 cd/m <sup>2</sup> or higher	
	Accuracy	30 Hz, AC/DC 10% sine wave	±0.4%	±0.4%	
		60 Hz, AC/DC 10% sine wave	±0.7%	±0.7%	
	Repeatability (2σ)	20 to 65 Hz, AC/DC 10% sine wave	0.3%	0.3%	
Flicker (JEITA)	Measurement range		15 cd/m <sup>2</sup> or higher	90 cd/m <sup>2</sup> or higher	
	Accuracy	30 Hz, AC/DC 4% sine wave	±0.35 dB	±0.35 dB	
		30 Hz, AC/DC 1.2% sine wave	±0.35 dB	---	
	Repeatability (2σ)	30 Hz, AC/DC 4% sine wave	0.1 dB	0.1 dB	
		30 Hz, AC/DC 1.2% sine wave	0.3 dB	---	

## Specifications of Each Probe (3)

				CA-MP410	CA-MP410H
Accuracy guaranteed measurement speed <sup>*4</sup>	xyL	AUTO	0.01 - cd/m <sup>2</sup>	1 time/sec	1 time/sec (0.1 - cd/m <sup>2</sup> )
			0.15 - cd/m <sup>2</sup>	5 times/sec	5 times/sec (0.9 - cd/m <sup>2</sup> )
			2 - cd/m <sup>2</sup>	20 times/sec	20 times/sec (12 - cd/m <sup>2</sup> )
	Flicker (Contrast)			20 times/sec	20 times/sec
Flicker (JEITA)			0.5 times/sec (at 1 Hz pitch) 2.5 times/sec (at 10 Hz pitch)	0.5 times/sec (at 1 Hz pitch) 2.5 times/sec (at 10 Hz pitch)	
Measurement synchronization mode				NTSC, PAL, EXT, UNIV, INT, MANU (4 ms to 4 s)	NTSC, PAL, EXT, UNIV, INT, MANU (4 ms to 4 s)
Measurement speed mode				AUTO, LTD. AUTO, SLOW, FAST	AUTO, LTD. AUTO, SLOW, FAST
Supported range to be measured (frequency)				0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)	0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)
User calibration memory channel				99 channels	99 channels
Interface	Communication			USB2.0, RS-232C	USB2.0, RS-232C
	Trigger			In & Out (5 V)	In & Out (5 V)
Size				□ 42 x 77	□ 42 x 77
Weight				200 g (including the mount)	200 g (including the mount)
Power supply				5 V DC (input from a USB bus power line or an RS communication connector)	5 V DC (input from a USB bus power line or an RS communication connector)
Operating temperature/humidity range				Temperature: 10 to 35°C, Relative humidity: 85% or less with no condensation With reference to 23°C, 40%: Luminance change: ±2% of reading for white; Chromaticity change: ±0.002 for white/±0.003 for monochrome, Measurement luminance: 100 cd/m <sup>2</sup>	
Storage temperature/humidity range				0 to 45°C, relative humidity 85% or less (at 35°C) with no condensation	

\*1: Measured under Konica Minolta's standard illuminant (6,500 K).

\*2: The luminance for monochrome is measured when reading of luminance for white is 100 cd/m<sup>2</sup>.

\*3: Temperature 23°C/±2°C, relative humidity 40%±10%

\*4: In NTSC sync mode, using USB, with one probe

Measured by Konica Minolta (with PC and probe directly connected, using the supplied measurement software)

## Specifications of Each Probe (4)

			CA-VP427	CA-VP410	
Measurement area			Ø27 mm	Ø10 mm	
Aperture angle			±2.5°	±8.5°	
Accuracy guaranteed measurement distance			30±10 mm	30±5 mm	
Display range	Luminance		0.0001 to 3000 cd/m <sup>2</sup>	0.0001 to 3000 cd/m <sup>2</sup>	
	Chromaticity		Displayed in 4 digits	Displayed in 4 digits	
Luminance	Accuracy guaranteed range		0.001 to 3000 cd/m <sup>2</sup>	0.001 to 3000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1,*3</sup>	0.001 - cd/m <sup>2</sup>	±9%	±9%	
		0.01 - cd/m <sup>2</sup>	±2%	±2.5%	
		0.1 - cd/m <sup>2</sup>	±1.5%	±2%	
		1 - cd/m <sup>2</sup>	±1.5%	±2%	
		10 - cd/m <sup>2</sup>	±1.5%	±1.5%	
		100 - cd/m <sup>2</sup>	±1.5%	±1.5%	
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.001 - cd/m <sup>2</sup>	10%	7%
			0.01 - cd/m <sup>2</sup>	1%	1%
			0.1 - cd/m <sup>2</sup>	0.25%	0.25%
			1 - cd/m <sup>2</sup>	0.10%	0.10%
10 - cd/m <sup>2</sup>			0.10%	0.10%	
100 - cd/m <sup>2</sup>			0.10%	0.10%	
Chromaticity	Accuracy guaranteed range		0.01 to 3000 cd/m <sup>2</sup>	0.01 to 3000 cd/m <sup>2</sup>	
	Accuracy (for white) <sup>*1,*3</sup>	0.01 - cd/m <sup>2</sup>	±0.003	±0.003	
		0.1 - cd/m <sup>2</sup>	±0.002	±0.002	
		1 - cd/m <sup>2</sup>	±0.002	±0.002	
		10 - cd/m <sup>2</sup>	±0.002	±0.002	
		100 - cd/m <sup>2</sup>	±0.002	±0.002	
	In 100 cd/m <sup>2</sup> (for monochrome) <sup>*2</sup>		100 cd/m <sup>2</sup>	±0.003	
	Repeatability (2σ) <sup>*1</sup>	AUTO	0.01 - cd/m <sup>2</sup>	0.0030	0.0020
			0.1 - cd/m <sup>2</sup>	0.0008	0.0008
			1 - cd/m <sup>2</sup>	0.0003	0.0003
			10 - cd/m <sup>2</sup>	0.0002	0.0002
100 - cd/m <sup>2</sup>			0.0002	0.0002	
Flicker (Contrast)	Measurement range		---	---	
	Accuracy	30 Hz, AC/DC 10% sine wave	---	---	
		60 Hz, AC/DC 10% sine wave	---	---	
	Repeatability (2σ)	20 to 65 Hz, AC/DC 10% sine wave	---	---	
Flicker (JEITA)	Measurement range		---	---	
	Accuracy	30 Hz, AC/DC 4% sine wave	---	---	
		30 Hz, AC/DC 1.2% sine wave	---	---	
	Repeatability (2σ)	30 Hz, AC/DC 4% sine wave	---	---	
		30 Hz, AC/DC 1.2% sine wave	---	---	

## Specifications of Each Probe (4)

				CA-VP427	CA-VP410
Accuracy guaranteed measurement speed <sup>*4</sup>	xyL	AUTO	0.001 - cd/m <sup>2</sup>	1 time/sec	1 time/sec
			0.15 - cd/m <sup>2</sup>	5 times/sec	5 times/sec
			2 - cd/m <sup>2</sup>	20 times/sec	20 times/sec
	Flicker (Contrast)			---	---
	Flicker (JEITA)			---	---
Measurement synchronization mode				---	---
Measurement speed mode				AUTO, LTD. AUTO, SLOW, FAST	AUTO, LTD. AUTO, SLOW, FAST
Supported range to be measured (frequency)				0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)	0.5 to 240 Hz (luminance and chromaticity) 0.5 to 130 Hz (flicker)
User calibration memory channel				99 channels	99 channels
Interface	Communication			USB2.0, RS-232C	USB2.0, RS-232C
	Trigger			In & Out (5 V)	In & Out (5 V)
Size				□ 47 x 190	□ 47 x 227
Weight				510 g (including the mount)	570 g (including the mount)
Power supply				5 V DC (input from a USB bus power line or an RS communication connector)	5 V DC (input from a USB bus power line or an RS communication connector)
Operating temperature/humidity range				Temperature: 10 to 35°C, Relative humidity: 85% or less with no condensation With reference to 23°C, 40%: Luminance change: ±2% of reading for white; Chromaticity change: ±0.002 for white/±0.003 for monochrome, Measurement luminance: 100 cd/m <sup>2</sup>	
Storage temperature/humidity range				0 to 45°C, relative humidity 85% or less (at 35°C) with no condensation	

\*1: Measured under Konica Minolta's standard illuminant (6,500 K).

\*2: The luminance for monochrome is measured when reading of luminance for white is 100 cd/m<sup>2</sup>.

\*3: Temperature 23°C/±2°C, relative humidity 40%±10%

\*4: In NTSC sync mode, using USB, with one probe

Measured by Konica Minolta (with PC and probe directly connected, using the supplied measurement software)



**Display Color Analyzer**  
**CA-410**

---

**Software**



## Safety Precautions

Before using the software, please read this manual as well as the instruction manuals of your instrument and personal computer (PC) carefully to ensure safe and correct use.

### Formal designations of application software used in this manual

(Designation in this manual)	(Formal designation)
Windows, Windows 7	Microsoft® Windows® 7 Professional Operating System
Windows, Windows 10	Microsoft® Windows® 10 Pro Operating System
Excel	Microsoft® Office Excel

### Trademarks

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### Notes on this Manual

- Copying or reproduction of all or part of the contents of this manual without the permission of KONICA MINOLTA is strictly prohibited.
- The contents of this manual are subject to change without prior notice.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions, or find an error or missing section, please contact your local sales office.
- KONICA MINOLTA will not accept any responsibility for the consequences arising from the use of the software without following the instructions in this manual.



## **Introduction**

PC Software CA-S40 For Color Analyzers is software that loads and saves measurements and data on a computer connected with the probe or data processor of Display Color Analyzer CA-410 via a USB cable.

Please note that this manual assumes that the reader is familiar with the basic operations of Windows.

The USB flash drive, provided as a standard accessory, includes a PDF version of this instruction manual.

To view PDF files, you will need Adobe Reader® from Adobe Systems Incorporated. The latest Adobe Reader® can be downloaded for free from the Adobe website.

## **Software License Agreement**

The terms of the license agreement for this software are provided in the [Software License Agreement] dialog box displayed during the installation process. This software can be used only if you agree to all the terms of the agreement. KONICA MINOLTA holds the copyrights to the CA-410 USB driver and this manual stored on the USB flash drive.

## **Notes on Use**

- This software is application software for use with Windows 7 and Windows 10. Please note that this software does not include any OS.
- One of the above OS must be installed on the PC in order to use this software.
- When plugging the USB flash drive into the USB port of your PC, note the correct orientation and plug it in gently.
- To connect the CA-410 series probe or data processor to a PC, you need the dedicated USB driver.
- This software only controls the CA-410 series probe or data processor connected to the PC with a USB cable. It does not support the CA-210 or CA-310 series.
- Make sure that the connector is oriented correctly and connected securely.
- Do not touch or otherwise dirty the terminal portion of the connector or subject the terminals to unreasonable force.
- Use a cord with a suitable length. Putting tension on the cable may cause connection failure or wire breakage.
- Disconnect the connection cord only by holding the plug or the connector. Also, do not pull the cord itself or bend it with unreasonable force.
- Avoid exposing the USB flash drive to rapid temperature changes and condensation.
- Avoid leaving it in locations where it may be exposed to high temperatures from direct sunlight or heaters.
- Do not drop the USB flash drive or subject it to strong impact.
- Keep the USB flash drive away from water, alcohol, paint thinners, and other such substances.
- When removing the USB flash drive, follow the instructions on the manual for your PC.

## **Notes on Storage**

- Keep the USB flash drive in a safe place.
- Avoid leaving the USB flash drive in locations where it may be exposed to high temperatures from direct sunlight or heaters.
- Do not keep the USB flash drive in a humid environment.

Every effort has been made in the preparation of this product to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your retailer or a KONICA MINOLTA-authorized service facility.

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# A

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# 1. System environment

## Operating requirements

<b>OS</b>	Windows 7 Professional 32bit Windows 7 Professional 64bit Windows 10 Pro 32bit Windows 10 Pro 64bit
	<ul style="list-style-type: none"> <li>The PC's system configuration must be either that recommended for the above OS or have the following specifications, whichever is higher.</li> </ul>
<b>PC</b>	Computer equipped with Intel Core i series, or equivalent or higher processor
<b>RAM</b>	4 GB or more
<b>Hard disk</b>	More than 100 MB of available space Out of the above, there must be at least 50 MB of available space on the system drive (drive where the OS is installed)
<b>Display resolution</b>	1024 x 768 or higher, 16-bit color or higher
<b>Other</b>	USB port required to connect the USB flash drive USB 2.0 or above required to connect the instrument

## Instruments controlled

**CA-410 data processor:** CA-DP40

**CA-410 probe:** CA-P427 / P427H / P410 / P410H / MP410 / MP410H / VP427 / VP410

## Language

**Display language** English

# 2. Setup

## 2-1. Installing the software

Double-click [setup.exe] on the supplied USB flash drive. Proceed as instructed on the screen. When you agree to the license agreement, the installation process starts and the following folders are created under the [Program Files (x86)] folder. The program and manual are installed, and the CA-S40 startup menu is registered in the Start menu.

[Program Files (x86)] – [KONICA MINOLTA] – [CA-S40]

## 2-2. Uninstalling the software

Open [Control Panel] - [Uninstall a program], select CA-S40 from the list, and double-click it or click [Uninstall]. Uninstall the CA-S40 Driver in the same way.

## 3. Major functions

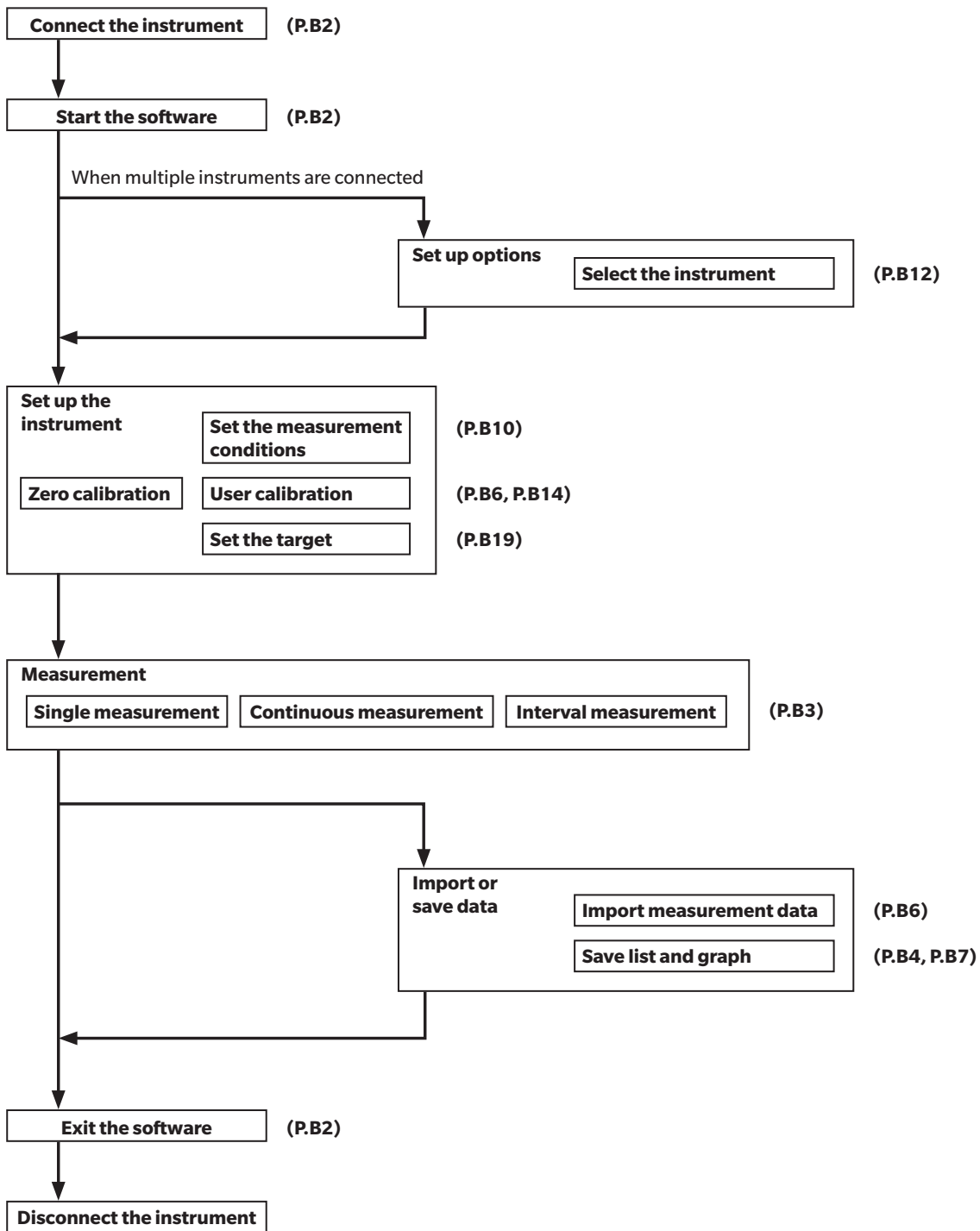
<b>Display</b>	<b>(Color)</b> L <sub>v</sub> , x, y, L <sub>v</sub> , u', v', L <sub>v</sub> , T <sub>cp</sub> , duv, X, Y, Z, L <sub>v</sub> , λ <sub>d</sub> , and P <sub>e</sub> values, chromaticity diagram, and trend graph
	<b>(JEITA)</b> Flicker value (dB) and trend graph, spectral intensity value and graph, and waveform graph
	<b>(FMA)</b> Flicker value (%) and trend graph

### About displayed values

- Although the CA-S40 offers a higher calculation accuracy through internal calculations using more decimal places than found in the displayed values, some calculations, such as rounding, and those during color space conversion may result in a different minimum decimal place from the output of the instrument by one digit. In addition, plotted positions may also differ from those obtained from the displayed values for the same reason.

<b>Instrument control</b>	Single measurement Continuous measurement Interval measurement Color and FMA Number of measurements: 1 to 4,000 times/Measurement interval: 0 to 7,259 sec Number of measurements: 4,001 to 40,000 times/Measurement interval: 1 to 7,259 sec JEITA Number of measurements: 1 to 4,000 times/Measurement interval: 0 to 7,259 sec Instrument settings Retrieval of data stored in the instrument User calibration
<b>Target</b>	Writing of a target to the instrument
<b>Data list</b>	Listing of measurement data Edit (delete, copy)
<b>External input/output</b>	Saving in text/CSV format, copying lists to the clipboard

## 4. Operation flow



## 5. Notes on measurement

### 5-1. Notes on hardware operation

---

- Use the USB cable to connect the instrument.
- The CA-VP410 high-sensitivity probe has a large aperture angle, which creates a higher dependence on panel directivity. When measuring panels with high directivity, run arbitrary calibration and use the probe without rotating it from the calibrated position.

# B

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# 1. Preparing and starting the software

## 1-1. Connect the instrument and start the software

### Connect the instrument

- (1) Connect the instrument (CA probe or data processor) to the PC's USB port. When connecting the instrument, connect it to a USB port that can supply power to the probe. When a message appears prompting for the installation of the USB driver, install the USB driver in the [Driver] folder.
  - (2) Check whether the probe's LED indicator blinks.
  - (3) Go to [Start menu] - [KONICA MINOLTA] - [CA-S40] and click CA-S40 to start the software.
    - When only one instrument is connected, the measurement screen appears. (See 2-1-1. Screen layout)
    - When multiple instruments are connected, the instrument selection screen appears. Select one instrument. (See 3-2-2. Instrument selection CA Info.)
    - When no instrument is connected, the error screen appears.
    - When the software starts and the instrument to be used has been chosen, the information of the instrument is displayed in the status bar, indicating that it is ready to be operated from the PC.
    - If a probe that has not been calibrated to its zero point is directly connected to the PC, the internal shutter closes automatically to start zero calibration.
    - When zero calibration is completed, the LED indicator changes from blinking to lighting up steadily.
- Notes: The probe operates on USB bus power and requires 5 V and 300 mA. It is recommended that an AC power supply is used for the PC as necessary. It is also recommended that the instrument be disconnected whenever it is not in use.
- (4) Click [Settings] and set the measurement conditions.

### Disconnect the instrument

Exit the software and disconnect the instrument from the PC.

### Precautions for connecting the instrument

- When the instrument's communication is controlled by another PC or other software, CA-S40 cannot control its communication. Make sure that the instrument's communication is not controlled by other software. If it is, exit that software as necessary. If the instrument is connected to another PC, disconnect that connection to ensure that it is only connected to the intended controlling PC.
- When connection-related problems occur even after an instrument has been connected successfully and proper communication has been established, a dialog appears showing "CA device not connected". Click [OK]. Restart CA-S40 after checking that the cable is connected and that the instrument (if a data processor is connected) is turned on. Also, the operating system on your PC may not operate when it is started (or restarted) after the PC is connected to the instrument using a cable. In this case, exit CA-S40 and, if the instrument is a data processor, turn it off and then on again, and if the instrument is a probe, disconnect and reconnect it to the PC before restarting CA-S40.
- If your PC enters power-saving mode while connected to an instrument, communication operations, such as for continuous measurement, may stop. In this case, change the power-saving mode settings on your PC as required.
- A Firewall alert may be displayed when CA-S40 is started for the first time after installation. In this case, click "Allow access" to grant access because CA-S40 does not connect to an external network.

## 2. Measurement

### 2-1. Chromaticity measurement

Click the [Color] tab to display the following screen. On this screen, you can measure chromaticity and display the results in the selected color space. User calibration and gamma measurement can also be performed.

#### 2-1-1. Screen layout



- (1) Function selection  
Chromaticity measurement (Color), Flicker (JEITA), Flicker (FMA)
- (2) Instrument information  
Information about the instrument that is connected to the PC is displayed.
- (3) Probe information  
Probe information is displayed when a data processor is connected. Click here to select the probe.
- (4) Measurement information  
This section displays the synchronization mode, measurement speed, calibration mode, and measurement status.
- (5) Help function  
The instruction manual, saved on the PC when the software was installed, opens.
- (6) License information  
Click here to open a screen that shows the software name and version along with copyright information.
- (7) Individual functions (pop-up)  
Zero calibration, settings, data import from data processor, user calibration, gamma measurement
- (8) Measurement start/pause/stop button
- (9) Color space selection tab
- (10) Latest data display  
This area shows the latest data in the color space specified in the color space selection tab above.



## 2-1-2. Measurement type

- 1) Select the measurement type.



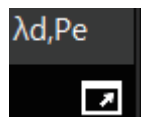
- Single: Single measurement
- Continuous: Continuous measurement (graph scrolls)  
\* Displays up to 100 data sets and deletes data from the oldest.
- Interval: Interval measurement, which performs the specified number of measurements at the specified interval.

- 2) Click  to start measurement.

\* When using continuous measurement or interval measurement, the button display changes to "Hold", which you click to pause or stop the measurement.

## 2-1-3. Data display

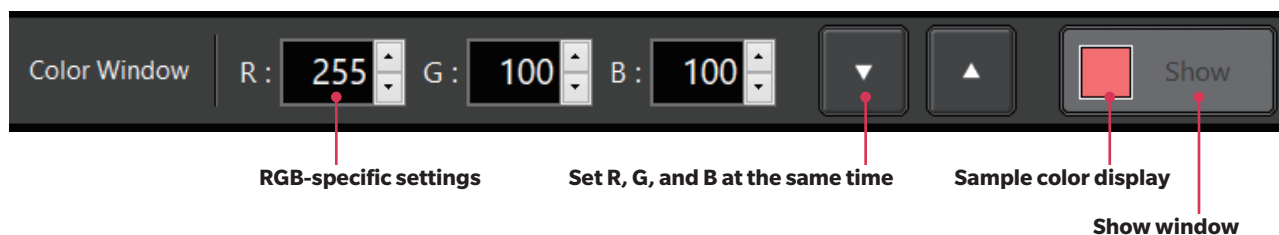
The most recent measurement results are displayed in the [Current Data] field and added to the data list and trend graph. Use the tab in (9) to select the color space to be used for display.



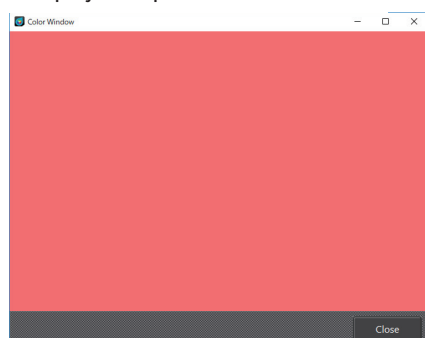
The trend graph is also displayed in the selected color space. Click the pop-up mark as shown on the left to display an enlarged view of "Current Data" in a pop-up window.

## 2-1-4. Color display window

You can display the color that you defined using the RGB levels in a pop-up window to be measured using the instrument. You can also change the RGB settings while having this window open.

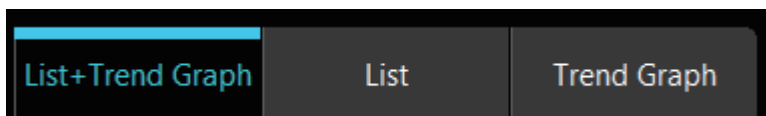



\* Display example

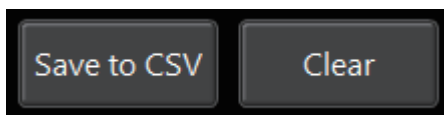


## 2-2. Common operations

- 1) On each measurement screen, you can toggle between “Data List” display and “Trend Graph” display.



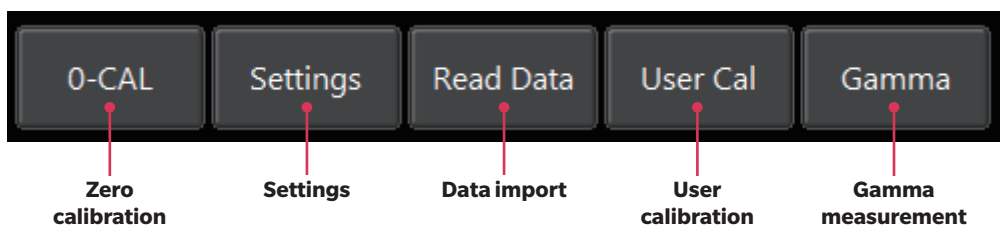
- 2) Click  to start the measurement with the settings applied.  
 3) Click [Save to CSV] to save the data to a file. Click [Clear] to clear data.



\* The data is saved in CSV format.

- 4) “Right-click” functions  
 Right-click on the data list or graph to display a pop-up menu from which you can copy the data or graph to the clipboard.  
 <Example>  
 You can also specify the background color (B/W) and size for the graph that you want to save.

## 2-3. Individual functions



### Zero calibration [0-CAL]

- When you click [0-CAL], the shutter inside the probe automatically closes, and zero calibration starts.
- It is recommended that zero calibration be used after start-up or whenever there is a change in ambient temperature or a temperature change inside the instrument due to using it for long periods.

### Settings [Settings]

- The pop-up window for setting the measurement conditions appears.
- You can set the measurement speed and the calibrated memory channels.

### Data import [Read Data]

- This function imports the data from the data processor.

### User calibration [User Cal] (only for chromaticity measurement)

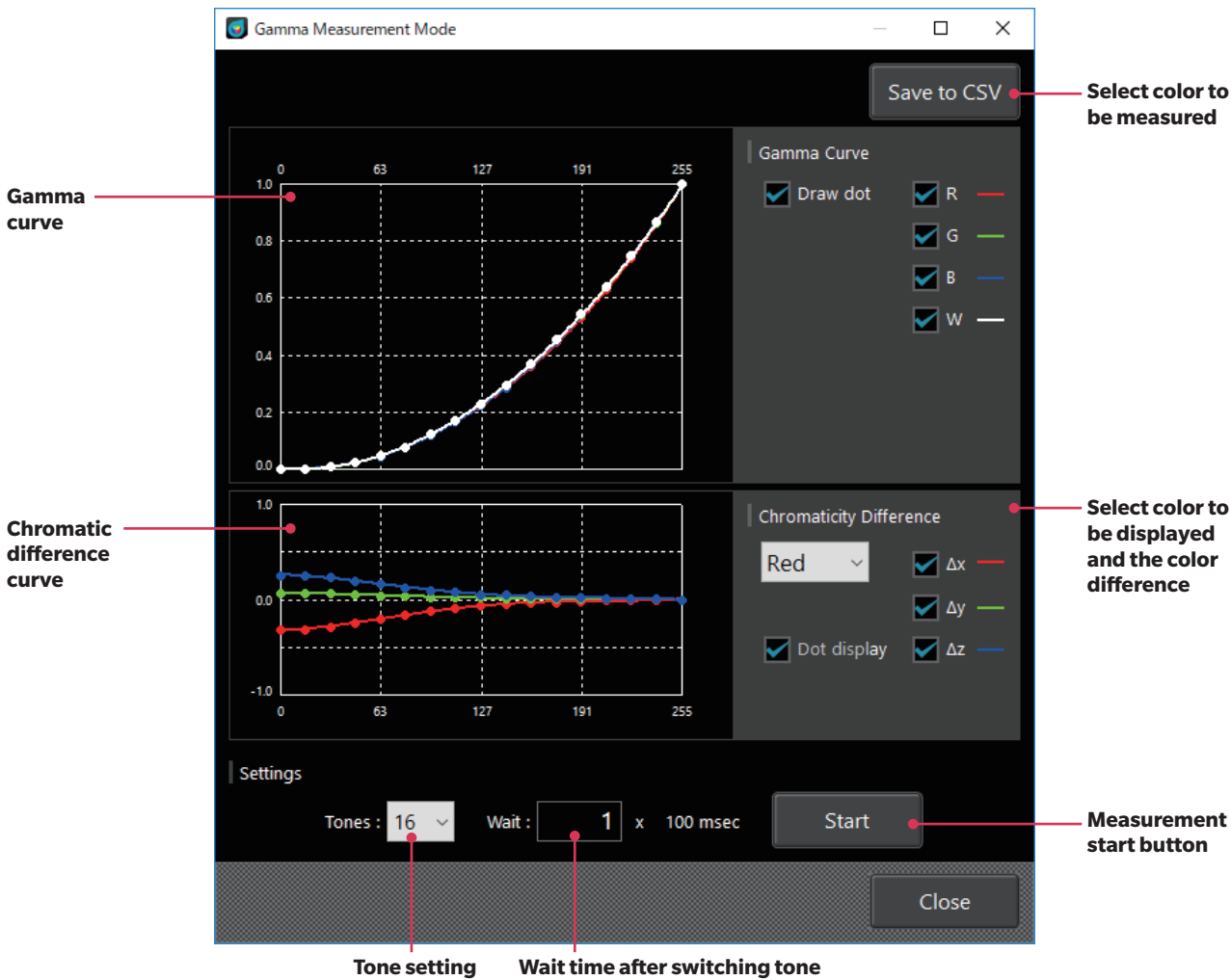
- The pop-up window for user calibration appears. (See 4. User calibration)
- The memory channel (CH00 to CH99) data is read before displaying the pop-up window.

### Gamma measurement [Gamma] (only for chromaticity measurement)

- The pop-up window for gamma measurement appears. (See 2-3-1. Gamma measurement)

### 2-3-1. Gamma measurement (only for chromaticity measurement)

- Click [Gamma] among the individual functions to bring up the pop-up window for gamma measurement. Here, you can measure the color output intensity for each color's input tone.
- When measuring, configure the settings related to the color and tone to be measured.
- Click the measurement start button. The measurement results are displayed in the graph as gamma curve and chromatic difference curve.
- The obtained chromaticity data is displayed on the chromaticity measurement screen and can be saved.



Right-click on the gamma curve or chromatic difference curve (chromatic difference for each tone when the 255 gradation value is set to 0) graph to display the following menu, which allows you to copy the graph and data to the clipboard or a file.

- |                        |                |                         |                   |
|------------------------|----------------|-------------------------|-------------------|
| Right-click on a graph | → to Clipboard | → Plot data (for Excel) |                   |
|                        |                | Back Color: Black       |                   |
|                        |                | Back Color: White       |                   |
|                        | to File        | → Plot data (for Excel) |                   |
|                        |                | Back Color: Black       | → Image Size: 50% |
|                        |                |                         | Image Size: 100%  |
|                        |                |                         | Image Size: 150%  |
|                        |                |                         | Image Size: 200%  |
|                        |                | Back Color: White       | → Image Size: 50% |
|                        |                |                         | Image Size: 100%  |
|                        |                |                         | Image Size: 150%  |
|                        |                |                         | Image Size: 200%  |

## 2-4. Flicker measurement (JEITA)

Click the [JEITA] tab to bring up the following screen, where you can set the JEITA frequency resolution. Click [Measure] to start measurement. The JEITA flicker measurement values, frequency characteristics, and waveform are displayed.

**JEITA frequency resolution**

**Measured value (dB)**

**Frequency characteristics**

**Waveform**

No.	JEITA	6Hz	7Hz	8Hz	9Hz	10Hz	11Hz	12Hz	13Hz	14Hz	15Hz	16Hz	17Hz	18Hz	19Hz	20Hz	21Hz	22Hz	23Hz	24Hz	25Hz	26Hz
1	-68.36	-70.06	-75.47	-71.06	-87.28	-73.48	-73.41	-82.65	-71.23	-68.80	-73.07	-76.71	-74.88	-85.86	-84.36	-79.83	-87.51	-76.54	-74.80	-78.24	-78.34	-77.83
2	-67.85	-71.60	-67.85	-73.06	-78.00	-73.40	-73.61	-81.20	-82.37	-80.34	-84.68	-83.75	-79.74	-75.27	-83.31	-81.52	-84.11	-79.86	-78.13	-86.39	-84.53	-87.14
3	-69.16	-70.30	-70.81	-69.16	-73.45	-94.96	-75.56	-73.56	-83.53	-82.18	-71.56	-74.15	-81.96	-76.76	-76.11	-79.81	-78.55	-86.83	-89.46	-93.04	-83.42	-82.03
4	-70.21	-83.81	-70.41	-70.85	-76.10	-76.99	-86.63	-73.56	-76.28	-77.91	-75.68	-79.69	-83.08	-81.40	-84.17	-80.45	-82.43	-77.28	-78.53	-89.44	-90.47	-85.53
5	-66.24	-67.53	-66.24	-69.25	-74.96	-86.31	-78.10	-84.48	-81.38	-91.09	-73.30	-83.84	-81.10	-83.29	-80.72	-82.34	-81.99	-84.44	-91.59	-83.53	-81.31	-84.07
6	-65.91	-78.92	-65.91	-67.92	-67.73	-84.04	-92.22	-76.14	-87.13	-76.53	-73.64	-76.62	-79.58	-78.37	-80.44	-80.84	-86.54	-91.87	-84.27	-85.53	-83.28	-86.57
7	-66.09	-66.09	-69.40	-66.49	-74.89	-72.97	-85.84	-79.86	-77.78	-92.76	-83.25	-81.79	-80.75	-85.34	-77.06	-72.16	-73.41	-90.18	-83.11	-89.15	-80.92	-76.14
8	-68.83	-71.28	-71.67	-68.83	-80.24	-78.02	-79.53	-75.27	-83.46	-75.81	-72.23	-72.35	-83.09	-91.80	-84.41	-93.17	-87.20	-88.75	-84.09	-78.89	-88.37	-86.81
9	-66.87	-70.10	-66.87	-68.02	-87.95	-75.21	-80.49	-81.35	-81.82	-74.03	-70.89	-78.49	-84.03	-82.84	-71.23	-74.41	-81.88	-76.76	-75.46	-77.14	-80.95	-92.96
10	-54.98	-56.24	-54.98	-64.08	-59.54	-55.42	-58.51	-62.17	-66.88	-70.36	-73.57	-82.40	-72.72	-71.01	-74.39	-74.67	-72.69	-75.60	-79.08	-80.69	-77.26	-76.31

Right-click on the graph to display the following menu, which allows you to copy the graph and data to the clipboard or a file. You can also change the scale on the Waveform graph.

The right-click functions accessible by right-clicking over the list or trend graph are the same as those for chromaticity measurement.

### Power Spectrum graph

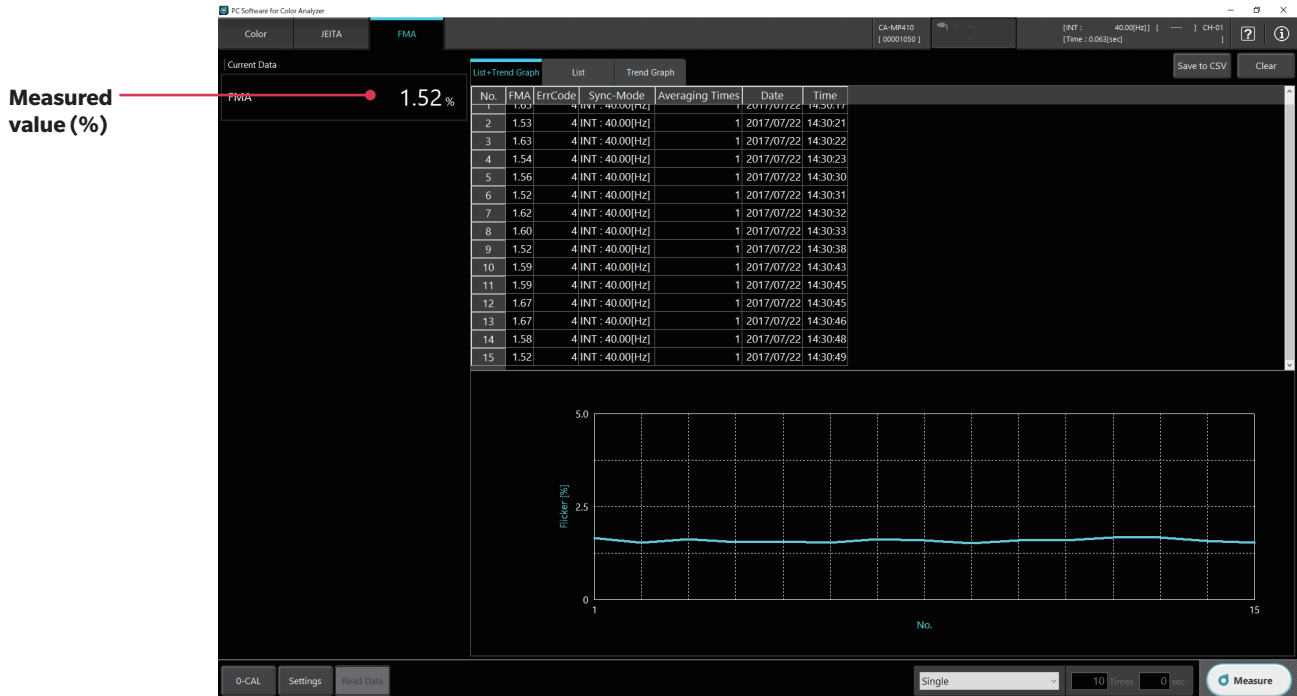
- Right-click → to Clipboard → Back Color: Black
- Back Color: White
- to File → Back Color: Black
- Image Size: 50%
- Image Size: 100%
- Image Size: 150%
- Image Size: 200%
- Back Color: White → Image Size: 50%
- Image Size: 100%
- Image Size: 150%
- Image Size: 200%

### Waveform graph

- Right-click → Change Scale
- to Clipboard → to Excel
- Back Color: Black
- Back Color: White
- to File → CSV
- Back Color: Black → Image Size: 50%
- Image Size: 100%
- Image Size: 150%
- Image Size: 200%
- Back Color: White → Image Size: 50%
- Image Size: 100%
- Image Size: 150%
- Image Size: 200%

## 2-5. Flicker measurement (FMA)

Click the [FMA] tab to bring up the following screen and click [Measure] to start measurement. The FMA flicker measurement values are displayed.



Right-click on the list or graph to copy the graph and data to the clipboard or a file. The right-click menu is the same as that for chromaticity measurement.

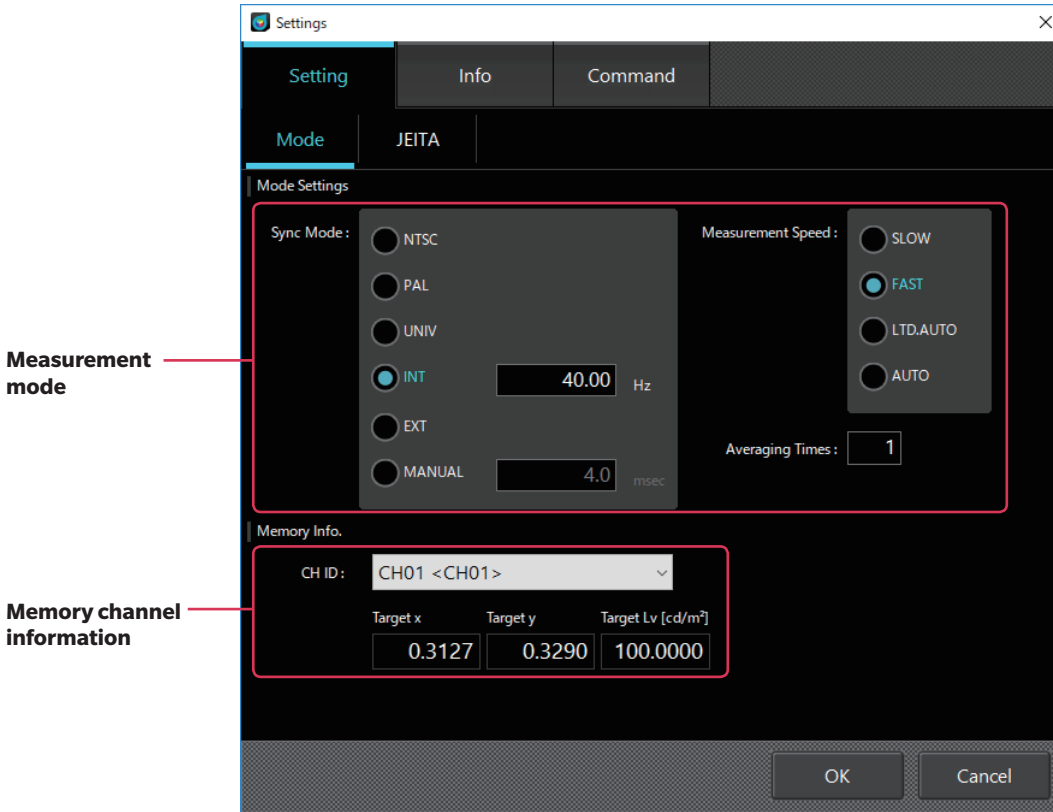


### 3. Measurement condition settings

<Settings> window

Click [Settings] among the individual functions to bring up the following pop-up window for setting the measurement conditions and optional items.

#### 3-1. Measurement condition settings <Setting> tab



#### 3-1-1. Measurement mode settings [Mode tab - Mode Settings]

○ Sync Mode : Select the mode for synchronized measurement. (NTSC/PAL/UNIV/INT/EXT/MANUAL)

Measurement synchronization mode	Description of mode	Measurement time (Sampling time)	Vertical scanning frequency	Vertical synchronization signal input
NTSC	Mode for measuring NTSC displays	33.3 ms	59.94 Hz	Not required
PAL	Mode for measuring PAL and SECAM displays	40.0 ms	50 Hz	Not required
EXT	Mode for measuring while synchronizing with the display's vertical synchronization signal input	(1 vertical scanning period) x 2	0.50 to 240.00 Hz (For FMA, 0.50 to 130.00 Hz)	Required
UNIV.	Mode used when the display's vertical scanning frequency is unknown or cannot be input; a mode that can measure any display	100 ms	—	Not required
INT	When the display's vertical synchronization signal is known, set that information so that it can be used for measurement.	(1 vertical scanning period) x 2	Settable range 0.50 to 240.00 Hz (For FMA, 0.50 to 130.00 Hz)	Not required
MANUAL	Mode that allows you to specify the integration time	Settable range 4.0 to 4000.0 ms (For FMA, 7.7 to 4000.0 ms)	—	Not required

- Measurement Speed : Select the measurement speed. (SLOW/FAST/LTD.AUTO/AUTO)
  - Selecting FAST can shorten measurement time, but may compromise measurement repeatability for low-luminance measurements.
  - Selecting SLOW repeats FAST measurements several times to ensure measurement with high repeatability.
  - When AUTO is selected, measurements are automatically selected between SLOW, FAST, and setting with a further longer integration time depending on the luminance level.
  - When LTD.AUTO is selected, measurements are automatically selected between SLOW and FAST depending on the luminance level.

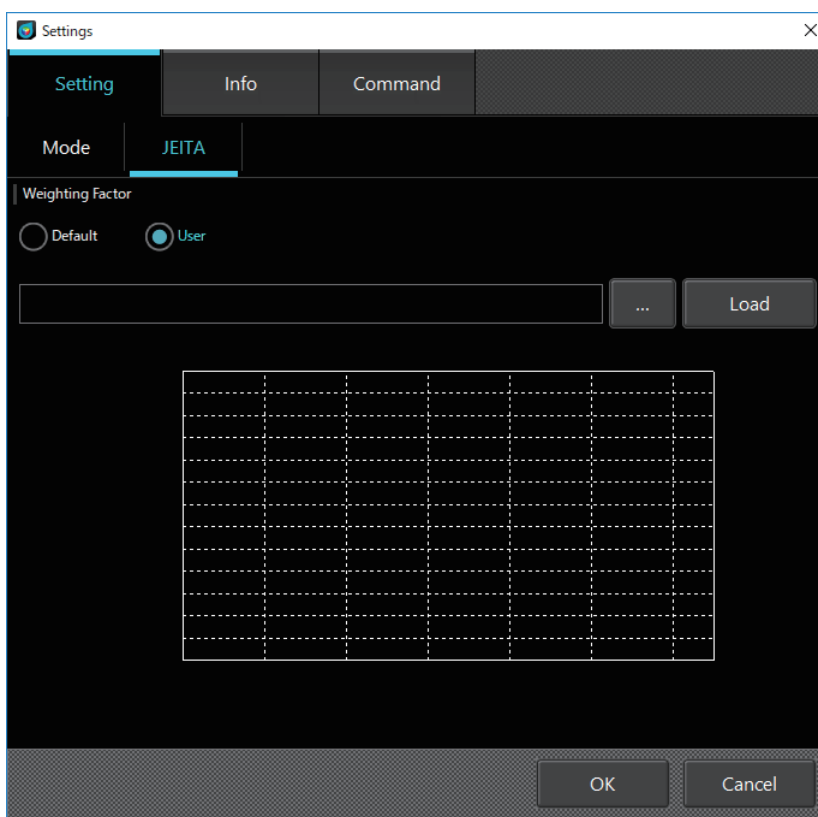
Notes: For the first measurement or when the brightness of the measurement target changes from the that in the previous measurement, the switching of ranges may result in longer measurement time.

- Averaging Times : Set the number of measurements taken to average for obtaining a single measurement value. (1 to 20)

### 3-1-2. Calibration channel selection [Mode tab - Memory Info.]

- CH ID : Select a calibrated memory channel. Measurement values are corrected using the calibration coefficient of the selected memory channel. If you do not need such correction, select CH00. The target saved to the selected memory channel is displayed.

### 3-1-3. JEITA frequency characteristics settings [JEITA tab - Weighting Factor]



- Weighting Factor : Specify the frequency characteristics for JEITA flicker measurements.
  - When “Original” is selected, a filter adjusted to the human eye, a KONICA MINOTA original filter, is used.
  - When “User” is selected, click the [Load] button to load a file containing a filter created by the user to be used for measurement. In the text file (.txt), include the starting frequency, end frequency, frequency pitch, number of data sets, and the respective gains in tab-delimited format.

Text file content:

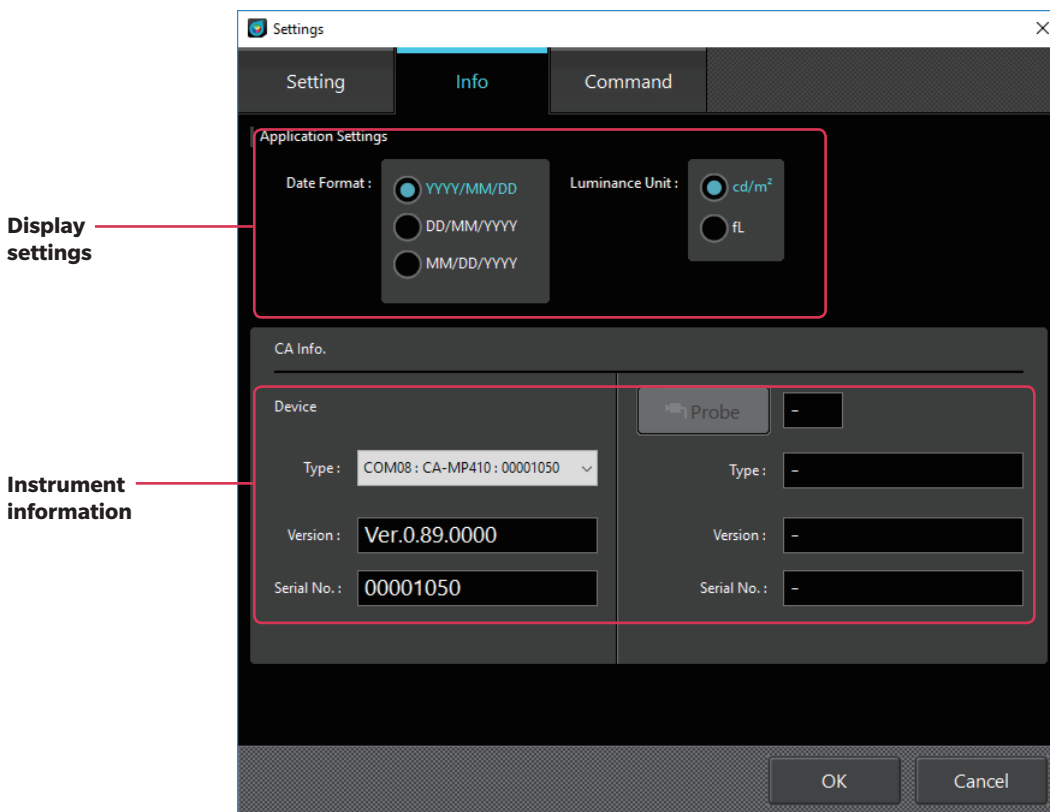
<Starting frequency>	<End frequency>	<Frequency pitch>	<Number of data sets>
<Frequency>	<Value>		
.	.		
.	.		
.	.		
.	.		

Example of text file content:

0.01	65	0.01	6500
0.01	1.0		
0.02	1.0		
.	.		
.	.		
.	.		
65	0.0		

Click [OK] to confirm the settings or click [Cancel] to cancel the edit and close the pop-up.

### 3-2. Option settings <Info> tab



#### 3-2-1. Selecting the date display format and luminance unit

Application Settings

- Date Format : Select a date display format.
- Luminance Unit : Select a luminance unit.

If the selection of [Luminance Unit] is not displayed on the screen, exit the software, and restart the software after adding “/u” as the startup option for the software execution file “CA-S40.”

#### 3-2-2. Instrument selection CA Info.

This screen appears first when the software is started with multiple instruments connected to the PC. Information about the selected instrument is displayed.

Device:

Among the instruments connected to the PC, select the one to be used in the drop-down menu. Information about the selected instrument (firmware version and serial number) is displayed.

If a data processor is selected as the instrument to be used, then also select the probe connected to the data processor in the [Probe] field on the right.

Information about the selected probe (firmware version and serial number) is displayed.

- Type : Displays the type of instrument connected.
- Version : Displays the firmware version of the selected instrument.
- Serial No. : Displays the serial number of the selected instrument.

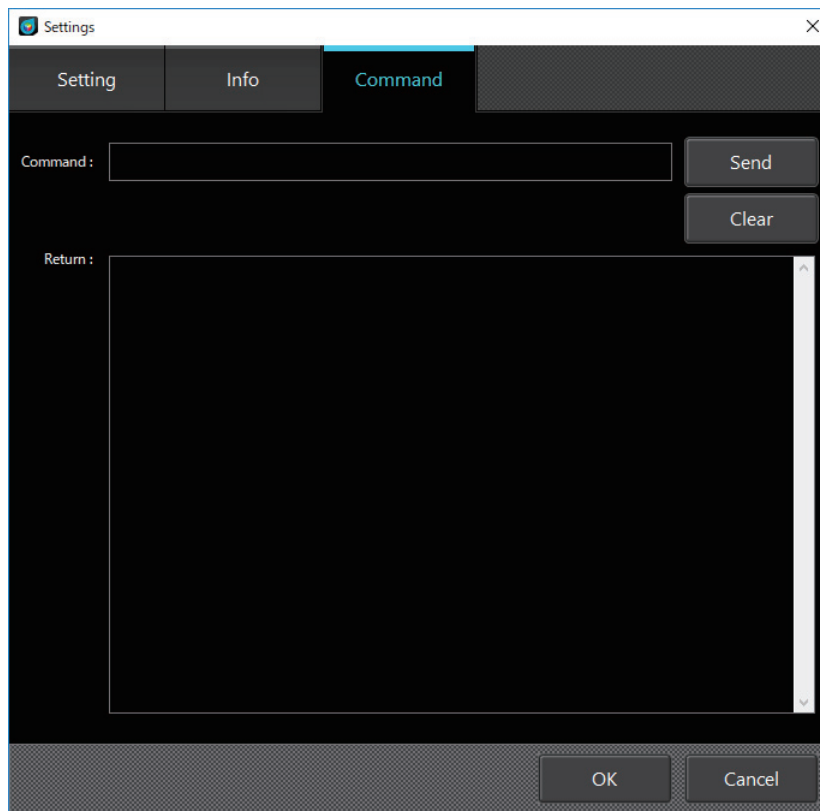
Click [OK] to confirm the settings or click [Cancel] to cancel the edit and close the pop-up.

### 3-3. Command communication <Command> tab

The user can check the operations of communication commands when developing original software.

The specifications of communication commands are available for download from the following product support webpage:

<https://www.konicaminolta.com/instruments/download/>



- Command : Enter a command to be sent and click [Send] to send it to the instrument.
- Return : Displays the command reception result from the instrument.

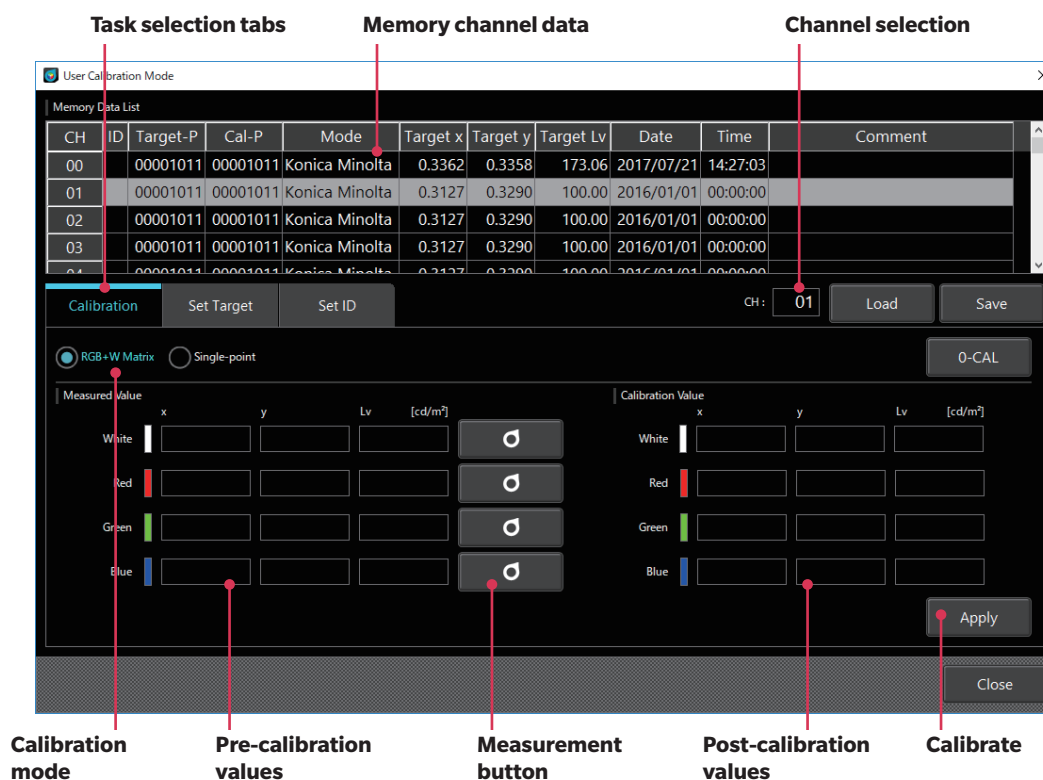
## 4. User calibration

### 4-1. About user calibration <User Calib> tab

- User calibration allows users to set their own correction coefficients to the memory channel of the probe by measuring any colors and setting calibration values to the probe. After setting, the values corrected with the specified correction coefficients can be displayed and output for every measurement.
- As user calibration, you can select single-point calibration or RGB+W matrix calibration.
- User calibration can be performed for every memory channel (except for CH00).
- User calibration cannot be performed for CH00 because it is calibrated in accordance with the Konica Minolta calibration standard.
- You can use user calibration to apply the following corrections to measurements based on the specified correction coefficients.
  - Correct the difference in the reading due to the inconsistencies in the spectral response of the light-receiving element of the probe.
  - Correct the difference in the readings between probes used simultaneously.

### 4-2. User calibration procedure

- Click the [User Cal] button on the chromaticity measurement screen to open the pop-up window for user calibration.
- The memory channel (CH00 to CH99) data is read from the probe before displaying the pop-up window.
- As memory channel data, the ID, target probe, calibration probe, calibration mode, Lv,x,y, calibration date/time, and comments are displayed.
- A user calibration coefficient is written to the specified memory channel. If a coefficient is already written in that memory channel, it is overwritten.
- The target value used is written to a memory channel as its target. If target data is already written in that memory channel, it is overwritten.
- Performing zero calibration by clicking the [0-CAL] button is recommended before running a calibration.



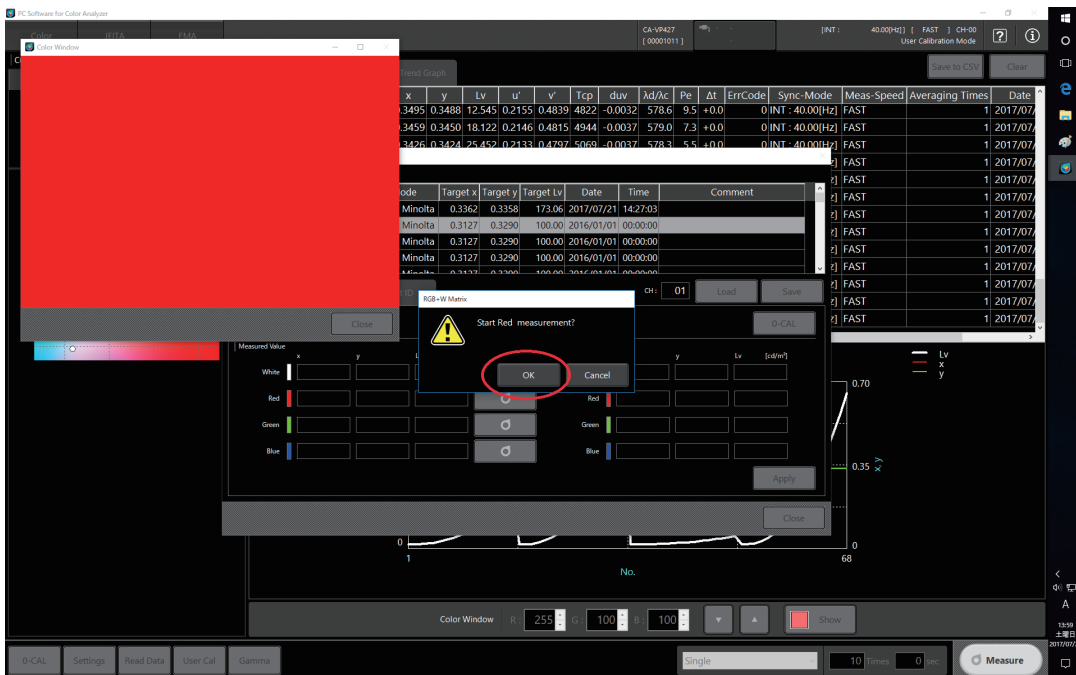
#### 4-2-1. User calibration (Matrix calibration)

- (1) Select the [Calibration] tab.
- (2) Select the memory channel to be calibrated. (CH01 to CH99)
  - Click over the memory channel data.
- (3) As calibration mode, select [RGB+W Matrix]. Repeat the following steps, (4) through (6), for Red, Green, Blue, and White.
  - You can start from any color (Red, Green, Blue, or White) when performing steps (4) to (6). As an example, the following explains how to measure Red and enter a target.

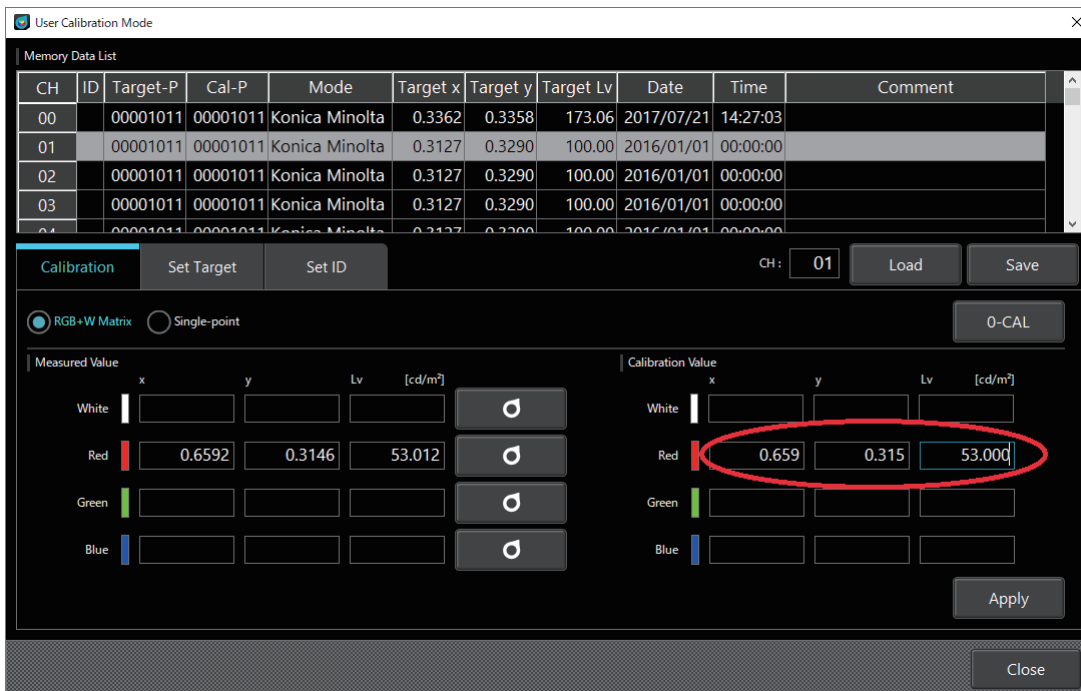
- (4) To measure Red, click the measurement button on the right of Red in the [Measured Value] field, which shows the color display window for measuring Red.



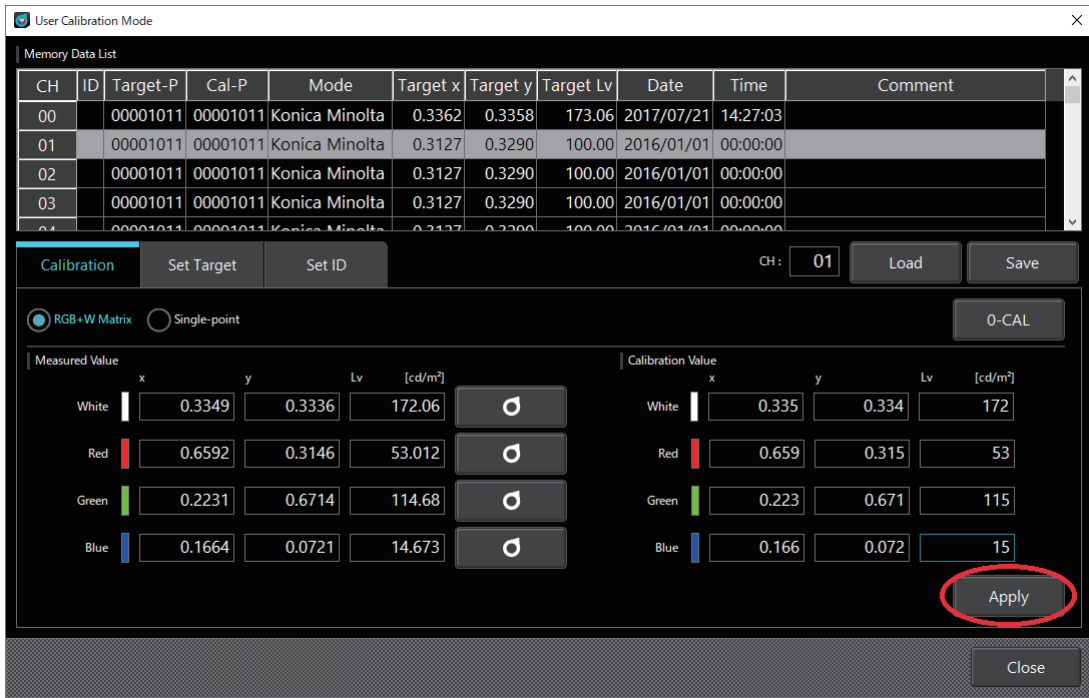
- (5) After you align the color display window and the instrument and click [OK] on the pop-up screen, the measured value is displayed in the [Measured Value] field for Red. After measurement is completed, click the [Close] button in the color display window to close the window.



- (6) Enter the target values you want to correct and display in the [Calibration Value] field.



- (7) After performing measurement and entering targets for all of Red, Green, Blue, and White, click the [Apply] button to complete matrix calibration.
- To stop the calibration, click [Close]. The change is not applied until you click the [Apply] button.



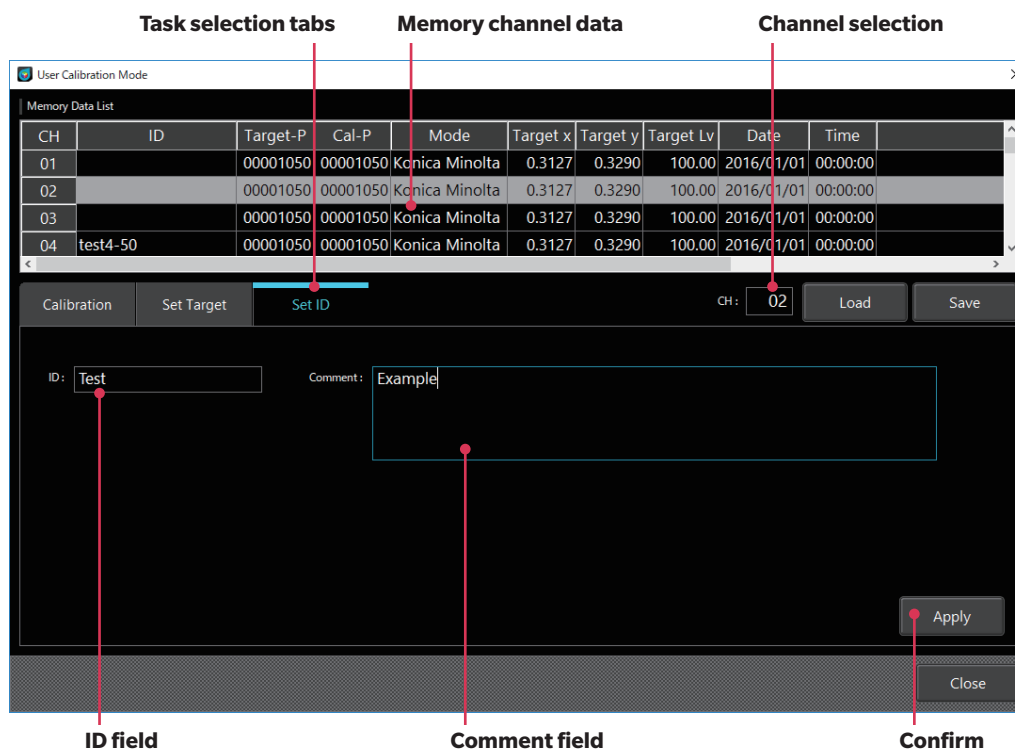
## 4-2-2. White calibration (Single-point calibration)

- (1) Select the [Calibration] tab.
- (2) Select the memory channel to be calibrated. (CH01 to CH99)
  - Click over the memory channel data.
- (3) As calibration mode, select [Single-Point].
- (4) Click the measurement button on the right of White in the [Measured Value] field to measure and obtain the value.
- (5) In the [Calibration Value] field, enter the target values that you want corrected for display.
- (6) Click [Apply] to complete the calibration.
  - To stop the calibration, click [Close]. The change is not applied until you click [Apply].

## 4-2-3. ID setup

You can add an ID and comment to a memory channel to make it easier to distinguish.

- (1) Select the [Set ID] tab.
- (2) Select a memory channel. (CH00 to CH99)
  - Click over the memory channel data.
- (3) Enter an ID in the ID text box. You can enter a comment in the Comment text box.
  - You can enter up to 10 alphanumeric characters for an ID and up to 50 alphanumeric characters as a comment.
- (4) Click [Apply]. The change is not applied until you click [Apply].
- (5) The entered ID and comment are applied.





### <Notes on user calibration>

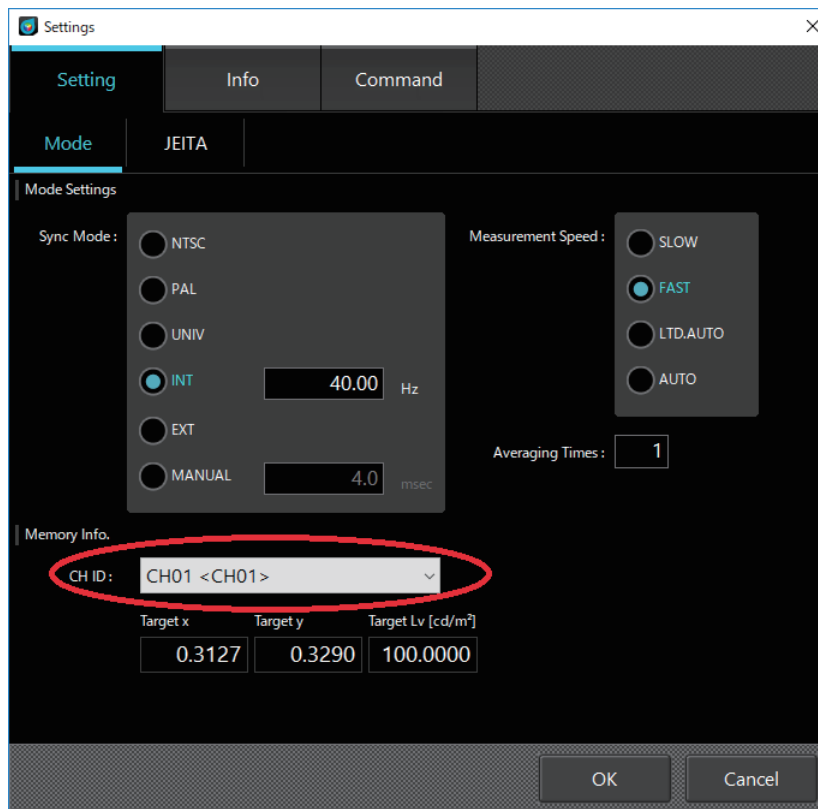
- Correction coefficients are used for all measurement modes (Lv xy, Lv u' v', Lv Tcp duv, XYZ, and Lvld Pe).
- You cannot perform user calibration for channel CH00.  
(CH00 is a channel for performing measurement in accordance with the Konica Minolta calibration standard.)
- Performing matrix calibration for a preset channel erases the last-set value.
- Performing matrix calibration for a single-point-calibrated channel erases the correction coefficients for the last single-point calibration and sets correction coefficients for matrix calibration.
- The target value used is written to a memory channel as its target. If target data is already written in that memory channel, it is overwritten.

## 4-3. Specifying the calibration coefficients <Settings> window

To perform measurement using your own correction coefficients, specify which memory channel's correction coefficients you want to use. Specify [CH00] to perform measurement without performing correction but in accordance with the Konica Minolta standard.

### 4-3-1. Selecting a calibrated memory channel

- (1) Click [Settings] to bring up the following pop-up window for setting the measurement conditions and optional items.
- (2) In the [CH ID:] field under [Memory Info.] in the [Setting] tab, select a calibrated memory channel.  
The target saved to the memory channel is displayed in the pane below for your review.
- (3) Click [OK] to confirm the memory channel for which the correction coefficients are to be used. The pop-up closes.  
Click [Cancel] to close the pop-up without confirming the calibration channel.



## 5. Target settings

The target values used for user calibration are written as the target in a memory channel. If you want to set a separate target for color difference assessment (this function is available with a data processor), you can set a target in a memory channel using [Set Target]. While any target data already written in that memory channel is overwritten, the set correction coefficients remain the same. If you do not want to lose the target values used for user calibration, it is recommended that you set them in a channel different from the one you used for user calibration.

- Click the [User Cal] button on the chromaticity measurement screen to open the pop-up window for user calibration.
- The memory channel (CH00 to CH99) data is read before displaying the pop-up window.
- As memory channel data, the ID, target probe, calibration probe, calibration mode, Lv,x,y, calibration date/time, and comments are displayed.

### 5-1. Setting the target

**Task selection tabs**      **Memory channel data**      **Channel selection**

CH	ID	Target-P	Cal-P	Mode	Target x	Target y	Target Lv	Date	Time
01		00001050	00001050	Konica Minolta	0.3127	0.3290	100.00	2016/01/01	00:00:00
02		00001050	00001050	Konica Minolta	0.3127	0.3290	100.00	2016/01/01	00:00:00
03		00001050	00001050	Konica Minolta	0.3127	0.3290	100.00	2016/01/01	00:00:00
04	test4-50	00001050	00001050	Konica Minolta	0.3127	0.3290	100.00	2016/01/01	00:00:00

Calibration    **Set Target**    Set ID    CH: 01    Load    Save

Measured Value

x	y	Lv	[cd/m <sup>2</sup> ]
0.3338	0.3350	177.90	

Apply    Close

**Calibration mode**      **Measurement button**      **Setup**

#### (1) Setting the target

- (1) Select the [Set Target] tab.
- (2) Select the memory channel in which the target is set. (CH01 to CH99)
  - Click over the memory channel data or select from the channel selection drop-down menu.
- (3) Enter the target values in the [Measured Value] field or obtain the value by clicking the measurement button on the right side. The values can be rewritten after measurement. Performing zero calibration by clicking the [O-CAL] button is recommended before running a measurement.
- (4) Click [Apply] to complete setting the target. The change is not applied until you click [Apply].

#### (2) Setting the ID

To set the ID or enter a comment, follow the same procedure as for setting the ID and entering a comment for user calibration. See 4-2-3 on P.B17 for instructions on how to set the ID. (ID is set for a memory channel.)

# C

## Appendix

Error message .....	C2
Caution .....	C2
Instruction.....	C4
Information .....	C6

**Error message: The operation is not correct. Follow the instructions displayed immediately.**

Message	Details
--failed to write or read on memory --reconnect the probe	A memory error has occurred inside the probe. If this condition persists after reconnecting, contact a service center to deal with the possible malfunction.
--System error --restart and application and a device	A program operation error has occurred inside the probe or SDK. If this condition persists after restarting, contact a service center to deal with the possible malfunction.
--SDK has problem --restart SDK	A program operation error has occurred inside the SDK. If this condition persists after restarting, contact a service center to deal with the possible malfunction.
Unknown error.	An unknown error code has been returned from the SDK. Due to the possibility of having an incompatible version, re-installation is recommended.
Cannot calibrate selected channel.	The selected channel cannot be calibrated. If the channel in question is not CH00, that channel may be locked. Contact a service center.
Cannot set target on selected channel.	Target cannot be set for the selected channel. The channel may be locked. Contact a service center.

**Caution : The setting or operation is not correct.**

Message	Details
Cannot open the manual Make sure that a PDF reader is installed and it is set as the default app for PDFs.	PDF viewer software for displaying the manual cannot be opened. Check whether PDF viewer software is installed and set to default.
Cannot find the manual Please check your app installation.	The manual is not found. The manual may have been moved from the correct folder path. Re-install CA-S40.
Failed to connect to selected probe. Please check probe connection.	This message appears when connection to a probe fails while a data processor is connected. Check the connection with the probe, and establish the connection again after restarting the application.
CA device not connected. Please connect device.	This message appears when the application is started without connecting a probe or an instrument. Restart the application after checking the connection.
[Max] is invalid. Please set it to [Min] - 99999.0.	This is an error in the manual setting of the vertical axis scale in the Waveform graph on the JEITA screen. The maximum value must be greater than the minimum value, but less than 99999.0.
[Min] is invalid. Please set it to -5 - [Max].	This is an error in the manual setting of the vertical axis scale in the Waveform graph on the JEITA screen. The minimum value must be smaller than the maximum value, but no lower than -5.0.
[Max] and [Min] cannot be the same.	The maximum and minimum values may not be the same.
Failed to re-connect to device. Please disconnect and connect the device again.	Reconnection to the device failed. The device must be reconnected.
Failed to connect to device. Please check device connection.	Reconnection of the device failed. Check the device connection status.
Cannot complete measurement. (ERROR: [SDK error message])	Measurement failed. Follow the instructions in the error message.
Device connection failed. Please check selected device.	Reconnection of the device failed. Check the device connection status.
Cannot calibrate CH00. Select other CH.	CH00 cannot be calibrated. Specify a different channel for calibration.
[WHITE/RED/GREEN/BLUE Lv] has input value error. Please input 0.0001 to 99999.0	True value input of Lv for one of the RGBW colors is out of range. Input a value between 0.0001 and 99999.0.

Message	Details
[WHITE/RED/GREEN/BLUE x] has input value error. Please input 0.0001 to 0.9999.	True value input of x for one of the RGBW colors is out of range. Input a value between 0.0001 and 0.9999.
[WHITE/RED/GREEN/BLUE y] has input value error. Please input 0.0001 to 0.9999.	True value input of y for one of the RGBW colors is out of range. Input a value between 0.0001 and 0.9999.
[WHITE/RED/GREEN/BLUE x] or [WHITE/RED/GREEN/BLUE y] has input value error. Make sure $x+y \leq 1$ .	True value input of x or y for one of the RGBW colors is out of range. Check whether $x + y$ is 1 or less.
Invalid memory channel ID. ID is too long (Max of 10 characters only).	Memory ID input character count exceeds character limit.
Invalid memory channel comment. Comment is too long (Max of 50 characters only).	Comment input character count exceeds character limit.
Loaded file is invalid. Please select .dat file.	Loaded calibration data file has incorrect data format.
[Times] has input value error. Please input a valid number.	A non-numeric value is entered for the number of measurements for interval measurement. Use only numeric values.
[Times] has input value error. Please input 0 - 40000 measurements.	An out-of-range value is entered for the number of measurements for interval measurement. Use a value within the specified range.
[sec] has input value error. Please input a valid number.	A non-numeric value is entered for the measurement interval time for interval measurement. Use only numeric values.
[sec] has input value error. Please input 0 - 7259 sec.	The measurement time interval input is out of range when the interval count is specified within 1 to 4000. Enter a value within 0 to 7259 seconds.
[sec] has input value error. Please input 1 - 7259 sec.	The measurement time interval input is out of range when the interval count is specified within 4001 to 40000. Enter a value within 1 to 7259 seconds.
[Wait] has input value error. Please input a valid number.	A non-numeric value is entered for the inter-tone wait time for gamma measurement. Use only numeric values.
[Wait] has input value error. Please input 0 - 36000 x 100 msec.	An out-of-range value is entered for the inter-tone wait time for gamma measurement. Enter a value within 0 to 36000.
INT Sync Mode setting is invalid. Please go to Settings and set INT value to 0.50 - 130.00 Hz.	Sync Mode INT out of range is entered for FMA measurement. Enter a value within 0.50 Hz to 130.00 Hz.
MANUAL Sync Mode setting is invalid. Please go to Settings and set MANUAL value to 7.7 - 4000.0 msec.	Sync Mode INT out of range is entered for FMA measurement. Enter a value within 7.7 to 4000.0 msec.
[INT] has input value error. Please input a valid number.	A non-numeric value is entered for Sync Mode INT. Use only numeric values.
[INT] has input value error. Please input 0.50 - 240.00 Hz.	An out-of-range value is entered for Sync Mode INT for colorimetry. Use a value within the specified range.
[INT] has input value error. Please input 0.50 - 130.00 Hz.	An out-of-range value is entered for Sync Mode INT for FMA measurement. Use a value within the specified range.
[MANUAL] has input value error. Please input a valid number.	A non-numeric value is entered for Sync Mode MANUAL. Use only numeric values.
[MANUAL] has input value error. Please input 4.0 - 4000.0 msec.	An out-of-range value is entered for Sync Mode MANUAL for colorimetry. Use a value within the specified range.
[MANUAL] has input value error. Please input 7.7 - 4000.0 msec.	An out-of-range value is entered for Sync Mode MANUAL for FMA measurement. Use a value within the specified range.
[Averaging Times] has input value error. Please input a valid number.	A non-numeric value is entered for averaging times. Use only numeric values.
[Averaging Times] has input value error. Please input 1 - 255.	An out-of-range value is entered for the number of averaging measurements. Use a value within the specified range.

Message	Details
File has incorrect format. Please input a valid file.	Weighting factor data for JEITA measurement could not be read. Check the file format.
Cannot get the saved weighting factor data.	Weighting coefficient data for flicker that has been read cannot be acquired. Load the weighting coefficient data file again.
Filepath does not exist. Please input a valid path.	File path is incorrect. Specify the correct path.
User-defined weighting factor data was not loaded. The previous setting will be retained. Do you want to proceed?	File cannot be loaded because of an error in the file format. Use the current settings or try applying the settings again.
The weighting factor setting will be reverted to the previous setting Do you want to proceed?	Settings reverted to the original setting.
Cannot overwrite existing file. Check that it is not in use.	Data cannot be saved to file due to reasons such as the save file is currently in used. Check the file.
--no_sync_signal --input an external synchronization signal	Vertical synchronization signals are not input in external synchronization mode. Check the signal transmitter and the connection status.
--data value is too high --set a color within CA's measuring range	The brightness of the measurement target exceeds the upper limit. Either adjust the brightness so that it is within the measurable range or use a high-luminance probe.
--failed to calculate color temp --Retry the measurement	Retry the measurement.
--FMA Flicker Value is out of range	Retry the measurement.

**Instruction: The flow of operation is displayed. Perform the operation according to the information displayed.**

Message	Details
Please wait for a moment.	A task is running. Please wait until the task is completed.
Transferring to Datalist...	Continuous/Interval measurement data is being transferred from the buffer to the list. Please wait until the task is completed.
Please perform 0-CAL.	This message appears when zero calibration is required. Perform zero calibration according to the information displayed.
Continuous measurement in progress. Please stop measurement first.	This message appears when you try to exit the application while Continuous measurement is running. Exit the application after stopping the measurement.
Interval measurement in progress. Please stop measurement first.	This message appears when you try to exit the application while Interval measurement is running. Exit the application after stopping the measurement.
Closing the application will clear all measurement data. Do you want to proceed?	This message appears when you try to exit the application when there is still measurement data. If the measurement data needs to be saved, use the [Save to CSV] button to save the data before exiting the application.
Device was changed. Do you want to apply previous probe settings to the new device?	This message appears when a new device has been connected to the application. If you want to use the settings for an existing device, click [Yes]. If you want to use the settings in the new device, click [No].
Start 0-CAL?	This message appears when the zero calibration button is pressed. Press [No] if you are not running the zero calibration.
Please input a valid number.	This message appears when an invalid value (such as characters) is entered for true value input for calibration. Enter a numeric value.
Start [WHITE/RED/GREEN/BLUE] measurement?	A message is displayed prompting whether or not to perform monochromatic measurement for calibration. While this message is displayed, you can change the position of the Color Window for measurement.
Start Target setting?	This message prompts whether or not to set the target.

Message	Details
The work is processing. Switch to other tab?	Switching to another tab results in the loss of edits and measurement data. If necessary, finish the tasks before switching tabs.
Delete CH data from all probes?	This message asks for confirmation whether to delete the data in the selected channel that saves measurement data.
Delete all data?	This message asks for confirmation whether to delete all data in the channels that save measurement data.
Overwrite [file name]?	This message asks for confirmation whether to overwrite the file for channels that save measurement data.
Executing continuous measurement will clear previous measurement data. Do you want to proceed?	This message appears when you try to run a continuous measurement while there is measurement data. If the measurement data is necessary, save it before running the measurement.
Executing interval measurement will clear previous measurement data. Do you want to proceed?	This message appears when you try to run an interval measurement while there is measurement data. If the measurement data is necessary, save it before running the measurement.
Executing package measurement will clear previous measurement data. Do you want to proceed?	This message appears when you try to run a package measurement while there is measurement data. If the measurement data is necessary, save it before running the measurement.
Executing Gamma measurement will clear previous measurement data. Do you want to proceed?	This message appears when you try to run a gamma measurement while there is measurement data. If the measurement data is necessary, save it before running the measurement.
Executing measurement will clear gamma measurement data. Do you want to proceed?	This message appears when you try to run another measurement while there is gamma measurement data. If the measurement data is necessary, save it before running the measurement.
Entering gamma measurement mode will clear previous measurement data. Do you want to proceed?	This message appears when you try to open the gamma measurement window while there is measurement data. If the measurement data is necessary, save it before running the measurement.
Closing the window will clear Gamma measurement data and graphs. Do you want to proceed?	This message appears when you try to close the gamma window while there is gamma measurement data. If the measurement data is necessary, save it before running the measurement.
Changing JEITA sampling condition will clear previous JEITA measurement data. Do you want to proceed?	This message appears when you try to change the JEITA sampling conditions while there is JEITA measurement data. If the measurement data is necessary, save it before running the measurement.
Data are over capacity. Max capacity = 40000	This message appears when the number of measurements reaches the maximum limit. Save the data first, and then clear it.
Delete data?	This message appears when deleting list data. If you need the data, save it first.
Start Gamma Measurement? Tone: [User specified tone] Wait Time: [User specified time] msec	Start gamma measurement? Tone: [User-specified tone] Wait time: [User-specified time] msec
The device was changed. Do you want to apply current settings to the new device?	The settings from the previously connected device can be applied to the newly connected device.
Please specify image format	Specify the image format.
Cannot save current data in file **	Measurement values cannot be saved.

**Information : Updated information is provided.**

Message	Details
New CA device is connected.	This message appears when a different device is connected after the USB connection has been disconnected or when there is a device switchover from the Settings screen.
New probe is connected.	This message appears when a separate probe is selected while a data processor is connected.
Another PC Software for Color Analyzer instance is already running.	This message indicates a repeated launch attempt. Multiple copies of the software cannot run simultaneously.
Re-connection to device in progress...	Re-connection to the device is in progress. Wait without unplugging the USB flash drive.
0-CAL in progress. . .	Zero calibration is in progress.
Measurement is cancelled.	The measurement has been canceled.
RGB+W Matrix is successfully applied.	RGB+W matrix calibration has been successfully completed.
Single-point is successfully applied.	Single-point calibration has been successfully completed.
Set Target is successfully applied.	Color difference target has been successfully set.
ID and Comment are successfully applied.	ID and comment have been successfully set.
Calibration measurement failed.	Measurement for calibration failed.
Target measurement failed.	Measurement for setting the target failed.
Read data in progress. . .	Instrument data is being read.
Saving data for Log No. [No.]...	Log data is being saved.
No data selected.	Data has not been selected.
No available data.	There is no operable data.
Cannot delete measurement data.	Measurement data cannot be deleted.
No data to save.	There is no data to be saved.
Gamma measurement cancelled.	Gamma measurement has been canceled.
Interval measurement in progress...	Interval measurement is in progress.
Package measurement in progress...	Package measurement is in progress.
JEITA flicker measurement in progress...	JEITA measurement is in progress.
Reading memory...	Memory is being read.
Please check the boxes corresponding to the colors to be measured.	No color has been selected to be measured. Check the check boxes of the colors to be measured.



**< CAUTION >**

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