Display Color Analyzer CA-310

INSTRUCTION MANUAL



Before using this instrument, please read this manual.



Safety Symbols

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



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



Denotes a sentence regarding safety precautions for risk of fire. Read the sentence carefully to ensure safe and correct use.



Denotes a sentence regarding safety precautions for risk of electric shock. Read the sentence carefully to ensure safe and correct use.



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



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



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



Denotes a prohibited operation. The part must never be disassembled.



Denotes an instruction. Connect the grounding terminal as instructed.

SIP/SOP Connections

- Accessories equipment connected the analog and digital interfaces must be certified to the respective IEC standards (i.e. IEC 60950 for data processing equipment).
- Furthermore all configurations shall comply with the system standard IEC 61010-1. Everybody who connects additional equipment to the signal input part or signal output part configures a electrical equipment for measurement system, and is therefore, responsible that the system complies with the requirements of the system standard (IEC 61010-1. If in doubt, consult the technical services department or your local representative).

Notes on this Manual

- Copying or reproduction of all or any part of the contents of this manual without KONICA MINOLTA's permission 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 any errors, please contact a Konica Minolta authorized service facility.
- KONICA MINOLTA will not accept any responsibility for consequences arising from the use of the instrument.

Safety Precautions

When using this hardware, the following points must be strictly observed to ensure correct and safe use. After you have read this manual, keep it in a safe place so that it can be referred to easily whenever it is needed.

	Do not use the CA-Series in places where flam- mable or combustible gases (gasoline etc.) are present. Doing so may cause a fire.	When disconnecting the AC power cord's plu always hold the plug and pull it to remove it. New pull the AC power cord itself. Doing so may da age the AC power cord, causing a fire or elect
	Always use the AC power cord supplied as a standard accessory (for $100-120V \sim$ or for $200-240V \sim$) with the CA-Series, and connect it to an AC outlet . Failure to do so may damage the	shock. In addition, do not insert or disconnect to AC power cord's plug with wet hands. Doing may cause electric shock.
Ŷ	CA-Series, causing a fire or electric shock.	Do not disassemble or modify the CA-Series. D ing so may cause a fire or electric shock.
	Securely insert the power plug as far as it will go. If the plug is not fully inserted, fire or electric shock may result.	
	Do not bend, twist or pull the AC power cord ex- cessively. In addition, do not place heavy items on the AC power cord, or damage or modify it in any way. Doing so may cause damage to the AC power cord, resulting in fire or electric shock.	Take special care not to allow liquid or metal of jects to enter the CA-Series. Doing so may caus fire or electric shock. Should liquid or metal of jects enter the CA-Series, turn the power OFF i mediately, disconnect the AC power cord from the AC powe
	If the CA-Series will not be used for a long time, disconnect the AC power cord from the AC out-	AC outlet, and contact the nearest Konica Mino authorized service facility.
	let. Accumulated dirt or water on the prongs of the AC power cord's plug may cause a fire. If there is any dirt or water on the prongs of the AC power cord's plug, remove it.	The CA-Series should not be operated if it is data aged, or smoke or odd smells are detected. Doi so may result in a fire. In such situations, turn to power OFF immediately, disconnect the AC power of the term of term
\mathbf{c}	The CA-Series should not be operated if dirt or dust has entered through the vent holes. Doing so	cord from the AC outlet, and contact the near Konica Minolta authorized service facility.
	may result in a fire. For periodic inspection, con- tact the nearest Konica Minolta authorized service facility.	Take care not to drop or overturn the CA-Serie Failure to adhere to this precaution may result injury or your body being trapped.

Do not place the instrument on an unstable or sloping surface. Doing so may result in its dropping or overturning, causing injury. Take care not to drop the instrument when carrying it.

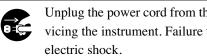


Do not block the vent. Doing so may cause fire.

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



Be sure to connect the AC power cord's plug to an AC outlet that has a protective grounding terminal. Also make sure that peripheral devices (e.g. PC) are connected to AC outlets that have a protective grounding terminal. Failure to do so may result in electric shocks.



Unplug the power cord from the outlet before servicing the instrument. Failure to do so may cause

Foreword

Thank you for purchasing the Display Color Analyzer CA-310. This instrument is designed for measurement of color, and lumminance of various types of color displays with LED Universal Measuring Probe or color, lumminance and flicker of color LCD displays with LED Flicker Measuring Probe. Before using this instrument, please read this manual thoroughly.

Notes on Use

- This instrument is designed for indoor use only, and should not be used outside.
- The instrument must never be disassembled as it is composed of precision electric components.
- Always use the rated power voltage. Connect the AC power cord (for 100-120 V or for 200-240 V) to an AC outlet. Make sure that main supply voltage fluctuates up to ±10 % of the nominal voltage.
- This instrument is classified as Pollution Degree 2(equipment which may cause temporary electrical hazards due to contamination or condensation, or products which are used in such an environment).
- Do not use the instrument at altitudes of higher than 2000 m.
- The instrument must not be used if foreign matter such as water and metal objects enter it, doing so is very dangerous.
- The instrument should not be used in certain environments, such as near a heater which will cause an excessive rise in its temperature resulting in breakdown. Therefore it should not be used in such an environment. It should be used in well-ventilated areas, and care should be taken not to allow the vent holes to become blocked.
- The instrument must not be used in areas subject to rapid changes of temperature, to avoid condensation.
- The instrument must not be used in areas where there is an excessive amount of dust or where the humidity is excessively high.
- The instrument should be used at ambient temperatures of between 10 and 28°C and humidity of 70 % relative humidity or less. Be aware that to use it beyond this condition may make it degrade the performance.
- The instrument must not be exposed to excessive impact and vibrations.
- The AC power cord must not be pulled or bent excessively nor must excessive force be exerted on it. Doing so may result in wire breakage.
- The AC power cord must not be connected to an AC line on which excessive noise is present.
- The instrument and personal computer must be grounded.
- If any irregularity or abnormality is found, turn OFF the power immediately, disconnect the AC power cord, and refer to "Troubleshooting Guide" on page 107.
- Should the instrument break down, do not try to disassemble by yourself. Contact a Konica Minolta authorized service facility.
- Zero Calibration shall be made only after duration of 30 minutes or more passed since the power supply switch is turned ON if the luminance of the display to be measured is the following.
 - 1.0 cd/m² or less for LED Universal Measuring φ27 Probe (CA-PU32, CA-PU35) / LED Flicker Measuring φ27 Probe (CA-P32, CA-P35)
 - 3.0 cd/m² or less for LED Universal Measuring ϕ 10 Probe (CA-PSU32, CA-PSU35) / LED Flicker Measuring ϕ 10 Probe (CA-PS32, CA-PS35)
- Do not turn OFF the power when accessing to the memory such as calibrating or measuring.

Notes on Storage

- The instrument should be stored at temperatures of between 0 and 28°C (70 % relative humidity or less and no condensation) or at temperatures of between 28 and 40°C (40 % relative humidity or less and no condensation). It is recommended that the instrument be stored at room temperature and humidity. Storing the instrument at a higher temperature and humidity may dateriorate the performance of the instrument.
- Take care not to allow condensation to form on the instrument during storage. In addition, pay attention to rapid temperature changes during transportation to the storage area to prevent condensation.

Cleaning

- If the instrument gets dirty, wipe it with a soft dry cloth. Never use solvents (e.g. benzene, thinner) or other chemicals.
- If the optics of the probe gets dirty, wipe it with a soft dry cloth or lens cleaning paper.
- If it is not possible to remove dirt from the instrument, contact a Konica Minolta authorized service facility.

Notes on transfer

- Use packaging material supplied when purchased to minimize vibration or shock generated during transfer.
- Put all material including unit and accessories in original packaging material when returning this instrument for service.

Maintenance

• Periodical checkup is recommended annually to maintain measurement accuracy of instrument. For details on checkup, please contact the nearest **KONICA MINOLTA** authorized service facility.

Disposal Method

- Please dispose of this product and the packing materials according to the rules and regulations of the governing body of the respective region.
- Contains Mercury in the backlighting of LCD used for display, Dispose According to Local, State or Federal Laws.

About This Manual

This manual is designed for those who possess basic knowledge of LCD displays.

Before using this instrument, please read this manual thoroughly.

In some parts of the description about LED Universal Measuring $\phi 27$ Probe, LED Universal Measuring $\phi 10$ Probe, LED Flicker Measuring $\phi 27$ Probe and LED Flicker Measuring $\phi 10$ Probe on this manual where type of probe is not specified, they are described as "Measuring Probe".

A quick summary of measurement methods is given in "Measurement/Quick Guide" (pages 114to 118), please refer to it when you need a quick check.

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.

<Example>
• Location of the explanation regarding 4-Probe Expansion Board CA-B15

When the optional 4-Probe Expansion Board CA-B15 is used

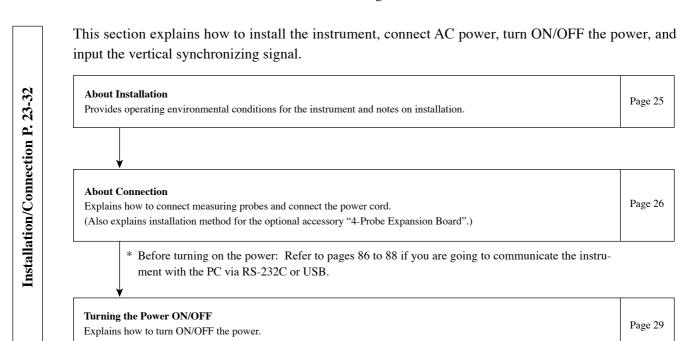
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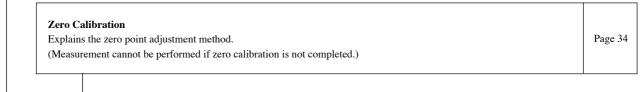
Manual Structure

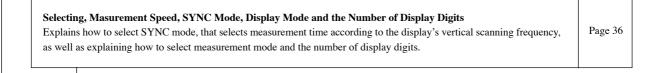
This manual is divided into sections as shown below according to the contents.

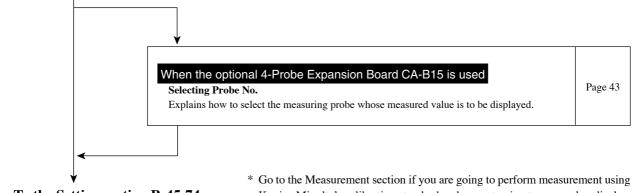


The Preparation/Setting/Measurement section explains the procedure up to measurement.

The Measurement Preparation section explains preparations (instrument setting, zero calibration) that are required prior to measurement.







To the Setting section P. 45-74

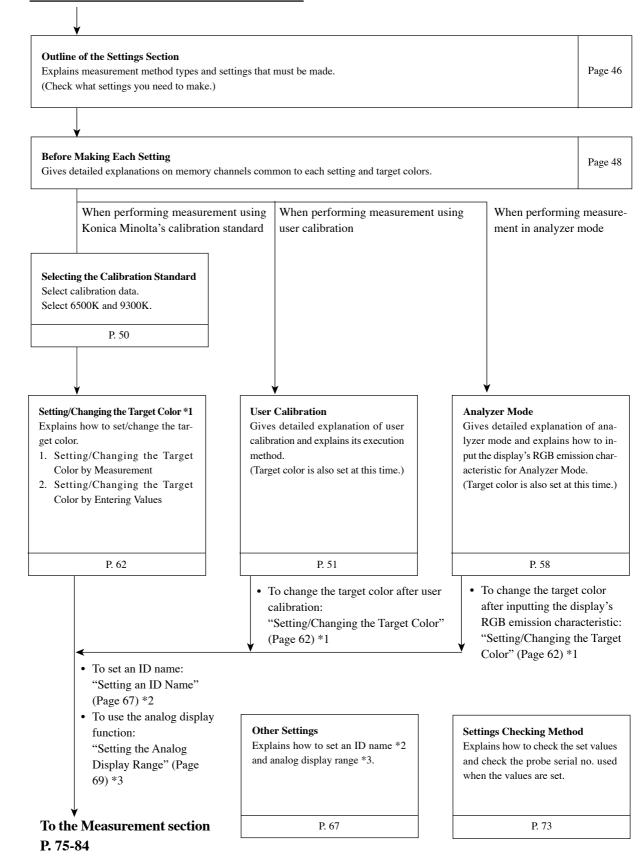
Measurement Preparation P. 33-44

Konica Minolta's calibration standard and are not going to use analog display.

This section explains settings that must be made according to measurement method. The setting method varies with measurement method.

From the Measurement Preparation section

Settings Section P. 45-74



This section explains measuring methods.

From the Settings section

Measurement

Explains measuring methods, how to hold the measured values and how to read them.

Page 76

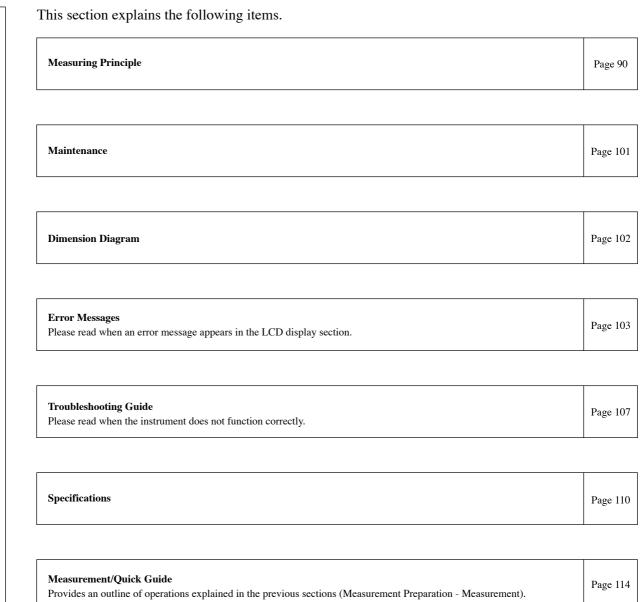
	White Balance Adjustment in Analyzer Mode Explains how to adjust white balance.	Page 81	
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This section explains communication with PC via RS-232C or USB.

Communicating with PC via RS-232C	
Explains how to connect the RS-232C cable and select the RS-232C baud rate to enable two-way communication with PC	Page 86
via RS-232C.	

Communicating with PC via USB Explains how to connect the USB cable to enable communication with PC via USB.	Page 88

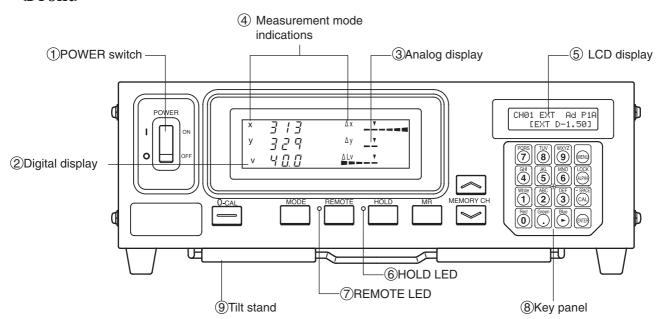
Remote Measurement	Page 88	
Explains how to perform measurement from the PC remotely.		



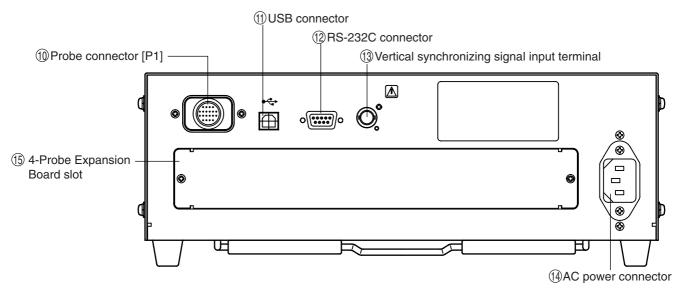
Explanation Section P. 89-118

Names and Functions of Parts

Main Body <Front>



<Rear>



Main Body <Front>

1	POWER switch	Used to turn ON and OFF the power to the instrument. (Page 29)
2	Digital display section	Displays the measured values.
3	Analog display section	Displays the difference (%) between the measured value and the
		target color or the difference (%) between measured values.
		Measured values are displayed in the case of flicker mode.
	•	The range for each dot can be set between 0.1 and 99%. (Page 69)
4	Measurement mode indications	Displays the measurement mode in which the measured values
		are displayed. (Page 40)

• The table below shows the relationship between measurement modes and data displayed in the digital display section 2 and analog display section 3.

Measurement mode	2 Digital display	3 Analog display
xyLv mode	x, y, Lv	$\Delta x, \Delta y, \Delta L v$
T∆uvLv mode	T, Δuv, Lv	$\Delta x, \Delta y, \Delta L v$
Analyzer mode (G reference)	R, B, G	$R/G, B/G, \Delta G$
Analyzer mode (R reference)	R, B, G	$\Delta R, B/G, G/R$
u'v'Lv mode	u', v', Lv	$\Delta x, \Delta y, \Delta L v$
Flicker mode**	Flicker value	Flicker value
XYZ mode	XYZ	$\Delta x, \Delta y, \Delta L v$

**Only when LED Flicker Measuring ø27 Probe or LED Flicker Measuring ø10 Probe is connected.

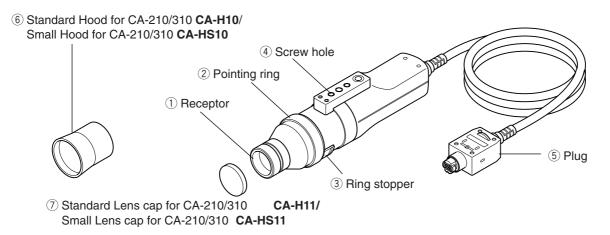
(5) LCD display	Displays the memory channel, probe no., ID name, warning and
	settings.
6 HOLD LED	Lights up during hold.
7 REMOTE LED	Lights up when the instrument is ready for communication with
	the PC via RS-232C or USB interface.
8 Key panel	Used to select/set probe no., SYNC mode, measurement speed,
	analog display range and ID name, as well as entering values.
	(Page 17)

(9) Tilt stand

<Rear>

 (1) USB connector	(1) Probe connector [P1] • Used to connect a measuring probe. (Page 26)
 (Page 86) (I) Vertical synchronizing signal	(1) USB connector
 (13) Vertical synchronizing signal	(12) RS-232C connector
input terminalwhen performing measurement in EXT SYNC mode. (Page 28) 	(Page 86)
 ▲ SYNC: Terminal shall tread as class 3 accordance with IEC 610101-1 Annex-H. ④ AC power connector	(13) Vertical synchronizing signal
610101-1 Annex-H. (1) AC power connector	input terminal when performing measurement in EXT SYNC mode. (Page 28)
 (1) AC power connector	SYNC: Terminal shall tread as class 3 accordance with IEC
the instrument. (Page 28) • The rating is 100-240V~, 50-60 Hz, 50VA. (15) 4-Probe Expansion Board slot	610101-1 Annex-H.
 The rating is 100-240V~, 50-60 Hz, 50VA. (5) 4-Probe Expansion Board slot Used to install the optional 4-Probe Expansion Board (CA-B15). 	(AC power connector
(5) 4-Probe Expansion Board slot	the instrument. (Page 28)
	• The rating is 100-240V∼, 50-60 Hz, 50VA.
	(15) 4-Probe Expansion Board slot
(Page 27)	(Page 27)

LED Universal Measuring Ø27 ProbeCA-PU32(2m)/CA-PU35(5m)LED Universal Measuring Ø10 ProbeCA-PSU32(2m)/CA-PSU35(5m)LED Flicker Measuring Ø27 ProbeCA-P32(2m)/CA-P35(5m)LED Flicker Measuring Ø10 ProbeCA-PS32(2m)/CA-PS35(5m)



Measuring is done with a probe in intimate contact with the surface of display in the measuring part of this equipment. There are 2 m(6.6ft.) and 5 m(16.4ft) long cord. There are 4 types of Measuring Probe.

Probe model	Cord length	Product name	Probe model	Cord length	Product name
LED Universal Measuring ø27 Probe	2m	CA-PU32	LED Flicker Measuring Ø27 Probe	2m	CA-P32
LED Universal Measuring ø27 Probe	5m	CA-PU35	LED Flicker Measuring Ø27 Probe	5m	CA-P35
LED Universal Measuring ø10 Probe	2m	CA-PSU32	LED Flicker Measuring ø10 Probe	2m	CA-PS32
LED Universal Measuring ø10 Probe	5m	CA-PSU35	LED Flicker Measuring ø10 Probe	5m	CA-PS35

* Either of the accessories described above is included.

① Receptor
② Pointing ring
For measurement: Set the ring to the "MEAS" position to perform
measurement.
③ Ring stopper
④ Screw hole
(5) Plug
on the optional 4-Probe Expansion board (CA-B15).
6 Hood
at the appropriate distance (30 mm) from the display and perpen-
dicular to it.
⑦ Lens cap

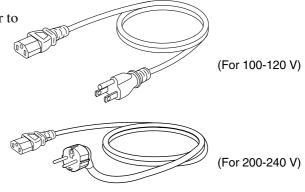
About Accessories

Standard Accessories

• AC power cord (For 100-120V or 200-240 V)

Connect this cord to the AC power connector to supply power to the instrument.

For a description of how to connect, refer to page 28.



- Measuring probe(with a lens cap)
- Hood
- Color analyzer PC software CA-SDK
- Instruction manual

Read this manual before operating the instrument.

Optional Accessories

- LED Universal Measuring ø27 Probe CA-PU32/CA-PU35
- LED Universal Measuring ø10 Probe CA-PSU32/CA-PSU35
- LED Flicker Measuring Ø27 Probe CA-P32/CA-P35
- LED Flicker Measuring ø10 Probe CA-PS32/CA-PS35 (Page 12)

Connect the probes to the main body or the probe connectors on the 4-Probe Expansion Board before measurement.

Location of the explanation

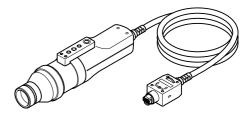
Connecting method: Page 26 Measuring method: Measurement Preparation, Setting, Measurement sections

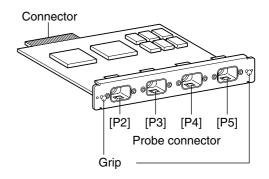
• 4-Probe Expansion Board CA-B15

Connect measuring probes to this board, to allow simultaneous measurement of the colors at up to 5 points on the display's surface. It is possible to install Measuring Probes of all types to be coresident.

Location of the explanation

Installation method: Page 27 Measuring method: Measurement Preparation, Setting, Measurement sections





- Standard Hood for CA-210/310 CA-H10 / Small Hood for CA-210/310 CA-HS10
- Standard Lens cap for CA-210/310 CA-H11 / Small Lens cap for CA-210/310 CA-HS11
- USB cable IF-A18

(Used for communication between this instrument and PC.)

Location of the explanation

Connecting method: Page 86

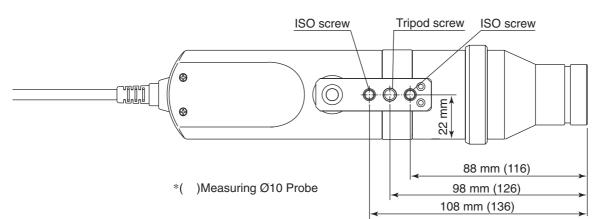
About Measuring Probe

Setting a Measuring Probe

Two types of screws are provided to secure the measuring prove.

Tripod screw: Used to mount the prove to a tripod. The screw depth is 6 mm.

ISO screw: Used to mount the prove to a jig. An ISO screw (5 mm, depth: 6 mm) can be used.



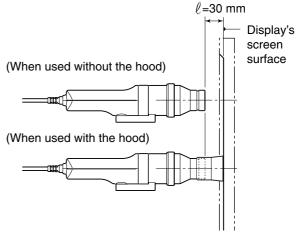
Setting the Measuring Distance

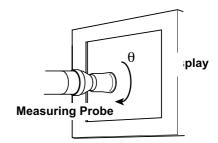
- **1**. Secure the display to be measured.
- **2**. Set the pointing ring to the MEAS position.
- **3**. Make sure that the distance from the display surface to the tip of the probe is 30 mm, and secure the probe.

Make sure that the probe is placed perpendicular to the display surface.

<Caution>

- Measurement reproducibility becomes [the way which does not change the installation angle θ for every measurement] high in measuring the high display of view angle dependability with the Measuring probe.
- Use of the hood (standard accessory) not only prevents entry of environmental light but also makes it easy to place the instrument at the specified distance and perpendicular to the object.
 - LED Universal Measuring ø27 Probe(CA-PU32/35), LED Flicker Measuring ø27 Probe(CA-P32/35)
 - : The stated accuracy remains valid when ℓ is in the range of 30 mm ±10 mm.
 - LED Universal Measuring ø10 Probe(CA-PSU32/35), LED Flicker Measuring ø10 Probe(CA-PS32/35)
 - : The stated accuracy remains valid when ℓ is in the range of 30 mm ±5 mm.



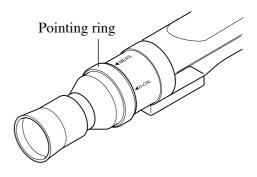


About Pointing Ring

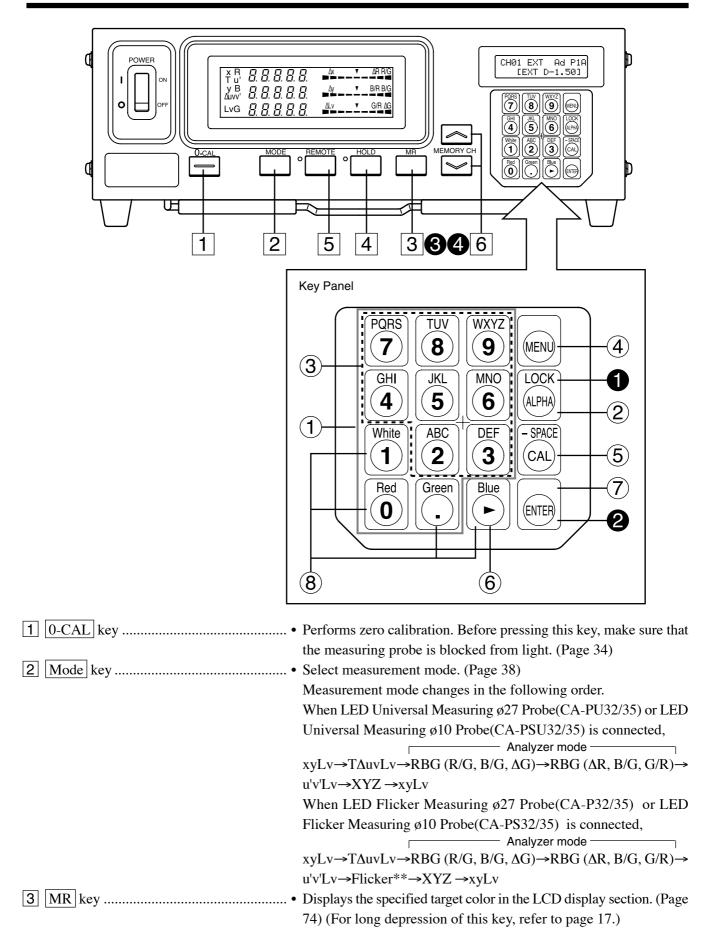
When you turn the pointing ring, it stops at two positions (MEAS, 0-CAL). To turn the ring, the stopper must be pulled toward you to unlock it.

- MEAS : To perform measurement, the ring must be set in this position.
- 0-CAL : To perform zero calibration, the ring must be set in this position.

Take care not to direct the measuring probe to a high-intensity light source.



Function of Each Key



4 HOLD key	• Holds the display of the measured value. (The HOLD LED will light up.)
	• Pressing this key while the HOLD LED is lit will cancel hold mode. (The HOLD LED will go out.)
5 <u>REMOTE</u> key	 Sets the instrument in remote mode (i.e. communication with the PC is possible via RS-232C or USB). (The REMOTE LED will light up. See page 88)
	 Pressing this key while the REMOTE key is lit will cancel remote mode. (The REMOTE LED will go out.)
	(Note) Remote mode should not be activated unless you are going to communi- cate with the PC.
	Otherwise, the other keys will be inoperative.
6 MEMORY CH key	• •
key	Pressing the $[]$ key will switch memory channel in the order " $00 \rightarrow 01 \rightarrow 02 \cdots$ 98 $\rightarrow 99 \rightarrow 00 \cdots$ ".
	Pressing the key will switch memory channel in the order " $00 \rightarrow 99 \rightarrow 98 \cdots $ $01 \rightarrow 00 \rightarrow 99 \cdots$ ".
	The memory channel switches from one to another each time the key is pressed, and switches continuously if the key is left held
	down.
<keys key="" on="" panel=""></keys>	
(1) Number-key ($\textcircled{0} \sim \textcircled{3}, \textcircled{0}$)	• Used to enter calibration data for user calibration (page 51), target color (page 62), ID name (page 67) and analog display range (page 69).
2 ALPHA key ())	• Used to enter alphabets. This key enables you to use the number- key as alphabet keys. Pressing this key again will restore the origi-
	nal function of the ten-key.
③ Alphabet keys (② ~ ⑨,)	• Used to enter alphabets for the ID name.
	• Switches the LCD display section to the menu selection screen.
	Pressing this key again will restore the original function of the LCD display section.
5 CAL key ()	. Normal Screen
	• When CH00 is selected as the memory channel
	You can enter a value for the target color. (Page 65)
	• When the memory channel other than CH00 is selected as the memory
	channel
	You can set CA-310 for input of WRGB data for user calibration.
	(Page 51)
	• When an analyzer measurement mode is selected
	You can set CA-310 for input of RGB emission characteristic and
	target color (W). (Page 59)
	This does not apply in the case of flicker mode**.
	Menu Selection Screen
	Pressing the key in the menu selection screen causes the screen
	to switch as follows.
	PROBE selection \rightarrow SYNC selection \rightarrow ID Name input \rightarrow RANGE
	setting \rightarrow Measurement Speed selection \rightarrow Number of Digits set-
	ting \rightarrow Calibration Standard selection \rightarrow RS232C Baud Rate se-
	lection \rightarrow PROBE selection

**Flicker Mode is a function which can be used only when LED Flicker Measuring ø27 Probe(CA-P32/35) or LED Flicker Measuring ø10 Probe (CA-PS32/35) is connected.

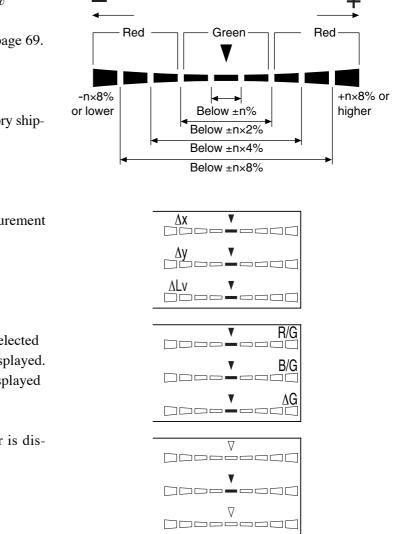
6	Cursor key ()	• Used to switch from one option to another in the PROBE, SYNC, Measurement Speed, Number of Digits, and RS232C baud rate screens, which are opened from the menu selection screen.
7	ENTER key ()	• Used to confirm each setting/selection you have made.
8	White, Red, Green,	• Used to set RGB emission characteristics of the display.
0	Holding down the 🛞 key for two seconds or more (Whistling sound.)	Locks all the keys except for the $\boxed{0-CAL}$ key. Holding down this key again for two seconds or more will unlock the keys.
2	Holding down the is key for five seconds or more (Bleeping sound. A whistling sound is heard when the setting is saved.)	Stores the current settings (probe, SYNC, memory channel, measurement mode) to the instrument. The settings will be effective when the power is turned on next time.
8	Holding down the <u>MR</u> key for two to four seconds (Bleeping sound.)	When xyLv, T∆uvLv or XYZ measurement mode is selected Displays serial number of the probe in use at the time calibration to a user selected reference was performed and the target color were set. (Page 74)
		When an analyzer mode is selected Displays serial number of the probe in use at the time RGB emission characteristics of the display and the target color (W) were set. (Page 74)
		When flicker mode** is selected "00000000" will be displayed. (Page 74)
4	Holding down the MR key for four seconds or more (Bleep sounds two seconds later and then four seconds later.)	. The unit of luminance will be displayed. (cd/m ² or fL)

^{**}Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

About Display

	① Measurement mode indications	(4) LCD display section:
X R T u' 8. 8. 8. 8. 8. X B Auvv' 8. 8. 8. 8. 8. LvG 8. 8. 8. 8. 8.	Δx V ΔR R/G Δy V B/R B/G ΔLv V G/R ΔG	CH00 EXT P1A [MINOLTA]
Digital disp	lay section ③ Analog display section	
\bigcirc	s shows when the entire display area is lit. (The	
() Measurement mode	each time the MODE key is p	from one to another as shown below ressed. (Page 40) ng ø27 Probe(CA-PU32/35) or LED
	u'v'Lv→XYZ →xyLv When LED Flicker Measuring ø Measuring ø10 Probe(CA-PS32	B/G, Δ G)→RBG (Δ R, B/G, G/R)→ 27 Probe(CA-P32/35) or LED Flicker 2/35) is connected, — Analyzer mode — B/G, Δ G)→RBG (Δ R, B/G, G/R)→
2 Digital display section		
 When xyLv measurement mode is x, y and Lv are displayed. When TAuvLy measurement mode 		× 0.3121 × 0.2801 Lv 84.18
 When TΔuvLv measurement mod T, Δuv and Lv are displayed. 	e is selected	ΓΓΓ ΔΧ Γ
T (correlated color temperature) is displayed in three significant digits.		
	ode is selected ence and G-reference are available. in the digital display area, whether	
 When u'v'Lv measurement mode i u', v' and Lv are displayed. 	s selected	u' 0.2149 Axaa aaaa v' 0.5098 Axaa aaaa Lv 6441 Alvaa aaaa
 When flicker measurement mode[*] Flicker^{**} is displayed. The displayed 		$\begin{array}{c c} F \downarrow I \Box \\ \hline \\ \hline$
• When XYZ measurement mode is X, Y and Z are displayed. (X, Y and Z)		
	19	

- (3) Analog display section Displays the difference (%) between the measured value and the target color or the difference (%) between measured values. The range for each dot can be set between 0.1 and 99%. (Page 69)
- How to read/when the range is set in "n" % except flicker mode
 For a description of flicker mode refer to page 69.



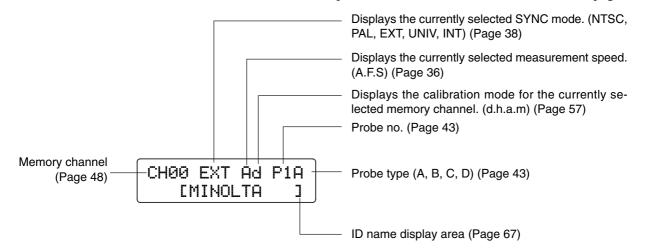
The range has been set to 10% prior to factory shipment.

- When xylv, TΔuvLv, u'v'Lv or XYZ measurement mode is selected Δx, Δy and ΔLv are displayed.
- When an analyzer measurement mode is selected For G-reference R/G, B/G and ΔG are displayed. For R-reference ΔR, B/R and G/R are displayed
- When flicker mode* *is selected Flicker is displayed.

(4) LCD display section Displays the memory channel, probe no., ID name, warning and settings.

In case of error, an error message will appear.

(For a description of what to do in case of error, refer to page 103.)

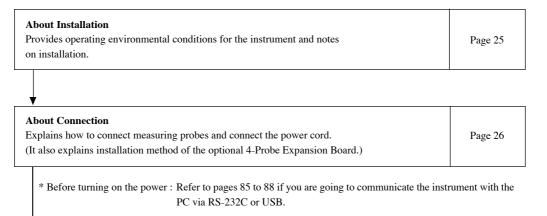


<out measurement="" of="" range=""></out>		
[For xylv, T∆uvLv, u'v'Lv or XYZ,Analyzer M	ode]	
• When the measurement range is exceeded	Digital display Analog display LCD display	: Not lit
[For T∆uvLv Mode]		
• T or Δuv are out of	Digital display	: ""
the display range	(T and Δuv)	
[For Flicker Mode**]		
• When the measured value has	Digital display	: ""
exceeded 999.9%	Analog display	: Not lit
	LCD display	: "FLICKER ERROR OVER"
• When Lv(luminance) is the following	Digital display	: ""
under 0.1cd/m ² for LED Flicker Measuring ø27 Probe	Analog display	: Not lit
(CA-P32/35)	LCD display	: "FLICKER ERROR UNDER"
under 0.3cd/m ² for LED Flicker Measuring ø10 Probe (CA-PS32/35)		

^{**}Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

Installation/Connection

This section explains how to install the instrument, connect AC power, turn ON $(1)/OFF(\bigcirc)$ the power, and input the vertical synchronizing signal.



A SAFETY WARNING



Do not use the instrument in areas where flammable or combustible gases (gasoline fumes etc.) are present.

Doing so may result in a fire.

If dust has entered through the vents and collected inside the instrument, do not use the instrument. Doing so may result in a fire.

For periodic inspection, contact a Konica Minolta authorized service facility.



Always use the AC power cord supplied as a standard accessory with the instrument, and connect it to an AC outlet ($100-240V\sim$, 50-60 Hz). Connecting to a voltage other than that specified

may result in damage to the instrument, fire or electric shock.

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

- Do not bend, twist or pull the AC power cord excessively.
- Do not place heavy items on the AC power cord or scratch it.
- Do not modify the AC power cord.



• Doing so may damage it, resulting in fire or electric shock.



When disconnecting the AC power cord's plug, always hold the plug and pull it to remove it. Never pull the AC power cord itself as it may be damaged, resulting in fire or electric shock.

Also do not insert or disconnect the AC power cord's plug with wet hands. Doing so may cause electric shock.



If you are not going to use the instrument for a long time, disconnect the AC power cord from the AC outlet. Dirt or water may accumulate on the prongs of the AC power cord's plug and it may cause a fire. If there is any dirt or water on the prongs, it must be removed.

A SAFETY PRECAUTIONS

- Do not place the instrument on an unstable or sloping surface.
- When you carry the product, take care not to let it drop.

Doing so may result in its dropping or overturning, causing injury. (Failure to adhere to the following points may result in injury or damage to the instrument or other property.)



Be sure to connect the AC power cord's plug to an AC outlet that has a protective grounding terminal. Also make sure that peripheral devices (e.g. PC) are connected to AC outlets that have a protective grounding terminal. Failure to do so may result in electric shocks.



About Installation

The operating environmental requirements are given in the "Specifications" of this manual. The instrument must be installed in a place that completely meets these requirements. (Page 110-113)

<Notes on Installation>

• Using the instrument in direct sunshine in midsummer or near a heater will cause a rapid rise in its temperature resulting in breakdown.

Special care must be taken when handling the instrument in such an environment. In addition, take care not to allow the vents to become blocked. Do not use the instrument in poorly ventilated areas.

- Do not use the instrument in a place where the temperature changes rapidly, since measured values will be incorrect.
- The instrument must not be used in areas where there is an excessive amount of dust or where the humidity is excessively high.
- The instrument must not be used if foreign matter such as water and metal objects enter it, doing so is very dangerous.
- The AC power cord must not be pulled or bent excessively nor must excessive force be exerted on it. Doing so may result in wire breakage.
- The AC power cord must not be connected to an AC line on which excessive noise is present.
- If any irregularity or abnormality is found, turn OFF(O) the power immediately, disconnect the AC power cord, and refer to "Troubleshooting Guide" on page 107.

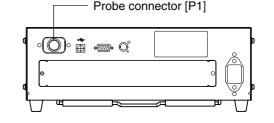
About Connection

1. Connecting a Measuring Probe

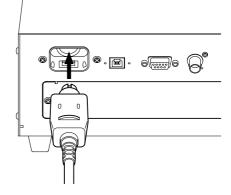
Before setting the POWER switch to ON(1), a measuring probe must be connected to the probe connector [P1] on the instrument.

[Connecting Method]

1. Set the POWER switch to OFF ("O" position).



- 2. Insert the probe's plug into the probe connector [P1], with the probe serial no. facing down.
- **3**. Check that the plug is inserted all the way and connected firmly
 - When disconnecting the measuring probe, set the POWER switch to OFF(○) first, and pull the probe by holding the plug. Never pull the probe by its cord.



<Notes when Connecting the Probe>

- Never connect or remove the measuring probe while the POWER switch is ON (1).
- When connecting/disconnecting the measuring probe, always hold the plug and connect/disconnect it. In addition, do not pull or bend the cord excessively or exert excessive force on it. Doing so may result in wire breakage.
- The Measuring Luminance Range will vary according to the type of Measuring Probe.
- When measurement is implemented, the same Measuring Probe to be used for the User Calibration is necessary. If measurement is carried out by connecting the different Measuring Probe, error message E1 will be displayed.

2. Installing the 4-Probe Expansion Board CA-B15

When the optional 4-Probe Expansion Board CA-B15 is used

[P1]

(O)• 🗆 🛥 Q

[P2]

 $\circ \bigcirc \circ \bigcirc \circ \bigcirc \circ \bigcirc \circ$

[P3]

[P4]

[P5]

Installing the optional 4-Probe Expansion Board CA-B15 in the instrument allows simultaneous measurement of the colors or flicker** at up to 5 points on the display's surface. Install the expansion board as shown below.

[Installation Method]

1. Remove the cover of the 4-Probe Expansion Board slot.

- (1) Set the POWER switch on the instrument to $OFF(\bigcirc)$.
- (2) Remove the two screws from the slot cover, and remove the cover.

2. Install the 4-Probe Expansion Board.

- 1 Place the 4-Probe Expansion Board along the right- and leftside guides in the slot.
- (2) Push the board all the way and make sure that the board is connected properly.
- (3) Secure the board with the two screws that were removed previously.
- · Repeatability of the measurement value becomes worse when the fixation by the screw is incomplete.
- To remove the board, remove the two screws first, then hold the grip of the board and pull it out. After the board is removed, attach the cover to the slot.

<Notes on Installation>

- When installing/removing the 4-Probe Expansion Board, always set the POWER switch to OFF() and pull the AC power cord from the AC outlet first.
- Do not touch the connectors (gold plated parts) or ICs on the 4-Probe Expansion Board with your hands. If oil or similar matter adheres to the connectors, wipe them with a soft, dry cloth.

<Connecting Measuring Probes>

The following 8 types of measuring probes can be connected.

- LED Universal Measuring Ø27 Probe CA-PU32 /CA-PU35
- LED Universal Measuring ø10 Probe CA-PSU32/CA-PSU35
- LED Flicker Measuring Ø27 Probe CA-P32 /CA-P35
- LED Flicker Measuring ø10 Probe CA-PS32 /CA-PS35

A total of five probes can be connected. When connecting two or more probes, always make sure that one of them is connected to the probe connector [P1].

Connect necessary number of probes to the probe connectors [P2] to [P5] on the 4-Probe Expansion Board. You do not have to connect any probes to those connectors ([P2] to [P5]). Probes can be connected to any connectors ([P2] to [P5]). The Measuring Luminance Range will vary according to the type of Measuring Probe.

6 types of optionally available Measuring Probes can be connected.

As a display model to be measured and the Measuring Luminance Range of Measuring Probe will vary according to the type, please install one that is fit for your use. Also, different types can be coresident.

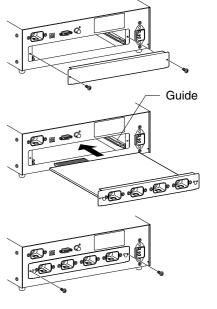
• The connecting method for connectors [P2] to [P5] is the same as that for [P1]. (Refer to page 26.)

Notes when connecting probes: Probe connectors on the 4-Probe Expansion Board where no probe is connected must be capped.

**Flicker Mode is a function which can be used only when LED Flicker Measuring ø27 Probe(CA-P32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.

When the optional 4-Probe Expansion Board CA-B15 is used

In Flicker Mode with LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) connected, a selected probe cannot be changed to LED Universal Measuring ø27 Probe(CA-PU32/35) or LED Universal Measuring ø10 Probe(CA-PSU32/35). 27



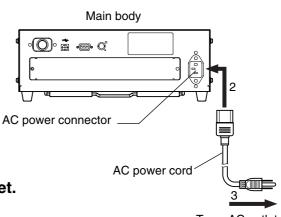
Installation/Connection

3. Connecting the Power

Power voltage range for the instrument -100 to $240 V \sim$

[Connection Method]

- 1. Set the POWER switch to OFF ("O" position).
- 2 Connect the AC power cord's connector to the AC power connector on the instrument. The AC power cord must be connected as shown in the figure.



To an AC outlet

3. Insert the AC power cord's plug to an AC outlet.

<Notes on Power Connection>

- Never connect or remove the AC power cord while the POWER switch is ON.
- When connecting/disconnecting the AC power cord, always hold the plug and connect/disconnect it. In addition, do not pull or bend the cord excessively or exert excessive force on it. Doing so may result in wire breakage.
- Be sure to connect the AC power cord's plug to an AC outlet that has a protective grounding terminal.

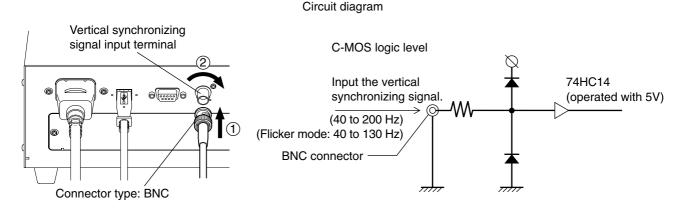
4. Inputting the Vertical Synchronizing Signal

The vertical synchronizing signal from the display can be input to the instrument to allow synchronous measurement (when EXT SYNC mode is selected).

However, if another SYNC mode is selected, it is not necessary to input the vertical synchronizing signal. Connect the BNC cable of the vertical synchronizing signal (frequency: 40 to 200 Hz) used for the display to the connector on the rear panel of the instrument as shown below. Before connecting, make sure that the power to both the instrument and display is turned OFF.

In the case of flicker mode, a vertical synchronizing signal of 40 to 130 Hz must be input.

(Only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.)



* To synchronize measurement with the display's vertical synchronizing signal, EXT must be selected as the SYNC mode. For details, refer to page 36.

Turning the Power ON (1)/OFF ()

1. Turning the Power ON (|)/OFF (())

Before setting the POWER switch to ON (1), prepare the following.

1. Connect a measuring probe to the probe connector [P1]. (Page 26)

- To synchronize measurement with the ...(1) Input the vertical synchronizing signal that is used for the display. display's vertical synchronizing signal (Page 28) (EXT is selected as the SYNC mode)
- To perform measurement(1) Install the 4-Probe Expansion Board (option) in the with two or more measuring probes
 - instrument. (Page 27) (2) Connect necessary number of probes to the probe connec-
- tors [P2] to [P5]. (Pages 26 and 27) via RS-232C
- To communicate with the PC via USB...(1) Connect the instrument's USB connector to the PC. (Page 88)

Probe serial no.

NO.XXXXXXX A

₽

DARKEN PROBE

PUSH 0-CAL KEY

2. Connect the AC power cord to an AC outlet. (Page 28) [Turning the Power ON (|)]

Set the POWER switch to ON (1). If the instrument is connected to external equipment, set the instrument's POWER switch to ON (1) first, then turn ON (1) the power to the external equipment.

[Turning the Power OFF (\bigcirc)]

If the instrument is connected to external equipment, turn OFF (O) the power to the external equipment first, then set the instrument's POWER switch to OFF (\bigcirc).

<Error Messages in LCD Display Section> ... For other error messages, refer to page 101.

PROBE [P1]

- "SET MAIN PROBE" (After the POWER switch is set to ON (1))
 - Cause 1 : The measuring probe is not connected to the probe connector [P1] properly.
 - Action 1: Set the POWER switch to OFF (\bigcirc) , then connect the measuring probe to the probe connector [P1] properly. (Before connecting/disconnecting the measuring probe, make sure that the POWER switch is set to OFF (\bigcirc) .)
- "PROBE ERROR"
 - Cause 1 : A measuring probe was connected or disconnected while the POWER switch was ON (1).
 - Action 1: Set the POWER switch to OFF (\bigcirc) first, connect necessary measuring probes, then set the POWER switch to ON (1). (Before connecting/disconnecting the measuring probe, make sure that the POWER switch is set to OFF (\bigcirc) .)

" C " : LED Universal Measuring ø27 Probe

D ": LED Universal Measuring ø10 Probe

LED Flicker Measuring ø27 Probe

: LED Flicker Measuring ø10 Probe

(CA-PU32/35)

(CA-PSU32/35)

(CA-P32/35)

(CA-PS32/35)

SET MAIN PROBE

PROBE ERROR

2. Instrument Status at Power-ON

The instrument has been set prior to factory shipment so that it will be set as follows when the POWER switch is set to ON.

① Measurement mode	Page 40	xyLv mode
(2) Memory channel no.	Page 48	CH00
③ Target color	Page 63	$x = 0.3127 \ y = 0.3293 \ Lv = 160.0 \ (cd/m^2)$
(4) PROBE	Page 43	P1
(5) SYNC mode	Page 36	EXT mode
6 ID name	Page 67	Consists of Blank spaces only.
⑦ Analog display range value	Page 69	10% (all ranges)
8 Measurement speed	Page 36	AUTO
9 Number of display digits	Page 42	4 digits
10 Calibration standard	Page 50	6500K Konica Minolta's standard data
(1) RS232C baud rate	Page 87	38400bps
(12) Calibration data (stored) in CH00 to CH99	Page 51	6500K Konica Minolta's standard data
13 Luminance unit	Page 32	cd/m ²

<Changing the Instrument Status at Power-ON>

Change necessary parameters and press the key for more than five seconds. A bleep will sound, followed by a whistling sound when the settings are saved. The instrument will start with the new settings when the power is turned ON next time. (The selected mode and memory channel etc. will be stored in the instrument's memory, and they will remain effective even if the POWER switch is set to OFF.) * For details, refer to the pages given in the above table.

Changing Method for parameters (1) and (2)

(1) Measurement mode Press the MODE key.

2 Memory channel Press the CH and keys.

Changing Method for parameter ③

Installation/Connection

Changing Method for parameters (4) to (1)

For parameters (4) to (11), switch the LCD display section to the menu selection screen as explained below.

1. Press the \log key.

The LCD display section will switch to the menu selection screen.

- 2. Press the → key until the desired screen is displayed. Each time the → key is pressed, the screen will switch in the order PROBE→SYNC→ID Name input→RANGE→Measurement Speed→ Number of Digits→Calibration Standard data→RS232C Baud Rate→PROBE.
- **3**. Press the 🕞 key to select the desired setting, and press the 🚌 key to confirm the selection.

For the ID name and range, enter the desired settings using the ten-key, ALPHA and alphabet keys, then press the key to confirm the settings.

Changing Method for parameter 1213

For the setting method, refer to the page given in the above table.

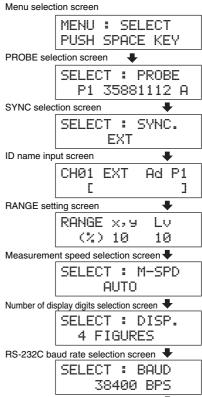
<About the **REMOTE** Key>

The <u>REMOTE</u> key should not be pressed unless you are going to communicate with the PC via RS-232C or USB.

• Pressing the <u>REMOTE</u> key sets the instrument in remote mode, enabling communication with the PC via RS-232C or USB.

(The REMOTE LED will light up.) In remote mode, no keys other than the <u>REMOTE</u> key are effective.

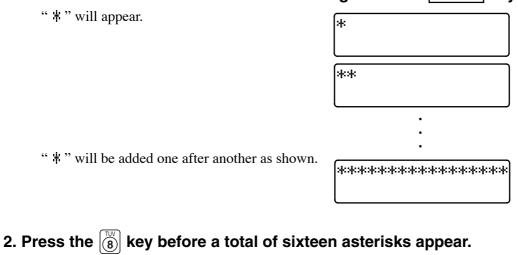
To cancel remote mode, press the **REMOTE** key again.



3. About the change of Luminance Unit

This instrument allows you to switch the unit for the displayed luminance between "cd/m²" or "fL". The method is given below.

1. Set the POWER switch to ON while holding down the MODE key.



Keeping the [3] key held down will display as shown below, switching the luminance unit from one to another.

Unit beforeUnit afterfL \rightarrow cd/m²cd/m² \rightarrow fL

LUMINANCE fL	UNIT
LUMINANCE cd/m*	

The newly set luminance unit will remain unchanged until it is changed again by the above method, even if the power is turned OFF.

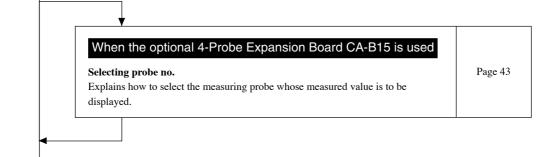
 \ast At the time of shipment, the luminance unit is set as cd/m².

Measurement Preparation

The Measurement Preparation section explains preparations (instrument setting, zero calibration) that are required prior to measurement.

Zero Calibration	
Explains the zero point adjustment method.	Page 34
(Measurement cannot be performed if zero calibration has not been completed.)	
	1

Selecting, Masurement Speed, SYNC Mode, Measurement Mode and the Number of Display Digits	
Explains how to select SYNC mode, that selects measurement time according to the display's	Page 36
vertical scanning frequency, as well as explaining how to select display mode and the number of	1 age 50
display digits.	



To the Setting section

* Go to the Measurement section if you are going to perform measurement using Konica Minolta's calibration standard and are not going to use analog display.

Zero Calibration

Zero calibration performs zero point adjustment while blocking entry of light into the measuring probe's receptor. Zero calibration must be performed whenever the POWER switch is set to ON.

1. Performing Zero Calibration

<Notes on Zero Calibration>

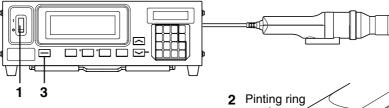
- If the luminance of the display to be measured is 1.0 cd/m² or less (if LED Universal Measuring ø10 Probe(CA-PSU32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35), 3.0 cd/m² or less), perform zero calibration after elapse of 30 minutes or more after the POWER switch is set to ON.
 When measuring such a low-luminance display for a long period of time, perform zero calibration approximately every hour.
- Perform zero calibration if the ambient temperature has changed.
- Zero calibration can be performed anytime even if "PUSH 0-CAL KEY" is not displayed.
- Never direct the measuring probe toward the illuminant with illuminance exceeding the measurement range during zero calibration.
- Never press any keys during zero calibration. Doing so will cause completion of zero calibration to take more time.
- When the optional 4-Probe Expansion Board CA-B15 is used

Zero calibration will be performed simultaneously with all the connected measuring probes.

[Operating Procedure]

3.

Before starting zero calibration, check that a measuring probe is connected to the probe connector [P1] on the instrument.



1. Check that the POWER switch is set to ON.

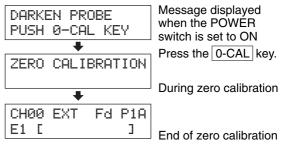
2. Set the pointing ring to the 0-CAL position.

Be careful because zero calibration can't be done properly.

• Don't turn the tip of Probe to the high illuminant with illuminance exceeding the measurment range.

When the optional 4-Probe Expansion Board CA-B15 is used

Set the switching ring of every measuring probe to the 0-CAL position. Zero calibration will not be performed correctly if the switching ring of any of the measuring probes is not set to the 0-CAL position.



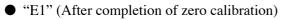
Measurement will start automatically at the end of zero calibration.

Press the 0-CAL key.

"E1" is always displayed if the instrument is used for the first time since shipment from the factory.

<Error Messages in LCD Display Section> ... For other error messages, refer to page 103.

- "TOO BRIGHT" (During zero calibration)
 - Cause : Light is entering the measuring probe's receptor.
 - Action : Block the light completely, and when "PUSH 0-CAL KEY" appears press the O-CAL key again to start zero calibration.



- Cause : "E1" is displayed if the instrument is used for the first time since shipment from the factory, because no target color has been set.
- For other cases, refer to page 103.

2. Zero Calibration Check Method

If you want to check whether zero calibration has been performed correctly, block entry of light into the measuring probe's receptor using a blackout curtain etc.

- If the message shown on the right appears in the LCD display section, perform zero calibration again.
- Zero calibration has been completed correctly if "000" blinks for "Lv" in the digital display section. If a value other than "000" is displayed, perform zero calibration again.

(Note) Even if "OFFSET ERROR" is displayed, measurement will start if the measuring probe's receptor is exposed to light.

ZERO CALIBRATION	The message switches		
+	automatically.		
TOO BRIGHT			
+	Approx. 1 second		
DARKEN PROBE			
PUSH 0-CAL KEY			

CH00	EXT	Ad	P1A
E1 []

OFFSET ERROR

Selecting, Measurement Speed, SYNC Mode, Display Mode and the Number of Display Digits

1. Selecting the Measurement Speed

Select the measurement speed according to your application.

If the measurement speed is changed, display frequency of the measurement results will change accordingly. The measurement results are displayed at the following frequency.

FAST mode

Requires short measurement time, but measurement accuracy is not sufficient in the case of measurement of a lowintensity display.

SLOW mode

Repeats measurement several times and displays the average. This mode is used when you want to perform accurate measurement.

AUTO mode

Switches measurement speed to FAST or SLOW automatically according to the luminance of the display measures. Normally, this measurement speed is recommended.

The measurement speed switches from FAST to SLOW or vice versa at the following luminance .

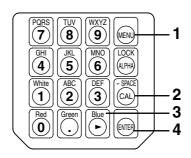
(LED Universal Measuring ø27 Probe)	FAST \rightarrow SLOW :When Lv drops below 4.0cd/m ² .
(CA-PU32/35)	SLOW \rightarrow FAST :When Lv exceeds 6.0cd/m ² .
(LED Universal Measuring ø10 Probe)	FAST \rightarrow SLOW :When Lv drops below 12.0cd/m ² .
(CA-PSU32/35)	SLOW \rightarrow FAST : When Lv exceeds 18.0cd/m ² .
(LED Flicker Measuring ø27 Probe)	FAST \rightarrow SLOW : When Lv drops below 2.0cd/m ² .
(CA-P32/35)	SLOW \rightarrow FAST : When Lv exceeds 3.0cd/m ² .
(LED Flicker Measuring ø10 Probe)	FAST \rightarrow SLOW : When Lv drops below 6.0cd/m ² .
(CA-PS32/35)	SLOW \rightarrow FAST : When Lv exceeds 9.0cd/m ² .

(In the case of Flicker Mode**, the measurement speed is always FAST mode.)

When the optional 4-Probe Expansion Board CA-B15 is used

(LED Universal Measuring ø27 Probe) (CA-PU32/35)	FAST \rightarrow SLOW : When Lv for any of probes drops below 4.0 cd/m ² . SLOW \rightarrow FAST : When Lv for all the probes exceed 6.0 cd/m ² .	
(LED Universal Measuring ø10 Probe) (CA-PSU32/35)	FAST \rightarrow SLOW : When Lv for any of probes drops below 12.0 cd/m ² SLOW \rightarrow FAST : When Lv for all the probes exceed 18.0 cd/m ² .	2.
(LED Flicker Measuring ø27 Probe) (CA-P32/35)	FAST \rightarrow SLOW : When Lv for any of probes drops below 2.0 cd/m ² . SLOW \rightarrow FAST : When Lv for all the probes exceed 3.0 cd/m ² .	
(LED Flicker Measuring ø10 Probe) (CA-PS32/35)	FAST \rightarrow SLOW : When Lv for any of probes drops below 6.0 cd/m ² . SLOW \rightarrow FAST : When Lv for all the probes drops exceed 9.0 cd/m ² .	

Currentlys elected measurement speed F : FAST mode Ád P1A CH00 EXT S : SLOW mode] Г A : AUTO mode



1.Press the e key.

The LCD display section will switch to the menu selection screen.

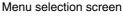
2. Press the 🖾 key to open the measurement speed selection screen.

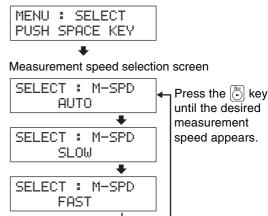
Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

3. Press the 🕞 key to display the desired measurement speed.

Each time the bis key is pressed, the measurement speed switches in the order [AUTO] \rightarrow [SLOW] \rightarrow [FAST] \rightarrow [AUTO].

4. $Press the <math>\bigcirc$ key to confirm the selection.





"F" is displayed when the [FAST] was selected.

CHAA	FXT	Éa	P10
01100		i u	1 1 1 1
г			7
L			

* By default (factory setting), the instrument is set so that [AUTO] will be selected automatically when the POWER switch is set to ON(1).

 \ast To cancel selection of measurement speed, press the [m] key.

<Notes when Selecting the Measurement Speed>

● The selected measurement speed data will be kept even if the POWER switch is set to OFF (○). The selected measurement speed will be effective when the POWER switch is set to ON(1).

^{**}Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

2. Selecting SYNC Mode

In SYNC mode, measurement time (sampling time) is selected according to the display's vertical scanning frequency. The following five SYNC modes are available. Select the SYNC mode suitable for the display to be measured.

SYNC Mode	Description	Measurement time (Sampling time)	Vertical scanning frequency	Display's vertical synchronizing signal
NTSC	Used for measurement of NTSC monitors	33.3 ms	60 Hz	Not required
PAL	Used for measurement of PAL and SECAM monitors	40.0 ms	50 Hz	Not required
EXT	Used to synchronize measurement with the monitor's vertical synchronizing signal (fre- quency: 40 to 200 Hz) that is input to the instrument. (For how to input the vertical syn- chronizing signal, refer to page 28.)	(1 vertical scan cycle) × 2	40 to 200 Hz (Flicker 40 to 130 Hz)	Required
UNIV.	Used for measurement of any monitors, for instance, when the frequency of monitor's ver- tical synchronizing signal is unknown or when the vertical synchronizing signal cannot be in- put into the instrument for some reason.	100 ms	_	Not required
INT	If the frequency of the monitor's vertical syn- chronizing signal is known, set it to be used for measurement.	(1 vertical scan cycle) × 2	40 to 200 Hz (Flicker 40 to 130 Hz)	Not required

[Selecting Method]

PORS TUV WXYZ 1 (1) (3) (4) (5) (6) (4) (4) (5) (6) (4) (4) (4) (5) (6) (4) (4) (5) (6) (4) (4) (6) (4) (

Menu selection screen

MENU : SELECT

CH00 EXT

С

PUSH SPACE KEY

SYNC selection screen

1. Press the iskey.

The LCD display section will switch to the menu selection screen.

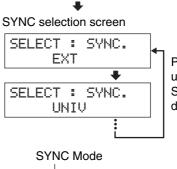
2. Press the 🖾 key to open the SYNC selection screen.

Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration standard \rightarrow RS232C baud rate \rightarrow PROBE.

3. Press the 🕑 key to display the SYNC mode you want to select.

Each time the b key is pressed, SYNC mode switches in the order EXT \rightarrow UNIV \rightarrow INT \rightarrow NTSC \rightarrow PAL \rightarrow EXT.

"INT" allows you to change the synchronizing frequency.



Ad P1A

]

Press the Skey until the desired SYNC mode is displayed.

4. Press the explored key to confirm the selection.

- * To use EXT mode, the vertical synchronizing signal used for the display must be input to the instrument. (Page 28)
- * By default (factory setting), the instrument is set so that EXT mode will be selected automatically when the POWER switch is set to ON. If you want to change this setting, refer to page 29.

< Changing the Synchronizing Frequency for INT>

Select INT as explained above, and enter the desired frequency using the number-key.

<Relationship between Measurement Speed and SYNC Mode>

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

The measurement speed (the number of measurements and outputs per second) is determined by the SYNC mode and the following conditions.

- Luminance of the display to be measured
- Measurement mode
- Data output (RS-232C or USB)
- In cace RS-232C, Baud rate
- Number of measuring probes to be used (when the optional 4-Probe Expansion Board is used)

The table below shows the measurement speed for each SYNC mode when measurement is performed under the following conditions.

RS232C

- Luminance of the display to be measured No errors and warnings, and the luminance is stable.
- Display mode xyLv or Flicker**
- Number of connected measuring probes 1

	xy	Flicker	
	FAST	SLOW	_
NTSC	17 measurements/sec.	4.5 measurements/sec.*1	16 measurements/sec.
PAL	15 measurements/sec.	4 measurements/sec.	14 measurements/sec.
EXT*2	17 measurements/sec.	4.5 measurements/sec.	16 measurements/sec.
UNIV.	7 measurements/sec.	1.5 measurements/sec.	—
INT*2	17 measurements/sec.	4.5 measurements/sec.	16 measurements/sec.

*1 Applies when luminance Lv is 0.1 cd/m² or higher for Measuring ø27 probe (CA-PU32/35, CA-P32/35), or 0.3 cd/m² or higher for Measuring ø10 probe (CA-PSU32/35, CA-PS32/35).

If Lv is lower than mentioned above, 3.5 measurements/sec. spplies.

*2 The measurement speed for EXT and INT when the vertical scanning frequency is 60 Hz is given.

USB

- Luminance of the display to be measured No errors and warnings, and the luminance is stable.
- Display mode xyLv or Flicker**
- Number of connected measuring probes 1

	xyLv		Flicker
	FAST	SLOW	—
NTSC	20 measurements/sec.	5 measurements/sec.*1	16 measurements/sec.
PAL	17 measurements/sec.	4 measurements/sec.	14 measurements/sec.
EXT*2	20 measurements/sec.	5 measurements/sec.	16 measurements/sec.
UNIV.	8 measurements/sec.	1.5 measurements/sec.	_
INT*2	20 measurements/sec.	5 measurements/sec.	16 measurements/sec.

*1 Applies when luminance Lv is 0.1 cd/m² or higher for Measuring ø27 probe (CA-PU32/35, CA-P32/35), or 0.3 cd/m² or higher for Measuring ø10 probe (CA-PSU32/35, CA-PS32/35).

If Lv is lower than mentioned above, 4 measurements/sec. spplies.

The measurement speed for EXT and INT when the vertical scanning frequency is 60 Hz is given.

5	Е	L	Е	С	Т	:	SYN	IC.	
					Ι	NT	30.	0Hz	

SELECT	:	SYNC.

^{**}Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

<Error Messages in LCD Display Section> ... For other error messages, refer to page 101.

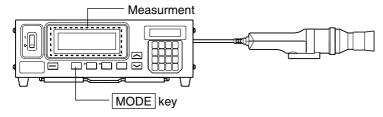
- "NO SYNC. SIGNAL" (when EXT mode is selected)
 - Cause 1 : The vertical synchronizing signal used for the display is not connected to the terminal on the instrument.
 - Action : If EXT mode is selected, input the vertical synchronizing signal to the terminal on the instrument properly.
 - Cause(2) : The frequency of the vertical synchronizing signal used for the display is below 40 Hz or beyond 200 Hz.
 - Action : Change SYNC mode to UNIV. mode and start measurement.

3. Selecting the Measurement Mode

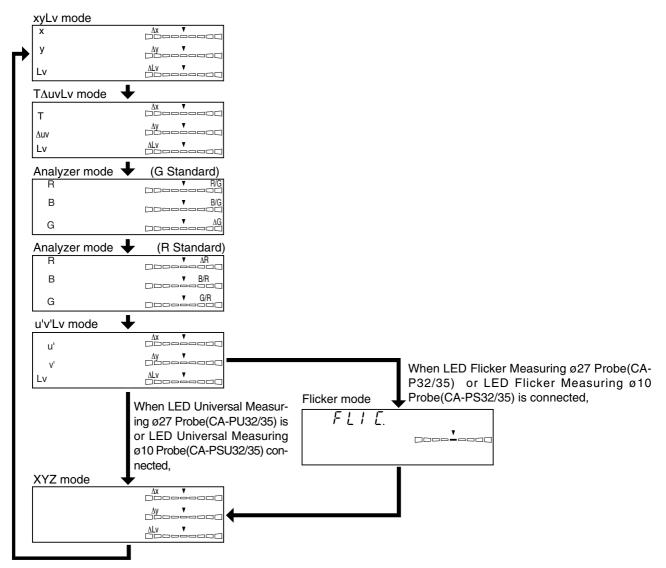
The following measurement modes are available.

Measurement Me	ode	Description
xyLv mode		Used to display/output chromaticity coordinates xy and luminance Lv. (The analog display section shows Δx , Δy and ΔLv .)
T∆uvLv mode		Used to display/output T (correlated color temperature), Δuv (color difference from blackbody locus) and luminance Lv. (The analog display section shows Δx , Δy and ΔLv .)
G Standard Analyzer mode R Standard		Used to display meeasurement RBG emission intensities as a percentage of the RGB emission intensities target color(W). Analog display shows measured ratios R/G and B/G, and Δ G
		Used to display meeasurement RBG emission intensities as a percentage of the RGB emission intensities target color(W). Analog display shows measured ratios G/R and B/R, and ΔR
u'v'Lv mode		Used to display/output u'v' chromaticity coordinates (CIE 1976 UCS chromaticity diagram) and luminance Lv. (The analog display section shows Δx , Δy and ΔLv .)
Flicker mode		Used to display flicker amount abtained form contrast format (AC/DC). The unit is %. Can be selected only when LED Flicker Measuring ø27 Probe(CA-P32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.
		When the optional 4-Probe Expansion Board CA-B15 is used Can be selected only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is selected.
XYZ mode		Used to display/output tristimulus values X, Y and Z. (The analog display section shows Δx , Δy and $\Delta L v$.)

Press the MODE key to display the measurement mode you want to select.



Each time the MODE key is pressed, measurement mode will switch as shown below.



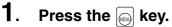
* By default (factory setting), the instrument is set so that xyLv mode will be selected automatically when the POWER switch is set to ON (1).

4. Selecting the Number of Display Digits

The number of display digits can be selected from 4 or 3.

However, T(correlated color temperature) is always displayed in three digits, and flicker is always displayed up to the first decimal place.

[Selecting Method]



The LCD display will switch to the menu selection screen.

2. Press the key to open the number of display digits selection screen.

Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

3. Press the 🕞 key until the desired number of display digits appears.

Each time the 🕞 key is pressed, the number of display digits switches alternately between "4 FIGURES" and "3 FIGURES".

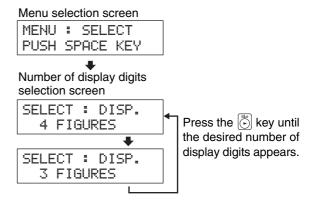
```
4. Press the election.
```

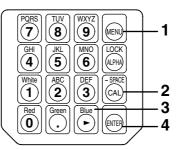
* By default (factory setting), the instrument is set so that "4 FIGURES" will be selected automatically when the POWER switch is set to ON(1).

* To cancel selection of the number of display digits, press \bigcirc key.



● The selected number of display digits will be kept even if the POWER switch is set to OFF(○). The selected number of display digits will be effective when the POWER switch is set to ON(1).



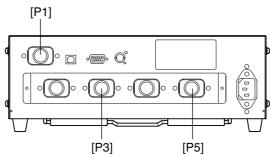


Selecting Probe No.

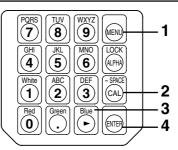
Measurement will be performed simultaneously with all the connected measuring probes. However, the digital and analog display sections show only the measurement results taken by the one selected probe.

Follow the procedure given below to select the probe connector No. (P1 to P5) to which the desired measuring probe is connected.

In this example, a measuring probe is connected to the probe connectors [P1], [P3] and [P5].



[Selecting Method]



Menu selection screen

MENU : SELECT PUSH SPACE KEY

PROBE selection screen

SELECT : PROBE

SELECT : PROBE

SELECT : PROBE

P5 35881114

P3 35881113

P1 35881112 A

1. Press the \bigcirc key.

The LCD display section will switch to the menu selection screen.

2. Press the 🙆 key to open the PROBE selection screen.

Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

3. Press the 🕞 key to display the probe no. you want to select.

Each time the \bigcirc key is pressed, the probe no. switches in the order [P1] \rightarrow [P3] \rightarrow [P5] \rightarrow [P1].

The probe type is displayed on the right of the probe serial number by the connected probe.

- "C" : LED Universal Measuring Ø27 Probe(CA-PU32/35)
- "D" : LED Universal Measuring ø10 Probe(CA-PSU32/35)
- "A" : LED Flicker Measuring Ø27 Probe(CA-P32/35)

"B" : LED Flicker Measuring ø10 Probe(CA-PS32/35)

* When the measurement mode is Flicker Mode, LED Universal Measuring Ø27 Probe(CA-PU32/35) or LED Universal Measuring Ø10 Probe(CA-PSU32/35) is not displayed.

Select the measurement mode other than Flicker Mode, if you want to select LED Universal Measuring Ø27 Probe(CA-PU32/35) or LED Universal Measuring Ø10 Probe(CA-PSU32/35).

4. Press the \bigcirc key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(|).
 43

СНАЙ	FXT	βd	P1A
E E]

Press the 🕞 key until

the desired probe no.

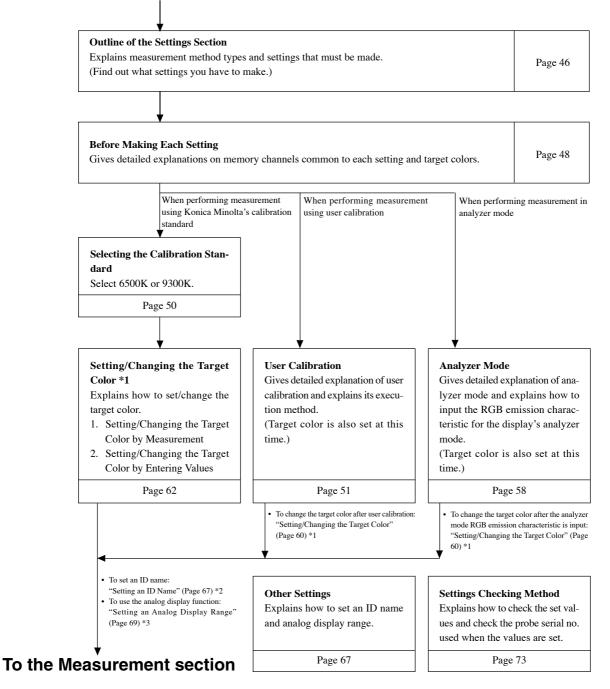
appears.

Settings Section

This section explains settings that must be made according to measurement mode.

The setting method varies with measurement mode.

From the Measurement Preparation Section



Outline of the Settings Section+

This section explains settings that must be made according to measurement method.

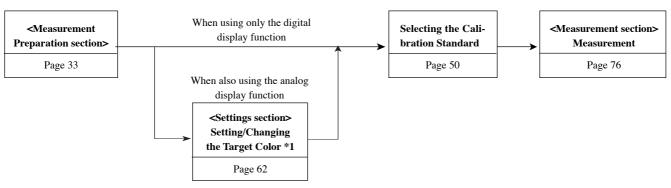
Available measurement methods and the settings that must be made are explained below.

<Measurement by Konica Minolta's Calibration Standard>

With this method, measurement is performed using Konica Minolta's calibration standard without calibration. Even if you are setting the target color to the memory channel CH00, measurement must be performed as explained below.

It is not necessary to set/change the target color if you are not going to use the analog display function.

[Operating Procedure]



• To set an ID name

: "Setting an ID Name" (Page 67) *2

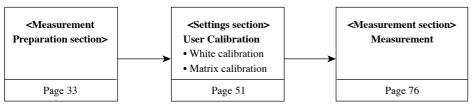
• To use the analog display function: "Setting an Analog Display Range" (Page 69) *3

<Measurement by User Calibration>

With this method, user calibration is performed and the obtained correction factor is used for measurement. Since the target color is also set, the analog display section can show the deviation of the measured values from the target color. User calibration must be performed in the following cases. (However, it is not possible to perform user calibration using the memory channel CH00.)

- To correct variation of readings that occur due to the deviation of spectral sensitivity from the CIE 1931 colormatching function
- To correct difference of readings between instruments when two or more instruments are used
- Correction of difference of readings between measuring probes when two or more probes are used

[Operating Procedure]



- Details of user calibration
- To change the target color after user calibration: "Setting/Changing the Target Color" (Page 62) *1
- To set an ID name
- To use the analog display function
- : "Setting an ID Name" (Page 67) *2 : "Setting an Analog Display Range" (Page 69) *3

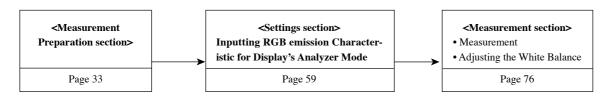
: "About User Calibration" (Page 51)

<Measurement by Analyzer Mode>

With this method, the measured colors are expressed in emission intensity of each R, B and G monochromatic light based on the display's analyzer mode RGB emission characteristic (which is input to the instrument's memory channel) and the target color (W).

Since the target color is also set, the analog display section can show the deviation of the measured values from the target color. If this method is used when adjusting display's white balance, the adjustment can be performed more easily than xyLv mode.

[Operating Procedure]



- Details of analyzer mode
- : "About Analyzer Mode" (Page 58)

: "Setting an ID Name" (Page 67) *2

: "Setting/Changing the Target Color" (Page 62) *1

: "Setting an Analog Display Range" (Page 69) *3

- To change the target color after the analyzer mode RGB emission characteristic is input
- To set an ID name
- To use the analog display function

*1 About "Setting/Changing the Target Color"

There are the following two methods for setting/changing the target color.

- ① Setting/changing the target The display's measured values are set as the target color.
- color by measurement This method can be used for any memory channels.

*2 About "Setting an ID Name"

An ID name is a name that can be assigned to each memory channel by entering it directly using keys. This function is useful when you want to specify that user calibration and target color have been set for what type of display with what colors.

*3 About "Setting an Analog Display Range"

Adjustment is performed by setting the analog display range for each dot.

* To check the specified target color, calibration data for user calibration and probe serial no. used when these settings are made, refer to "Settings Checking Method" on page 73.

Before Making Each Setting

1. About Memory Channels

This instrument has a total of 100 channels (CH00 to CH99). The following items can be set for each of these channels.

- (3) Target color (For details, refer to page 49.)
- (4) ID name (For details, refer to page 67.)

CH00 is provided for calibration that uses Konica Minolta's calibration standard.

For this channel, only the target color, RGB emission characteristic for display's analyzer mode and ID name can be set.

The desired memory channel can be selected by switching from one to another by pressing the MEMORY CH \sim and \sim keys.

It is also possible to assign an ID name to each memory channel by entering it directly using keys. The ID name is displayed together with the memory channel no. in the LCD display section.

- If the RGB emission characteristic for analyzer mode is input using a memory channel that has been matrixcalibrated, the correction factor for matrix calibration will be deleted. (If xylv, T∆uvLv, u'v'Lv or XYZ measurement mode is selected, the Konica Minolta's calibration standard will be used for measurement.)
- In the case of the same memory channels and probes, the RGB emission characteristic for analyzer mode is stored in their common memory irrespective of measurement mode. Therefore, when matrix calibration is performed, the RGB emission characteristic for analyzer mode is also input at the same time.

User Calibration How the memory is used in the case of analyzer mode

Calibration values xyLv for W	Calibration values xyLv for R	Calibration values xyLv for G	Calibration values xyLv for B
Measured value for W	Measured value for R	Measured value for G	Measured value for B
Used for white calibration	Used for a	nalyzer mode RGB emission cha	racteristic
— Used for matrix calibration —			

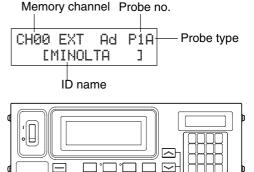
When the optional 4-Probe Expansion Board CA-B15 is used

<Relationship between Memory Channels and Probes>

If the 4-Probe Expansion Board is installed, each probe ([P1] to [P5]) has a total of 100 channels (CH00 to CH99). The correction factor for user calibration (1), RGB emission characteristic for analyzer mode (2) and target color (3) can be set for each probe. However, ID name (4) is common to all the probes of the same memory channels.

For instance, if the ID name "CRT-001" is assigned to CH01 when the measured values for probe [P1] are displayed, "CRT-001" will be displayed for CH01 of all the probes [P1] to [P5].

Probe no.	[P1]	[P2]	[P3]	[P4]	[P5]
Usable memory channels	CH00 to 99	CH00 to 99	CH00 to 99	CH00 to 99	CH00 to 99
ID name (page 65)	CH00 to 99 (Common to all probes)				



MEMORY CH wand keys

2. About the Target Color

The target color is the reference used to measure how much the measured values are deviated from a certain color. The target color can be set for each probe of each memory channel.

The target color is set when the following is performed.

performed.
Performing user calibration sets the calibration values as the target
color.
Set or change the target color in the following cases.
• When you want to set the target color for memory channel CH00
• When you want to set a color that differs from the color used for user
calibration as the target color to a user-calibrated memory channel
• When you want to perform measurement using Konica Minolta's
calibration standard without user calibration and want to use the
analog display function
When you select analyzer measurement mode and input the RGB
emission characteristic for analyzer mode, also set the target color
(W).

- Since when calibration factor is input for user calibration/analyzer mode the target color is also set at the same time, the previously set target color will be deleted.
- To change the currently set target color, change it as explained in "Setting/Changing the Target Color" (page 62). Even if the target color is changed, the currently set correction factor for user calibration and the RGB emission characteristic for display's analyzer mode will remain unchanged.

In the case of the same memory channels, the target color is stored in their common memory irrespective of measurement mode.

As a result, the target color set last will be stored irrespective of how it was set.

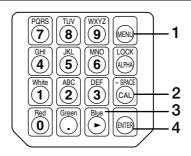
In one memory channel and one probe, a correction factor of User Calibration is common to xyLv mode, $T\Delta uvLv$ mode, u'v'Lv mode and XYZ mode.

Target color is common to all measuring modes.

3. Selecting the Calibration Standard (data)

This section explains how to select the instrument's calibration standard (6500K, 9300K). Selecting the instrument's calibration standard will set the calibration standard for CH00 as well as for all the memory channels which have not been user-calibrated.

[Selecting Method]



1. Press the key.

The LCD display section will switch to the menu selection screen.

2. Press the 🕅 key to open the calibration standard selection screen.

Each time the $\left| \begin{array}{c} \frac{1}{2} \\ \frac{1}{2} \end{array} \right|$ key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration Standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

Menu selection screen MENU : SELECT PUSH SPACE KEY The currently selected calibration . standard will be displayed. SYNC selection screen SELECT : STD-DT 6500K calibration standard appears. . SELECT : STD-DT 9300K

Press the 🔄 key until the desired

${f 3}$. Press the 🔄 key to display the calibration standard you want to select. Each time the $[\mathbb{E}]$ key is pressed, the calibration standard switches alternately between "6500K" and "9300K".

4. Press the is key to confirm the selection.

The selected calibration standard will be set for CH00 as well as for all the memory channels that have not been user-calibrated.

* By default (factory setting), the instrument is set so that 6500K mode will be selected automatically when the POWER switch is set to ON(1).

* To cancel calibration standard setting, press the key.

<Notes on Calibration Standard Setting>

• The specified calibration target values will be kept even if the POWER switch is set to OFF (O). The selected calibration standard will be set for CH00 as well as for all the non-user-calibrated memory channels when the POWER switch is set to ON(1).

User Calibration

1. About User Calibration

- User calibration is provided to set the user's own correction factor to the instrument's memory channels by measuring the color of a display and setting the calibration values (x, y, Lv) to the instrument.
 Once this factor is set, the values corrected by this factor will be displayed and output each time measurement is taken.
- This instrument allows two kinds of user calibration; white calibration and matrix calibration. By default (factory setting), matrix calibration is selected.
- User calibration can be performed for each memory channel. (Except for CH00)
- When the optional 4-Probe Expansion Board CA-B15 is used User calibration is performed independently for probe ([P1] to [P5]) for each memory channel. (Except for CH00)
- When this instrument is used for the first time since shipment from the factory, measurement will be performed based on the calibration carried out by the Konica Minolta's calibration standard. This applies to all the memory channels. Once user calibration is performed, the following correction will be made when measurement is performed using the obtained correction factor.
 - Correction of variation of readings that occur due to the deviation of spectral sensitivity from the CIE 1931 color-matching function
 - 2 Correction of difference of readings between instruments when two or more instruments are used

③ When the optional 4-Probe Expansion Board CA-B15 is used Correction of difference of readings between measuring probes when two or more probes are used

- At the same time as user calibration is performed for a memory channel, the obtained color will be set as the target color to that memory channel. The target color is the color used as the reference when displaying how much the measured values are deviated from a certain color. (Page 49)
- When User Calibration is implemented, the same Measuring Probe to be used for the measurement is necessary. If measurement is carried out by connecting the different Measuring Probe, error message E1 will be displayed. In this case, it is necessary to replace it with the Measuring Probe that received User Calibration or you have to execute User Calibration once again using the Measuring Probe to be used for the measurement.

<When Two or More Instruments are Used>

When two or more instruments are used or when the optional 4-Probe Expansion Board CA-B15 is used to perform measurement with two or more measuring probes, the difference between readings can be corrected if user calibration is performed as explained below.

When the values of the color to be used as the target are known:

The color set to the reference display is displayed and user calibration is performed for all the bodies (or measuring probes).

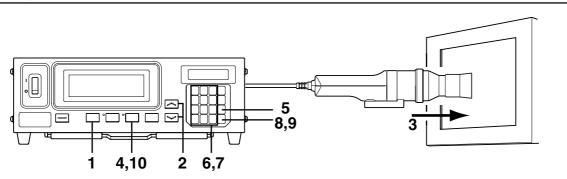
When the values of the color to be used as the target are unknown:

- 1 Select one master body (or select one master probe).
- (2) Select "xyLv" measurement mode (page 40), and place the master body's measuring probe (or the master probe) against the display on which the target color is displayed.
- ③ While the probe is placed against the display, press the HOLD key.
- (4) By using the display on which the target color is displayed and the values displayed at step (3), perform user calibration for the other bodies (or measuring probes).

2. Performing White Calibration

- User calibration cannot be performed with the memory channel CH00.
 (CH00 memory channel is provided for measurement that uses the Konica Minolta's calibration standard.)
- White calibration must be performed for each display type (model). Characters of displays vary with the display type (model). Because of this, measured values differ even if the same color is measured. Thus, a different memory channel must be used for each display type (model) to perform white calibration.
- If white calibration is performed with a memory channel to which the target color has already been set, that target color will be deleted.
- If white calibration is performed with a memory channel which has already been matrix-calibrated, the correction factor of the previous matrix calibration will be deleted and the correction factor obtained from the white calibration will be set.

[Operating Procedure]



When the optional 4-Probe Expansion Board CA-B15 is used

Select the probe no. to be white-calibrated. White calibration can be performed independently for each probe connector ([P1] to [P5]) for each memory channel.

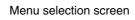
1 Press the 📾 key.

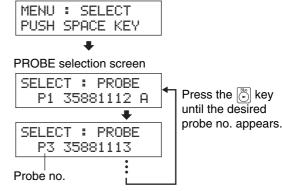
The LCD display section will switch to the menu selection screen.

Press the key to open the PROBE selection screen.

Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration Standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

3 Press the 🕑 key to display the probe no. you want to select.





Each time the \bigcirc key is pressed, the probe no. switches in the order [P1]

(4) Press the implement key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(1).

- **1**. Press the MODE key to select xyLv measurement mode.
- 2 Press the MEMORY CH is and is keys until the memory channel where you want to perform white calibration appears.

3. Place the measuring probe against the display.

Make sure that the white color whose values are known is shown on the display.

4. While the probe is placed against the display, press the HOLD key.

The latest measured values will be hold and the HOLD LED lights up.

5. Press the 🕅 key.

The LCD display section will switch to the user calibration input screen.

6. Press the 🕅 key.

The LCD display section will switch to the W calibration value input screen.

7. Enter calibration values (x, y, Lv).

For x and y, a value 10000 times the calibration value must be entered.

Use the number-key (\bigcirc^{Red}) to $\bigcirc^{\text{(NYZ)}}$ to enter the values.

The cursor moves to the right each time a value is entered.

Each time the $|\widehat{(\cdot)}|$ key is pressed, the cursor moves in the order $x \to y \to Lv \to x$.

- In this example, x=0.3300, y=0.3000 and Lv=39.50 are entered.
- 1 Press the [3], [3], [0] and then [0] key to enter the "x" value.
- (2) Press the \mathbb{A} key. The cursor (_) will move to "y".
- 3 Press the (3), (0), (0) and then (0) key to enter the "y" value.
- (4) Press the $|\widehat{}|$ key.

The cursor (_) will move to "Lv".

(5) Press the [3], [9], [5], [5] and then [0] key to enter the "Lv" value.

8. Press the 🕞 key.

The LCD display section will return to the user calibration input screen, with the "*" mark displayed indicating that values have been entered for "W".

9. Press the 📾 key.

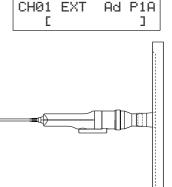
White calibration will start, and the entered values will be set as the target color when the correction factor is entered.

10. Press the HOLD key to start measurement.

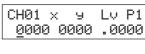
- * To cancel white calibration, press the 🗒 key before pressing the key at step 9.
- * To view the white-calibrated values (target color values), press the MR key. However, if the target color is set after white calibration is performed with the same memory channel, the values for that target color will be displayed. (For details, refer to page 73.)
- * If measurement is performed with non-user-calibrated memory channel for the first time since shipment from the factory, the Konica Minolta's calibration standard will be used for the measurement.

* To change the target color you set, change it as explained in "1. Setting/Changing the Target Color by Measurement" (page 63). The currently set correction factor for white calibration will remain unchanged even if the target color is changed.

* White calibration can still be performed even if the measured values are not hold (i.e. even if the HOLD key is not pressed). In this case, white calibration will be performed for the measured values set by pressing the [m] key at step 9.

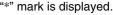




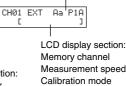


СН01 × 9 <u>3</u> 300 0000	Lv P1 .0000
+	
СН01 х 9	Lv P1
3300 3000	.0000
+	
СН01 х 9	Lv P1
3300 3000	<u>3</u> 9.50
-	





"a" is displayed after white calibration.



Probe no.

ID name

3,9,5,0 Digital display section: Analog display section: **Displays** calibration Displays the center values. dots only.

Screen example after white

<u>0.3300</u>

0.3000

calibration

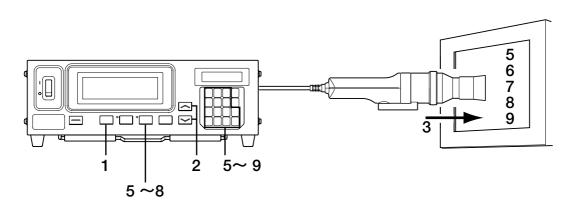
у

Ιv

3. Performing Matrix Calibration

- Matrix calibration cannot be performed with the memory channel CH00. (CH00 memory channel is provided for measurement that uses the Konica Minolta's calibration standard.)
- Matrix calibration must be performed for each display type (model). Characters of displays vary with the display type (model). Because of this, measured values differ even if the same color is measured. Thus, a different memory channel must be used for each display type (model) to perform matrix calibration.
- If matrix calibration is performed with a memory channel to which the target color has already been set, that target color will be deleted.
- If matrix calibration is performed with a memory channel which has already been white-calibrated, the correction factor of the previous white calibration will be deleted and the correction factor obtained from the matrix calibration will be set.
- If matrix calibration is performed with a memory channel for which the RGB emission characteristic for the analyzer mode is to be set, the previous RGB emission characteristic will be deleted and the WRGB set for matrix calibration will be set as the RGB emission characteristic.

[Operating Procedure]



When the optional 4-Probe Expansion Board CA-B15 is used

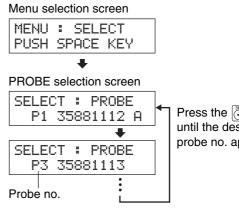
Select the probe no. to be white-calibrated. White calibration can be performed independently for each probe connector ([P1] to [P5]) for each memory channel.

 $(\mathbf{1})$ Press the 🥽 key.

> The LCD display section will switch to the menu selection screen.

(2) Press the key to open the PROBE selection screen.

Each time the $\begin{bmatrix} -\infty \\ (\alpha) \end{bmatrix}$ key is pressed, the screen will switch in the order $PROBE \rightarrow SYNC \rightarrow ID$ Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration Standard \rightarrow RS232C Baud Rate \rightarrow PROBE.



Press the 🕞 key until the desired probe no. appears.

(3) Press the 🕑 key to display the probe no. you want to select. Each time the \bigcirc key is pressed, the probe no. switches in the order [P1]

(4) Press the key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(1).

[Preparation]

- **1**. Press the MODE key to select xyLv measurement mode.
- 2. Press the MEMORY CH and keys until the memory channel where you want to perform user calibration appears.

A memory channel other than CH00 must be selected.

3. Place the measuring probe against the display and take measurement.

Set the display so that it can display four colors (RGBW) whose xyLv values are known.

4. Press the key.

The LCD display section will switch to the user calibration input screen.

- 5. Enter the emission characteristic of R and calibration values (x, y, Lv).
 - (1) Place the measuring probe against the display, which is now emitting monochrome light of R.

Currently measured values will be displayed.

- (2) While the probe is placed against the display, press the HOLD key. The measured values will be hold and the HOLD LED lights up.
- 3 Press the 0 key.

The LCD display section will switch to the R calibration value input screen.

(4) Enter calibration values (x, y, Lv).

Enter them in the same way as when you enter W calibration values for white calibration (see step 7 in "Performing White Calibration" on page 52).

5 Press the key.

The LCD display section will return to the user calibration input screen, with the "*" mark displayed on the left of "R".

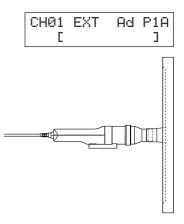
(6) Press the HOLD key to resume measurement.

6. Enter the emission characteristic of G and calibration values (x, y, Lv).

- (1) Place the measuring probe against the display, which is now emitting monochrome light of G. Currently measured values will be displayed.
- (2) While the probe is placed against the display, press the HOLD key. The measured values will be hold and the HOLD LED lights up.
- ③ Press key. The LCD display section will switch to the G calibration value input screen.
- (4) Enter calibration values (x, y, Lv).

Enter them in the same way as when you enter W calibration values for white calibration (see step 7 in "Performing White Calibration" on page 53).

- (5) Press the key.The LCD display section will return to the user calibration input screen, with the "*" mark displayed on the left of "G".
- 6 Press the HOLD key to resume measurement.



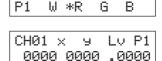


CH01	×	Э	Lν	Ρ1
CH01	30	000	.00	300

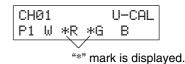
CH0:	1		U	-CAL
P1	ω	*R	G	В

"*" mark is displayed.

U-CAL



CH01



7. Enter the emission characteristic of B and calibration values (x, y, Lv).

- (1) Place the measuring probe against the display, which is now emitting monochrome light of B. Currently measured values will be displayed.
- (2) While the probe is placed against the display, press the HOLD key. The measured values will be hold and the HOLD LED lights up.
- (3) Press the $|\hat{F}|$ key. The LCD display section will switch to the B calibration value input
- screen. (4) Enter calibration values (x, y, Lv). Enter them in the same way as when you enter W calibration values for white calibration (see step 7 in "Performing White Calibration" on page 53).
- (5) Press the $|_{\bigcirc}|$ key. The LCD display section will return to the user calibration input screen, with the "*" mark displayed on the left of "B".
- 6 Press the HOLD key to resume measurement.

8. Enter the emission characteristic of white light and calibration values (x, y, Lv).

- (1) Place the measuring probe against the display, which is now emitting white light. Currently measured values will be displayed.
- (2) While the probe is placed against the display, press the HOLD key. The measured values will be hold and the HOLD LED lights up.
- 3 Press the |1| key. The LCD display section will switch to the W calibration value input screen.
- (4) Enter calibration values (x, y, Lv).

Enter them in the same way as when you enter W calibration values for white calibration (see step 7 in "Performing White Calibration" on page 53).

 \bigcirc Press the \bigcirc key.

The LCD display section will return to the user calibration input screen, with the "*" mark displayed on the left of "W".

6 Press the HOLD key to resume measurement.

9. Press the 🕞 key.

Matrix calibration will start, and the W measured values entered at step 8 will be set as the target color when the correction factor is entered.

- * Steps 5 to 8 can be performed in any order.
- * Pressing the [6], [.], [.] or [1] key before pressing the [.] key at step 9 allows you to re-enter the emission characteristic of the color or the measured values of white light and calibration values.



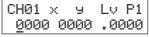
* To view the target color values set for matrix calibration, press the MR key. However, if the target color is set after matrix calibration is performed with the same memory channel, the values for that target color set last will be displayed. (For details, refer to page 73.)

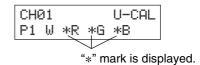
у

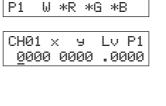
Lv

- * If measurement is performed with non-user-calibrated memory channel for the first time since shipment from the factory, the Konica Minolta's calibration standard will be used for the measurement.
- * To change the target color you set, change it as explained in "1. Setting/Changing the Target Color by Measurement" (page 63). The currently set correction factor for matrix calibration will remain unchanged even if the target color is changed.
- Matrix calibration can still be performed even if the measured values are not hold (i.e. even if the HOLD key is not pressed). In this case, the measured values confirmed by pressing the indicate key at steps 5 to 8 will be used for calculation of the correction factor for matrix calibration.

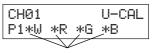








CH01



"*" mark is displayed.

U-CAL

"m" is displayed after Example of screen after matrix matrix calibration. calibration CH01 EXT Am P1A 0.3300 0.3000 LCD display section: 3,957 Memory channel Measurement speed Digital display section: Analog display section: Calibration mode Displays the center **Displays** calibration Probe no. values dots only ID name

<Notes on User Calibration>

- The target color is also set when user calibration is performed. Note that the target color is common to all measurement modes (xyLv, T Δ uvLv, analyzer, u'v'Lv, XYZ).
- If the intensity of the display to be measured is 1.0 cd/m² or less (3.0 cd/m² or less when a LED Universal Measuring ø10 Probe(CA-PSU32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.) or if the ambient temperature has changed, zero calibration must be performed before user calibration.
- Static electricity on the display's screen surface must be removed as much as possible.
- Make sure that the measuring probe is placed straight against the display. If it is tilted or moved, user calibration will not be accurate.
- Take care not to let the measuring probe be exposed to excessive impact. Neither should the cord be pulled or bent excessively nor excessive force be exerted on it. Failure to observe these cautions may result in breakdown or wire-breakage.
- The $\left[\frac{1}{600}\right]$ key may not be operable if "OVER" is displayed on the LCD display section.
- Never press the following keys during user calibration. Doing so will cancel user calibration and activate the mode corresponding to the pressed key.



<Calibration Mode and LCD>

The following alphabet will appear at the "*" position on the LCD display section according to the selected calibration mode.

- d : Matrix calibration with Konica Minolta's calibration standard 6500K
- h : Matrix calibration with Konica Minolta's calibration standard 9300K
- a : White calibration (user calibration)
- m: Matrix calibration (user calibration)

• Cause

Error Messages in LCD Display Section> ... For other error messages, refer to page 103.

- "E3" (When the [m] key is pressed in the calibration value input screen)
 - Cause : Incorrect calibration values are set. Incorrect calibration values mean the following.

(1) One of x, y and Lv is "0".

- (2) $1-x-y \leq 0$
- (3) Values which are beyond the instrument's calculation capability or contradicting values
- Action : Enter correct values and then press the key.
- "E5" (When the [m] key is pressed in the calibration value input screen)
 - Cause ①: Calibration values (x, y, Lv) for white color have not been entered.

Action : Enter the calibration values (x, y, Lv) for white color and then press the [m] key.

• Cause ②: Calibration values for only some of R, G and B have been entered.

Action : If you are going to perform white calibration, enter the values for W only.

(Restart from step 4, where you were asked to press the $\begin{bmatrix} -390E \\ (A) \end{bmatrix}$ key.)

If you are going to perform matrix calibration, enter values for the colors whose values have not been entered, and then press the $|_{(m)}|$ key.

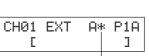
- "E6" (When the [m] key is pressed in the calibration value input screen) : Incorrect calibration values are set. Incorrect calibration val-
- CH01 U-CAL E6 *W *R *G *B

CH01

E5 *W *R

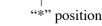
- "E6" will appear if the calculation results obtained when calculation for matrix calibration is performed are inappropriate.
- Action : Enter correct values and then press the [m] key.

ues mean the following.



ы

3300 0000 100.0



LV P1

U-CAL G *8

Analyzer Mode

1. About Analyzer Mode

<What is Analyzer Mode?>

Analyzer measurement mode is provided for adjustment of the display's white balance.

The measured colors are expressed in output of each R, B and G monochromatic light based on the display's analyzer mode RGB emission characteristic (input to the instrument) and the target color (W).

Thus, adjusting the emission intensity of R causes the measured value of R only to change, and measured values for B and G remain unchanged This mode is useful when you adjust the emission intensity of R, B and G to match the target color (W).

The following measured values will be displayed when the display's emission intensity (emission intensity of R, B and G monochrome lights) and the target color (W) are set and measurement is performed in analyzer mode.

• Digital display section R, B, G : Outputs of the currently measured monochrome lights R,

B and G in ratio (%) to those of the specified target color (W)

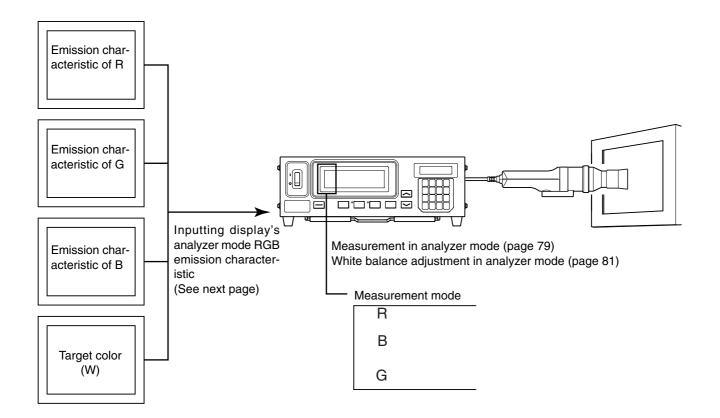
• Analog display section When analyzer mode (G-reference) is selected

R/G, B/G: Ratio of measured values

 ΔG : Difference from the target color in the case of monochrome light G

When analyzer mode (R-reference) is selected

- ΔR : Difference from the target color in the case of monochrome light R
- G/R, B/R : Ratio of measured values



2. Inputting the RGB Emission Characteristic for Analyzer Mode

The RGB emission characteristic for analyzer mode must be input to each memory channel. When it is input, the target color (W) must also be set.

To adjust white balance, the values of the white-balanced white must be entered as the terget color (W).

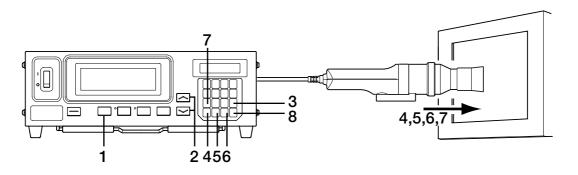
If the RGB emission characteristic for the display's analyzer mode is input to a memory channel for which the target color has already been set, the previously set target color will be deleted. The target color to be used is the same as that for xyLv, $T\Delta uvLv$, u'v'Lv and XYZ measurement modes.

The RGB emission characteristic for the display must be input for each display type (model).

Characters of displays vary with the display type (model). Because of this, measured values differ even if the same color is measured.

Thus, a different memory channel must be used for each display type (model) to input the RGB emission characteristic for analyzer mode.

[Operating Procedure]



When the optional 4-Probe Expansion Board CA-B15 is used

Select the probe no. for which the RGB emission characteristic for the display is to be input. The RGB emission characteristic for the display can be input independently for each probe connector ([P1] to [P5]) for each memory channel.

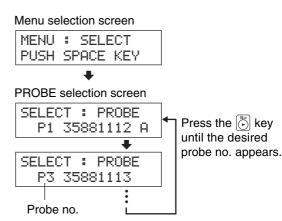
1 Press the 📾 key.

The LCD display section will switch to the menu selection screen.

2 Press the key to open the PROBE selection screen.

> Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration Standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

③ Press the key to display the probe no. you want to select.



Each time the \bigcirc key is pressed, the probe no. switches in the order [P1] \cdots .

(4) Press the integration key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(1).

- 1. Press the MODE key to select analyzer measurement mode (RGB).
- 2. Press the MEMORY CH and keys until the memory channel where you want to input the RGB emission characteristic appears.

3. Press the $\overline{\mathbb{A}}$ key.

The LCD display section will switch to the analyzer mode RGB emission characteristic input screen.

4. Input the emission characteristic of R.

- (1) Press the measuring probe against the display, which is now emitting monochrome light of R.
- (2) Press the (5) key. In the LCD display section, the "*" mark will appear on the left of "R".

5. Input the emission characteristic of G.

- (1) Place the measuring probe against the display, which is now emitting monochrome light of G.
- 2 Press the 💮 key. In the LCD display section, the "*" mark will appear on the left of "G".

6. Input the emission characteristic of B.

- (1) Place the measuring probe against the display, which is now emitting monochrome light of B.
- (2) Press the key. In the LCD display section, the "*" mark will appear on the left of "B".

7. Enter the target color (W)

- (1) Place the measuring probe against the display, which is now emitting the target color(W).
- (2) Press the (1) key. In the LCD display section, the "*" mark will appear on the left of "W".

8. Press the 🕞 key.

The RGB emission characteristic for the display's analyzer mode and target color (W) will be set.

- * Steps 4 to 7 can be performed in any order.
- * Pressing the 🐻, 🗒, 🖉 or 📆 key before pressing the 📾 key allows you to re-enter the emission characteristic.
- * To cancel emission characteristic setting, press the $\overline{[m]}$ key before pressing the $\overline{[m]}$ key.
- * To change the target color you set, change it as explained in "1. Setting/Changing the Target Color by Measurement" (page 63). Even if the target color is changed, the currently set RGB emission characteristic for display's analyzer mode will remain unchanged.
- * Pressing the MR key displays "100.0" as the target color value for R, B and G.

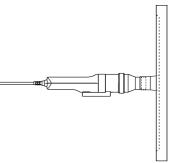
<Error Messages in LCD Display Section> ... For other error messages, refer to page 103.

- "E1"
 - Cause (1): The display's RGB emission characteristic has never been input for the currently selected memory channel since shipment from the factory.
 - Action : This error will disappear if you enter the emission characteristic.
 - Cause(2) : The currently used measuring probe is different from the one that was used to input the display's RGB emission characteristic and target color (W).
 - Action : Connect the same probe as the one used to input the display's RGB emission characteristic and target color (W).

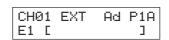
Memory channel

CH01	EXT	Ad	P1A
Γ]





CHe	91			ALZ	
Ρ1	ω	*R	G	В	
		•	•		
CHe	91			ALZ	
Ρ1	ω	*R	*G	В	
		-	•		
CH6	91			ALZ	
P1	ω	*R	*G	*B	
+					
CHe	91			ALZ	
Ρ1	$* \mathfrak{h}$	*R	*G	*B	



Alternatively, input the display's RGB emission characteristic with the currently used measuring probe.

- "E5" (after the \bigcirc key is pressed)
 - Cause ① : The emission characteristic for one of W, R, G and B has not been input.
 - Action : Input the emission characteristic for the color for which the emission characteristic has not been input, and then press the key.
 - Cause (2): The (1) key was pressed when the measuring range for target color (W) was exceeded.
 Action : Input the target color values (W) that are within the measuring range, and press the (1) key.

<Notes on When Inputting the RGB Emission Characteristic for Analyzer Mode>

• By default (factory setting), the RGB emission characteristic for the display's analyzer mode has not been input.

Thus, before performing measurement in analyzer mode, the RGB emission characteristic must be input.

- The target color is also set when the RGB emission characteristic is input. Note that the target color is common to all measurement modes (xyLv, T∆uvLv, analyzer, u'v'Lv, XYZ).
- If the intensity of the display to be measured is 1.0 cd/m² or less (3.0 cd/m² or less when a LED Universal Measuring ø10 Probe(CA-PSU32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.) or if the ambient temperature has changed, zero calibration must be performed before inputting the RGB emission characteristic.
- Static electricity on the display's screen surface must be removed as much as possible.
- Make sure that the measuring probe is placed against the display. If it is tilted or moved, it is not possible to input accurate emission characteristic.
- Take care not to let the measuring probe be exposed to excessive impact. In addition, do not pull or bend the cord excessively or exert excessive force on it. Failure to observe this may result in breakdown or wire-breakage.
- 🖾 keys may not be operable if "OVER" is displayed on the LCD display section.
- Never press the following keys during setting.

Doing so will cancel setting of the emission characteristic and activate the mode corresponding to the pressed key.

(O-CAL, MODE, MR, MEMORY CH ,),)

- If the RGB emission characteristic for analyzer mode is input using a memory channel that has been matrixcalibrated, the correction factor for matrix calibration will be deleted. (Konica Minolta's calibration standard will be used for measurement if xyLv, T∆uvLv, u'v'Lv or XYZ measurement mode is selected.)
- In the case of the same memory channels and probes, the RGB emission characteristic for analyzer mode is stored in their common memory irrespective of measurement mode. Therefore, when matrix calibration is performed, the RGB emission characteristic for analyzer mode is also input at the same time.

User Calibration How the memory is used in the case of analyzer mode

Calibration values xyLv for W	Calibration values xyLv for R	Calibration values xyLv for G	Calibration values xyLv for B
Measured value for W	Measured value for R	Measured value for G	Measured value for B
Used for white calibration	Used for	analyzer mode RGB emission char	acteristic
— Used for matrix calibration —			

CH0	1			ALZ
E5	*W	*R	G	*8

Setting/Changing the Target Color

If you have input the RGB emission characteristic for user calibration/analyzer mode:

It is not necessary to set the target color in the following cases.

- (1) When you want to set the user-calibrated color as the target color for a memory channel
- (2) When you want to set the target color (W) which was set when the RGB emission characteristic for the display's analyzer mode was set as the target color

The target color set here is the same as those set by (1) and (2) Only when you want to change the currently set target color, should it be changed it as explained below.

By setting the target color, the difference between the measured value and the target color can be displayed in the analog display section. The target color can be set for each probe of each memory channel.

The target color must be set in the following cases.

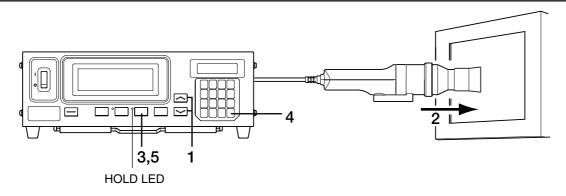
- When you want to set the target color for memory channel CH00
- When you want to perform measurement using Konica Minolta's calibration standard without user calibration and want to use the analog display function
- When you want to set a color that differs from the color used for user calibration as the target color to a usercalibrated memory channel
- When the optional 4-Probe Expansion Board CA-B15 is used

When you want to set the target color (W) that has already been set and another color as the target color to a memory channel for which the RGB emission characteristic for analyzer mode has been input

There are the following two methods of setting/changing the target color. Some memory channels do not allow you to set the target color.

- 1. Setting/changing the target The display's measured value is set as the target color.
- color by measurement This method can be used for any memory channels.

[Operating Procedure]



When the optional 4-Probe Expansion Board CA-B15 is used

Select the probe no. to which you want to set the target color. The target color can be set independently for each probe connector ([P1] to [P5]) for each memory channel.

(1) Press the [m] key.

The LCD display section will switch to the menu selection screen.

Press the key to open the PROBE selection screen.

Each time the key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration Standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

Press the key to display the probe no.
 you want to select.

Each time the $[\bigcirc]$ key is pressed, the probe no. switches in the order [P1] \cdots .

(4) Press the explanation key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(1).

- **1**. Press the MEMORY CH is and is keys until the memory channel where you want to set the target color appears.
- 2. Place the measuring probe against the display and take measurement.
- **3**. While the probe is placed against the display, press the HOLD key.

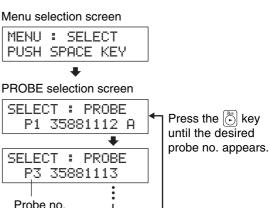
The latest measured values will be hold and the HOLD LED lights up.

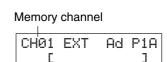
- **4**. Press the \bigcirc key.
- The measured color of the display will be set as the target color.**5.** Press the HOLD key to start measurement.

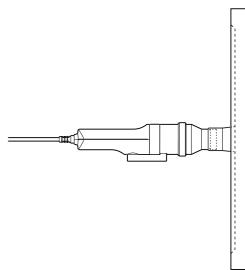
The HOLD LED will go out.

* To view the target color you set, press the <u>MR</u> key. (For details, refer to page 72.)

* By default (factory setting), x=0.3127, y=0.3293 and Lv=160.0 (cd/cm²) are set for each memory channel.







<Notes when Setting/Changing the Target Color by Measurement>

- Note that the target color is common to all measurement modes (xyLv, T∆uvLv, analyzer, u'v'Lv, XYZ).
- If the intensity of the display to be measured is 1.0 cd/m² or less (3.0 cd/m² or less when a LED Universal Measuring ø10 Probe(CA-PSU32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.) or if the ambient temperature has changed, zero calibration must be performed before setting the target color.
- Static electricity on the display's screen surface must be removed as much as possible.
- Make sure that the measuring probe is placed straight against the display. If it is tilted or moved, it is not possible to input accurate target color.
- Take care not to let the measuring probe be exposed to excessive impact. In addition, do not pull or bend the cord excessively or exert excessive force on it. Failure to observe this may result in breakdown or wire-breakage.
- If "OVER" is currently displayed, it is not possible to set the currently measured color as the target color since the instrument's measurement range is exceeded.

<Error Messages in LCD Display Section> ... For other error messages, refer to page 103.

- "OVER" (after the HOLD key is pressed)
 - It is not possible to set the currently measured color as the target color since the instrument's measurement range is exceeded by the measured value.
- "E1"
 - Cause : The target color was set using a measuring probe which is different from the one used to perform user calibration/input the RGB emission characteristic for the analyzer mode.
 - Action : ① Set the target color using the measuring probe that was used to perform user calibration/input the RGB emission characteristic for the analyzer mode.
 - 2 Perform user calibration/input the RGB emission characteristic for the analyzer mode again using a measuring probe connected to the instrument, and then set the target color.
- * For a description of how to check the probe serial no., refer to page 74.

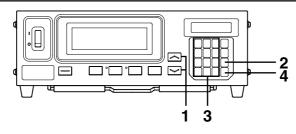
OVER		

CH01	EXT	Ad	P1A
E1 []

2. Setting/changing the target color by entering values

This method can be used for memory channel CH00 only.

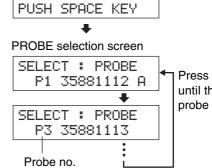
[Operating Procedure]



When the optional 4-Probe Expansion Board CA-B15 is used

Select the probe no. to which you want to set the target color. The target color can be set independently for each probe connector ([P1] to [P5]) for each memory channel.

- 1 Press the image key. The LCD display section will switch to the menu selection screen.
- (2) Press the key to open the PROBE selection screen.
 Each time the key is pressed, the screen will switch in the order PROBE → SYNC → ID Name input → RANGE → Measurement Speed → Number of Digits → Calibration Standard→ RS232C Baud Rate → PROBE.



Menu selection screen

MENU : SELECT

Press the 🕞 key until the desired probe no. appears.

Settings Section

③ Press the is key to display the probe no. you want to select.

Each time the b key is pressed, the probe no. switches in the order [P1] \cdots .

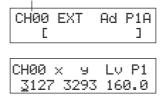
(4) Press the (a) key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(1).

- **1**. Press the MEMORY CH and keys until the memory channel CH00 appears.
- **2**. Press the $\overline{\mathbb{A}}$ key.

In the LCD display section, the current target color values are displayed.

Memory channel



Lv P1

<Error Messages in LCD Display Section> ... For other error messages, refer to page 101.

- "E3" (after the key is pressed)
 - Cause : An attempt was made to set Incorrect target color values.

Incorrect calibration values mean the following.

- (1) One of x, y and Lv is "0".
- (2) $1-x-y \leq 0$
- ③ Values which are beyond the instrument's calculation capability or contradicting values.

E3

х 9

0000 3293 160.0

• Action : Enter correct values and then press the 🕞 key.

3. Enter target color values (x, y, Lv).

For x and y, a value 10000 times the calibration value must be entered.

Use the number-key (0 to 0, 0) to enter the value.

The cursor moves to the right each time a value is entered.

Each time the \bigcirc key is pressed, the cursor moves in the order $x \rightarrow y \rightarrow Lv \rightarrow x$.

- In this example, x=0.3300, y=0.3000 and Lv=39.50 are entered.
- 1 Press the [3], [3], [0] and then [0] key to enter the "x" value.
- 2 Press the key. The cursor (_) will move to "y".
- (3) Press the [3], [0], [0] and then [0] key to enter the "y" value.
- Press the key.
 The cursor (_) will move to the "Lv" position.
- (5) Press the (3), (3), (3), (5) and then (6) key to enter the "Lv" value.

4.Press the result is key.

The target color will be set to CH00.

- * To cancel target color setting, press the $\overline{\textcircled{\mbox{\footnotesize only }}}$ key before pressing the $\overline{\textcircled{\mbox{\scriptsize only }}}$ key.
- * To view the target color you set, press the MR key. (For details, refer to page 73.)
- * By default (factory setting), x=0.3127, y=0.3293 and Lv=160.0 (cd/m²) are set for the memory channels for which no target color has been set.

<Notes when Setting/Changing the Target Color>

- The key may not be operable if "OVER" is displayed on the LCD display section.
- Note that the target color is common to all measurement modes (xyLv, T∆uvLv, analyzer, u'v'Lv, XYZ).
- Never press the following keys during target color setting.

Doing so will cancel setting and activate the mode corresponding to the pressed key.

(O-CAL, MODE, REMOTE, MR, MEMORY CH (), (), ())

СН00 х у	Lv P1	
3300 3293	160.0	
+		
СН00 х у	Lv P1	
3300 3000	160.0	
+		
СН00 х у	Lv P1	
3300 3000	<u>3</u> 9.50	
•		
СН00 х у	Lv P1	
3300 3000	39.50	

Other Settings

1. Setting an ID Name

An ID name is a name that can be assigned to each memory channel by entering it directly using keys. When measurement is performed, the ID name is displayed together with the memory channel no. and probe no. in the LCD display section.

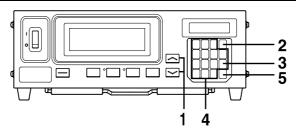
- Number of characters you can enter Up to 10 characters

For instance, if you set "EXT D-1.50" for CH01, the LCD display section will look like the one shown on the right.

Memory channel Probe no. CH01 EXT Ad P1A Probe type [EXT D-1.50] - ID name

This function is useful when you want to specify that user calibration and target color have been set for what type of display with what colors.

[Operating Procedure]



- 1. Press the MEMORY CH and keys until the memory channel to which you want to set an ID name appears.
- 2. Press the key. The LCD display section will switch to the menu selection screen.
- 3. Press the key to open the ID name input screen.
 Each time the key is pressed, the screen will switch in the order PROBE → SYNC → ID Name input → RANGE → Measurement Speed → Number of Digits → Calibration Standard→ RS232C Baud Rate → PROBE.
- Memory channel CHØ1 EXT Ad P1A CHØ1 EXT Ad P1A MENU : SELECT PUSH SPACE KEY CHØ1 EXT Ad P1 CHØ1 EXT Ad P1 CL J

4. Enter the desired ID name.

Number-key () to), Used to enter values. (The cursor moves to the right each time a value is entered.)

key The 😰 to 🗑 and 👼 keys on the key panel can be used to enter an alphabet, hyphen (-) and space. Pressing this key again will restore the original function of the number-key.

key Moves the cursor to the right each time this key is pressed.

In this example, "EXT D-1.50" is set as the ID name.

(1) Press the $\left(\begin{array}{c} \cos \theta \\ \cos \theta \end{array} \right)$ key.	
	CH01 EXT Ad P1
(2) Press the $\begin{bmatrix} 0 \\ 3 \end{bmatrix}$ key twice.	
"E" will appear at the cursor position.	•
③ Press the 🛞 key twice.	CH01 EXT Ad P1
"X" will appear at the cursor position.	
(4) Press the $[\mathbb{R}]$ key once.	CH01 EXT Ad P1
"T" will appear at the cursor position.	
5 Press the 🖾 key twice.	CH01 EXT Ad P1
"" will appear at the cursor position.	EEXT_]
6 Press the 3 key once.	•
"D" will appear at the cursor position.	CH01 EXT Ad P1
7 Press the 6 key once.	
"-" will appear at the cursor position.	CH01 EXT Ad P1
8 Press the 🕅 key.	EEXT D=]
9 Press the \mathbb{N} key.	CH01 EXT Ad P1
"1" will appear at the cursor position.	CHOILEXT D-1]
(1) Press the $\overline{[]}$, $\overline{[]}$ and then $\overline{[]}$ key.	
".", "5" and then "0" will appear at the cursor position.	CH01 EXT Ad P1 [<u>E</u> XT D-1.50]

5. Press the 📾 key.

The ID name will be set for the selected memory channel. * To cancel ID name setting, press the i key.

<Notes when Setting an ID Name>

- The ID name will be kept even if the POWER switch is set to OFF.
- Never press the following keys during ID name setting.
 - Doing so will cancel setting and activate the mode corresponding to the pressed key.

(O-CAL, MODE, REMOTE, MR, MEMORY CH ,)

If the key is pressed while the key is not held down (i.e. the number-key is not used as alphabet key), a screen for setting the analog display range will appear.

• When the optional 4-Probe Expansion Board CA-B15 is used

Only one ID name can be set for each memory channel irrespective of the number of probes. (The specified ID name will be common to all probes [P1] to [P5].)

2. Setting the Analog Display Range

The analog display section displays the difference (%) between the measured value and the target color as well as the difference (%) between measured values in the case of a measurement mode other than flicker mode**. In the case of flicker mode, the measured values will be displayed as they are.

The range for each dot can be set as follows.

- (1) xyLv, T Δ uvLv, u'v'Lv or XYZ measurement mode Δ x, Δ y and Δ Lv
- 2 Analyzer Mode

For G-reference $R/G,\,B/G$ and ΔG

For R-reference ΔR , B/R and G/R

③ Flicker Mode** Flicker value

The range must be set independently of (1), (2) and (3)

In the case of (1), the range set here will be used commonly by all the modes. Thus, for instance, if Δx and Δy are set to 2% and ΔLv is set to 10% for xyLv mode, Δx and Δy will be displayed in 2% and ΔLv in 10% irrespective of the measurement mode (xyLv, T $\Delta uvLv$, u'v'Lv or XYZ).

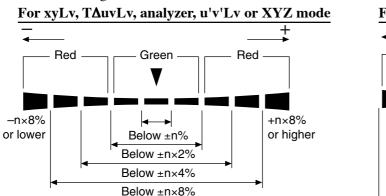
In the case of (2), the value set for ΔG (G-reference), the value set for ΔR (R-reference), the values set for R/G and B/G (G-reference) and those set for B/R and G/R (R-reference) will be common. Thus, for instance, if ΔG is set to 5% and both R/G and B/G are set to 3% in the case of G-reference, ΔR will be displayed in 5% and both B/R and G/R in 3% in the case of R-reference.

In the case of (3), the analog display range for each dot can be set for flicker value.

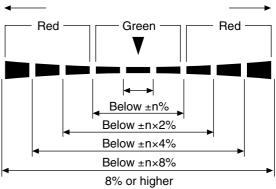
• Settable range 0.1 to 99%

In 0.1% step for the range from 0.1 to 9.9% In 1% step for the range from 10 to 99%

• How to Read Analog Display When n% range is set







• Values displayed in the analog display section

For xyLv, T
$$\Delta$$
uvLv, u'v'Lv or XYZ mode

$$\Delta x = \left(\frac{x-xt}{xt}\right) \times 100 \ (\%)$$

$$\Delta y = \left(\frac{y-yt}{yt}\right) \times 100 \ (\%)$$

$$\Delta Lv = \left(\frac{Lv-Lvt}{Lvt}\right) \times 100 \ (\%)$$
where, xt, vt, Lvt : Target color values

x, y, Lv : Measured values

^{**}Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

For analyzer mode (G reference)

$$\begin{aligned} \mathsf{R}/\mathsf{G} &= \left(\frac{\mathsf{R}-\mathsf{G}}{\mathsf{G}}\right) \times 100 \text{ (\%)} \\ \mathsf{B}/\mathsf{G} &= \left(\frac{\mathsf{B}-\mathsf{G}}{\mathsf{G}}\right) \times 100 \text{ (\%)} \\ \Delta\mathsf{G} &= \left(\frac{\mathsf{G}-\mathsf{Gt}}{\mathsf{Gt}}\right) \times 100 = \mathsf{G}-100 \text{ (\%)} \end{aligned}$$

For analyzer mode (R reference)

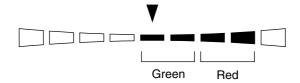
$$\Delta R = \left(\frac{R - Rt}{Rt}\right) \times 100 = R - 100 (\%)$$
$$B/R = \left(\frac{B - R}{R}\right) \times 100 (\%)$$
$$G/R = \left(\frac{G - R}{R}\right) \times 100 (\%)$$

where Gt, Rt : Target color values, being 100 R, G, B: Measurement Values

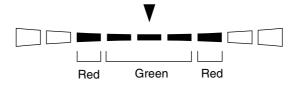
For flicker mode**

Measured values are displayed as they are. The display lights up crosswise.

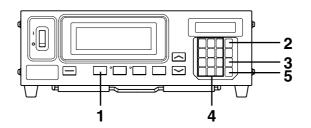
• Display examples $\Delta x=15\%$ when set to 2%



Measured flicker 13% when set to 5%



[Setting Procedure]



1. Press the MODE key to select the measurement mode for which you want to set the range.

2. Press the \bigcirc key.

The LCD display section will switch to the menu selection screen.

3. Press the key to open the RANGE setting screen. Each time the key is pressed, the screen will switch in the order PROBE → SYNC → ID Name input → RANGE → Measurement Speed → Number of Digits → Calibration Standard→ RS232C Baud Rate → PROBE.

4. Enter the desired range value.

Use the number-key (0) to 0, 0) to enter the value. (The cursor moves to the right each time a value is entered.)

Each time the $\textcircled{B}{}^{\text{lim}}$ key is pressed, the cursor moves between x, y and Lv, between G and B/G, R/G or between R and B/G, R/G. (This does not apply in the case of flicker mode**.)

In this example, the "x, y" range is set to 2.5%, and the "Lv" range is set to 2.0%.

Press the (2), (3) and then (5) key to set the "x, y" range.
 Press the (5) key.

The cursor (_) will move to the "Lv" position.

3 Press the (2), (-) and then (0) key to set the "Lv" range.

5. Press the \bigcirc key.

The ranges will be set.

* To cancel range setting, press the \bigcirc key before pressing the \bigcirc key.

* By default (factory setting), the ranges are set to 10%.

<Error Messages in LCD Display Section> ... For other error messages, refer to page 103.

• "E4" (after the key is pressed)

- Cause : 0.0% was entered.
- Action : Enter a correct value and then press the
 key. The settable range is from 0.1 to 99%.

RANGE	х, 9	Lv	
E4(%)	0.0	10	

•				
Range setting screen (For xyLv, T∆uvLv, u'v'Lv or XYZ mode)				
RANGE x,9 Lv (%) 10 10				
For analyzer mode (G reference)				
RANGE G B/G,R/G (%) 10 10				
For analyzer mode (R reference)				
RANGE R B/R,G/R				
(%) 10 10				
For flicker mode**				
RANGE FMA				
(%) 10				

Menu selection screen

PUSH SPACE KEY

RANGE		Lv	
(%)	2.5	10 •	
DOLICE		Τu	
RANGE	X79	LV.	

<Notes on Range Setting>

- The range settings will be kept even if the POWER switch is set to OFF (\bigcirc). The specified analog range will be effective when the POWER switch is set to ON (1).
- The specified range settings are common to all the probe nos. and memory channels.
- Keys may not be operable if "OVER" is displayed on the LCD display section.
- Never press the following keys during range setting.

Doing so will cancel range setting and activate the mode corresponding to the pressed key.

(O-CAL, MODE, REMOTE, MR, MEMORY CH ,)

<Digital and Analog Display>

In the case of four-digit digital display, measured values are displayed in four digits with the fifth digit rounded off. Similarly, in the case of three-digit digital display, measured values are displayed in three digits with the fourth digit rounded off.

However, the values calculated from the digital display may not match the values displayed in the analog display section.

Settings Section

Settings Checking Method

1. Checking the Set Values

<Checking the Specified Target Color>

By pressing the MR key for less than two seconds in xyLv, T Δ uvLv, u'v'Lv or XYZ mode, the values of the target color for the currently selected memory channel is displayed in the LCD display section as shown on the right.

When the optional 4-Probe Expansion Board CA-B15 is used

The values of the target color for the currently selected memory channel probe no. will be displayed.

<Checking the Calibration Values for User Calibration>

- When white calibration is performed as user calibration
 - (1) If only user calibration has been performed, the calibration values can be checked by checking the target values. Since when user calibration is performed the color at the time of user calibration will be set as the target color automatically, the target color values match the calibration values. However, if a different color is set as the target color after user calibration, it is not possible to check the calibration values with this method.
 - (2) It is possible to check the calibration value for W by performing steps 5 and 6 (key→ () key) of the white calibration operating procedure (page 53).
 The value that appears first when the () key is pressed is the calibration value that was entered when the previous user calibration was performed. The values for the target color will be displayed if user calibration.

previous user calibration was performed. The values for the target color will be displayed if user calibration has not been performed.

• When matrix calibration is performed as user calibration

(1) If only user calibration has been performed, the W calibration values can be checked by checking the target values. Since when user calibration is performed the color at the time of W calibration will be set as the target color automatically, the target color values match the W calibration values.

However, if a different color is set as the target color after user calibration, it is not possible to check the calibration values with this method.

(2) It is possible to check the calibration value for W by performing steps 5 and 6 (key→) key) of the white calibration operating procedure (page 53).

The value that appears first when the \bigcirc key is pressed is the calibration value that was entered when the previous user calibration was performed. The values for the target color will be displayed if user calibration has not been performed.

③ To check the calibration values for R, G and B, perform steps 4 then 5 (key→) key), steps 4 then 6 (key→) key) or steps 4 and then 7 (key→) key) of the matrix calibration operating procedure (page 55).

The value that appears first when these keys are pressed is the calibration value that was entered when the previous user calibration was performed. "0" will be displayed for R, G and B if user calibration has not been performed.

M3189	4079	366.0

Э

Lv P1

CH01 \times

2. Checking the Probe Serial No. when Making Settings

	eriod foi ressed	which	the MR	key	y is	To che two to
0		2	4	Ļ	(sec)	and ch
Á		Á	4			
Blee	р	Bleep	Ble	ep		
	Target co is displaye	ed. no.us	probe serial sed to mak- settings is	inte	ensity is	6

displayed.

To check the probe serial no. when making settings, press the MR key for two to four seconds (a bleep will sound after two seconds have elapsed) and check it in the LCD display section.

<When xyLv, T\u00e5uvLv, u'v'Lv or XYZ mode is selected>

The serial number of the probe used when user calibration is performed or when target color is set will be displayed.

When the optional 4-Probe Expansion Board CA-B15 is used

The probe serial no. of the	ne probe connector used for the current selected memory channel will be displayed.
16790160	Probe serial no. used when user calibration was performed
16790160	2 Probe serial no. used when the target color was set

By default (factory setting), "00000000" is set for both (1) and (2).

• When "00000000" is set for (1): If measurement is performed with this memory channel, Konica

Minolta's calibration standard will be used for the measurement. (Same

as when measurement is performed with the memory channel CH00.)

• When "00000000" is set for (2): x=0.3127, y=0.3293 and Lv=160.0 (cd/m²) are set as the values of the target color.

<When an analyzer measurement mode is selected>

The probe serial no. that was used to input the analyzer mode RGB emission characteristic or set the target color for the currently selected memory channel will be displayed.

When the optional 4-Probe Expansion Board CA-B15 is used

The probe serial no. of the probe connector used for the current selected memory channel will be displayed.

16790160	TProbe serial no. used to input the analyzer mode RGB emission characteristic
16790160	2 Probe serial no. used when the target color was set

By default (factory setting), "00000000" is set for both (1) and (2).

- When "00000000" is set for (1): The RGB emission characteristic for the display's analyzer mode has not been input.
- * The serial no. of the currently used measuring probe can be viewed in the PROBE selection screen, that can be opened by pressing the limit then the selection screen is the selection screen.

(If the 4-Probe Expansion Board is used, the probe no. will switch from one to another each time the \bigcirc key is pressed. For details, refer to page 43.)

SELECT : PROBE P1 35881112 A

<When flicker measurement mode** is selected>

"00000000" will be displayed for both data lines.

^{**}Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

Measurement Section

This section explains measuring methods.

From the Settings Section

•	
Measurement Explains measuring methods, how to hold the measured values and how to read them.	Page 76

White Balance Adjustment in Analyzer Mode	Page 81
Explains how to adjust white balance.	Page 61

Measurement

Berore starting measurement, perform the following.		
Installation/Connection section (page 23)	Install the instrument, connect the power cable, and turn ON the power.	
♥		
Measurement Preparation section (page 33)	Perform preparations (instrument setting, zero calibration) that are required prior to measurement.	
↓		
Settings section (page 45)	Set up the instrument according to the setting method. This is not necessary if the instrument has already been set up or if you are going to perform measurement using Konica Minolta's calibration standard and are not going to use the analog display function	

Before starting measurement, perform the following.

1. Performing Measurement

[Measuring Method]

 Press the MEMORY CH and keys. keys to select the memory channel for which user calibration has been performed (page 51), the RGB emission characteristic for analyzer mode that has been input (page 59) and the target color that has been set/changed (page 62).

(Not required in the case of flicker measurement)

2. Place the measuring probe flat against the display and perform measurement.

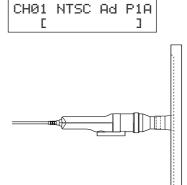
The measurement results will be displayed in the digital and analog display sections in the selected measurement mode.

<Notes on Measurement>

- Since the luminance of the display will be unstable for a while immediately after the display is turned ON, the measured values must be read after they have stabilized.
- Static electricity on the display's screen surface must be removed as much as possible.
- Perform zero calibration if the ambient temperature has changed.
- When measuring a display at a low luminance level of 1.0 cd/m² or less (3.0 cd/m² or less when a LED Universal Measuring ø10 Probe(CA-PSU32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.) for a long period of time, perform zero calibration approximately every hour.
- Make sure that the measuring probe is placed straight against the display. If it is tilted or moved, accurate measurement cannot be performed.
- Take care not to let the measuring probe be exposed to excessive impact. In addition, do not pull or bend the cord excessively or exert excessive force on it. Failure to observe these cautions may result in breakdown or wire-breakage.
- When measurement is implemented, the same Measuring Probe to be used for the User Calibration is necessary.
- For measurement of flicker(only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.), make sure that the correct vertical synchronizing frequency is recognized by the instrument. If an incorrect vertical synchronizing frequency is set in the INT mode or instrument is used in the UNIV mode, correct measured values will not be obtained in flicker measurement.

When the optional 4-Probe Expansion Board CA-B15 is used

• If two or more measuring probes are connected, measurement will be performed with all the probes simultaneously. However, the digital and analog display sections show only the measurement results taken by the one selected probe (page 43).



2. Holding the Measured Values

• To hold the measured values, press the HOLD key. The HOLD LED will light up. (Hold mode)

Pressing the HOLD key again will cancel hold mode and resume measurement. This will cause the HOLD LED to go out.

* If the conditions (e.g. measurement mode) set for hold mode are changed, the measured values that are currently hold will be re-calculated according to the new conditions and then displayed. (This does not apply in the case of SYNC mode.)

<Notes on when Holding the Measured Values>

- It is not possible to hold the measured values in the following cases.
 - ① Until the measured values appear after the POWER switch is set to ON and then 0-CAL key is pressed
 - (2) Until the measured values appear after the 0-CAL key is pressed
 - ③ When the error message "NO SYNC. SIGNAL" is currently displayed in the LCD display section
- To cancel hold mode, press the 0-CAL key.

3. Displaying the Measured Values

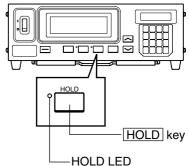
<For xylv, T∆uvLv, u'v'Lv or XYZ Mode>

The measurement results will be displayed in the digital and analog display sections.

• The digital display section shows the measurement results.

All measurement values can be acquired by communicating with PC, however the display of the main unit always displays measurement values 3 to 5 times / second and does not display all the measurement values.

Please see P. 41 for measuring modes.



Х F 7 1 0280 y ΔLv 84 la Lv For T∆uvLv mode 556a Δx т 0.0092 Δy ∆uv 84.18 Lv For XYZ mode 754Δy ΔLv $\zeta \neg \zeta$ For u'v'Lv mode Δx 0.1977 u' 0.4685 Δy v' 160.0 o Lv Δx

ΔLv

According to the selection of number of digits to be displayed (P. 42), an effective number of 3 or 4 digits will be displayed. However, Correlated Color Temperature T will always be displayed with an effective number of 3 digits. For Auv, a Color Difference from Blackbody Locus, 0 of the integer will not be displayed when the value is minus. It will be displayed like "-.0092". Luminance Lv will be displayed to two digits to the right of the decimal.

The range to be displayed for $T\Delta uvLv$ mode is as follows.

 $2300 \le T \le 20000 (K)$

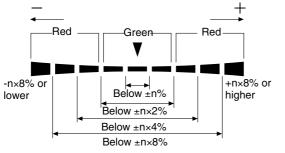
 $|\Delta uv| < 0.1$

The range to be displayed for Luminance Lv is as follows.

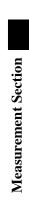
When LED Universal Measuring Ø27 Probe(CA-PU32/35) or LED Flicker Measuring \emptyset 27 Probe(CA-P32/35) is connected: Lv $\leq 1000(cd/m^2)$

When LED Universal Measuring ø10 Probe(CA-PSU32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected: Lv≦3000(cd/m²)

- The analog display section shows the difference between the measured value and the target color in percentage (%).
 - Display contents: Δx , Δy , ΔLv
- * For details on the analog display function and how to set the range for each dot, refer to page 69.
- When the analog display range is set to n%



For xyLv or u'v'Lv mode



77

<For Analyzer Mode>

If analyzer measurement mode is selected, measurement results will be displayed as shown below.

- Digital display section
 - Display contents : R, B, G

Outputs of the currently measured monochrome lights R, B and G in ratio (%) to those of the specified target color (W)

• Display range : The range to be displayed: When the effective number of digits is 3 digits to 99900(%) When the effective number of digits is 4 digits to 99990(%)

- ()		
R	941	▼ R/G
B	88.77	▼ B/G
G	9300	▼ ∆G

An effective number that has

been set in the selection of number of digits to be displayed (P.42) will be displayed. However only to two digits to the right of the decimal will be displayed.

• Analog display section

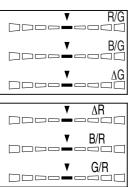
• Display contents : When analyzer mode (G-standard) is selected

R/G, B/G: Ratio of measured values

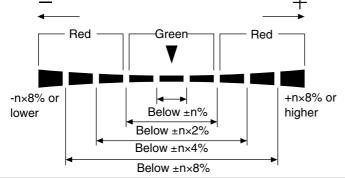
G/R, B/R: Ratio of measured values

 ΔG : Difference from the target color in the case of monochrome light G

When analyzer mode (R-standard) is selected ΔR : Difference from the target color in the case of monochrome light R



- * For details on the analog display function and how to set the range for each dot, refer to page 67.
- When the analog display range is set to n%



<Out of Measurement Range>

[For xylv, T∆uvLv, u'v'Lv or XYZ,Analyzer №	lode]
• When the measurement range is exceeded	Digital display : ""
	Analog display : Not lit
	LCD display: "OVER"
[For T∆uvLv Mode]	
• T or Δuv are out of	Digital display : ""
the display range	(T and Δuv)
[For Flicker Mode]	
• When the measured value has	Digital display : ""
exceeded 999.9%	Analog display : Not lit
	LCD display: "FLICKER ERROR OVER"
• When Lv(luminance) is the following	Digital display : ""
under 0.1cd/m ² for LED Flicker Measuring Ø27 Probe	Analog display : Not lit
(CA-P32/35)	LCD display: "FLICKER ERROR UNDER"
under 0.3cd/m ² for LED Flicker Measuring ø10 Probe	- •
(CA-PS32/35)	

<For Flicker Mode>

Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring ø10 Probe(CA-PS32/35) is connected.

When the optional 4-Probe Expansion Board CA-B15 is used

In Flicker Mode with LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) connected, a selected probe cannot be changed to LED Universal Measuring ø27 Probe(CA-PU32/ 35) or LED Universal Measuring ø10 Probe(CA-PSU32/35).

If flicker measurement mode is selected, measurement results will be displayed as shown below.

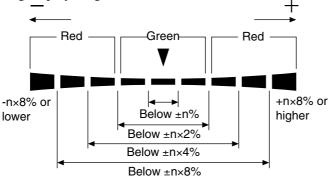
• Digital display section

- Display contents : Contrast flicker value (%)
- Display range

- Flicker mode
- : 0.0 to 999.9% (up to the first
 - decimal place)

 $F \mid I$ 0.5

- Analog display section
 - Display contents : Contrast flicker value (%)
- * For details on the analog display function and how to set the range for each dot, refer to page 69.
- When the analog display range is set to n%



Measurement range for flicker mode

The average luminance (Lv) is 5.0 cd/m² or above(15.0 cd/m² or above when a Measuring ø10 Probe is coneected.) or above and the maximum luminance(Lv) is 1000 cd/m² or less (3000 cd/m² or less when a Measuring ø10 Probe is coneected.) in the case of white calibration with Konica Minolta's calibration standard. Vertical scanning frequency 40 to 130 Hz

(EXT is selected as the SYNC mode)

- Measurement is not possible since the frequency of the vertical syn-
- (INT is selected as the SYNC mode)
- Measurement is not possible since the currently set vertical scanning frequency is beyond 130 Hz.
- "FLICKER ERROR PROBE TYPE"
 - Cannot measure as the measured probe is not for LCD Flicker Measuring.

- Action: Use the same probe as the one used to input the RGB emission characteristic and set the target color. Alternatively, input the RGB emission characteristic and set the target color using the currently
- "E2"
 - Cause : An error has occurred due to shift of the zero point because the ambient temperature has changed since zero calibration.
 - Action: Perform zero calibration.
- * Measurement can still be performed even if "E2" is currently displayed.

used measuring probe.

* "E2" will not appear if "E1" is currently displayed.

[For Flicker Mode**]

• "FLICKER ERROR UNDER"

- Measurement is not possible since Lv is below 0.1 cd/m^2 (0.3 cd/m² when a LED Flicker Measuring Ø10 Probe(CA-PS32/35) is coneected.)(white calibration with Konica Minolta's calibration standard).
- "FLICKER ERROR OVER"
 - Measurement is not possible since flicker value is beyond 999.9%.
- "FLICKER ERROR VSYNC OVER"
- - chronizing signal input to this instrument is beyond 130 Hz.

<Error Messages in LCD Display Section>

For other error messages, refer to page 101.

- is exceeded by the measured value. In the case of analyzer mode, the instrument's measurement range or
- display range (100,000%) is exceeded by the measured value.
- •"E1"

• "OVER"

- Cause : In the case of xyLv, $T\Delta uvLv$, u'v'Lv or XYZ measurement mode, the currently used measuring probe is different from the one used to perform user calibration and set the target color. In the case of analyzer mode, the currently used measuring probe is different
 - from the one used to input RGB emission characteristic for analyzer mode and set the target color (W).
 - CH01 NTSC Ad P1A E2 []

FLICKER ERROR UNDER

FLICKER ERROR OVER

FLICKER ERROR USYNC OVER

CH01 NTSC Ad P1A E1 [1





White Balance Adjustment in Analyzer Mode

<About Analyzer Mode>

Analyzer measurement mode is provided for adjustment of the display's white balance.

The measured colors are expressed in emission intensity of each R, B and G monochromatic light based on the RGB emission characteristic for analyzer mode (page 59) and the target color (W) which are set to the instrument. Thus, adjusting the emission intensity of R causes the measured value of R only to change, and measured values for B and G remain unchanged.

This mode is useful when you adjust the emission intensity of R, B and G to match the target color (W).

<White Balance Adjustment in Analyzer Mode>

First, set the RGB emission characteristic for analyzer mode and the target color (W) to the instrument. For the target color (W), the values of the white-balanced white must be entered. (Page 59)

If "100" is displayed for R, B and G in the digital display section when measurement is performed in analyzer mode, this indicates that the color of the display measured is the same as the target color (W) (i.e. the xyLv values are the same) for the selected memory channel. In the analog display section, only the center green segments light up.

When each display of R, B, G of the digital display part are a same value except for 100, that means the chromaticity coordinate is same as the standard color (W) although Lv (Luminance) is different. Even if the intensity of the display changes, the chromaticity coordinates (x, y) are the same as those of the target color (W) as long as the values for R, B and G are the same.

<About G-Standard and R-Standard>

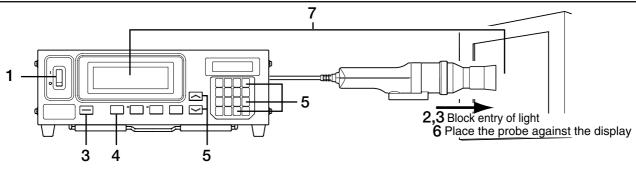
G-Standard or R-Standard must be chosen according to the display whose white balance is to be adjusted.

- G-Standard: Must be used for displays whose G output cannot be adjusted independently.
- R-Standard: Must be used for displays whose R output cannot be adjusted independently.

* Any of G-standard and R-standard can be used for displays whose R, G and B outputs can be adjusted independently.

R	[] [] []
В	[] [].[]
G	100.0
I R	1000
11	10.00
В	10.00 10.00

[Operating Procedure]



- **1**. Set the POWER switch to ON.
- **2**. Set the 0-CAL ring of the measuring probe to the 0-CAL position.

Never direct the measuring probe toward a high-intensity illuminant.

When the optional 4-Probe Expansion Board CA-B15 is used

Set the 0-CAL ring of every measuring probe to the 0-CAL position. Zero calibration will not be performed correctly if the 0-CAL ring of any of the measuring probes is not set to the 0-CAL position.

3. Press the **0-CAL** key.

After zero calibration is complete, set the 0-CAL ring to the MEAS position and start measurement.

- 4. Press the MODE key to select analyzer measurement mode (RGB).
- 5. Press the MEMORY CH and keys to select the memory channel for which the RGB emission characteristic for analyzer mode has been set (page 59).

Memory channel		Probe no.
CHØ1 CHØ1	EXT	P3A J

Menu selection screen

MENU : SELECT

PUSH SPACE KEY

SELECT : PROBE

SELECT : PROBE

Probe no.

P3 35881113

P1 35881112 A

♣

Press the

key until the desired probe

no. appears.

■ PROBE selection screen

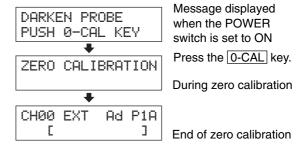
When the optional 4-Probe Expansion Board CA-B15 is used

Select the probe no. for which the RGB emission characteristic for the analyzer mode has been input. (1) Press the \bigcirc key.

- The LCD display section will switch to the menu selection screen.
- (2) Press the key to open the PROBE selection screen. Each time the key is pressed, the screen will switch in the order PROBE → SYNC → ID Name input → RANGE → Measurement Speed → Number of Digits → Calibration Standard → RS232C Baud Rate → PROBE.
- (3) Press the is key to display the probe no. you want to select. Each time the is pressed, the probe no. switches in the order [P1]
- **(4)** Press the is key to confirm the selection.

* By default (factory setting), the instrument is set so that [P1] will be selected automatically when the POWER switch is set to ON(|).

6. Place the measuring probe against the display and take measurement.



7. Adjust the white balance.

Normally, white balance is adjusted by adjusting the cutoff and drive voltages. However, in the procedure below, the display is adjusted so that the white generated on the display matches the target color (W) stored in memory.

The method is explained by taking the following cases where the measured values are as follows compared to the target color (W).

- emission intensity of R: Higher by 20%
- emission intensity of B: Lower by 10%
- emission intensity of G: Higher by 10%

7-1. When analyzer mode (G-standard) is selected

(1) Adjust the luminance (or emission intensity of G) so that the displayed value for G changes from "110" to "100.0".

The other value (R and B) may change somewhat if the intensity is adjust.

(2) Adjust the out put of R so that the displayed value for R changes from "109.0" to "100.0", and adjust the out put of B so that the displayed value for B changes from "81.80" to "100.0".

When all the values for R, B and G are changed to "100.0", adjustment of the white color of the display to the target color (W) (i,e,the xyLv values are the same) is complete.

7-2. When analyzer mode (R-standard) is selected

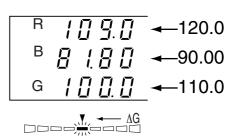
 Adjust the luminance (or emission intensity of R) so that the displayed value for R changes from "120" to "100".

The other value (G and B) may change somewhat if the intensity is adjust.

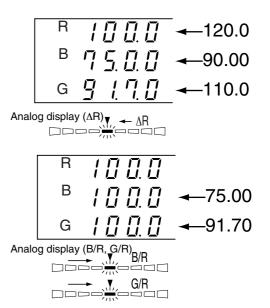
(2) Adjust the out put of B so that the displayed value for B changes from "75.00" to "100.0", and adjust the out put of G so that the displayed value for G changes from "91.70" to "100.0".

When all the values for R, B and G are changed to "100.0", adjustment of the white color of the display to the target color (W) (i,e,the xyLv values are the same) is complete.

R	
В	90.00
G	[].[]



R **←**109.0 В **→**81.80 G Analog display (R/G, B/G) B/G



* The RGB values given in the above example are based on calculations, and may not correspond to the actual display.

Communications Section

This section explains communication with PC via RS-232C or USB.

Communicating with PC via RS-232C	
Explains how to connect the RS-232C cable and select the RS-232C baud rate to enable two-way	Page 86
communication with PC via RS-232C.	

Communicating with PC via USBPageExplains how to connect the USB cable to enable communication with PC via USB.Page

Remote Measurement	Daga 99
Explains how to perform measurement from the PC remotely.	Page 88

Communicating with PC

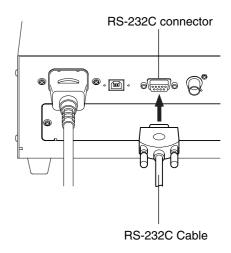
This instrument allows two-way communication via RS-232C or USB.

1. Communicating with PC via RS-232C

Before setting the POWER switch to ON, connect a RS-232C cable (foe 9-pin D-sub Female) to the RS-232C connector on the instrument. Refer to the following for the wiring diagram.

[Connecting Method]

- **1**. Set the POWER switch to OFF (\bigcirc).
- 2. Connect the instrument to the computer with the RS-232C cable.
- **3**. Connect the cable to the connector and secure them with two screws firmly.
- When disconnecting the RS-232C cable, set the POWER switch to OFF(O) first, and pull the cable by holding the plug. Never pull the cable by its cord.

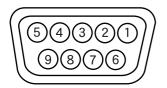


PC

<Reference Document>

RS-232C Pin Assignment and Cable Wiring Diagram

Pin Assignment



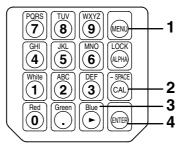
Wiring Diagram

CA-310					FC	
Pin No.	Signal	Input/Output	Description		Signal	Pin No.
1	CD	Input	Carrier Detect		FG	1
2	RXD	Input	Received data	•	TXD	3
3	TXD	Output	Transmitted data		RXD	2
4	DTR	Output	Data terminal Ready]	RTS	7
5	GND				CTS	8
6	DSR	Input	Data Set Ready	$] \qquad \qquad$		6
7	RTS	Output	Request To Send		GND	5
8	CTS	Input	Clear To Send		DTR	4
9	GND					

2. Selecting the RS-232C Baud Rate

The RS-232C baud rate can be changed according to the setting made on the computer that is used for remote measurement.

[Operating Procedure]



1. Press the image key.

The LCD display section will switch to the menu selection screen.

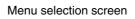
2. Press the key to open the RS232C baud rate selection screen.

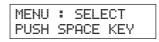
Each time the \bigcirc key is pressed, the screen will switch in the order PROBE \rightarrow SYNC \rightarrow ID Name input \rightarrow RANGE \rightarrow Measurement Speed \rightarrow Number of Digits \rightarrow Calibration Standard \rightarrow RS232C Baud Rate \rightarrow PROBE.

3. Press the 🕞 key until the desired baud rate appears.

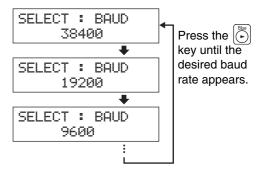
Each time the be key is pressed, the baud rate switches in the order $38400 \rightarrow 19200 \rightarrow 9600 \rightarrow 4800 \rightarrow 2400 \rightarrow 1200 \rightarrow 600 \rightarrow 300 \rightarrow 38400.$

4. Press the election.





RS-232C baud rate selection screen



.(1)N Communications Section

* By default (factory setting), the instrument is set so that [38400] will be selected automatically when the POWER switch is set to ON(|). * To cancel selection of RS-232C baud rate, press the is key.

<Notes when Selecting the RS-232C Baud Rate>

• The specified RS-232C baud rate will be kept even if the POWER switch is set to OFF(O). The selected RS-232C baud rate will be effective when the POWER switch is set to ON(1).

<Reference>

Communication parameter setting (RS-232C) Set the same communications settings as those on the instrument to the computer. Baud rate: 38400 (factory setting), 19200, 9600, 4800, 2400, 1200, 600, 300, BPS Start bit: 1 bit Character length: 7 bits (ASCII code) Parity check: EVEN Stop bit: 2 bits

3. Communicating with PC via USB

The USB cable can be connected/disconnected even if the power to the instrument is ON. However, in this manual, the power must be turned OFF before connecting the USB cable.

[Connecting Method]

- **1**. Set the POWER switch to OFF(O).
- 2. Connect the USB cable to the USB port on the instrument.
- **3**. Check that the USB cable's plug is fully inserted and connected firmly.
- Use the USB cable IF-A18 of optional accessory.
- When disconnecting the USB cable, pull it by holding the plug. Never pull the cable by its cord.
- Pay attention to the shape of the USB cable's plug and make sure that the correct USB plug is connected to the USB port on the instrument.
- If the computer has two or more USB ports, the USB cable can be connected to any of them.
- When it uses at the same time with other machines, it doesn't sometimes work normally.

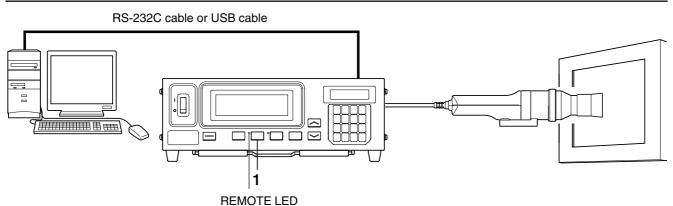
<Notes on Communication via USB>

- One computer can control up to five instruments.
- If you want to control more than two instruments from one computer via both RS-232C and USB, connect only one instrument via USB. It is not possible to control instruments via RS-232C, when you connect two instruments or more via USB.

4. Remote Measurement

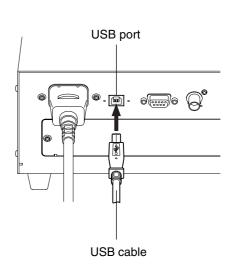
In remote measurement mode, the instrument is controlled from the computer.

[Operating Procedure]



1. Press the REMOTE key.

The REMOTE LED will light up, indicating the instrument is ready for remote measurement (i.e. ready for communication via RS-232C or USB).



Explanation Section

This section explains the following items.

Measuring Principle

Page 90

Page 101

Maintenance

Dimension Diagram Page 102

Error Messages Page 103 Please read when an error message appears in the LCD display section. Page 103	
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Troubleshooting Guide Please read when the instrument does not function correctly.	Page 107
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Specifications	Page 110
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Measurement/Quick Guide	
Provides an outline of operations explained in the previous sections	Page 114
(Measurement Preparation - Settings).	

Measuring Principle

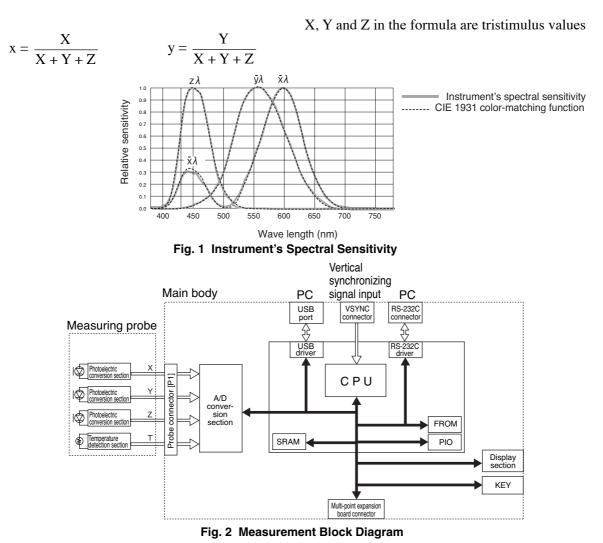
1. Measuring Principle

This instrument uses sensors of a spectral sensitivity similar to the CIE 1931 color-matching function $(\bar{x}\lambda, \bar{y}\lambda, \bar{z}\lambda)$ to measure RGB emission energy of a color display, and displays the results in xyLv, T Δ uvLv, u'v'Lv or XYZ values.

Measurement is performed in the following sequence.

- (1) RGB emission energy of the color display is acquired through the measuring probe's receptor, and then converted to a voltage by the photoelectric conversion section. (Outputs: X, Y, Z)
- (2) The temperature of the probe is detected by the temperature detection section. (Output: T)
- (3) The outputs (X, Y and Z of (1)) from the photoelectric conversion section and the output (T of (2)) from the temperature detection section are digitized in the A/D conversion section. A/D conversion is performed simultaneously within the measurement time according to SYNC mode.
- (4) The digitized values (counts) are sent to the instrument's CPU, where they are calculated according to the measurement mode, SYNC mode and correction factor (user calibration), which have been set using keys and switches.
- (5) The processing results are then displayed in the display sections, and output to a PC via RS-232C or USB.

Chromaticity coordinates (x, y) for xyLv (CIE 1931 color space) are obtained by the following formula.



2. About T∆uvLv

If the instrument's measurement mode is set to $T\Delta uvLv$, the following values can be displayed in the digital display section.

- T : Correlated color temperature
- Δuv : Color difference from the blackbody locus
- Lv : Luminance

In T Δ uvLv mode, colors are expressed in the correlated color temperature (T) and color difference from the blackbody locus (Δ uv), and the luminance is expressed in Lv.

<About Correlated Color Temperature T and Color Difference from Blackbody Locus ∆uv>

The temperature of a blackbody (an ideal radiator) that has the same chromaticity coordinates as that of a light is called the color temperature of that light. However, only the colors that are present along the blackbody locus can be expressed in color temperatures.

Thus, with a widened concept of color temperature, correlated color temperatures are used to express colors that are slightly off the blackbody locus.

When a color is on the isotemperature line, the color temperature at the point where that line crosses the blackbody locus is assumed to be the correlated color temperature of that color. The isotemperature line is the line that is drawn along the chromaticity coordinates of a collection of colors that you feel visually similar to color temperatures along the blackbody locus.

However, since all the colors on the same isotemperature line are expressed by the same correlated color temperature, it is not possible to express colors using correlated color temperatures only. Thus, to express colors, Δuv , that indicates positional relationship with the correlated color temperature T, is also used.

 Δuv is signed with "+" if the color is located above the blackbody locus, and is signed with "-" if it is below the blackbody locus.

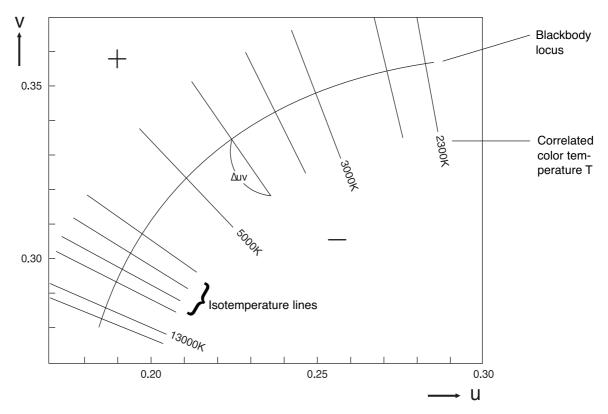


Fig. 1 Relationship between Correlated Color Temperature T and ∆uv

3. Principle of User Calibration

This instrument uses three detectors provided in the measuring probe's receptor to measure the colors of the display.

The spectral sensitivity of these detectors does not match that of CIE 1931 color-matching function perfectly.

Because of this, some colors of the display are affected by slightly shifted spectral sensitivity, resulting in the situation that absolute values of the measured values differ from the values (true values) obtained when the CIE 1931 color-matching function is used.

By performing user calibration, the influences that occur due to slight differences between the spectral sensitivity of the detectors used in the instrument and that of CIE 1931 color-matching function can be corrected when measurement is performed.

(When two or more instruments are used or when the optional 4-Probe Expansion Board CA-B15 is used to use two or more measuring probes)

Some measuring probes may have a slightly different spectral sensitivity. As a result, even if you are measuring the same display, measured values may differ from one instrument to another (difference of readings between instruments).

Such influences can be corrected by performing user calibration using the same display and the same calibration values.

This instrument allows one of the user calibration methods; white calibration (single-color calibration) or matrix calibration (RGB+W calibration).

These user calibration methods have the following features, so the user calibration that best suits your application must be selected.

White Calibration

User's own correction factor is set to the memory channels by measuring the white color of known values and setting the obtained calibration values (xyLv) to the instrument. Once this factor is set, the measured values will be displayed after correction by this factor and output each time measurement is taken.

Performing user calibration provides higher accuracy for measurement of colors that are close to the white color.

Matrix Calibration

User's own matrix correction factor is set to the memory channels by measuring three monochrome colors (R, G and B) of known values and setting the obtained calibration values (xyLv) and emission characteristic to the instrument. Once this factor is set, the measured values will be displayed after correction by this factor and output each time measurement is taken.

Performing matrix calibration enables high-accuracy measurements of displays that provide colors through additive color mixing of three monochrome colors (R, G and B).

Since the matrix correction factor obtained from Konica Minolta's calibration standard has been set, measured values calculated based on this factor will be acquired when this instrument is used for the first time since shipment from the factory.

4. Principle of Analyzer Mode

In analyzer mode, the emission characteristics of the display's three monochrome lights (R, G, B) and the target color are set to the instrument's memory. Once they are set, display's screen colors obtained by measurement can be converted to emission of each monochromatic light and displayed.

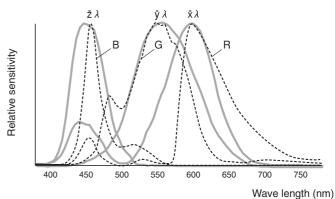
For instance, if emission of R among R, G and B is adjusted, only the output of R will change and the outputs of B and G will remain the same, making white balance adjustment easy (white balance measurement is performed by adjusting the output of a monochrome color).

Each sensor (spectral sensitivity: $\bar{x}\lambda$, $\bar{y}\lambda$, $\bar{z}\lambda$) of the measuring probe has sensitivity towards the display's R, G and B. Thus, even if R monochrome light is emitted on the display's screen, an output will be provided from each sensor ($\bar{x}\lambda$, $\bar{y}\lambda$, $\bar{z}\lambda$). This is also true in the case of G and B monochrome colors.

Therefore, to measure each of R, G and B monochrome colors independently, a certain technique is required. In this instrument's analyzer mode, measurement is performed based on the following concept.

<About Principle of Analyzer Mode>

Fig. 1 shows measuring probe sensor's spectral sensitivity and display's R, G and B spectral distributions.





The outputs of sensors $\overline{x}\lambda$, $\overline{y}\lambda$, and $\overline{z}\lambda$ when only the monochrome light R is emitted are the values equivalent to the hatched areas X_R, Y_R and Z_R, respectively. Although the outputs of these sensors change according to the output of the monochrome color R, the output ratio will be constant because of the spectral characteristic of the display and sensors.

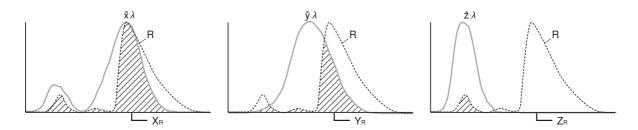


Fig. 2 Outputs of Sensors $\overline{x}\lambda$, $\overline{y}\lambda$, and $\overline{z}\lambda$ by Emitted Monochrome Light R

The above also applies when only monochrome light G is emitted as well as when only monochrome light B is emitted, and the outputs are shown in Figs. 3 and 4, respectively.

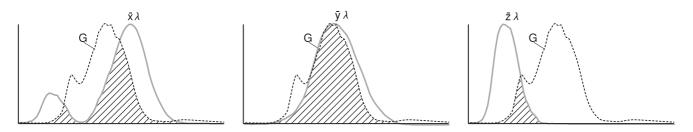


Fig. 3 Outputs of Sensors $\overline{x}\lambda$, $\overline{y}\lambda$, and $\overline{z}\lambda$ by Emitted Monochrome Light G

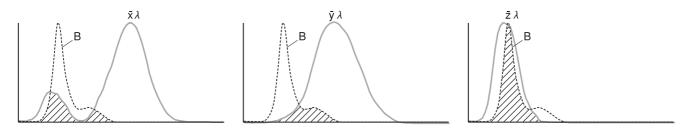


Fig. 4 Outputs of Sensors $\overline{x}\lambda$, $\overline{y}\lambda$, and $\overline{z}\lambda$ by Emitted Monochrome Light B

By emitting each monochrome light alone and setting the output ratio of each sensor as a constant (correction factor) to the memory, the output of each monochrome light (R, G, B) can be calculated based on the output of each sensor, even when three colors are emitted by the display at the same time.

R, G and B are displayed in percentage (%) to each monochrome light of the target color (W), being 100.

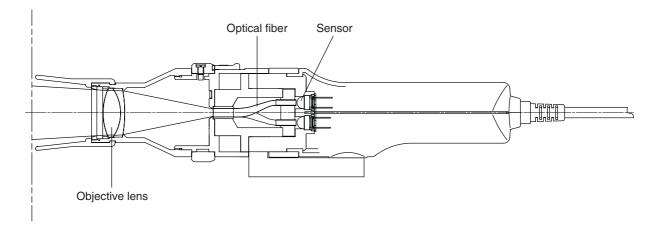
Therefore, before performing measurement in analyzer mode, the display's emission characteristic and target color (W) must always be set to the instrument's memory.

In addition, for measurement in analyzer mode, the memory channel to which the same emission characteristic and target color (W) as those for the display to be measured were set must be used.

5. Optical System of Measuring Probe

The optical system consists of an objective lens and optical fiber.

Among the lights emitted from the LCD under measurement, only the lights that are emitted at within ± 2.5 degrees (LED Universal Measuring ø10 Probe(CA-PSU32/35) and LED Flicker Measuring ø10 Probe(CA-PS32/35) : ± 5 degrees) perpendicular to the LCD are guided by the objective lens to the fiber. After being input to the fiber, the lights are divided into three portions, and each portion is received by a sensor that has a spectral sensitivity similar to the CIE 1931 color-matching function. (Three sensors in total).



IEC 61747-6 stipulates the following measuring requirements for LCD evaluation methods.

- Light receiving angle must be within 5 degrees.
- The measuring area must consist of 500 pixels or more.

Measuring probe satisfies the above requirements since it employs an optical system that receives only the lights emitted within ± 2.5 degrees from a relatively wide measuring area ($\phi 27$).

(LED Universal Measuring \emptyset 10 Probe(CA-PSU32/35) and LED Flicker Measuring \emptyset 10 Probe(CA-PS32/35), within ±5 degrees from a small measuring area(\emptyset 10).)

6. Principle of Flicker Mode

<What is Flicker?>

"Blinking" that appears on the display under certain conditions is called flicker.

This symptom occurs when settings like refresh rate and resolution do not match those set on the display, and in the case of LCD, it may also occur depending on the displayed colors.

Since flicker occurs periodically, it has an adverse effect on the user's eyes.

The relationship between the time axis (horizontal) and intensity level (vertical axis) is shown in Fig. 1.

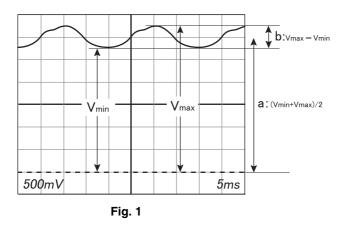
From this, it is obvious that the intensity level changes periodically and the larger its amplitude the more clearly the flicker is recognized.

In addition, it is known that the frequency of intensity level change is twice as large as that of the display's vertical synchronizing signal.

<Flicker Measurement Method>

Two kinds of quantifying measurement methods are available: contrast method and JEITA method. With the CA-310 with LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/ 35) alone, the contrast method is possible. Use of the software supplied with the instrument also allows JEITA method. This section gives an outline of both quantifying measurement methods.

(1) Contrast Method



If the intensity level of the display changes as Fig. 1, it is considered that AC component (b) overlaps on the DC component (a). With the contrast method, the ratio of AC component to DC component is defined as the flicker amount.

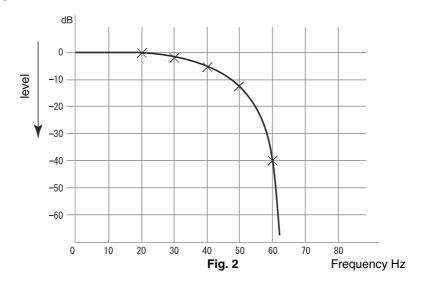
AC component (a) is defined as Vmax - Vmin and DC component (b) as (Vmax + Vmin)/2, and the flicker amount is calculated by the following formula.

Flicker amount = AC component / DC component = (Vmax - Vmin)/{(Vmax + Vmin)/2} ×100 [%]

(2) JEITA Method

With the contrast method, the amount of flicker does not depend on its frequency, and is calculated based on the AC and DC components of the measured luminance.

However, human sensitivity to flickering starts to drop gradually at about 30 Hz, and when the frequency exceeds 60 Hz, it is no longer possible for humans to sense it.



From this, it is possible that even if a flicker of a large amplitude and frequency of 60 Hz or higher exists the human eye cannot recognize it as a flicker.

Thus, with the JEITA method of flicker measurement, it is very important to know the exact amplitude and frequency of flicker energy, in addition to the AC /DC component ratio, that is defined by the contrast method. With the JEITA method, the measuring devices shown below are required for measurement.

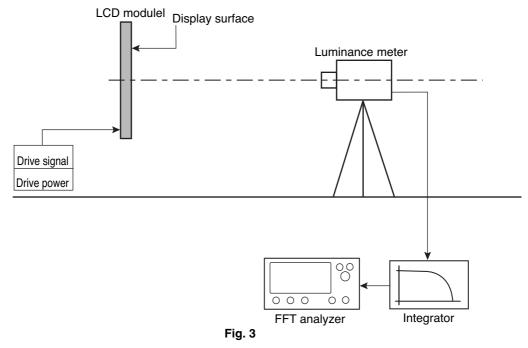
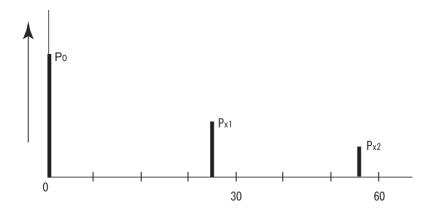


Fig. 3 shows that the output signal (Fig. 1) from the luminance meter (used to measure the LCD) is guided to the integrator.

To reconstruct what is seen by the human eye, the integrator sends the signal through a filter that decreases the sensitivity because of frequency difference, and then outputs it to the FFT analyzer.

The signal is processed by the FFT analyzer (Fast Fourier Transform Analyzer), and is displayed in a form of energy distribution of frequency components (Fig. 4).



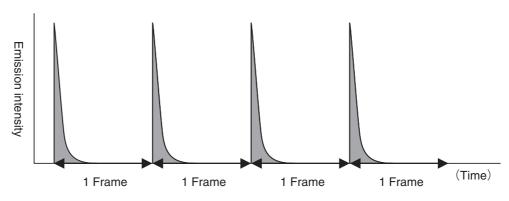
As shown in Fig. 4, when two or more frequency components (P0, Px1, Px2) exist, the maximum value among all the frequency components (Px1, Px2 in the case of Fig. 4) except for P0, that is the component of frequency 0, will be set as Px. With the JEITA method, the flicker amount in this example is calculated by the following formula.

Flicker amount = $10 \times \log (Px/P0)$ [dB]

<Emission intensity fluctuation of displays and "Flicker" measuring function of the CA-310>

Emission characteristics of different displays

Fig. 5-1 to 5-3 is the figure of emission characteristics of popular displays.





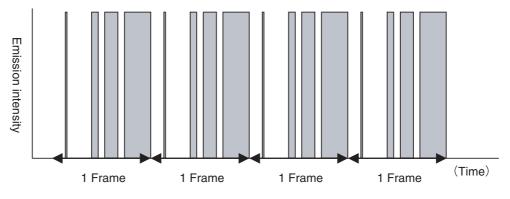


Fig. 5-2. Emission Characteristics of PDP

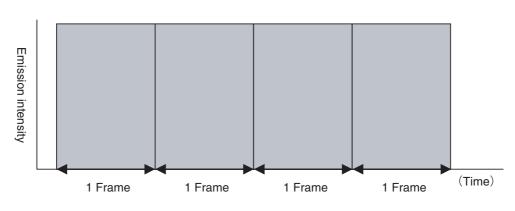


Fig. 5-3 Emission Characteristics of Active matrix LCD

As shown in the Fig. 5-1, emission intensity of CRT fluctuates in a scanning period of the single frame. CRT emits light when electronic beam hits phosphor by scanning the screen. But the electronic beam hits the phosphor only for a moment and phosphor emits maximum light at that time and decreases the intensity gradually. So the emission intensity repeats this variation in a frame.

The reason of the variation is different by type of the display and the intensity of the PDP also fluctuates in the single frame period. On the other hand, the intensity of the active matrix LCD is stable in the single frame as shown in the Fig. 5-3.

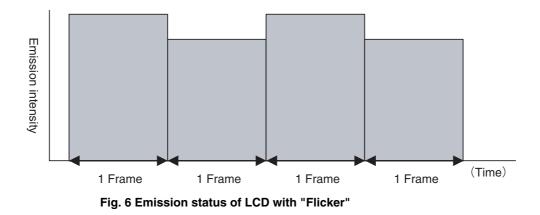
<Applicable model of the CA-310 vs. display types>

The CA-310 with LED Universal Measuring Ø27 Probe(CA-PU32/35) or LED Universal Measuring Ø10 Probe(CA-PSU32/35) can measure the display devices whose intensity fluctuates such as CRT or PDP. On the other hand, when using LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) the CA-310 is limited to be used only for measuring displays whose intensity does not vary in a frame scanning period as shown in Fig. 5-3. So inaccurate measurement data is sometimes obtained for CRT or PDP with the CA-P32/35 or CA-PS32/35.

The emission intensity of some types of LCD fluctuates in a scanning period of the single frame. In this case, inaccurate measurement data is sometimes obtained for even the active matrix LCD with the CA-P32/35 or CA-PS32/35. Please contact Konica Minolta for more information.

<"Flicker" measuring function of the CA-310>

Followings explain how the CA-310 measures "Flicker". When the "Flicker" happens to active matrix LCD that is stable during single frame scanning period (see Fig. 5-3.), the emission status is as shown in Fig. 6. When the intensity fluctuates by each frame, human eyes notice it as flicker. "Flicker measuring function of the CA-310 quantifies the amount of this fluctuation. Since the display perception becomes very bad with "Flicker", it is adjusted to minimum in the LCD manufacturing process.



Note : The emission of CRT or PDP fluctuates in a frame and such light is called "flickering light" among the display industry. This "flickering light" and the "Flicker" which is measured by the CA-310 are two different things.

Maintenance

If you are not going to use the instrument for a long time, disconnect the AC power cord from the AC outlet. Dirt or water may accumulate on the prongs of the AC power cord's plug and it may cause a fire. If there is any dirt or water on the prongs, it must be removed.	 Take special care not to allow liquid or metal objects to enter the instrument. Should liquid or metal objects enter the instrument, turn the power OFF immediately, disconnect the AC cord from the AC outlet, and contact the nearest Konica Minolta authorized service facility.
Do not disassemble or modify the instrument. Doing so may cause a fire or electric shock.	Failure to observe this may cause a fire or electri shock.
	 The instrument should not be used if it is damaged, or if smoke or odd smells occur. If smoke or odd smells occur or if the instrument is damaged, turn the power OFF immediately, disconnect the AC cord from the AC outlet, and contact the nearest Konica Minolta authorized service facility. Failure to observe this may result in a fire.

1. Cleaning the Instrument

- If the instrument gets dirty, wipe it with a soft dry cloth. Never use solvents such as thinner and benzene.
- If the measuring probe receptor's objective lens gets dirty, wipe it with a soft dry cloth or lens cleaning paper.
- Should the instrument break down, do not try to disassemble it by yourself. Contact a Konica Minolta authorized service facility.

2. Storing the Instrument

- The instrument and its optional accessories should be stored within the following temperature range. It is recommended that the instrument be stored at room temperature and humidity. Storing the instrument at a higher temperature and humidity may dateriorate the performance of the instrument.
 - Main body and measuring probes 4-Probe Expansion Board CA-B15

Storage temperature

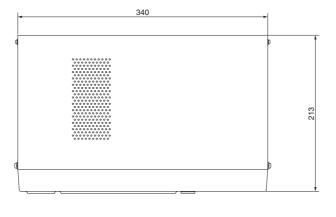
0 to 28° C : relative humidity 70% or less with no condensation 28 to 40°C : relative humidity 40% or less with no condensation

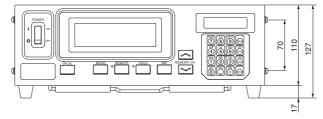
- Take care not to allow condensation to form on the instrument during use. When moving the instrument to the location where it is to be used, take care not to expose it to temperature changes.
- When storing the optional 4-Probe Expansion Board CA-B15, always put it in the anti-static bag in which the board is supplied.

Dimension Diagram

<Main Body>

(Unit:mm)



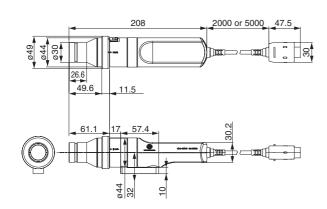


LED Universal Measuring ø27 Probe (CA-PU32 / CA-PU35) LED Flicker Measuring ø27 Probe

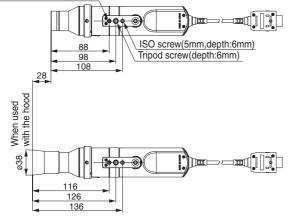
(CA-P32 / CA-P35)

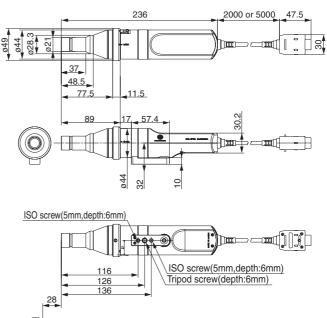
LED Universal Measuring ø10 Probe (CA-PSU32 / CA-PSU35)

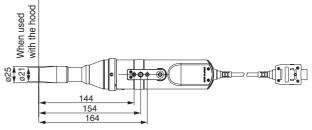
LED Flicker Measuring ø10 Probe (CA-PS32 / CA-PS35)



ISO screw(5mm,depth:6mm)







Error Messages

The following error messages appear if the instrument does not operate correctly. The table below shows kinds of error message, their meanings (description) and corrective actions.

	Error Message	Cause: (Description)	Corrective Action
*1 *2	E1 CHØ1 NTSC Ad P1A E1 []	 When xyLv, T∆uvLv, u'v'Lv, or XYZ measurement mode is selected No target color has been set to the memory channel since shipment from factory. The currently used measuring probe is different from the one used to perform user calibration and set the target color. 	 Perform user calibration or set the target color. Use the same probe as the one used to perform user calibration and set the target color. (Page 26) Or set the target color using the currently used probe. (If you press the MR key for two to four seconds while a menu is displayed on the LCD, the upper line will show the user calibration/emission characteristic, and the lower line shows the probe no. used to set the target color. However, in the case of xyLv, TΔuvLv, u'v'Lv or XYZ mode, the upper line shows the probe no. that was used to perform user calibration. In the case of analyzer mode, it shows the probe no. that was used to input the RGB emission characteristic for analyzer mode. In flicker mode, both upper and lower lines show "00000000".)
		 When analyzer measurement mode (RGB) is selected The RGB emission characteristic for analyzer mode has not been input for the selected memory channel since shipment from factory. The currently used measuring probe is different from the one used to input the RGB emission characteristic for display's analyzer mode and set the target color (W). 	 Input the RGB emission characteristic for display's analyzer mode. Perform corrective action 2 given in . *3*4
		• The settings made to the selected memory channel have been lost.	• Make them again.
*2	E2 CH01 NTSC Ad P1A E2 []	• An error has occurred due to shift of the zero point because the ambient temperature has changed since zero calibration.	• Perform zero calibration. (Page 34) (Measurement can still be performed even if "E2" is currently displayed.)
	E3 E3 × 9 Lv P1 3300 0000 39.50	 An attempt was made to set an incorrect value when performing user calibration or setting the target color to CH00 by entering its values directly. Incorrect calibration values mean the following. One of x, y and Lv is "0". 1 - x - y ≤ 0 Values which are beyond the instrument's calculation capability or other contradicting values 	• Enter correct values and then press the ENTER key.
	E4 RANGE x,9 Lv E4(%) <u>0</u> .0 2.0	• "0%" was set when setting the analog display range.	• Enter a correct value and then press the ENTER key. The settable range is from 0.1 to 99%. (Page 69)
	E5 CH01 U-CAL E5 *W *R G *B	 No entry has been made for one of W, R, G and B. The White key was pressed when the measuring range for target color (W) was exceeded. 	 Enter values for the color for which no values have been made, and then press the <u>ENTER</u> key. (Page 54 or 59) Enter values for the color for which no Input the target color values (W) that are within the measuring range, and press the <u>ENTER</u> key.
	E6 CHØ1 U-CAL E6 *W *R *G *B	• An attempt was made to set an incorrect value when performing matrix calibration.	• Enter correct values and then press the ENTER key.
	E7 SELECT : SYNC. E7 INT000.0Hz	• Although INT SYNC mode is selected, the setup value isn't correct.	• Set the correct value, the correct value is value between 40-200 Hz.

(Note) • *1: If "E1" appears, the cause of the error can be located easily by checking the serial no. of the probe used to make settings and the current probe serial no. For details, refer to page 106.

• *2: "E2" will not appear if "E1" is currently displayed.

	Error Message	Cause: (Description)	Corrective Action
*3 *4	OFFSET ERROR OFFSET ERROR PUSH Ø-CAL KEY	 Zero calibration has not been performed correctly. (Zero calibration was performed with insufficient blocking of entry of light.) Pressure is given to purobe. 	 Perform zero calibration again. (Page 34) (Even if the error message is currently displayed, measurement will start if the measuring probe's re- ceptor is exposed to light.) Don't give the pressure.
	TOO BRIGHT TOO BRIGHT	• Zero calibration is being performed with insufficient blocking of entry of light.	• Block the light completely for all the measuring probes, and when "DARKEN PROBE PUSH 0-CAL KEY" appears press the 0-CAL key again. (Page 34)
*3 *5	NO SYNC. SIGNAL	 Although EXT SYNC mode is selected, the vertical synchronizing signal used for the display is not input correctly to the terminal on the instrument. The vertical synchronizing signal used for the display is outside the range of 40 to 200 Hz. 	 Input the vertical synchronizing signal correctly. (When the vertical synchronizing signal is outside the range of 40 to 200 Hz/page 28) Change SYNC mode to NTSC, PAL, UNIV or INT mode and start measurement.
*3 *4	OVER OVER	 The measured value is exceeding the instrument's measurement range. The measured value is above 100,000% in analyzer mode. (Display range over) 	• Measurement must be performed within the measuring range.
	SET MAIN PROBE	• The measuring probe is not connected to the probe connector [P1] properly.	 Connect the probe to the probe connector [P1] properly. (Before connecting/disconnecting the measuring probe, make sure that the POWER switch is set to OFF.)
	PROBE ERROR	• A measuring probe was connected or dis- connected while the POWER switch was ON.	• Set the POWER switch to OFF first, con- nect the measuring probe, then set the POWER switch to ON. (Before connecting/disconnecting the measuring probe, make sure that the POWER switch is set to OFF.)
*3 *4	DATA ERROR DATA ERROR	• Measurement is not possible since the mea- suring circuit is not functioning correctly.	• Set the POWER switch to OFF. If this error still appears even if the POWER switch is set to ON, the instru- ment has broken down. Contact a Konica Minolta authorized ser- vice facility.
	MEMORY ERROR	 The instrument's memory is abnormal. If the message disappears when the probe is changed, the probe's memory is abnormal. If the message keeps appearing when the probe is changed, the main body's memory is abnormal. 	• Set the POWER switch to OFF. If this error still appears even if the POWER switch is set to ON, the instru- ment has broken down. Contact a Konica Minolta authorized ser- vice facility.
	FLICKER ERROR UNDER FLICKER ERROR UNDER	• Lv is below the instrument's flicker mea- suring range.	• Measurement must be performed within the measuring range.
	FLICKER ERROR OVER FLICKER ERROR OVER	• Flicker value (contrast method) has exceeded 100.0%.	• Measurement must be performed within the measuring range.
	FLICKER ERROR VSYNC OVER FLICKER ERROR VSYNC OVER	• VSYNC is exceeding 130 Hz in flicker mode.	• In the case of flicker mode, VSYNC of 40 to 130 Hz must be input.
	FLICKER ERROR PROBE TYPE FLICKER ERROR PROBE TYPE	• A measured probe not for LCD flicker mea- suring is selected in Flicker Mode.	• In Flicker Mode, select a measured probe for LCD flicker measuring.

Error Message	Cause: (Description)	Corrective Action
INCORRECT PROBE PROBE : <i>CA100Plus</i>	00Plus differs from the one used on the instrument. PROBE Image: Complete on the instrument.	• Connect the correct probe or expansion board.
INCORRECT PROBE PROBE:CA100Plus		
INCORRECT BOARD BOARD : <i>CA100Plus</i>		
INCORRECT BOARD BOARD:CA100Plus		
(The indication in italics shows the model name of the probe or expansion board.)		

(Note) • The $\left[\begin{array}{c} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} \end{array} \right]$ key is inoperable if error message *3 is displayed.

- The instrument operates as follows if error message *4 is displayed.
 - \bigcirc Clears the display by the MR key.
- (2) Aborts CAL ON state (i.e. the state that is effective when the $\boxed{(2)}$ key is pressed).
- (3) Aborts MENU ON state (i.e. the state that is effective when the we is pressed).
- (4) Aborts measuring probe selection.
- (5) Aborts SYNC mode selection.
- (6) Aborts ID name setting.
- O Aborts analog display range setting.
- (8) Aborts measurement speed selection.
- (9) Aborts selection of the number of display digits.
- 10 Aborts calibration standard selection.
- 1 Aborts RS-232C baud rate selection.
- The instrument operates as follows if the error message *5 is displayed.
- 1) The my key is inoperable during CAL ON state (i.e. the state that is effective when the key is pressed).
- ② The HOLD key is inoperable.

<Relationship Between Probe Serial No. and Error Message "E1">

If "E1" appears, the cause of the error can be located easily by checking the serial no. of the probe used to make settings and the current probe serial no.

• Probe serial no. used for making settings : Displayed when the MR key is held down for two to four sec-

onds. (The buzzer sounds once immediately after the MR key is pressed. It will also sound two and four seconds later if the key is kept held down. Thus, to display the probe serial no. used for making settings, release the key after the buzzer has sounded twice in total.)

• Current probe serial no.

: Displayed in the PROBE selection screen when the 📾 and

Probe Serial No.	Cause and Action for "E1"	
Displayed during Measurement	When xyLv, T∆uvLv, u'v'Lv or XYZ measurement mode is selected	When analyzer measurement mode is selected
Both lines show "00000000". 00000000 00000000	Cause : User calibration has not been per- formed or the target color has not been set for the currently selected memory channel since shipment from the fac- tory. Action : Perform user calibration or set the tar- get color.	Cause : Neither the RGB emission character- istic for display's analyzer mode nor target color (W) have been set for the currently selected memory channel since shipment from the factory. Action : Set the RGB emission characteristic for the display's analyzer mode and target color (W).
Upper line shows "00000000". 00000000 16790160		 Cause : The RGB emission characteristic for the display's analyzer mode has not been input. Action : Set the RGB emission characteristic for the display's analyzer mode. If you want to set a target color different from the one that was set when the emission characteristic was set, set a new target color.
Different probe nos. 21593001 16790160	 Cause : The measuring probe used to perform user calibration is different from the one used to set the target color. Action : ① Set the target color using the measuring probe that was used for user calibration. ② Perform user calibration again using the currently connected measuring probe. 	 Cause : The measuring probe used to input the RGB emission characteristic for display's analyzer mode is different from the one used to set the target color. Action : ① Set the target color using the measuring probe that was used to input the emission characteristic for the analyzer mode. ② Input the emission characteristic for the analyzer mode again using the currently connected measuring probe.
Same probe nos. 16790160 16790160	 Cause : The currently used measuring probe is different from the one that was used to perform user calibration and set the target color. Action : ① Perform measurement using the measuring probe that was used to perform user calibration and set the target color. ② Perform user calibration and set the target color .using the currently connected measuring probe. 	 Cause : The currently used measuring probe is different from the one used to input the RGB emission characteristic for display's analyzer mode and set the target color. Action : ① Perform measurement using the measuring probe used to input the RGB emission characteristic and set the target color. ② Input the emission characteristic and set the target color using the currently connected measuring probe.
Upper line shows "00000000". Lower line shows "999999999". 00000000 99999999	Cause : The settings made to the selected memory channel have been lost from the instrument's memory. As a result, the default (factory) cor- rection factor and ID name will be used instead. Action : Set them again.	Cause : The settings made to the selected memory channel have been lost from the instrument's memory. As a result, the default (factory) ID name will be used instead. Action : Set them again.

Troubleshooting Guide

If any of the following symptoms occur with the instrument, take the corrective actions given in the table below. If the instrument still does not operate correctly even if the necessary corrective actions are taken, the instrument might have broken down. Contact a Konica Minolta authorized service facility. When doing so, please inform them of the breakdown No.

Break- down No.	Symptom	Check Point	Action	Ref.
1	The display is blank after the POWER switch is set to ON.	Is the AC power cord connected?	Connect the AC power cord.	29
		Is the power within the specified rating? (100-240 V \sim , 50-60 Hz, 50VA)	Use the power that is within the rating.	26
2	Keys are inoper- able.	Check whether the instrument is in remote mode (i.e. the REMOTE LED is lit).	Press the <u>REMOTE</u> key to turn off re- mote mode (i.e. the REMOTE LED goes out).	30
		You are maybe pressing a key that does not function.	Press the correct key.	_
		Check whether the key is in LOCK mode.	Hold down the $\underbrace{\text{lock}}_{\text{lock}}$ key (for two seconds) to cancel LOCK mode.	18
3	Zero calibration does not end. ("ZERO CALI- BRATION" is displayed in the LCD display section.) "TOO BRIGHT" is displayed even if the light is blocked properly.		Turn the power OFF, turn it ON again, and then perform zero calibration. If this symp- tom still occurs, the instrument is broken down.	29 35
4	"NO SYNC. SIGNAL" is dis- played in EXT SYNC mode.	Is the cable for the vertical synchronizing signal connected to the terminal on the in- strument and is the vertical synchronizing signal input?	Connect the cable to the connector on the instrument and display, and input the vertical synchronizing signal.	28
		Does the level of the vertical synchroniz- ing signal conform to the specified input condition?	Set the signal level so that it conforms to the specified input condition.	28
		If the frequency is 130 to 200 Hz in the case of flicker mode, the error message "FLICKER ERROR VSYNC OVER" will appear. (Page 102)	Make sure that the frequency is within the following range. Color measurement 40 to 200 Hz Flicker measurement 40 to 130 Hz	38
5	The calibration val- ues entered for user calibration using keys differ from those displayed at the end of calibration.	Is Lv of the calibration values for low lu- minance?	If a low-luminance value is used as the calibration value, this symptom may occur due to calculation error.	50
6	Measurement re- sults fluctuate.	Is an appropriate SYNC mode selected for the display measured?	Select an appropriate SYNC mode and per- form measurement.	38
		You are maybe measuring a low-luminance display.	Repeatability for x and y drops if a low- luminance display is measured.	76
		Is the measuring probe placed with the display and secured firmly?	Make sure that the probe is placed with the display and secured firmly.	76 13
		Is "4-Probe Expansion Board CA-B15" fixed by the screw?	Fix it with the screw securely.	27
		Is the AC power code connected to protec- tive grounding terminal properly?	Be sure to connect the AC power cord's plug to an AC outlet that has a protective ground- ing terminal.	28

Break- down No.	Symptom	Check Point	Action	Ref.
7	Odd measured values are dis- played.	Is the receptor of the measuring probe clean?	If it is dirty, wipe it with a soft dry cloth or lens cleaning paper.	107
		Is the ambient temperature stable?	If the ambient temperature has changed, perform zero calibration.	34
		Was user calibration performed correctly?	Perform user calibration again.	50
8	Analog display does not change.	Is the analog display range correct?	Set the correct range.	68
		Was the target color set correctly?	Set the correct target color. (Perform user calibration, set the RGB emission characteristic for the display's analyzer mode or set/change the target color correctly.)	50 58 61
9	During com- munication with RS-232C	Are the instrument (RS-232C connector) and PC connected with a RS-232C cable properly?	Connect them properly.	84
	Data output from the instru-	Is pin assignment of the RS-232C cable correct?	A RS-232C cable with correct pin assignment must be used.	84
	ment cannot be imported to PC.	Is the correct RS-232C baud rate set?	Make sure that the RS-232C baud rate set on PC matches that on the instrument.	85
	Commands or data cannot be input from PC to the instrument.	Check whether the instrument is in remote OFF mode (i.e. the REMOTE LED is not lit).	Press the <u>REMOTE</u> key to turn ON re- mote mode (i.e. the REMOTE LED lights up).	86
		Is the created program correct?	Check it by referring to a sample program.	-
10	During com- munication with USB	Are the instrument (USB port) and PC con- nected with a USB cable properly?	Connect them properly.	86
	Data output from the instru-	Is pin assignment of the USB cable correct?	A USB cable with correct pin assignment must be used.	86
	ment cannot be imported to PC. Commands or	Check whether the instrument is in remote OFF mode (i.e. the REMOTE LED is not lit).	Press the <u>REMOTE</u> key to turn ON re- mote mode (i.e. the REMOTE LED lights up).	86
	data cannot be input from PC to the instrument.	Is the created program correct?	Check it by referring to a sample program.	-
11	"DATE ER- ROR" is dis- played continu- ously in the LCD display section.		Turn the power OFF, and then turn it ON again. If this symptom still occurs, the in- strument has broken down.	29
12	"MEMORY ER- ROR" is dis- played in the LCD display section.	If the message disappears when the probe is changed, the probe's memory is abnormal. If the message keeps appearing when the probe is changed, the main body's memory is abnormal.	Turn the power OFF, and then turn it ON again. If this symptom still occurs, the in- strument has broken down.	29

When the optional 4-Probe Expansion Board CA-B15 is used

Break- down No.	Symptom	Check Point	Action	Ref.
13	Probes P2 to P5 cannot be se- lected. (cannot be dis- played in the LCD display section)	Is the 4-Probe Expansion Board installed correctly?	Install it correctly.	27
		Are the measuring probes connected to the probe connectors [P2] to [P5] properly?	Connect necessary number of probes to the probe connectors properly.	26 27
14	Probe cannot be changed. (cannot be dis- played in the LCD display section)	Do you want to select LED Universal Mea- suring ø27 Probe(CA-PU32/35) or LED Universal Measuring ø10 Probe(CA- PSU32/35) when the measurement mode is Flicker Mode?	Select the measurement mode other than Flicker Mode.	43

Specifications

Te a sur		I ED Usinger I Manuaria (02 Decks		
Item		LED Universal Measuring Ø27 Probe		
Receptor		Detector: Silicon photo cell		
Measurement area		Ø27 mm		
Acceptance angle		±2.5°		
Measurement di	stance	30±10 mm		
Display range	Luminance	0.0001 to 1000 cd/m ²		
Display lange	Chromaticity	Displayed in 4 or 3-digit value (Can be chosen)		
	Measurement range	0.0050 to 1000 cd/m ²		
		0.0050 to 0.0999 cd/m ² $\pm 4\% \pm 0.0015$ cd/m ²		
	Accuracy (for white)*1	0.1000 to 9.999 cd/m ² $\pm 3\% \pm 0.0010$ cd/m ²		
Luminance	()	10.00 to 1000 cd/m ² $\pm 2\% \pm 0.0010$ cd/m ²		
		$0.0050 \text{ to } 0.0999 \text{ cd/m}^2$ 1% + 0.0010 cd/m ²		
	Repeatability(2o)*1	0.1000 to 0.9999 cd/m ² $0.2\% + 0.0010 \text{ cd/m}^2$		
		1.000 to 1000 cd/m ² 0.1% +0.0010 cd/m ²		
	Measurement range	0.0500 to 1000 cd/m ²		
		$0.0500 \text{ to } 4.999 \text{ cd/m}^2 \pm 0.005 \text{ for white}$		
	Accuracy *1	5.000 to 19.99 cd/m ² ± 0.004 for white		
	(temperature:23°±2°, relative humidity:	20.00 to 1000 cd/m ² ± 0.003 for white		
Chromatcity	$(40\pm10)\%))$	120 cd/m ² ±0.002 for white (±0.004 for monochrome)*2		
		0.0500 to 0.0999 cd/m ² 0.010		
		$0.1000 \text{ to } 0.1999 \text{ cd/m}^2$ 0.004		
	Repeatability (2σ) *1	$0.2000 \text{ to } 0.4999 \text{ cd/m}^2$ 0.002		
		$0.5000 \text{ to } 1000 \text{ cd/m}^2$ 0.001		
	xyL _v	$0.0050 \text{ to } 0.0999 \text{ cd/m}^2$ 4(3.5) times/sec.		
Measurement		$0.1000 \text{ to } 1.999 \text{ cd/m}^2$ 5(4.5) times/sec.		
speed*4		2.000 to 1000 cd/m ² 20(17) times/sec.		
	Digital	xyL_v , $T\Delta uvL_v$, RGB analyze, XYZ, $u'v'L_v$		
Display	Analog	$\Delta x \Delta y \Delta L_v$, R/G B/G ΔG , ΔR B/R G/R		
Display	LCD	16 characters by 2 lines (with backlight)		
SYNC mode	Leb	NTSC, PAL, EXT, UNIV, INT		
Object under me	aguramant			
Memory channe		Vertical synchronization frequency: 40 to 200 Hz		
-		100 channels Standard function		
Analyzer function	011	Standard function		
Interface		USB; RS-232C (38,400 bps or below)		
Multi-point Mea	asurement	Max. 5 points (Use 4-Probe Expansion Board CA-B15)		
Operating temperature/humidity range		Temperature: 10 to 28°C; relative humidity 70% or less with no condensation Luminance change: $\pm 2\%$ of reading for white Chromaticity change ± 0.002 for white, ± 0.006 for monochrome from reading of Konica Minolta's standard LCD *1, 120 cd/m ² , with 23°C 40%		
Storage temperature/humidity range		0 to 28°C: relative humidity 70% or less with no condensation 28 to 40°C: relative humidity 40% or less with no condensation		
Input voltage range		100-240V~, 50-60 Hz, 50 VA *6		
~	Main body	340(W)×127(H)×216(D) mm / 3.58 kg		
Size/weight	Probe	Ø49×208 mm / 530 g		
Standard accessories		AC power cord, PC Software for Color Analyzer CA-SDK, Standard Hood CA-H10		
Optional accessories		4-Probe Expansion Board CA-B15, Universal Measuring Ø27 Probe CA-PU32(2 m) CA-PU35(5 m), Standard Hood CA-H10, Standard Lens Cap CA-H11, USB cable IF-A18		

*1 The chromaticity and luminance are measured under Konica Minolta's condition (standard LCD(6500K, 9300K) is used).

^{*1} The chromaticity and luminance are measured under Konica Minolita's condition (standard LCD(0.000K),
*2 The luminance for monochrome is measured when the reading of luminance for white is 120 cd/m²
*3 Measurement of flicker (JEITA method) is supported by SDK software.
*4 Measuring probe connected to probe connector Pl only, used USB(used RS-232C Baud rate: 38400 bps)
*5 Measured by Konica Minolta's PC (P3-600 MHz)
*6 "~ " represents alternating current available at power outlets.
The specifications and drawings given here are subject to change without prior notice.

-				
Item		LED Universal Measuring Ø10 Probe		
Receptor		Detector: Silicon photo cell		
Measurement area		Ø10 mm		
Acceptance angle		±5°		
Measurement di	stance	30±5 mm		
Disular	Luminance	0.0001 to 3000 cd/m ²		
Display range	Chromaticity	Displayed in 4 or 3-digit value (Can be chosen)		
	Measurement range	0.0150 to 3000 cd/m ²		
		$0.0150 \text{ to } 0.2999 \text{ cd/m}^2 \pm 4\% \pm 0.0045 \text{ cd/m}^2$		
	Accuracy (for white)*1	0.3000 to 29.99 cd/m ² $\pm 3\% \pm 0.0030$ cd/m ²		
Luminance	(for white) 1	$30.00 \text{ to } 3000 \text{ cd/m}^2 \pm 2\% \pm 0.0030 \text{ cd/m}^2$		
		$0.0150 \text{ to } 0.2999 \text{ cd/m}^2$ $1\% + 0.0030 \text{ cd/m}^2$		
	Repeatability(2 \sigma) *1	$0.3000 \text{ to } 2.999 \text{ cd/m}^2$ $0.2\% + 0.0030 \text{ cd/m}^2$		
		$3.000 \text{ to } 3000 \text{ cd/m}^2$ $0.1\% + 0.0030 \text{ cd/m}^2$		
	Measurement range	0.1500 to 3000 cd/m ²		
		$0.1500 \text{ to } 14.99 \text{ cd/m}^2 \pm 0.005 \text{ for white}$		
	Accuracy *1	15.00 to 59.99 cd/m ² ± 0.004 for white		
	(temperature:23°±2°, relative humidity:	$60.00 \text{ to } 3000 \text{ cd/m}^2 \pm 0.003 \text{ for white}$		
	$(40\pm10)\%))$	120 cd/m^2 $\pm 0.002 \text{ for white}$		
Chromatcity		(±0.004 for monochrome)*2		
		0.1500 to 0.2999 cd/m ² 0.010		
		$0.3000 \text{ to } 0.5999 \text{ cd/m}^2$ 0.004		
	Repeatability (2σ) *1	$0.6000 \text{ to } 1.499 \text{ cd/m}^2$ 0.002		
		1.500 to 3000 cd/m ² 0.001		
		0.0150 to 0.2999 cd/m ² 4(3.5) times/sec.		
Measurement speed*4	xyLv	0.3000 to 5.999 cd/m ² $5(4.5)$ times/sec.		
speed		6.000 to 3000 cd/m ² 20(17) times/sec.		
	Digital	xyL _v , T Δ uvL _v , RGB analyze, XYZ, u'v'L _v		
Display	Analog	$\Delta x \Delta y \Delta L_v$, R/G B/G ΔG , ΔR B/R G/R		
	LCD	16 characters by 2 lines (with backlight)		
SYNC mode	I	NTSC, PAL, EXT, UNIV, INT		
Object under me	easurement	Vertical synchronization frequency: 40 to 200 Hz		
Memory channe	1	100 channels		
Analyzer function	on	Standard function		
Interface		USB; RS-232C (38,400 bps or below)		
Multi-point Measurement		Max. 5 points (Use 4-Probe Expansion Board CA-B15)		
Operating temperature/humidity range		Temperature: 10 to 28°C; relative humidity 70% or less with no condensation Luminance change: ±2% of reading for white Chromaticity change ±0.002 for white, ±0.006 for monochrome from reading of Konica Minolta's standard LCD *1, 120 cd/m ² , with 23°C 40%		
Storage temperature/humidity range		0 to 28°C: relative humidity 70% or less with no condensation 28 to 40°C: relative humidity 40% or less with no condensation		
Input voltage range		100-240V~, 50-60 Hz, 50 VA *6		
	Main body	340(W)×127(H)×216(D) mm / 3.58 kg		
Size/weight	Probe	Ø49×236 mm / 550 g		
Standard accesso	ries	AC power cord, PC Software for Color Analyzer CA-SDK, Standard Hood CA-H10		
Optional accessories		4-Probe Expansion Board CA-B15, Universal Measuring ø10 Probe CA-PSU32(2 m) CA-PSU35(5 m), Standard Hood CA-H10, Standard Lens Cap CA-H11, USB cable IF-A18		

*1 The chromaticity and luminance are measured under Konica Minolta's condition (standard LCD(6500K, 9300K) is used).
*2 The luminance for monochrome is measured when the reading of luminance for white is 120 cd/m²
*3 Measurement of flicker (JEITA method) is supported by SDK software.
*4 Measuring probe connected to probe connector P1 only, used USB(used RS-232C Baud rate: 38400 bps)
*5 Measured by Konica Minolta's PC (P3-600 MHz)
*6 "~ " represents alternating current available at power outlets.
The specifications and drawings given here are subject to change without prior notice.

Itom		LED Elister Maggying (27 Decks		
Item		LED Flicker Measuring Ø27 Probe		
Receptor		Detector: Silicon photo cell		
Measurement area		Ø27 mm		
Acceptance angle		±2.5°		
Measurement di		30±10 mm		
Display range	Luminance	0.0001 to 1000 cd/m ²		
	Chromaticity	Displayed in 4 or 3-digit value (Can be chosen)		
	Measurement range	0.0050 to 1000 cd/m ²		
	Accuracy	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
	(for white)*1	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
Luminance		$\frac{10.00 \text{ to } 1000 \text{ cd/m}^2}{\pm 2\% \pm 0.0010 \text{ cd/m}^2}$		
		$0.0050 \text{ to } 0.0999 \text{ cd/m}^2 \qquad 1\% + 0.0010 \text{ cd/m}^2$		
	Repeatability (2σ) *1	$0.1000 \text{ to } 0.9999 \text{ cd/m}^2 \qquad 0.2\% + 0.0010 \text{ cd/m}^2$		
		1.000 to 1000 cd/m ² 0.1%+0.0010 cd/m ²		
	Measurement range	0.0500 to 1000 cd/m ²		
		0.0500 to 4.999 cd/m ² ± 0.005 for white		
	Accuracy *1 (temperature:23°±2°,	5.000 to 19.99 cd/m ² ± 0.004 for white		
	relative humidity:	20.00 to 1000 cd/m ² ± 0.003 for white		
Chromatcity	(40±10)%))	120 cd/m ² ±0.002 for white (±0.004 for monochrome)*2		
		0.0500 to 0.0999 cd/m ² 0.010		
		$0.000 \text{ to } 0.0999 \text{ cd/m}^2$ 0.004		
	Repeatability (2σ) *1			
		0.2000 to 0.4999 cd/m ² 0.002 0.5000 to 1000 cd/m ² 0.001		
	Management			
Flicker	Measurement range	5 cd/m ² or higher		
Contrast	Display range	0.0 ~ 999.9 %		
method	Accuracy	± 1 % (Flicker frequency: 30 Hz AC/DC 10% sine wave) ± 2 % (Flicker frequency: 60 Hz AC/DC 10% sine wave)		
	Repeatability (2σ)	1 % (Flicker frequency: 20 to 65 Hz AC/DC 10% sine wave)		
Flicker JEITA	Measurement range	5 cd/m ² or higher		
method *3	Accuracy	±0.5 dB (Flicker frequency: 30 Hz AC/DC 10% sine wave)		
	Repeatability (2σ)	0.3 dB (Flicker frequency: 30 Hz AC/DC 10% sine wave)		
	xyL _v	$0.0050 \text{ to } 0.0999 \text{ cd/m}^2$ 4(3.5) times/sec.		
Measurement		0.1000 to 1.999 cd/m^2 5(4.5) times/sec.		
speed*4		2.000 to 1000 cd/m ² 20(17) times/sec.		
	Flicker Contrast	16 (16) times/sec.		
	Flicker JEITA *3	0.5 (0.3) times/sec. *5		
	Digital	xyL_v , T ΔuvL_v , RGB analyze, XYZ, u'v'L _v , Flicker (Contrast method) *3		
Display	Analog	$\Delta x \Delta y \Delta L_v$, R/G B/G ΔG , ΔR B/R G/R, Flicker (Contrast method) *3		
	LCD	16 characters by 2 lines (with backlight)		
SYNC mode		NTSC, PAL, EXT, UNIV, INT		
Object under me		Vertical synchronization frequency: 40 to 200 Hz (Luminance or chromaticity measurement), 40 to 130 Hz (Flicker measurement)		
Memory channel		100 channels		
Analyzer function		Standard function		
Interface		USB; RS-232C (38,400 bps or below)		
Multi-point Measurement		Max. 5 points (Use 4-Probe Expansion Board CA-B15)		
Operating temperature/humidity range		Temperature: 10 to 28°C; relative humidity 70% or less with no condensation Luminance change: $\pm 2\%$ of reading for white Chromaticity change ± 0.002 for white, ± 0.006 for monochrome from reading of Konica Minolta's standard LCD *1, 120 cd/m ² , with 23°C 40%		
Storage temperature/humidity range		0 to 28°C: relative humidity 70% or less with no condensation 28 to 40°C: relative humidity 40% or less with no condensation		
Input voltage range		100-240V~, 50-60 Hz, 50 VA *6		
Size/weight Main body		340(W)×127(H)×216(D) mm / 3.58 kg		
Size/weight	Probe	Ø49×208 mm / 530		
Standard accesso	ories	AC power cord, PC Software for Color Analyzer CA-SDK, Standard Hood CA-H10		
Optional accessories		4-Probe Expansion Board CA-B15, LED Flicker Measuring ø27 Probe CA-P32(2 m) CA-P35(5 m), Standard Hood CA-H10, Standard Lens Cap CA-H11, USB cable IF-A18		
		neasured under Konica Minolta's condition (standard LCD(6500K, 9300K) is used).		

*1 The chromaticity and luminance are measured under Konica Minolta's condition (standard LCD(6500K, 9300K) is used).
*2 The luminance for monochrome is measured when the reading of luminance for white is 120 cd/m²
*3 Measurement of flicker (JEITA method) is supported by SDK software.
*4 Measuring probe connected to probe connector P1 only, used USB(used RS-232C Baud rate: 38400 bps)
*5 Measured by Konica Minolta's PC (P3-600 MHz)
*6 "~" represents alternating current available at power outlets.
The specifications and drawings given here are subject to change without prior notice.

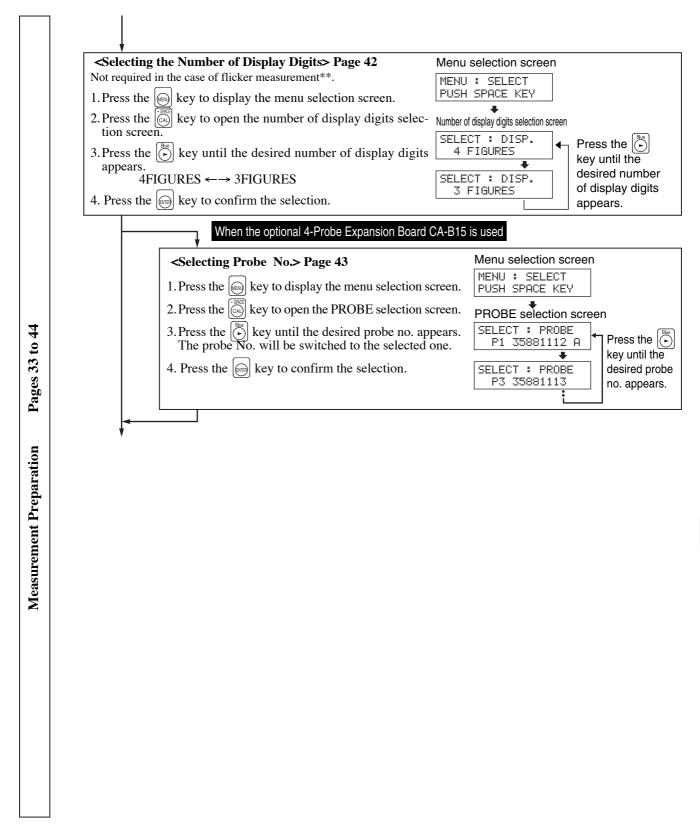
	LED Flicker Measuring Ø10 Probe Detector: Silicon photo cell		
	Detector: Silicon photo cell		
	A		
a	Ø10 mm		
	±5°		
ance	30±5 mm		
Luminance	0.0001 to 3000 cd/m ²		
Chromaticity	Displayed in 4 or 3-digit value (Can be chosen)		
Measurement range	0.0150 to 3000 cd/m ²		
	0.0150 to 0.2999 cd/m ² $\pm 4\% \pm 0.0045$ cd/m ²		
	0.3000 to 29.99 cd/m ² $\pm 3\% \pm 0.0030$ cd/m ²		
() -	30.00 to 3000 cd/m ² ±2%±0.0030 cd/m ²		
	0.0150 to 0.2999 cd/m ² $1\% + 0.0030$ cd/m ²		
Repeatability(20)*1	0.3000 to 2.999 cd/m ² $0.2\% + 0.0030$ cd/m ²		
	3.000 to 3000 cd/m ² $0.1\% + 0.0030$ cd/m ²		
Measurement range	0.1500 to 3000 cd/m ²		
	0.1500 to 14.99 cd/m ² ± 0.005 for white		
Accuracy *1	15.00 to 59.99 cd/m ² ± 0.004 for white		
(temperature:23°±2°,	60.00 to 3000 cd/m ² ± 0.003 for white		
$(40\pm10)\%))$	120 cd/m^2 $\pm 0.002 \text{ for white}$		
	(±0.004 for monochrome)*2		
	0.1500 to 0.2999 cd/m ² 0.010		
	0.3000 to 0.5999 cd/m ² 0.004		
Repeatability(2 σ)*1	$0.6000 \text{ to } 1.499 \text{ cd/m}^2$ 0.002		
	1.500 to 3000 cd/m ² 0.001		
Measurement range	15 cd/m ² or higher		
Display range	0.0 ~ 999.9 %		
	±1 % (Flicker frequency: 30 Hz AC/DC 10% sine wave) ±2 % (Flicker frequency: 60 Hz AC/DC 10% sine wave)		
-	1 % (Flicker frequency: 20 to 65 Hz AC/DC 10% sine wave)		
	15 cd/m ² or higher		
	±0.5 dB (Flicker frequency: 30 Hz AC/DC 10% sine wave)		
-	0.3 dB (Flicker frequency: 30 Hz AC/DC 10% sine wave)		
	0.150 to 0.2999 cd/m ² 4(3.5) times/sec.		
xvI	$0.3000 \text{ to } 5.999 \text{ cd/m}^2$ $5(4.5) \text{ times/sec.}$		
NJ DV	6.000 to 3000 cd/m ² 20(17) times/sec.		
Elicker Contrast			
	16 (16) times/sec.		
	0.5 (0.3) times/sec. *5		
	xyL_v , $T\Delta uvL_v$, RGB analyze, XYZ, $u'v'L_v$, Flicker (Contrast method) *3		
	$\Delta x \Delta y \Delta L_v$, R/G B/G ΔG , ΔR B/R G/R, Flicker (Contrast method) *3		
LCD	16 characters by 2 lines (with backlight)		
	NTSC, PAL, EXT, UNIV, INT		
surement	Vertical synchronization frequency: 40 to 200 Hz (Luminance or chromaticity measurement), 40 to 130 Hz (Flicker measurement)		
	100 channels		
1	Standard function		
	USB; RS-232C (38,400 bps or below)		
urement	Max. 5 points (Use 4-Probe Expansion Board CA-B15)		
ature/humidity range	Temperature: 10 to 28°C; relative humidity 70% or less with no condensation Luminance change: ±2% of reading for white Chromaticity change ±0.002 for white, ±0.006 for monochrome from reading of Konica Minolta's standard LCD *1, 120 cd/m ² , with 23°C 40%		
ure/humidity range	0 to 28°C: relative humidity 70% or less with no condensation 28 to 40°C: relative humidity 40% or less with no condensation		
ge	100-240V~, 50-60 Hz, 50 VA *6		
Main body	340(W)×127(H)×216(D) mm / 3.58 kg		
Probe	Ø49×236 mm / 550 g		
es	AC power cord, PC Software for Color Analyzer CA-SDK, Standard Hood CA-H10		
es	4-Probe Expansion Board CA-B15, LED Flicker Measuring ø10 Probe CA-PS32(2 m) CA-PS35(5 m), Standard Hood CA-H10, Standard Lens Cap CA-H11, USB cable IF-A18		
L C N A(t) = R = N = A(t) = R = N = A R = A R = x = F F E A L = s -1 = u -a = u -s N P e	Juminance Chromaticity Aeasurement range Accuracy for white)*1 Repeatability(2 σ)*1 Aeasurement range Accuracy *1 temperature:23°±2°, elative humidity: 40±10)%)) Repeatability(2 σ)*1 Measurement range Display range Accuracy Repeatability(2 σ) Measurement range Display range Accuracy Repeatability(2 σ) Measurement range Display range Accuracy Repeatability(2 σ) Measurement range Accuracy Repeatability(2 σ) Measurement range Accuracy Repeatability(2 σ) Malog Jigital Analog Jigital Analog Jurement Tirement Ature/humidity range Probe Probe Ature/humidity range		

*1 The chromaticity and luminance are measured under Konica Minolta's condition (standard LCD(6500K, 9300K) is used).
*2 The luminance for monochrome is measured when the reading of luminance for white is 120 cd/m²
*3 Measurement of flicker (JEITA method) is supported by SDK software.
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*5 Measured by Konica Minolta's PC (P3-600 MHz)
*6 "~" represents alternating current available at power outlets.
The specifications and drawings given here are subject to change without prior notice.

Measurement/Quick Guide

Before starting measurement, perform necessary preparations as explained in the Installation/Connection section (page 23).

	 <zero calibration=""> Page 34</zero> 1. Check that the POWER switch is set to ON. 2. Set the Pointing ring of the measuring probe to the 0-CAL position. 	1 POWER switch
	When the optional 4-Probe Expansion Board CA-B15 is used	
	Set the Pointing ring of every measuring probe to the 0- CAL position. 3. Press the 0-CAL key.	3 O-CAL key
	The digital and analog display sections will light up and measurement starts.	OD
	Selecting Measurement Speed> Page 36 Not required in case of flicker measurement**.	Menu selection screen MENU : SELECT PUSH SPACE KEY
	1.Press the key to display the menu selection screen.	
44	2. Press the key to open the measurement speed selection screen.	SELECT : M-SPD AUTO Press the 🕞
: 33 to	$\rightarrow PROBE \rightarrow SYNC \rightarrow ID \text{ Name input} \rightarrow RANGE$ $RS232C \text{ Baud Rate} \rightarrow Calibration \text{ Standard} \rightarrow Number of digitts \rightarrow Measurement \text{ Speed} \leftarrow$	SELECT : M-SPD SLOW
Pages 33 to 44	3. Press the \bigcirc key to display the desired measurement speed.	■ measurement SELECT : M-SPD speed
_		F ^a st displayed when the [FAST] was selected.
Measurement Preparation	4. Press the election.	CH00 EXT Fd P1A []
aent Pr		
suren	Selecting SYNC Mode> Page 36 1. Press the key to display the menu selection screen.	Menu selection screen
Mea	2. Press the is key to open the SYNC selection screen.	PUSH SPACE KEY
	3. Press the \textcircled{blue} key until the desired SYNC mode appears.	SYNC selection screen
	─ > EXT→UNIV→INT→NTSC→PAL ──	EXT Press the key until the desired SYNC
	 4. Press the key to confirm the selection. * To use EXT mode, the vertical synchronizing signal used for the 	UNIU mode appears.
	display must be input to the instrument. (Page 28)	
	Selecting Measurement Mode> Page 40	Measurement mode
	1. Press the MODE key until the desired measurement mode appears. → xyLv→T∆uvLv→Analyzer (G standard)	
	∠XY←FLIC**←u'v'Lv←Analyzer (R standard) ← ਪਾਥ	1 Mode key
	\downarrow	



**Flicker Mode is a function which can be used only when LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) is connected.

When the optional 4-Probe Expansion Board CA-B15 is used

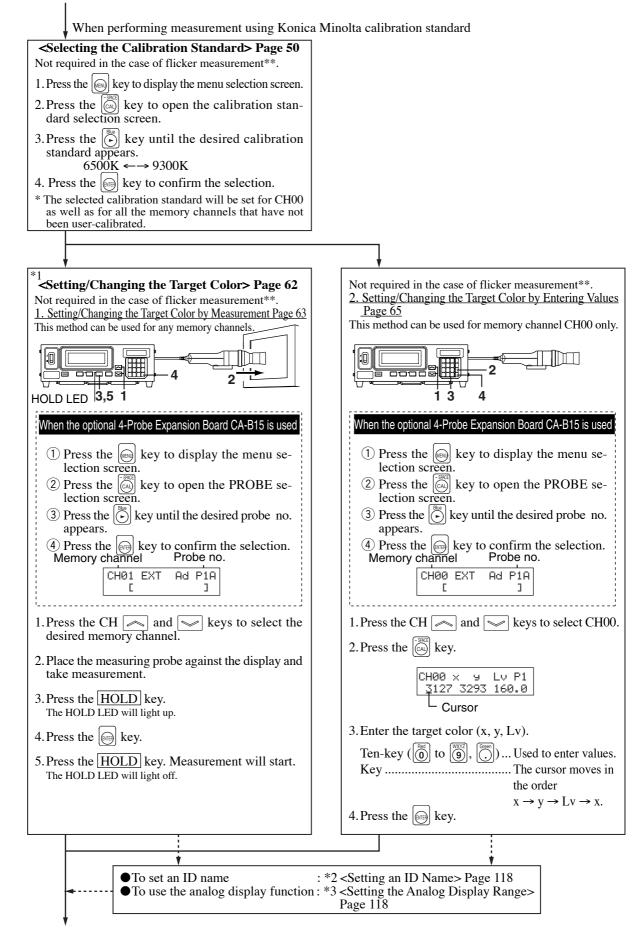
In Flicker Mode with LED Flicker Measuring Ø27 Probe(CA-P32/35) or LED Flicker Measuring Ø10 Probe(CA-PS32/35) connected, a selected probe cannot be changed to LED Universal Measuring Ø27 Probe(CA-PU32/35) or LED Universal Measuring Ø10 Probe(CA-PSU32/35). 115

From the Measurement Preparation section

4

Pages 45 to

Setting Section



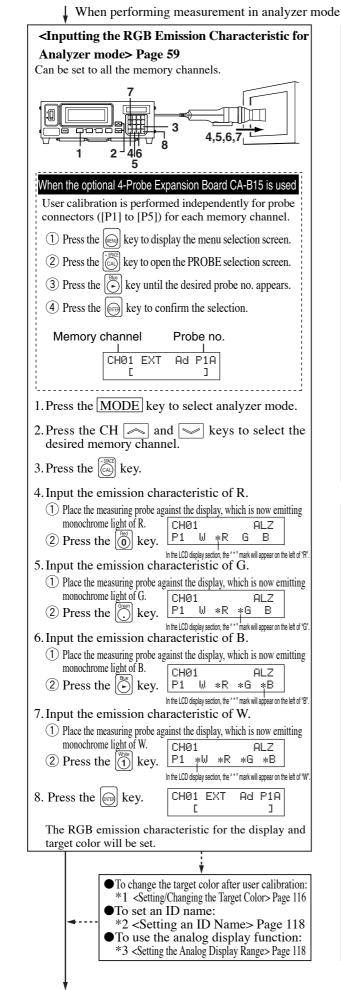
To the Measurement section Page 75

From the Measurement Preparation section

	When performing measurement using user calibration				
	User Calibration> Page 51 Not required in the case of flicker measurement**. 1. Performing White Calibration Page 52	Not required in the case of flicker measurement**. <u>2. Performing Matrix Calibration Page 54</u> Cannot be performed with memory channel CH00.			
	Cannot be performed with memory channel CH00.				
Setting Section Pages 45 to 74		9,11 5 1,0 7,8 When the optional 4-Probe Expansion Board CA-B15 is used User calibration is performed independently for probe no. ([P1] to [P5]) for each memory channel. 1 Press the low key to display the menu selection screen. 2 Press the low key to open the PROBE selection screen. 3 Press the low key to confirm the selection. Memory channel Probe no. CH01 EXT Ad P1A 1. Press the low key to select xyLv mode. 2. Press the low key to select xyLv mode. 3. Place the measuring probe against the display and set the display so that it can display known RGBW. 4. Press the low key. 4. Press the low key. CH01 U-CAL P1 W R G B 5. Cause the display to show red (green), (blue), (white). 6. Press the low light up. 7. Press the low light off. Measurement will displayed. 10. Press the low light off. Measurement will displayed. 10. Press the low light off. Measurement will displayed. 10. Press the low light off. Measurement will displayed. 11. * HOLD LED will light off. Measurement will start. 1. * Hepent steps 4 to 10 for G, B and W. * When *** is displayed for R, G, B and W. * When *** is displayed for R, G, B and W. * When *** is displayed fo			
	• To use the analog display function: *3 <setting analog="" display="" range="" the=""> Page 118</setting>	11. Press the \bigcirc key. $\begin{array}{c} CH01 \ EXT \ Am \ P1A \\ \hline L \ \end{bmatrix}$ Matrix calibration will be performed.			

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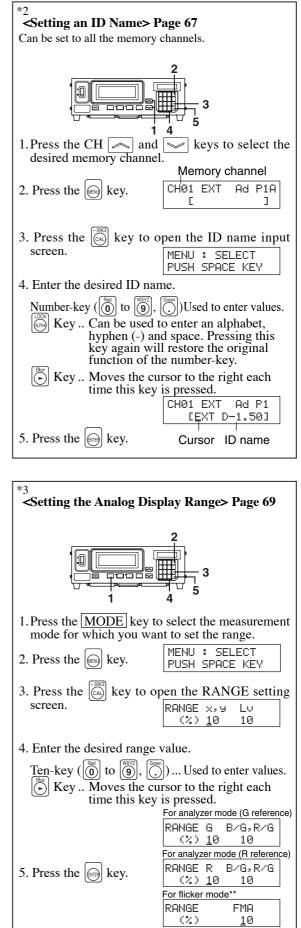
From the Measurement Preparation section



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Pages 45 to

Setting Section





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