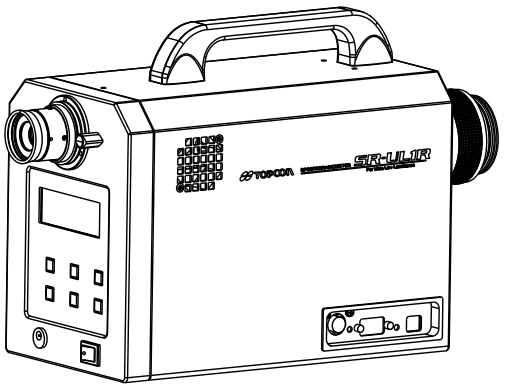
TOPCON



INSTRUCTION MANUAL

SPECTRORADIOMETER

SR-LEDW
SR-UL2
SR-UL1R
SR-3AR

Rev.23

Introduction

Thank you for your purchasing the TOPCON TECHNOHOUSE SR-LEDW/SR-UL2/SR-UL1R/SR-3AR Spectroradiometer.

THIS INSTRUMENT HAS THE FOLLOWING FEATURES:

The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR spectroradiometer measures PDP's, CRT's, LCD's or the back light of LCD's, and light emitting objects such as LED's, and the reflected light of a painted surface or printed matter can also be measured very low level luminance with a high accuracy.

This manual provides an outline, basic operation and specifications of the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR. Always keep this manual at hand.

Display for Safe Use

In order to encourage the safe use of products and prevent any danger to the operator and others or damage to existing facilities, important warnings are put on the products and inserted into the instruction manuals.
We suggest that everyone understand the meaning of the following displays and icons before reading the “Safety Cautions” and text.

Displays

Icon	Use
DANGER	Ignoring or disregarding this display may lead to the impending danger of death or serious injury.
WARNING	Ignoring or disregarding this display may result in serious injury or lead to life threatening situations.
CAUTION	Ignoring or disregarding this display may lead to personal injury or damage of facilities.

- “Personal injury” means an injury, burn or electric shock which does not require entering or going to hospital.
- “Damage of facilities” refers to extensive damage to buildings, household belongings, livestock or pets.

Icons

Icon	Use
	This icon indicates Caution. Specific content is expressed with words or an icon located close to the icon. (Example:  Be careful about an electric shock.)
	This icon indicates Prohibition. Specific content is expressed with words or an icon located close to the icon. (Example:  Don’t touch the operating unit.)
	This icon indicates Mandatory Action. Specific content is expressed with words or an icon located close to the icon. (Example:  Install earth ground.)

Warning


Prohibited

Do not operate the SR-LED in locations with inflammable or combustible vapors such as gasoline.
Doing so may result in a fire.


Prohibited

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


Mandatory

Do not use AC adapters other than those included or sold separately by TOPCON.
AC adapter failure may result in a fire or electric shock.


Prohibited

Do not disassemble the AC adapter.
Doing so may result in a fire or electric shock.


Mandatory

Remove dust and moisture from the plug of the AC adapter.
Doing so may result in a fire.


Mandatory

In the event the instrument should make an unusual sound or emit smoke, immediately turn off the power and unplug the AC adapter.
Continuing to use the instrument may result in a fire.
In this event, consult with your retailer or TOPCON TECHNOHOUSE.

Caution


Prohibited

Do not look directly at bright objects such as the sun or bulb filaments.
Doing so may result in optical damage.


Prohibited

Do not place the SR-LED on unstable or unsteady surfaces.
Doing so may result in the instrument falling or tipping over.


Prohibited

Do not plug or unplug the instrument with wet hands.
Doing so may result in electric shock.


Mandatory

Use only specified screws when using the tripod screw and screw holes for jig attachment.
Do not tighten the screws any more than necessary. Doing so might cause internal breakage.

Escape Clauses

- TOPCON TECHNOHOUSE will not bear any responsibility whatsoever for damage resulting from fire, earthquakes, actions by a third party, other accidents, acts by the user whether intentional or negligent, misuse, or use under improper conditions.
- TOPCON TECHNOHOUSE will not bear any responsibility whatsoever for incidental damage arising from the use or the inability to use the Spectroradiometer SR-LEDW/SR-UL2/SR-UL1R/SR-3AR (loss of business profits, interruption of work, etc.)
- TOPCON TECHNOHOUSE will not bear any responsibility whatsoever for damage arising from uses of SR-LEDW/SR-UL2/SR-UL1R/SR-3AR not in accordance with the instructions in this manual.
- TOPCON TECHNOHOUSE will not bear any responsibility whatsoever for damage arising from malfunction or the like due to connections with other devices.

Recommendations for Use

- Use only the AC adapter provided with the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR or sold separately specifically for the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR. The using of adapters other than the specified AC adapters may cause damage to the instrument. The input voltage specification is between 100 and 240 V AC with a frequency between 50 and 60 Hz.
- For energy saving, when the unit will not be used for an extended period of time,unplug the power plug from the socket.
- Keep the instrument away from water and liquid. This instrument is not water-resistant.
- Do not measure bright objects exceeding the measurement range including the sun. Doing so may damage the light receiving elements, making future measurements unstable.
- Do not turn on the power of the instrument right after it is turned off. Sometimes the protection circuit works because the instrument's inside is hot and so an error is displayed. In this case, turn off the power first. Leave the instrument in the environment meeting the use condition (SR-LEDW,SR-UL2,SR-UL1R:5-30 ℃) (SR-3AR:5-35 ℃)for about 30 minutes and then turn on its power.

☞'5.1 Error Display on the Instrument'

- Do not use the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR in locations which are dusty or extremely humid or where corrosive gases occur.
- Do not use the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR in places with rapid temperature changes. Although the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR has an internal temperature compensation circuit, rapid temperature changes may lead to unstable measurements.
- Avoid dropping and other strong shocks, and do not use or store the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR in locations with constant vibration. The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR has precision optical parts and such use or storage may lead to malfunction. When carrying the instrument, place in its carrying case and avoid direct vibration or shock.
- Store in the provided carrying case at room temperature. Do not store it in hot or humid environments (e.g., in a vehicle).
- In order to maintain measurement precision, run a calibration test about once a year. Consult with your retailer or TOPCON TECHNOHOUSE regarding calibration.
- Note that all data stored in the instrument will be erased during calibration. Transfer all required data to your personal computer before calibration.
- Please do not peel off the sticker stuck on the back of the main unit. If you peel it off, all warranty will be invalid.
- The backup battery may be exhausted when the power of SR-LEDW/SR-UL2/SR-UL1R/SR-3AR is OFF and the PC connection cable is connected while the PC is ON. We recommend

disconnecting the PC connection cable or power off the PC.

User Maintenance

Do not perform maintenance on the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR other than those instructed in this manual. All other maintenance should be performed by a qualified service technician for safety and to maintain performance. The following item can be carried out by the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR user. Regarding the maintenance method, read the applicable text in this manual.

Cover and Lens Cleaning

Using a diluted neutral detergent and a soft cloth, wipe the case and lens of the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to remove dirt, then gently wipe them with a dry cloth. Do not use solvents including paint thinner, benzine and acetone. This may lead to discoloration of the surface.

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Conventions in This Manual

This manual employs the following conventions for ease of use.

Symbol	Description
[FUNCTION], [UP]	Use of square brackets indicates the wording for the panel switches or the title of a window displayed on the screen.
☞' '	Indicates a reference to another section in this manual.
☞" "	Indicates a reference to another manual.
 **Remember!**	Indicates tips to remember to ensure smooth operation.
Note	Indicates tips that are handy to know when performing an operation.

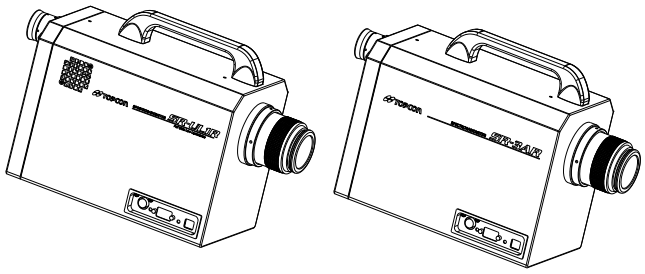
1. Before Use

1.1 Confirmation of Contents

Confirm that the main body and accessories are included as listed below;

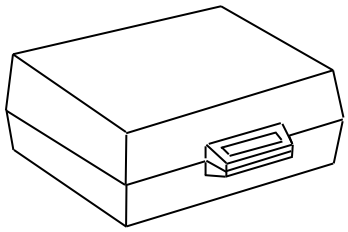
If anything is missing, please contact your retailer or TOPCON TECHNOHOUSE.

• Main body (SR-LEDW/SR-UL2/SR-UL1R/SR-3AR) 1



SR-LEDWSR-UL2/SR-UL1R SR-3AR

- •Objective lens cap 1
- •Quick Start manual for SR-LEDW/SR-UL2/SR-UL1R/SR-3AR& CS-900A 1
- •Colorimetry program CS-900A & Manual 1
- •AC adapter 1
- •USB cable 1
- •Inspection report 1
- •Carrying case 1

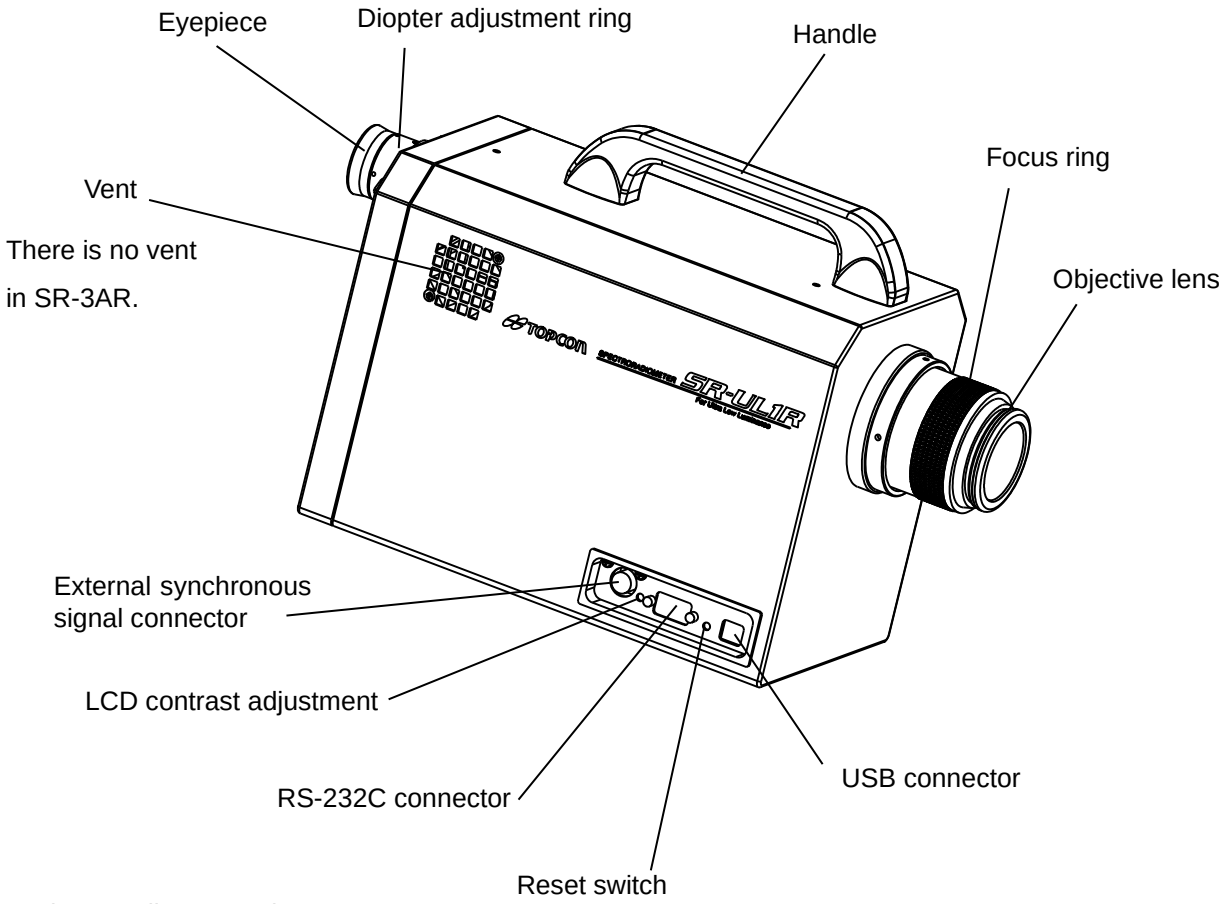


Remember!	When the instrument measures some object by using CS-900A, only the accessory CS-900A (Version 4.20 or higher) can be used.

1.2 Parts and Functions

Following designation and function of SR-UL1R are in common with SR-LEDW,SR-3AR and SR-UL2.

■ Main Body



Diopter adjustment ring
: Used when adjusting the focus of the finder on the reticle mark.

Focus ring : Used when focusing on the measured object during measurement.

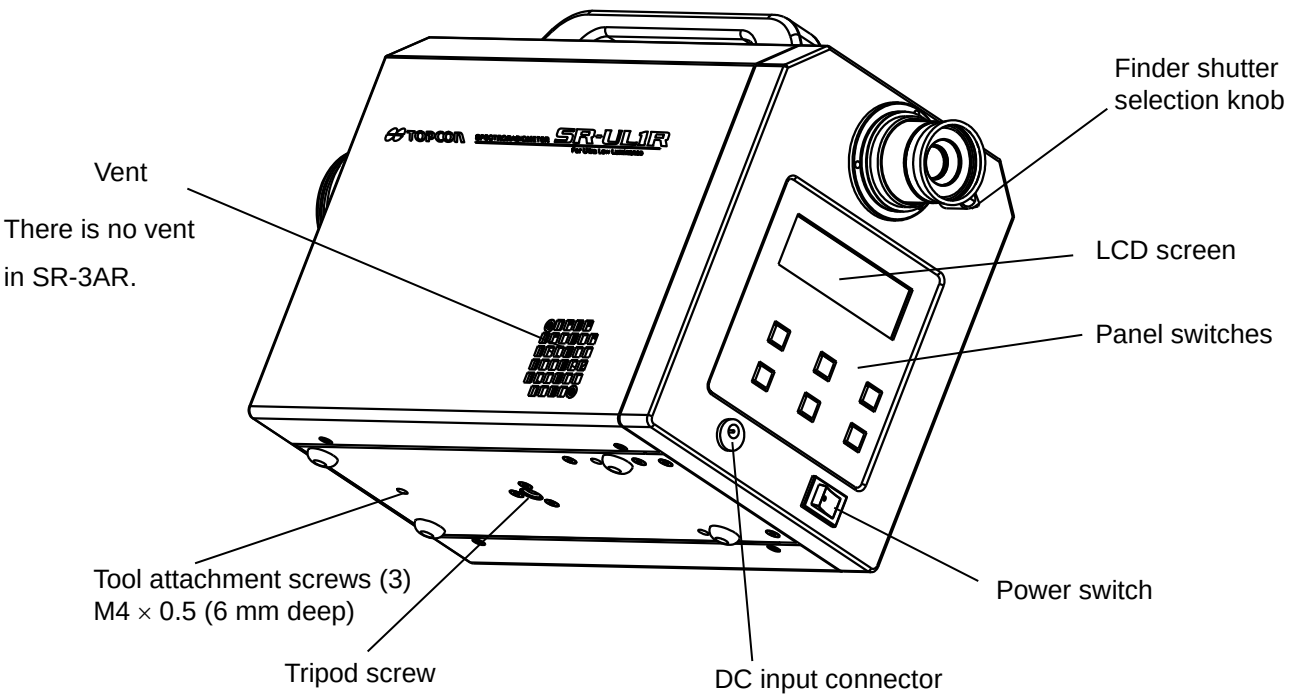
USB Connector : A port to connect the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a personal computer for remote measurement.
Connecting to the Personal Computer ☞ '1.3.2 Connecting to the Personal Computer'

RS-232C connector : A port to connect the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a personal computer for remotemeasurement.
Connecting to the Personal Computer ☞ '1.3.2 Connecting to the Personal Computer'

External synchronous signal connector
: When measuring a blinking light source such as a CRT, a synchronous signal is inputted from this connector.

Reset switch : Resets the software in the main body.

LCD contrast adjustment
: Used to adjust the contrast of the LCD screen. Adjust when the letter on the LCD screen is difficult to see.



Power switch : Turns the power to the instrument on and off.

DC input connector : Connection outlet for the AC adapter.

Finder shutter selection knob

: Set the knob to "CLOSE", and the light sent through the finder can be interrupted. When the brightness of the object is very low or when there is a light emitting object on the finder side, set the finder shutter to "CLOSE" to prevent light from entering through the eyepiece.

LCD screen : Displays the values, conditions and other information for measurement.

Panel switches : Includes switches to perform operations such as starting and stopping measurements and to make the function mode settings.

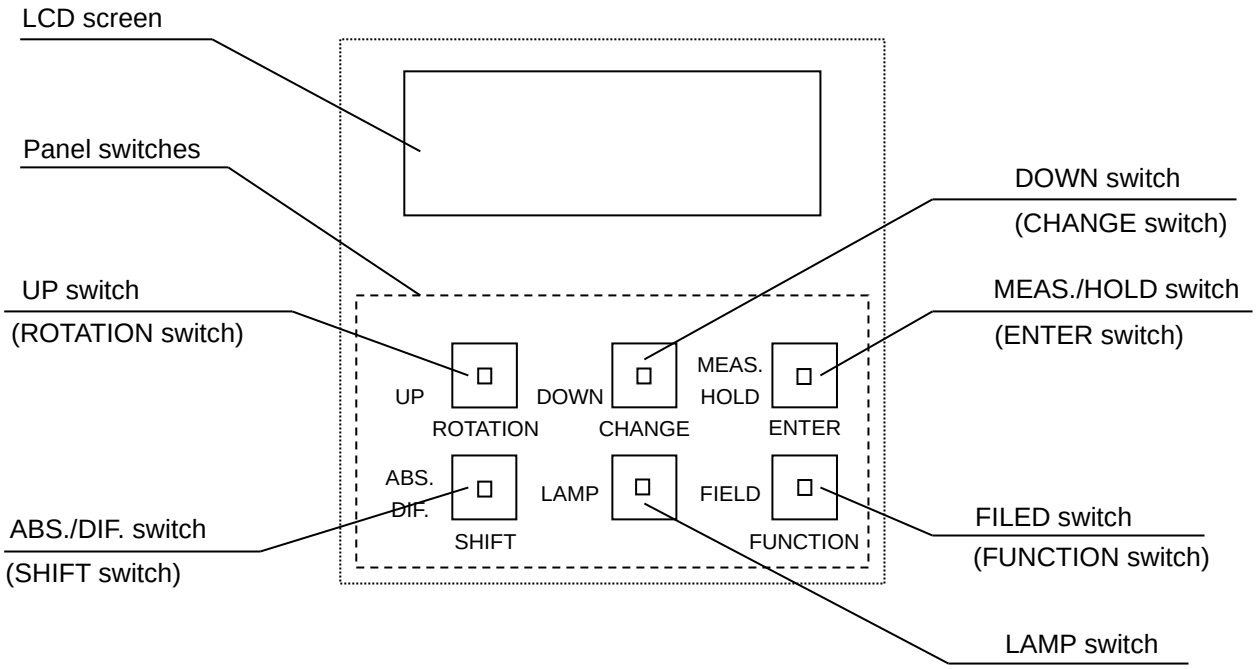
Tripod screw : For attaching the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a tripod. A 1/4-UNC screw for mounting a camera is used.

Tool attachment screws : These are the screws for mounting the instrument. Use them when installing a system.
The dimensions of these screws are M4 × 0.5, 3 mm in diameter with a 0.5 mm pitch.

☞ '6 Appendix: External Dimension Diagram'

✸ **Request**	Use only specified screws when using the tripod screw and screw holes for jig attachment. Do not tighten the screws any more than necessary. Doing so might cause internal breakage.

■ Names and Functions on Panel Switches



Switches

The switches on the panel have the following two functions.

· Measurement functions – The functions listed beside the switches

· Function mode functions – The functions listed below the switches

Switching Function Mode ☞ '3.1.2 Entering/Returning from the Function Mode'

Switch functions are as follows:

MEAS./HOLD switch : Starts measurements and stops "Auto Run".
☞ '2.2 Auto Run'

FIELD switch : Changes the measuring field.
Available measuring range and diameter
☞ 6 'Appendix Specifications and Performance'

UP switch and DOWN switch : Moves up/down the measurement data number on the LCD screen.
The measurement result can be stored up to 50 data.

ABS./DIF. switch : Used to change the display of the absolute value and the color difference/relative luminance. "ABS." is set in the initial condition.

LAMP switch : Turns the LCD screen on and off. The default setting is on.

Functions of function mode

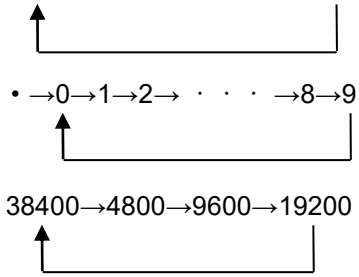
FUNCTION switch : Turns the function mode on and off. Press it for approximately 2 seconds until a beeping sound is made to turn the function mode on. When the function mode is on, press to turn it off (no need to hold for 2 seconds).

ENTER switch : Used to change the displayed menu, input values into memory and store the changed data in memory.

CHANGE switch : Used to change the stored data. When this switch is pressed, the displayed data is deleted and the cursor blinks. Then input new data.

ROTATION switch : Used to select parameters to be inputted. When this switch is pressed, the parameters to be inputted are displayed in order. The displayed parameters are different according to the setting menu.

Example : AUTO→FREQ→MANU→SYNC



SHIFT switch : Used to move the digit when inputting a value of many numerals. By using this switch, the cursor moves from the high digit to the low.

Indication of LC Display Unit

• The initial display

Indicated when turning on the power or pressing the reset switch.

```
** Start SR-UL1R **
```

Note

· The SR-3AR display “Start SR-3AR” in the initial display

• The display during measurement

Indicated during measurement

```
 * Measuring *
IntegTime=  100
```

← Integral time: millisecond

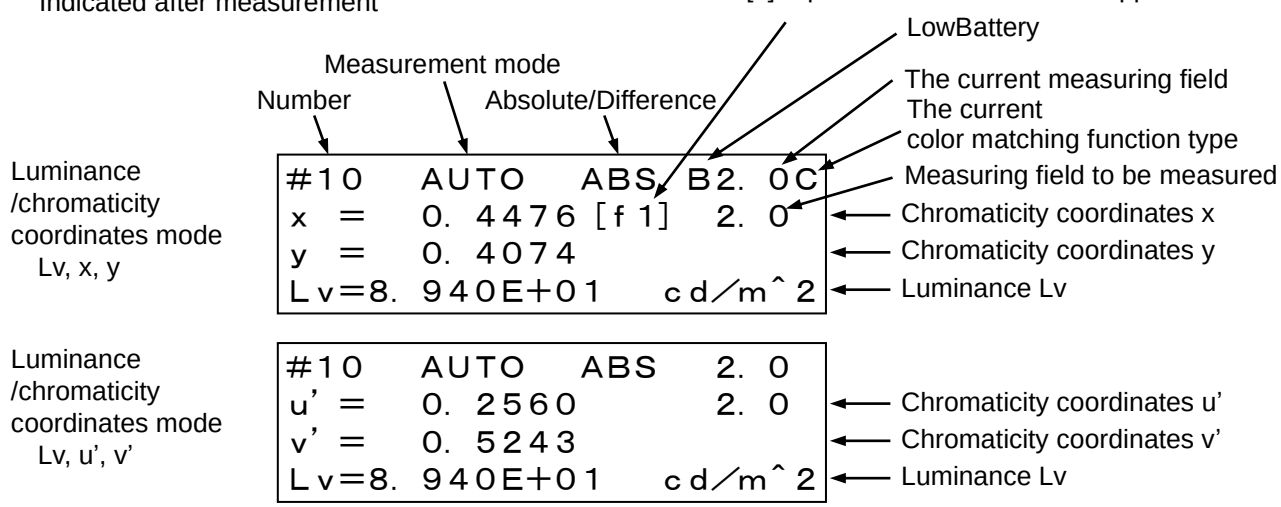
• Measurement Cancellation

If want to stop measuring, press the [MEAS./HOLD] switch. And then can see the following display, measurement is stopped.

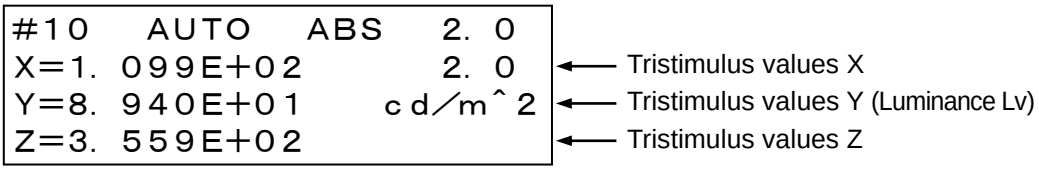
```
#10   AUTO  ABS  2.0
x = 0.4476       2.0
y = 0.4074
*Canceled  Measuring
```

• The display of measurement values

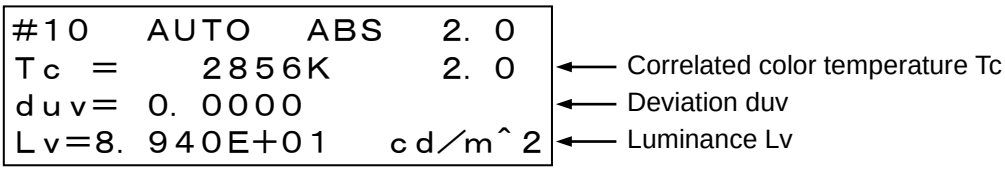
Indicated after measurement



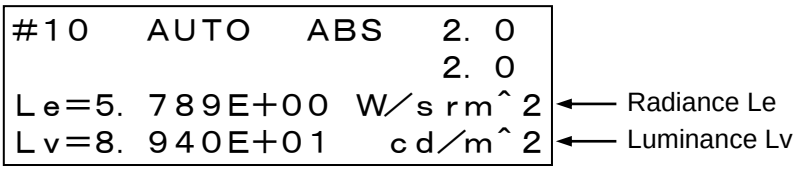
Tristimulus values mode
X, Y, Z



Correlated color temperature mode
Tc, duv, Lv



Radiance /luminance mode
Le, Lv



Note

Only when the color function of CIE 170 - 2 is selected, the color matching function type indicator "C" is displayed on the LCD. The indicator is displayed after the current measuring field value.With the setting of CIE1931, the color matching function type indicator is not display on the LCD.

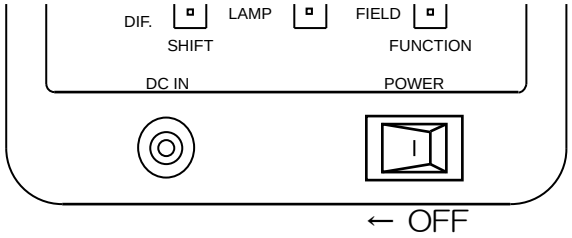
1.3 Preparations

1.3.1 Connecting the AC Adapter

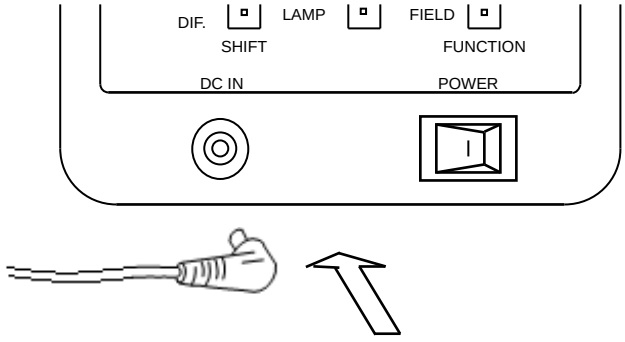
Mandatory	**Do not use AC adapters other than those included or sold separately by TOPCON TECHNOHOUSE.** AC adapter failure may result in a fire or electric shock.
Mandatory	**Remove dust and moisture from the plug of the AC adapter.** Doing so may result in a fire.
Prohibited	**Do not plug or unplug the instrument with wet hands.** Doing so may result in electric shock.

Use the following procedure to connect the AC adapter to the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR:

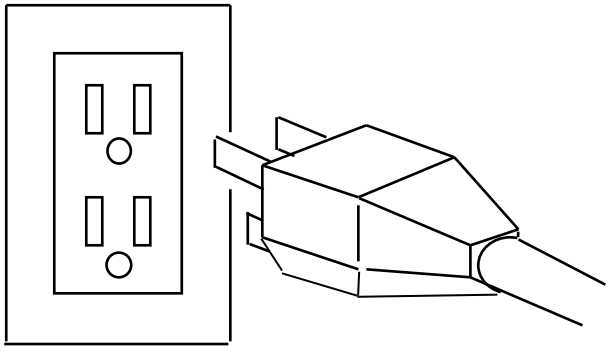
1. Confirm that SR-LEDW/SR-UL2/SR-UL1R/SR-3AR is turned off.



2. Plug the output end of the AC adapter into the DC input connector of the instrument.



3. Plug the AC adapter in to an outlet.



1.3.2 Connecting the Personal Computer

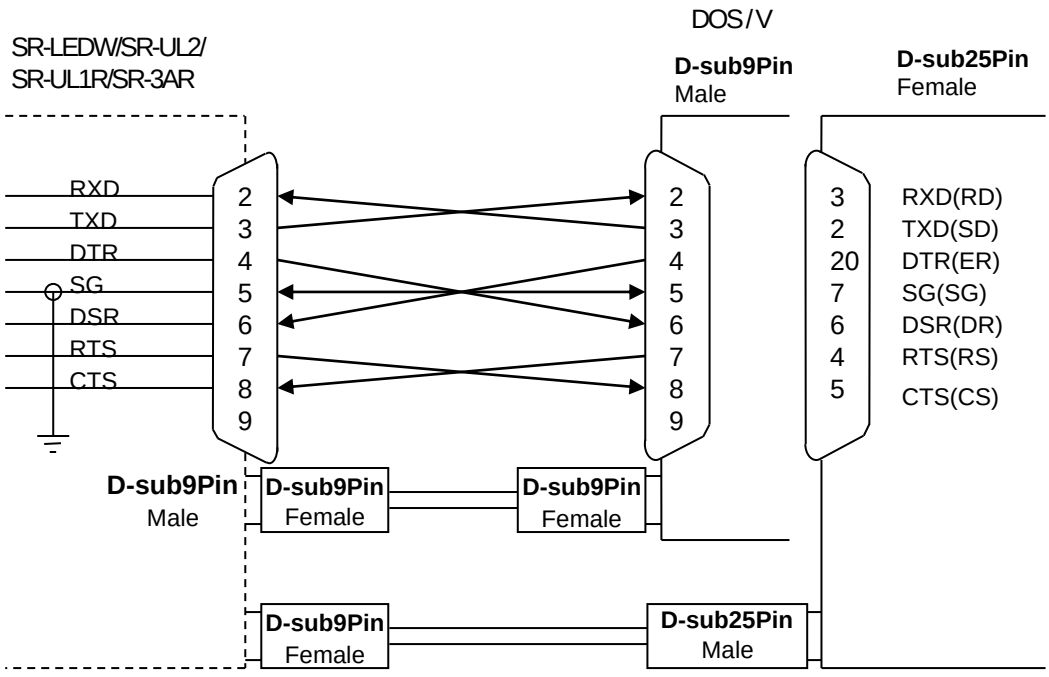
When connecting SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a PC, use a RS-232C or USB cable. When using a RS-232C cable, use an interlink cable of serial cross type supporting for a DOS/V PC.

The RS-232C signal line of the instrument is arranged according to the 9 pin D-SUB being used in the DOS/V personal computer, etc. Arrange the wiring while referring to the following diagram when connecting to a computer.

Note

- Communication cables are not supplied with the unit. If cables are to be used, they should be purchased separately.
- For the connection at the personal computer, refer to the manual of your personal computer.

Remember!	· Please do not insert and remove cables while the power of instrument is on.



Specifications for the RS-232C are as follows:

- · Communication method : Full duplex
- · Synch method : Start-stop transmission
- · Communication rate : 4800/9600/19200/38400 bps (**B**its **P**er **S**econd)
- · Bit structure : Data length : 7 bits/8 bits
  Parity : Even/Odd/None
  Stop bit : 1 bit/2 bits
- · Communication format : ASCII
- · Delimiter : "CR+LF" or "CR" is appended to the end of the communication data row before transmission.

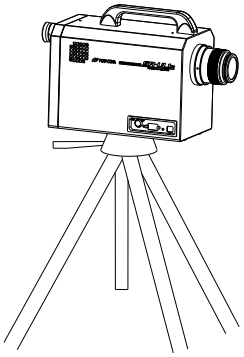
Select the remote command terminal codes ☞ '3.10 Remote Command Terminal codes'

1.3.3 Object Collimation

Prohibited	**Do not look directly at bright objects such as the sun or bulb filaments.** Doing so may result in optical damage.

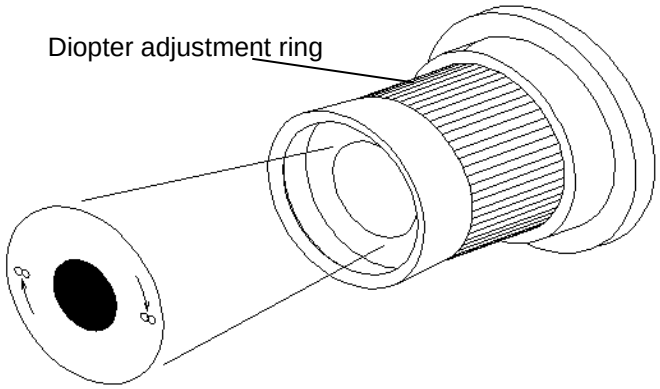
Request	Use only specified screws when using the tripod screw and screw holes for jig attachment. Do not tighten the screws any more than necessary. Doing so might cause internal breakage.

1 Fix the instrument, using the tripod screw or the tool attachment screws.



2 Remove the cap from the objective lens and set the finder shutter selection knob to "OPEN".

3 Look into the eyepiece, and turn the diopter adjustment ring of the eyepiece so that the reticle marks are clearly seen in the view finder.



4 Collimate with the measured object, and turn the focus ring of the objective lens and adjust the focus on the measured object.

5 Change the measuring field according to the size and brightness of the measured object.
Use the [FILED] switch to change the measuring field.
Each time the switch is pressed, the measuring field changes as follows:

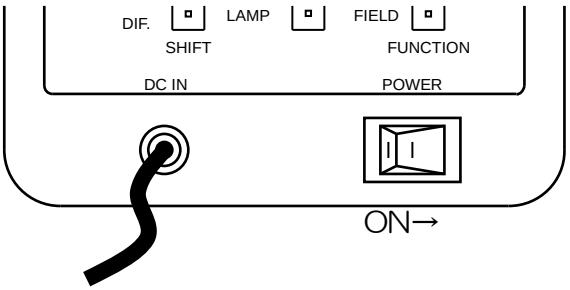
$2^\circ \rightarrow 1^\circ \rightarrow 0.2^\circ \rightarrow 0.1^\circ$

The current measuring field is displayed on the LCD screen.

LCD screen display ☞ '1.2 Parts and Functions'

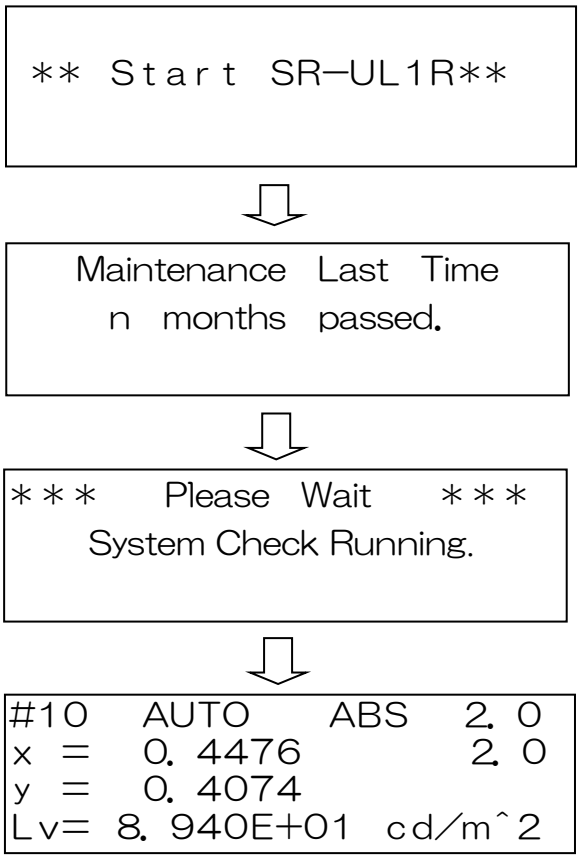
1.3.4 Turning ON/OFF the Power

Flip the power switch to the right side to turn on the power.



When the power is turned on, the LCD screen will display an initialization screen, a maintenance reminder screen and then the most recent measurement data.

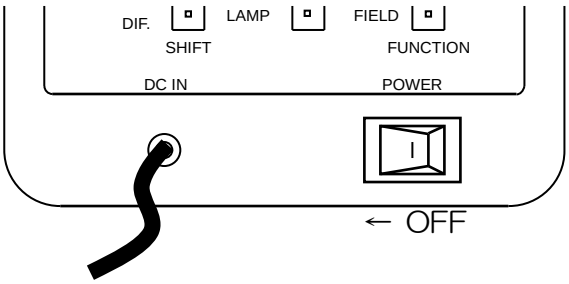
Maintenance Recommended Display ☞ '1.4 Maintenance Recommend Display'



Note

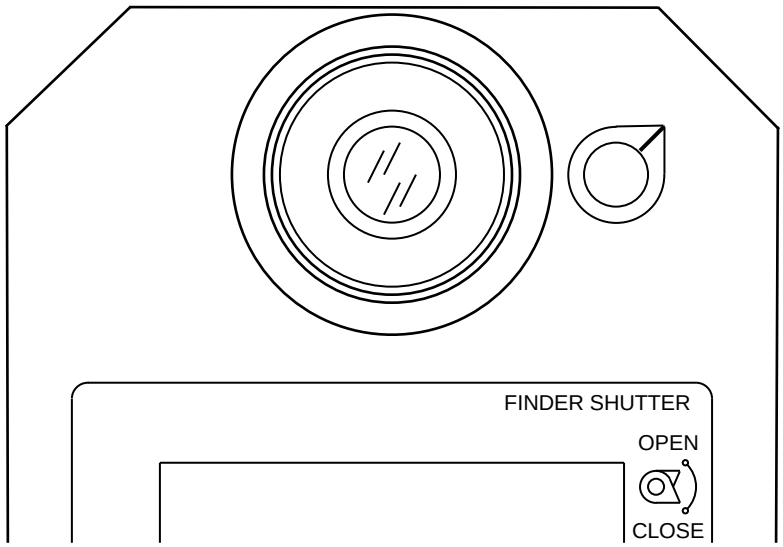
· The SR-3AR display "Start SR-3AR" in the initial display

Flip the power switch to the left side to turn off the power.



1.3.5 Open and shut a Finder Shutter

When the brightness of the object is very low or when there is a light emitting object on the finder side, set the finder shutter to "CLOSE" to prevent extra light from being dispersed by the finder.



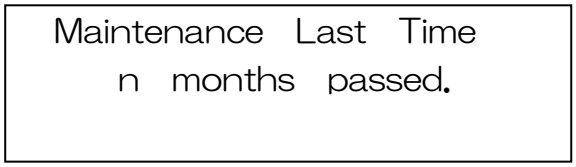
This is the "OPEN" condition and you can observe through the finder.

This is the "CLOSE" condition and the light sent from the finder is shielded.

1.4 Maintenance Recommended Display

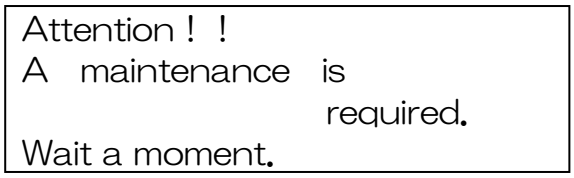
The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR displays a maintenance reminder to run a calibration test about once a year to maintain measurement accuracy. When the power is turned on, the screen displays the number of months that have elapsed since the purchase or most recent calibration test as shown in Figure A below. When one year has passed, the message shown in Figure B is displayed. When this message is displayed, have your unit calibrated as soon as possible.

Figure A



* The number of months ranges from 0 to 11

Figure B



A buzzer rings for 5 seconds simultaneously with indication of Figure B, and the display advances to the next screen automatically.

To automatically pass this process, set the setting for the maintenance recommended display to OFF.

Maintenance Recommended Display ☞ '3.19 Maintenance Recommended Display'

2. Measurement Procedures

2.1 Single Measurement

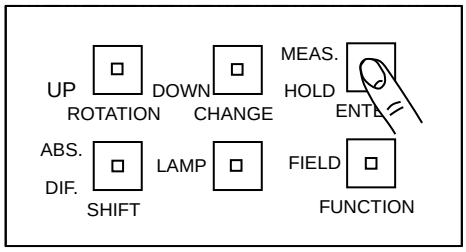
Use the following procedure for single measurement.

Remember!	· The measurement data will be stored at the number after the one currently displayed. If the registered data already exists at the number, its contents will be overwritten.

Note

· Up to 50 measurement data can be stored.

1 Press the [MEAS./HOLD] switch to start measurement.



2 The integral time will be displayed on the LCD screen. The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR is ready for measurement.

Integral time ☞ '3.3 Measurement Mode'

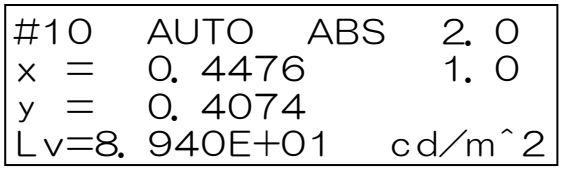
```
  * Measuring *
IntegTime=     100
```

```
  * Measuring *
IntegTime=     100
1cycle[ms] =    20
```

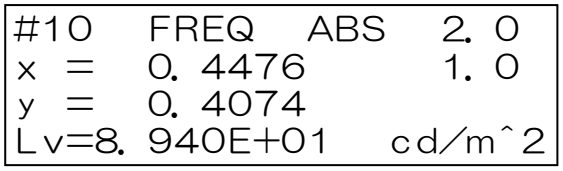
When "SYNC" is selected, one cycle time of the vertical synchronous signal is also indicated.

3 When measurement is done, the results are displayed. The display details will differ according to the measurement mode.

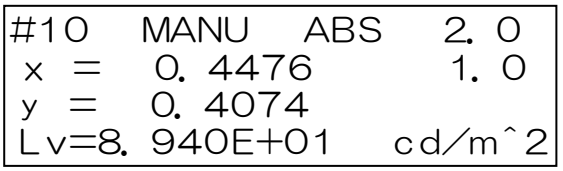
Measurement Mode ☞ '3.3 Measurement Mode'



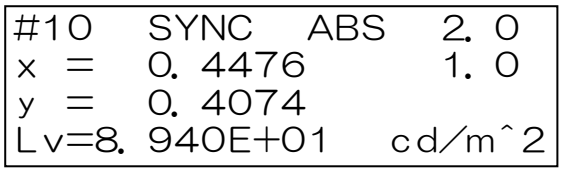
When AUTO is selected



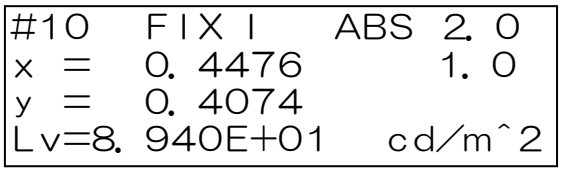
When FREQ is selected



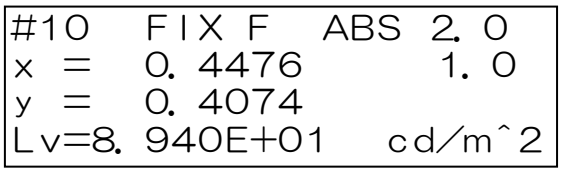
When MANU is selected



When SYNC is selected



When FIX INTEG selected
(SR-LEDW only)



When FIX FREQ selected

Each time a measurement is completed, the data number "#xx" will increase.

2.2 Auto Run

Use the following procedure for automatic continuous measurements.

Remember!	· The measurement data will be stored at the number currently displayed. If the registered data already exists at the number, its contents will be overwritten.

1 Switch the measurement mode to auto run.

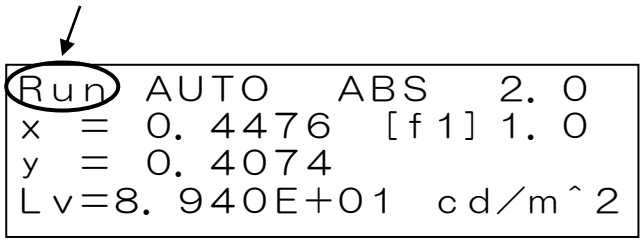
Setting the Measure Mode ☞ '3.5 Single or Auto Run'

2 Press the [MEAS./HOLD] switch.

Note

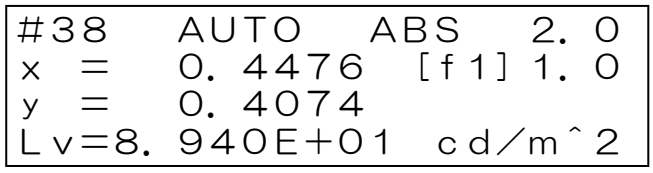
- Unlike in single measurement mode, the integral time is not displayed in auto run.
- Each time a measurement is completed, the data number "#xx" will increase.

During measurement, the data number portion displays "Run".



3 Press the [MEAS./HOLD] switch to stop measurement.

[HOLD] will light up on the operation panel and results will appear.



2.3 Difference Measurement

The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR can measure the difference between measurement data and standard sample data.

Use the following procedure:

Change to the difference measurement.

↓

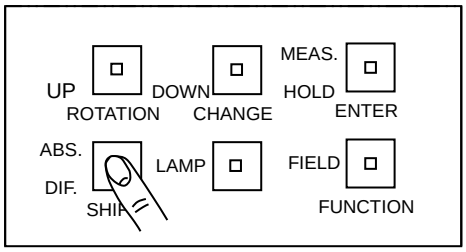
Input or selection of the standard sample data:

In the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR, the standard sample can be stored up to 20 points.

↓

Measurement

1 Change the measurement of the absolute value to the difference measurement. Press the [ABS./DIF.] switch.



The display of the panel switches is changed to "DIF." The display is changed as follows and the standard sample input/selection menu appears.

Standard sample number

```
M20*Std Sample*   2.0
   ** No Data **
```

(When the standard sample data is not stored)

2 Press the [MEAS./HOLD] switch. Measurement will begin for the standard sample. When done, the measurement data will be stored as a standard sample data.

```
M01*Std Sample*   2.0
x =   0.4476      2.0
y =   0.4074
Lv=8.940E+01   cd/m^2
```

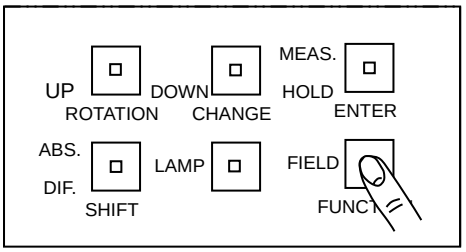
Every time a measurement is done, the standard sample number is increased and registered ("M01 →M02 → M03 ⋯ M20"). When the number has reached 20, it returns to 01.

Remember!	· Standard sample data is stored at the number after the one currently displayed. If the registered data already exists at the number, its contents will be overwritten.

3 If the standard sample data has already been registered, select a desirable number for a new standard sample data with the [UP] or [DOWN] switch.

4 For the standard sample data, press the [FIELD] switch to confirm.

The screen will return to normal.



5 Perform measurement of color difference.

Measure the difference in the same way as the absolute values. The measurement mode can be changed and auto run mode can also be used.

Switching measurement mode ☞ '3.3 Measurement Mode'

Continuous measurement ☞ '2.2 Auto Run'

After the measurement is done, the difference values will appear.

```
#10   AUTO   DIF    2. 0
x  =   0. 0001       2. 0
y  = −0. 0003
Lv=1. 240E−03   cd/m^2
```

Remember!	· To change the standard sample number or input standard sample data, press the [ABS./DIF.] switch to return to ABS. (absolute values), then press again to get back to DIF. mode. Return to step 1 and follow the procedure.

2.4 Displaying Measurement Data

Numbers are attached to measurement data. Up to 50 data can be stored in internal memory.
Use the [UP] and [DOWN] switches among the panel switches to view stored data.
The [UP] switch shows the next number data, and the [DOWN] switch shows the previous number data.

Remember!	· When data is being displayed and the [MEAS./HOLD] switch is pressed to begin measurement, measured data is stored at the number following the number currently displayed. If the registered data already exists at the number, its contents will be overwritten.

Note

- Batch deletion of all measurement data can be performed.

☞ '3.20 Batch Deletion of Measurement and DIF Standard Data'

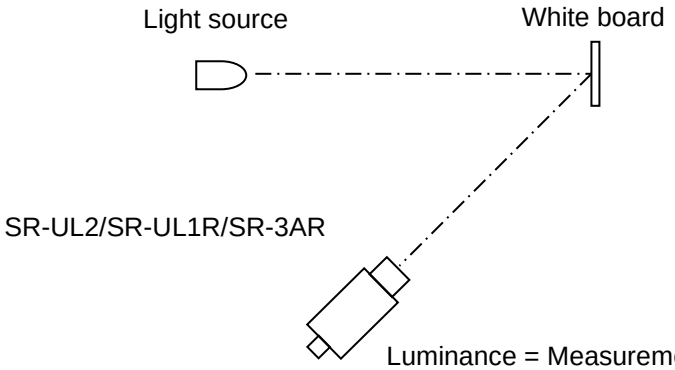
2.5 Measuring

with the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR

Examples of measurements are introduced in this section for reference.

2.5.1 Measuring Directional Light Sources

When measuring an LED or other directive or uneven light source, use a white board as shown in the figure. A direct observation may result in irreproducible data.



Luminance = Measurement value Lv × Luminance factor

2.5.2 Measuring Very Small Surfaces

For measuring smaller area than the specification of SR-LEDW/SR-UL2/SR-UL1R/SR-3AR, one of the optional attachment lens is available. The two attachment lenses are the AL-6 and the AL-11.

SR-LEDW/SR-UL2/SR-UL1R/SR-3AR Measurement Diameter ☞ 6‘Appendix: Specifications and Performance’

The attachment lens can be screwed onto the end of the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR objective lens.
When using an attachment lens, a correction factor must be set on SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

Setting a Correction Factor ☞ ‘3.11 Using a Correction Factor’, '3.12 Displaying and Editing the Correction Factor'

The measuring field will affect the measurement diameter.

For the AL-6

Measuring field	Measurement Dia.(mm)
2°	2.00 – 2.88
1°	1.00 – 1.44
0.2°	0.20 – 0.29
.1°	0.10 – 0.14

For the AL-11

Measuring field	Measurement Dia.(mm)
2°	1.18 – 1.53
1°	0.59 – 0.76
0.2°	0.19 – 0.15
0.1°	0.06 – 0.08

∗ Measurement distance from metal edge : For the AL-6: 51.72 to 68.53 mm

For the AL-11: 19.56 to 24.80 mm

2.5.3 System Integration

The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR can be integrated with a system. For example, it is loaded on a mobile XY stage and is moved as measuring.

Refer to the following references for system integration:

Communication specifications ☞ '4 Communication with Personal Computer'

Attachment reference ☞ '6Appendix: External Dimension Diagram'

2.5.4 Measuring a Frequency Light Source

Use the following procedure to measure the frequency light samples.

■ **The measurement with FREQ and FIX FREQ mode**

In case of knowing the frequency of a measuring object, set the measurement mode to FREQ or FIX FREQ mode, enter the value of frequency and start measuring.

☞'3.3 Measurement Mode'

In FREQ and FIX FREQ mode, the integral time is automatically set to an integer multiple of the cycle to eliminate error.

■ **The measurement with AUTO mode**

The followings cases will result in measurement errors.

1. When measuring a light source with high duty ratio as well as high intensity
2. When periodically-changing light sources include very low intensity such as black
3. When cycles of a light source which are measured within the given integral time are not enough

Increasing the integral time is effective in decreasing the error. The integral time delay function can be used to increase the integration time, to allow stable measurements.

☞'3.4 Integral Time Delay Function'

Set the measurement mode to AUTO mode, turn on the integral time delay function and set a delay time. We recommend at least 100 cycles for the delay time.

Example: For a 10 % error per cycle:

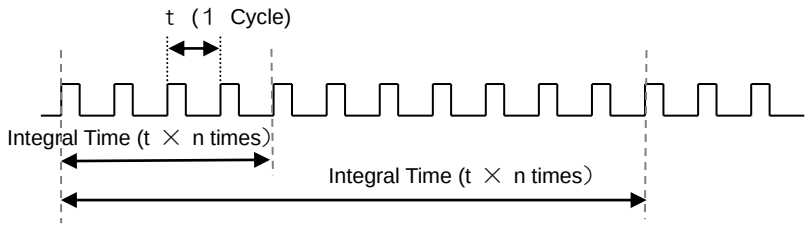
· Measure with an integral time of 10 cycles (t: 1 cycle time)

Error = 0.1 t/10 t = 1 %

· Measure with an integral time of 100 cycles

Error = 0.1 t/100 t = 0.1 %

In this manner, a longer integral time can be set to decrease error.



2.5.5 Reducing instrument error between a plurality of instruments

Please use the spectral correction function to reduce an error between the instruments. This function can do spectrum correction between SR-LEDW/SR-UL2/SR-UL1R/SR-3AR and a reference instrument such as SR-3, SR-3A (L1), SR-UL1, SR-3AR,SR-UL1R SR-LEDW and SR-UL2 only by a RS232C cable, reduce an error and measure.

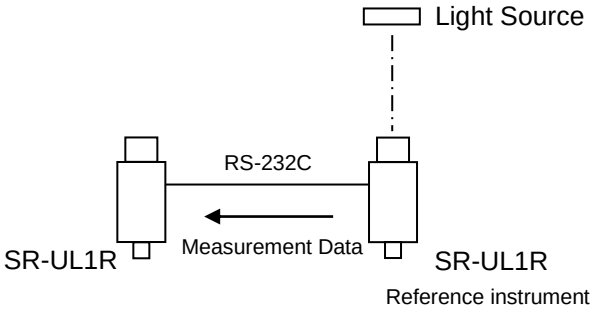
When performing spectral correction between the instruments, use the direct correction function.

■ Using the Direct Correction Function

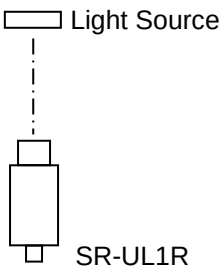
There is the method of using RS-232C cable to directly connect to luminance colorimeters, and this function is called the Direct Correction Function. In the method of using the Direct Correction Function, a RS-232C cable (an interlink cable of serial cross type supporting for a DOS/V PC) and a reference light soruce sample are necessary.

Remember!	· As a reference light source sample, recommend a standard light source A, a Halogen lamp and an incandescent light bulb, which have the spectral range from 380 nm to 780 nm. · To use the Direct Correction Function, the RS-232C parameters of the two luminance colorimeters must be the same.

When using the Direct Correction Function, first, measure a reference light source using the reference instrument, and write measured spectral radiance data to the SR-UL1R to be corrected.



Next, place the SR-UL1R to be corrected in the location where the reference instrument placed, and measure the same light.



A correction factor is calculated for the SR-UL1R to be corrected based on the measured spectral radiance data of the reference instrument and that of the SR-UL1R to be corrected.

The procedure of measurment for spectral correction between instruments using the Direct Correction Function is as explained below.

1 Set beforehand the user defined measurement condition, the data output method and communication method for the reference instrument in reference to the table below. Also, set the user defined measurement condition and RS-232C parameter settings include delimiter of the SR-UL1R to be corrected are the same as those of the reference instrument.

☞'3 Settings'

☞'3.8 RS-232C Parameter'

☞'3.9 Data Communication Methods'

☞'3.10 Remote Command Terminate Codes'

Reference Instrument	Communication Type	Data Output Type	RS-232C Cable
SR-３	RS-232C	CS-900 Type	Interlink
SR-３A(L1)			
SR-3AR			
SR-UL1R			
SR-UL2			
SR-LEDW			

2 Turn on the power to SR-UL1R to be corrected.

3 Turn on the power to the reference instrument. Collimate the object. Turn the focus adjustment ring of the objective lens to focus the lens on the object.

4 Connect a RS-232C cable to SR-UL1R to be corrected.

Remember!	· Please connect the RS-232C cable between reference instrument and SR-UL1R, after turn on the power to both instruments.

5 The SR-UL1R to be corrected changes to the function mode, and the [Direct-Conn Factor]-[FACTOR] screen is displayed.

Moving to the Function Mode ☞'3.1.2 Entering/Return from the Function Mode'

```
＊Ｄｉｒｅｃｔ－Ｃｏｎｎ Ｆａｃｔｏｒ＊
CHANGE：Ｓｅｔｔｉｎｇ
```

6 Press the [CHANGE] switch, and then the display appears as follows.

```
*Direct-Conn Factor*
 Measure Reference
ENTER : Start
FIELD : Cancel
```

[ENTER] : Identifies the connected refernece instrument automatically, and perform measurement, and write the measured spectral radiance data in the SR-UL1R to be corrected.

[FIELD] : Cancel the direct correction function.

7 Press the [ENTER] switch.

Searching the reference instrument.

```
*Searching*
RemoteMode =
```

The connection of communication is fail.
Disconnect the RS-232C cable from instruments first. And then retry the process from step 2.

```
*Searching*
RemoteMode= failure
```

The connection of communication is success.

```
*Searching*
RemoteMode = success
```

The searching process for reference instrument is completed.

```
*Searching*
DEVICE = SR-UL1R
```

The confirmation of connecting between the both instruments.

```
*Searching*
SR-UL1R = success
```

```
*Measuring*
Interval(sec)=250
```

The measurment is started for the reference instrument. After 4 times measurement, the measurement is over. “Interval(sec)=250” means that the maximum time interval between each measuring measurement time is less than 250 seconds.

```
*Direct-Conn Factor*
 Measure Factor
ENTER : Start
FIELD : Cancel
```

If the error occurred on the process, the process return to step ***6***. In this case, should clear the error, and then retry please.

☞‘5 Error Display’

Note

The maximum time interval :
SR-3、SR-3A(L1), SR-3AR ：40 sec
SR-UL1, SR-UL1R,SR-UL2.SR-LEDW : 250 sec

Note

From the next step, it is not necessary to use RS-232C cable

8 For SR-UL1R to be corrected, Collimate the object. Turn the focus adjustment ring of the objective lens to focus the lens on the object.

9 Press the [ENTER] switch on the following display.

```
*Direct-Conn Factor*
 Measure Factor
ENTER : Start
FIELD : Cancel
```

[ENTER] : Perform measurement for the SR-UL1R to be corrected, and write the measured spectral radiance data in that.

[FIELD] : Cancel the direct correction function.

```
    *Measuring*
IntegTime=     100
```

The measurment is started for the SR-UL1R to be corrected. After 4 times measurement, the measurement is over.

```
*Direct-Conn Factor*
 Write   Factor
ENTER : Start
FIELD : Cancel
```

If the error occurred on the process, the process return to step ***8***. In this case, should clear the error, and then retry please.

☞'5 Error Display'

10 When press the [ENTER] switch, the spectral correction factor is saved in the SR-UL1R.

```
*Direct-Conn Factor*
 Write   Factor
ENTER : Start
FIELD : Cancel
```

[ENTER] : Save the spectral correction factor in the SR-UL1R to be corrected.

[FIELD] : Cancel the direct correction function.

11 Press the [SHIFT] switch, and then the spectral correction factor becomes valid.

```
   Factor(1nm) Set ON

SHIFT  :  OK
CHANGE:  NO
```

[SHIFT] : The spectral correction factor (1 nm) in SR-UL1R to be corrected is valid.

[CHANGE] : The spectral correction factor (1 nm) in SR-UL1R to be corrected is invalid.

Note

If move to this display manually and press the [SHIFT] switch, the correction factor is allowed to use although choose the [CHANGE] switch on this step.

☞ '3.11 Using a Correction Factor

Remember!	· In the Direct Correction Function, it is impossible to save the measurement data of reference instrument and SR-UL1R for the calculating the correction factor. If want to save those, use the CS-900A Software. · It is possible to write the spectral correction factor on the instrument and read it out from the instrument using CS-900A installed in a PC. CS-900A instrument manual ☞"5.1.2" Correcting Measurement Value

3. Settings

3.1 Function Mode

3.1.1 Settings

The operation panel can be used to make the following settings.

- · Table color selection ☞'3.2 Table Colors'
- · Measurement mode selection ☞'3.3 Measurement Mode'
- · Frequency setting (during FREQ mode) ☞'3.3.1 FREQ Mode'
- · Integral time setting (during MANU mode) ☞'3.3.2 MANU Mode'
- · FIX INTEG mode setting (during FIX I mode) ☞'3.3.3 FIX INTEG Mode'
- · FIX FREQ mode setting ☞'3.3.4 FIX FREQ Mode'
- · Integral time delay function ☞'3.4 Integral Time Delay Function'
- · Delay time setting ☞'3.4.1 Delay Time Setting'
- · Measurement method selection ☞'3.5 Single or Auto Run'
- · Speed measurement selection ☞'3.6 Measuring Speed'
- · High Speed Calibration ☞'3.6.1 High Speed Calibration'
- · PC connection selection ☞'3.7 PC Connection Method'
- · RS-232C parameter setting ☞'3.8 RS-232C Parameters'
- · Data communication selection ☞'3.9 Data Communication Methods'
- · Remote command terminate code selection ☞'3.10 Remote Command Terminal Codes'
- · Correction factor ☞'3.11 Using a Correction Factor'
- · Displaying and Editing the Correction Factor ☞'3.12 Displaying and Editing the Correction Factor'
- · CIE Color Matching function selection (Visual field) ☞'3.13 CIE Color Matching Function(Visual field)'
- · CIE Color Matching function selection (Type) ☞'3.14 CIE Color Matching Function (Type)'
- · Measurement averaging selection ☞'3.15 Measurement Averaging'
- · Average count setting ☞'3.15.1 Averaging Count'
- · Configuration of "Over Range" Detection in MANU ☞'3.16 Selection of "Over Range" Detection in MANU'
- · Buzzer setting ☞'3.17 Buzzer'
- · Luminance display format selection ☞'3.18 Luminance Display Format'
- · Luminance display digit count setting ☞'3.18.1 Luminance Display Format'
- · Maintenance reminder setting ☞'3.19 Maintenance Reminder Screen'
- · Panel light on/off setting ☞'3.20 Panel Light Control'
- · Batch deletion of measurement and DIF. reference data ☞'3.21 Batch Deletion of Measurement and DIF. Standard Data'
- · LowBattery operation setting ☞'3.22 LowBattery Operation'

3.1.2 Entering/Returning from the Function Mode

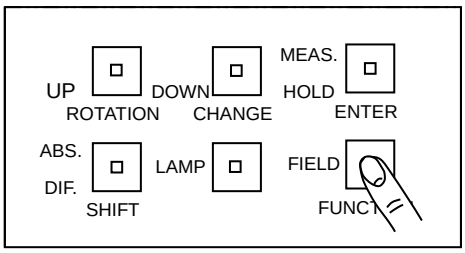
■ Function Menu

Settings are made in the function mode.

Use the following procedure to switch to the function mode and display setting items.

Make sure that the instrument is in the stand-by status and then keep pressing the [FUNCTION] switch among the panel switches for about 2 seconds. When hear a beep sound, release the switch.

The function mode is set.



Note

· If you release the [FUNCTION] switch before the beeping begins, the function mode is not set. Keep pressing the [FUNCTION] switch until the beeping begins.

The display of the function mode

```
*MEASURE        MAINTAIN
 FACTOR
 COMM.
 DISPLAY
```

Press the [ROTATION] or [CHANGE] switch, and then the "*" mark moves in order.

Set the "*" mark to desired position, and press the [ENTER] switch to decide the vale.

For each of the function menu, describe as follows.

(1) MEASURE: For the measurement

① Measure Type : Set the measurement mode.

☞ '3.3 Measurement Mode'

② Frequency Input : Set the frequency value in the FREQ mode.

This menu is indicated when set the measurement mode to the FREQ mode (refer to the ① Measure Type).

☞ '3.3.1 FREQ Mode'

③ Integ Time Input : Set the integral time in the MANU mode.

This menu is indicated when set the measurement mode to the MANU mode (refer to the ① Measure Type).

☞ '3.3.2 MANU Mode'

④ Integ Delay ON/OFF : Set whether to use integral time delay function or not.

☞ '3.4 Integral Time Delay Function'

⑤ Integ Delay Time : Set the integral delay time.

This menu is indicated when set the Integ Delay ON/OFF to ON (refer to ④ Integ Delay ON/OFF).

☞ '3.4.1 Delay Time Setting'

⑥ Single or Auto Run : Set the measurement method.

☞ '3.5 Single or Auto Run'

⑦ AverageMeasON/OFF : Set whether to use average measurement function or not.

☞ '3.14 Measurement Averaging'

⑧ Average time : Set the measuring times.

This menu is indicated when set the AverageMeasON/OFF to ON. (refer to ⑦ AverageMeasON/OFF)

☞ '3.14.1 Averaging Count'

⑨ Measurment speed : Set the Measuring speed.

☞ '3.6 Measuring Speed'

⑩ High Speed Cal. : Perform the calibration before conducting measurement in High Speed mode.

☞ '3.6.1 High Speed Calibration'

⑪ FIX FREQ Setting :Set the frequency value and inner-filter type in the FIX FREQ mode.

☞ '3.3.4 FIX FREQ Mode'

(2) FACTOR: For the correction factor

① Factor ON/OFF : Set whether to use a correction factor or not.

☞ '3.11 Using a Correction Factor'

② X Y Z factor : Set the a correction factor for tristimulus values X, Y, Z.

This menu is indicated when set the Factor (XYZ) to ON.

☞ '3.12 Displaying and Changing the Correction Factor'

③ CIE Type Select : Set the CIE Color Matching Function. (Visual field)

☞ '3.13 CIE Color Matching Function (Visual field)'

④ Color Match Type : Set the CIE Color Matching Function. (Type)

☞ '3.14 CIE Color Matching Function (Type)'

⑤ Direct-Conn Factor : Perform the Direct Correction function for reducing instrumental error between a plurality of instruments.

☞ '2.5.5 Reducing instrumental error between a plurality of instruments'

(3) COMM.: For the communication between instrument and PC

① Communication-Type : Set the communication type (USB/RS232C)

☞ '3.7 PC Connection Method'

② RS-232C Parameter : Set the parameters of RS-232C.
This menu is indicated when set communication type to RS-232C.
(refer to ① Communication-Type)

☞ '3.8 RS-232C Parameters'

③ CS900 ON/OFF : Set the data communication methods.
This menu is indicated when set communication type to RS-232C.
(refer to ① Communication-Type)

☞ '3.9 Data Communication Methods'

④ Delimiter : Set the end code of communication.

☞ '3.10 Remote Command Terminal Codes'

(4) DISPLAY: For the LCD Screen

① Display Mode : Set the table colors.

☞ '3.2 Table Colors'

② Auto Panel Light : Set whether to use the function that controls of panel light ON/OFF automatically or not.

☞ '3.19 Panel Light Control'

③ Beep ON/OFF : Set whether to beep out or not.

☞ '3.16 Buzzer'

④ Luminance Format : Set the format of luminance output (decimal/exponential)

☞ '3.17 Luminance Display Format'

⑤ Luminance Decimal : Set the digit of luminance out in decimal.
This menu is indicated when set the luminance format to decimal.
(refer to ④ Luminance Format)

☞ '3.17.1 Luminance Display Format'

(5) MAINTAIN: For the maintenance

① Maintenance Display : Set whether to display maintenance reminder screen or not.

☞ '3.18 Maintenance Reminder Screen'

② Memory AllClear : Be used when delete measured data and standard data for calculation of DIF. value.

☞ '3.20 Batch Deletion of Measurement and DIF Standard Data'

③ LowBattery Condition : Set the operation when low battery.

☞ '3.22 LowBattery Operation'

Note

- Each time the [ENTER] switch is pressed, the displayed setting item changes. Continue pressing until the desired item is displayed.
- In function mode, the switch functions are those listed below the switches. In the following descriptions, switches will be referenced by the wording below them.

■ Cancelling Function Mode

Press the [FUNCTION] switch after the setting of function mode is over, and then return to the initial display of the function menu. To finish the function mode, press the [FUNCTION] switch once again. And then the measurement result appears on the LCD screen.

Describe the example about the setting of measurement mode as follows.

☞ '3.3 Measurement Mode'

Example) The setting of measurement mode

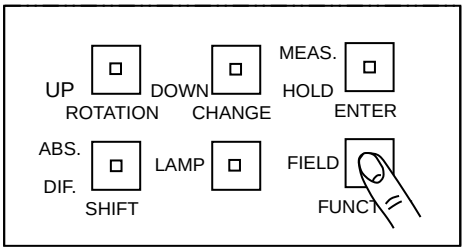
(1) Set the measurement mode to AUTO

```
*   Measure Type   *

        *AUTO
```

(2) *To return the initial function mode menu, press [FUNCTION] switch.*

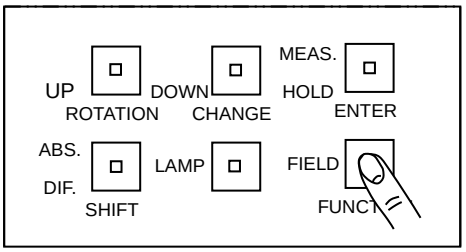
The display of function mode

```
*MEASURE        MAINTAIN
 FACTOR
 COMM.
 DISPLAY
```



(3) As the [FUNCTION] is pressed once again, function mode is out.

```
#10   AUTO    ABS   2.0
x =  0.4476         1.0
y =  0.4074
Lv= 8.940E+01   cd/m^2
```



3.1.3 Setting Values

In the function mode, it is necessary to input a numerical value for the item.
The procedure for inputting a numerical value is the same for all the items.
Setting of integral time will be explained here as an example.

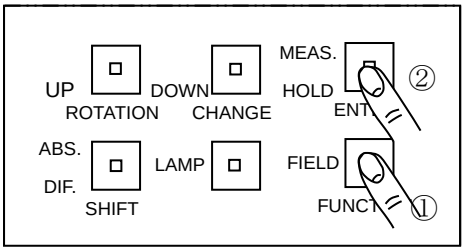
1 Set to the function mode.

Select the [MEASURE] as one of function mode, and press [ENTER] switch.

And then the display appears as follows.

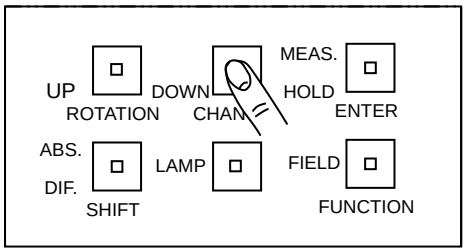
☞ '3.1.2 Entering/Returning from the Function Mode'

```
*     Measure Type     *

          *AUTO
```



2 Press the [CHANGE] switch. The cursor will be lit in the input stand-by status.

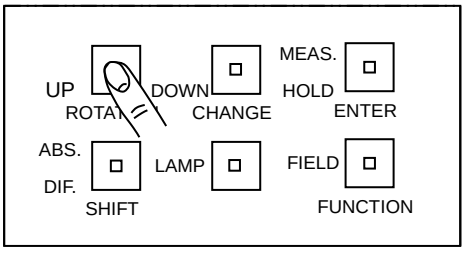
```
*     Measure Type     *

          *AUTO
```



3 Press the [ROTATION] switch to set the measurement mode to [MANU] mode. Each time the [ENTER] switch is pressed, the measurement modes to be supported are displayed in order.

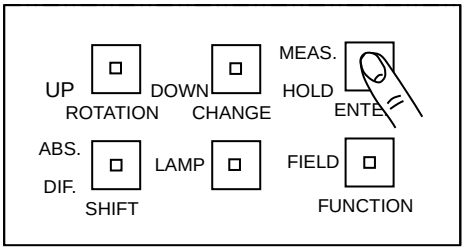
☞ '3.3 Measurement Mode'

AUTO→FREQ→MANU→SYNC→FIX INTEG→FIX FREQ

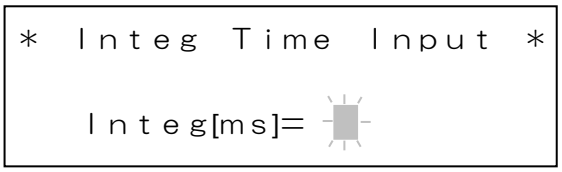


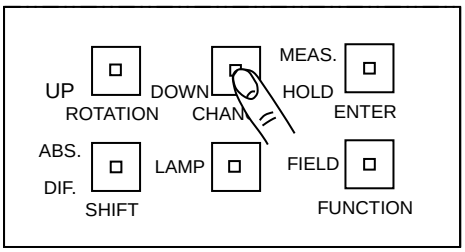
4 Press the [ROTATION] switch once again, the display appears as follows.

```
*  Integ Time Input  *

    Integ[ms]=  1000
```

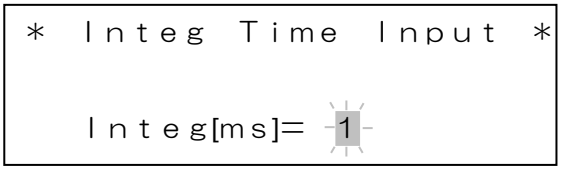


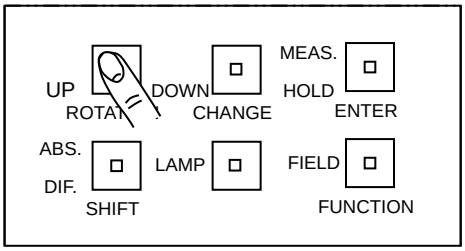
5 Press the [CHANGE] switch. The cursor will be lit in the input stand-by status.



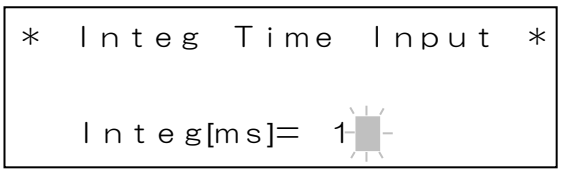


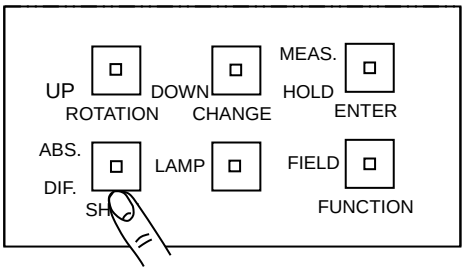
6 To input the value which user wants to set, use the [ROTATION] switch.





7 To move to the next digit, press the [SHIFT] switch.





8 Repeat step 6 and 7 to input a desirable value.

9 After inputting, press the [ENTER] switch to decide the value.

Note

- If a input value exceeds the limit, go back to step 5. Re-enter the number.
- When failing in way input, please even do step 9 and redo from step 5.

3.2 Table Colors

The Colorimetric systems used for measurement data can be set.

Five colorimetric systems are available with the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR. Display them as follows:

• Chromaticity coordinates xy / Luminance Lv

```
#10   AUTO   ABS    2. 0
x  =   0. 4476        2. 0
y  =   0. 4074
Lv=8. 940E+01    cd/mˆ2
```

• Chromaticity coordinates u' v' / Luminance Lv

```
#10   AUTO   ABS    2. 0
u' =   0. 2560        2. 0
v' =   0. 5243
Lv=8. 940E+01    cd/mˆ2
```

• Radiance Le / Luminance Lv

```
#10   AUTO   ABS    2. 0
                      2. 0
Le=5. 789E+00 W/srmˆ2
Lv=8. 940E+01    cd/mˆ2
```

• Tristimulus values XYZ

```
#10   AUTO   ABS    2. 0
X=1. 099E+02          2. 0
Y=8. 940E+01    cd/mˆ2
Z=3. 559E+02
```

• Correlated color temperature Tc / Deviation duv/ Luminance Lv

```
#10   AUTO   ABS    2. 0
Tc =    2856K         2. 0
duv= 0. 0000
Lv =8. 940E+01  cd/mˆ2
```

Use the following procedure to set the colorimetric system.

1 Switch to the function mode to display [DISPLAY]-[Display Mode]

☞ '3.1.2 Entering/Returning from the Function Mode'

```
***  DISPLAY  MODE  ***

       *xy/L
```

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to find the desired colorimetric system.

The value cycles as follows:

xy/Lv → u'v'/Lv → XYZ → Tc/duv/Lv → Le/Lv

4 Press the [ENTER] switch to accept the displayed colorimetric system.

3.3 Measurement Mode

Set the measurement mode.

The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR has four measurement modes depending on the target light source. The integral time calculation method differs depending on the mode.

Note

· The integral time is the period in which the sensor is exposed to light. Light energy accumulates on the sensor during the integral time. The integral time differs from the measurement time. The formula for finding the measurement time is as follows:
Measurement time = Integral time × 2 + Shutter opening time + Processing time

The available measurement modes are as follows.

○AUTO — Used to measure the normal light. The optimum integral time is automatically set according to the brightness of the light source to be measured.

○FREQ — Used to measure CRT, the light of a fluorescent lamp, etc. Set the vertical synchronous signal frequency for CRT and the commercial frequency (50 or 60 Hz) for the light of a fluorescent lamp, etc. The optimum integral time is calculated according to the entered frequency and the brightness of the light source. The input range is 1.5~250 Hz.

Frequency input ☞ '3.3.1 FREQ Mode'

○MANU — This mode sets an optional integral time and performs the measurement. The input range is SR-LEDW : 10~120 000 ms, SR-UL2/SR-UL1R : 20~120 000 ms, SR-3AR : 20~15 000 ms

Integral time input ☞ '3.3.2 MANU Mode'

Remember!	· When a smaller integral time is entered in MANU mode than the time calculated in AUTO mode, the measurement precision will drop.

○SYNC — When CRT is measured, the vertical synchronous signal of CRT is entered into the external synchronous signal connector of the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR. The optimum integral time is calculated according to the entered frequency and the brightness of the light source. The frequency detection range is 1.5~250 Hz.

○FIX INTEG (SR-LEDW only) — Uses to reduce measurement time. In this mode, Inner-filter and integral time are fixed.Optimum inner-filter and integral time is automatically set according to initial measurement in Fix Integ mode after turn on power.

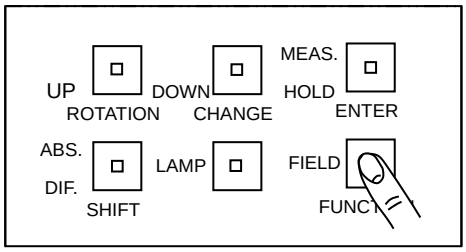
☞ '3.3.3 FIX INTEG Mode'

○FIX FREQ

Use this mode to fix the filter setting during FREQ mode in order tomeasure flashing light and flicker light such as fluorescent light.
Set the vertical synchronous signal frequency for CRT and the commercial frequency (50 or 60Hz) for the light of fluorescent lamp. The optimum integration time is calculated according to the combination of entered frequency value and brightness of the light.
Valid value range is from 1.5 to 250Hz.

☞'3.3.4 FIX FREQ Mode'

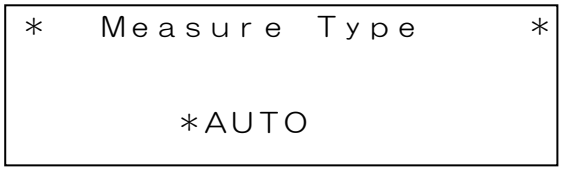
Use the following procedure to set the measurement mode:

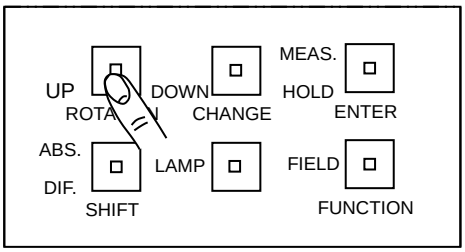


1 Switch to the function mode to display [MEASURE]-[Measure Type].
☞ '3.1.2 Entering/Returning from the Function Mode'

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to find the desired measurement mode.





Each time the [ROTATION] switch is pressed,
the mode is changed as follows.

AUTO → FREQ → MANU → SYNC → FIX INTEG → FIX FREQ

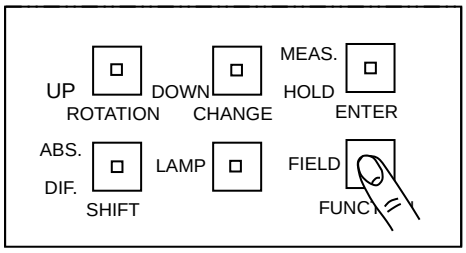
4 Press the [ENTER] switch to accept the displayed value.

3.3.1 FREQ Mode

In the “FREQ” measurement mode, the frequency of the light source to be measured can be set. Use the following procedure to set the frequency:

1 Switch to the function mode to display [MEASURE]-[frequency input].

☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.

3 Input a desirable value according to "How to input a numerical value in the function mode". The value which can be inputted is 1.5 to 250 Hz.

Setting Method ☞ ‘3.1.3 Setting Values’

```
*   Frequency Input    *

  Freq[Hz]=   50
```

4 Press the [ENTER] switch to accept the displayed value.

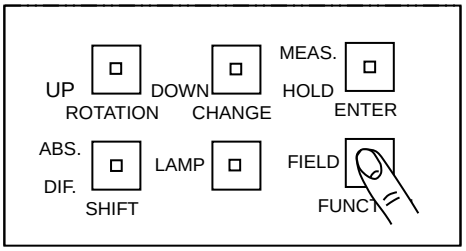
3.3.2 MANU Mode

In “MANU” measurement mode, the integral time can be set.

Use the following procedure to set the integral time:

1 Switch to the function mode to display [MEASURE]-[Integ Time Input]

☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.

3 Input a desirable value according to "How to input a numerical value in the function mode".

The value which can be inputted is 10 to 120 000 milliseconds:SR-LEDW, 20 to 120 000 milliseconds:SR-UL2 and SR-UL1R, 20 to 15 000 milliseconds: SR-3AR

Setting Method ☞ ‘3.1.3 Setting Values’

```
* Integ Time Input *

  Integ[ms]=    100
```

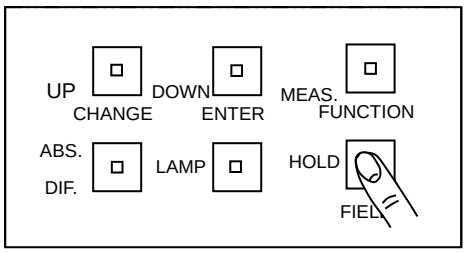
4 Press the [ENTER] switch to accept the displayed value.

3.3.3 FIX INTEG Mode

Uses this mode to reduce measurement time.Inner-filer and integral time is fixed in measuring. This mode is suited for the continuous measurement of the light source without fluctuation under stable condition. Optimum inner-filter and integral time is automatically set according to initial measurement in Fix integ mode after turn on power. (SR-LEDW only)

1 Switch to the FUNCTION mode to display [MEASURE]-[Integ Time Input]

☞'3.1.2 Entering/Returning from the Function mode」



2 Press the [CHANGE] switch. Press [ROTATION] switch to find [FIX INTEG], and then the [ENTER] switch to accept your selection.

3 Press the [FUNCTION] switch twice to escape from FUNCTION mode.

4 Collimate the object and press the [MEAS.] switch. Optimum inner-filter and integral time is set automatically in initial measurement after setting FIX INTEG mode.

☞'Object Collimation'

Remember!	Measurement should be conducted at the same condition as the initial measurement in measurement angle, Object and measurement distance.

Remember!	Integral time and Inner-filter setting for FIX INTEG mode are erased when the power off.

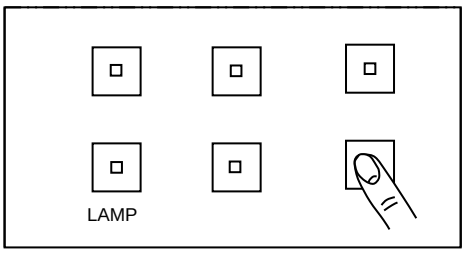
Setting value in FIX INTEG mode

Inner-filter type and integral time can be set.

Use the following procedure

1 Switch to the function mode to display [MEASURE]-[Integ Time Input]

☞'3.1.2 Entering/Returning from the Function mode'



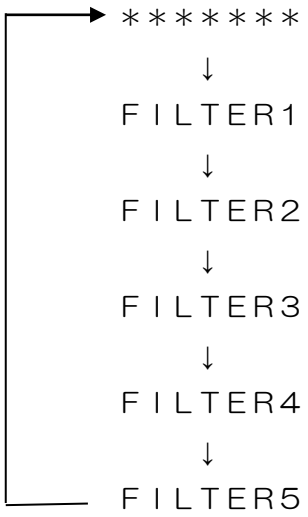
2 Input a desirable value according to “How to input a numerical value in the function mode”.
The value which can be inputted is 50 -120000 ms

Setting method☞’3.1.3 Setting values’

```
*FIX INTEG Setting*

  Integ[ms]=    100
  Shutter   = *******
```

3 Press the [ENTER] switch to accept the integral time value on the display.

4 Pres the [ROTATE] switch to select inner-filter type. Each time the [ROTATION] switch is pressed, the inner-filter type is changed as follows. Press the [ENTER]switch to accept the display value.



＊＊＊＊＊＊＊：Inner-filter and integral time setting is reset. When conduct measurement after selecting this, former inner-filter and integral time setting are erased and new optimum setting are calculated.

Remember!	• If inner-filter and integral time are not proper as follows, the accuracy in measured data may be affected. • Designated integral time is smaller than proper integral time • Designated inner-filter is not proper

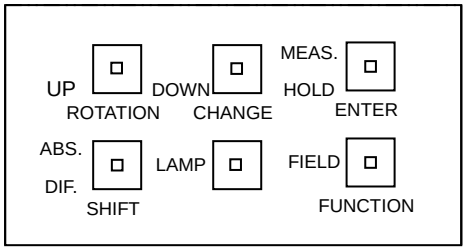
Remember!	• A combination of following measuring filed and inner-filter can not be used. Filed　Inner-filter 0.2°　FILTER5 0.1°　FILTER4、FILTER5

3.3.4 FIX FREQ Mode

This mode is used to fix the filter setting during FREQ mode. The optimum integration time is calculated according to the combination of entered frequency value and brightness of the light.

1 Switch to the FUNCTION mode to display [MEASURE]-[Integ Time Input]

☞'3.1.2 Entering/Returning from the Function mode」



2 Press the [CHANGE] switch. Press [ROTATION] switch to find [FIX FREQ], and then the [ENTER] switch to accept your selection.

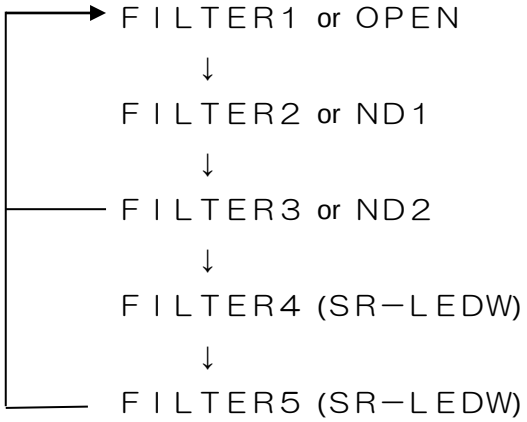
3 Then, enter [MEASURE]-[FIX FREQ Setting] in FUNCTION mode.

```
＊ ＦＩＸ ＦＲＥＱ Ｓｅｔｔｉｎｇ ＊

    Ｆｒｅｑ [Hz] ＝   60
  Ｓｈｕｔｔｅｒ ＝ ＊ＦＩＬＴＥＲ１
```

Setting method☞'3.1.3 Setting values'

4 Press the [ENTER] switch to accept the frequency value on the display.

5 Press the [ROTATE] switch to select inner-filter type. Each time the [ROTATION] switch is pressed, the inner-filter type is changed as follows. Press the [ENTER] switch to accept the display value.



Remember!	• A combination of following measuring filed and inner-filter can not be used. SR-3AR/UL1R/UL2 / SR-LEDW Filed / Inner-filter / Filed / Inner-filter 0.2° / ND2 / 0.2° / FILTER5 0.1° / ND2 / 0.1° / FILTER4、FILTER5

3.4 Integral Time Delay Function

Set whether to use the integral time delay function or not. Explain how to set the integral time delay function to usable state as follows.

The followings cases will result in measurement errors.

1. When measuring a light source with high duty ratio as well as high intensity
2. When periodically-changing light sources include very low intensity such as black
3. When cycles of a light source which are measured within the given integral time are not enough

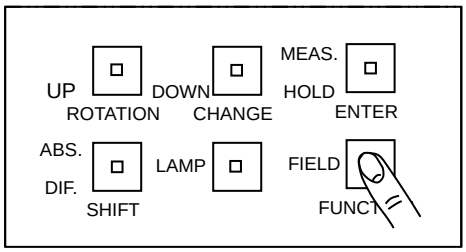
Increasing the integral time is effective in decreasing the error. The integral time delay function can be used to increase the integration time, to allow stable measurements.

☞ '2.5.4 Measuring a Frequency Light Source'

Use the following procedure to set the integral time delay:

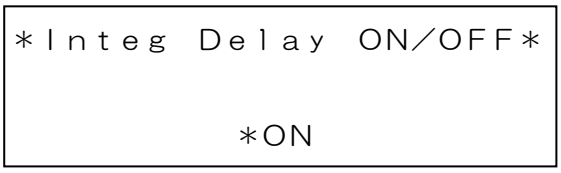
1 Switch to the function mode to display [MEASURE]-[Integ Delay ON/OFF].

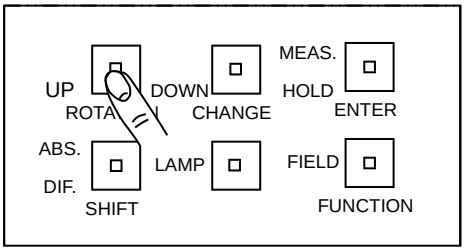
☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.

3 To change the setting, press the [ROTATION] switch. ON/OFF is changed to each other.





4 Press the [ENTER] switch to accept the displayed value.

3.4.1 Delay Time Setting

Turn on the integral time delay function and set a delay time.

Note

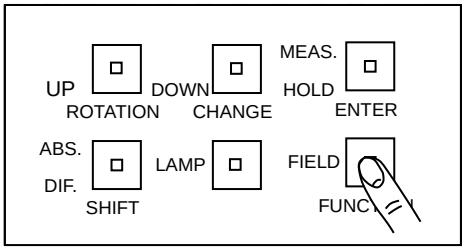
We recommend to set the integral time to at least 100 cycles.
Example: Measurement of a light source with a 10 % cycle error
When measuring with a 10-cycle integral time, the error is
0.1 t/10 t = 1 % (where t is the cycle time)
When measuring with a 100-cycle integral time, the error is
0.1 t/100 t = 0.1 %

Use the following procedure to set the delay time:

Setting

1 Switch to the function mode to display [MEASURE]-[Integ Delay Time].

☞ '3.1.2 Entering/Returning from the Function Mode'




```
* Integ Delay Time *

  Integ [ms] = 1000
```

2 Input a desirable value according to "How to input a numerical value in the function mode". The value which can be inputted is 50 to 3 000 milli-seconds.

Setting Method ☞ '3.1.3 Setting Values'

```
* Integ Delay Time *

  Integ [ms]=50
```

3 Press the [ENTER] switch to accept the displayed value.

3.5 Single or Auto Run

Set the measurement method.

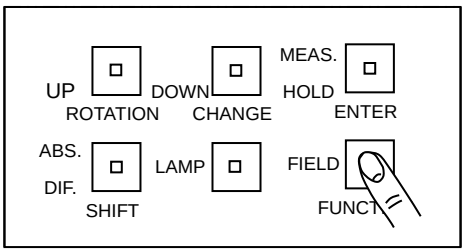
The two measurement methods available are single measurement and auto run (continuous measurement).

Measurement Method	
Single Measurement	After the [MEAS./HOLD] switch is pressed, one measurement is made and the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR stops.
Auto Run	Once the [MEAS./HOLD] switch is pressed, measurements are made continuously until the switch is pressed again.

The procedure for setting the measurement method is as follows:

1 Switch to the function mode to display [MEASURE] [Single or Auto].

☞ '3.1.2 Entering/Returning from the Function Mode'




```
*Single or Auto Run*

        *Single
```

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to change to a measurement method to be set.

Each time the [ROTATION] switch is pressed, the display is changed as follows.

Single → Auto Run

4 Press the [ENTER] switch to accept the displayed value.

3.6 Measuring Speed

Set the Measuring speed.

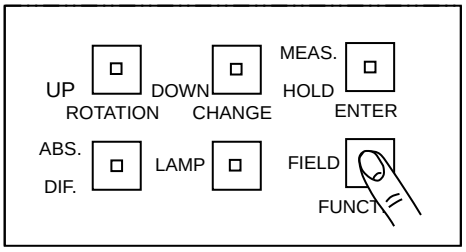
The two measuring speed mode available are NORMAL SPEED and HIGH SPEED, HIGH SPEED2, HIGH SPEED3.

Measuring speed	
NORMAL SPEED	The measurement is conducted at normal time and with high accuracy. Measuring time SR-LEDW/SR-UL2,SR-UL1R:1-248sec., SR-3AR:1-31sec.
HIGH SPEED	The measuring device conducts measurement at high speed by using dedicated sequence Measuring time 1-17sec.
HIGH SPEED 2	Apply proprietary algorithm to the NORMAL SPEED processing and execute measurements at high speed. Measuring time SR-LEDW/SR-UL2,SR-UL1R:1-60sec., SR-3AR:1-10sec.
HIGH SPEED 3	Apply proprietary algorithm to HIGH SPEED processing and execute measurements at high speed. Measuring time 1-6sec.

*****Against the standard light A.

*****The measurement time differs depending on the measurement target.

Use the following procedure to set the measuring speed:



1 Switch to the function mode to display the [MEASURE] - [Measurement Speed]

☞ '3.1.2 Entering/Returning from the Function Mode'

```
＊Measurement Speed＊

＊ NORMAL SPEED
```

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired speed.

The measuring speed value cycles as follows:

NORMAL SPEED → HIGH SPEED → HIGH SPEED 2 → HIGH SPEED 3

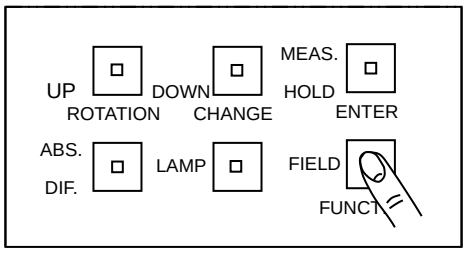
4 Press the [ENTER] switch to accept the displayed value.

3.6.1 High Speed Calibration

Performe High Speed Calibration when select “HIGH SPEED” or “HIGH SPEED 2”, “HIGH SPEED 3”. Use the following procedure to set the measuring speed;.

1 Switch to the function mode to display the [MEASURE] -[High Speed Cal]

☞ '3.1.2 Entering/Returning from the Function Mode'




```
*High Speed Cal.*

CHANGE: Calibration
```

2 Press the [CHANGE] switch.

```
*High Speed Cal.*
      SHIFT   : OK
      CHANGE : NO
```

3 The calibration starts after closing finder shutter and pressing the [SHIFT] switch. It takes about three minute to complete calibration

☞ '1.3.5 High Speed Calibration'

Remember!	Close the finder shutter before calibration.

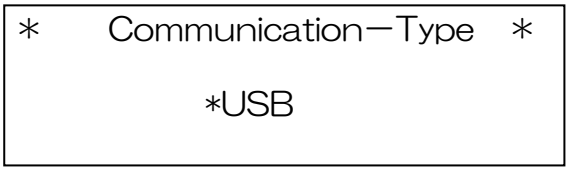
3.7 PC Connection Method

Make the settings for a connection between the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR and a PC. This is required to connect the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a PC.

Use the following procedure to set the connection method:

1 Switch to the function to display the [COMM]-[Communication-Type].

☞ '3.1.2 Entering/Return from the Function Mode'

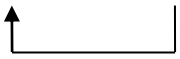


2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired value.

The value cycles as follows:

USB → RS-232C



4 Press the [ENTER] switch to accept the displayed value.

5 To activate this setting, the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR must reset using the reset switch.

3.8 RS-232C Parameters

Set the RS-232C interface parameters. This is required to connect the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a PC with an RS-232C cable.

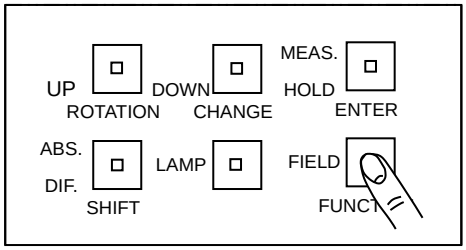
Set the parameters of the RS-232C with the function mode. In this example, "Baud rate 9 600/Data length 8/Parity None/Stop bit 2" will be changed to "Baud rate 38 400/Data length 7/Parity ODD/Stop bit 1".

Note

The RS-232C Parameters screen is not displayed if the PC Connection method is set to USB.

1 Switch to the function mode to display the [COMM] -[RS-232C Parameter].

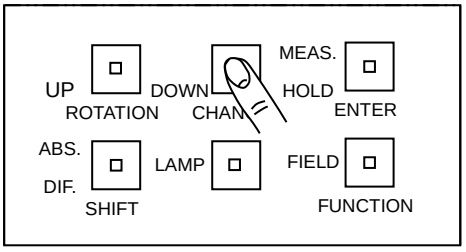
☞ '3.1.2 Entering/Returning from the Function Mode'




```
*RS-232C Parameters*
Baud rate= 9600
Length=8 Parity=NONE
Stop bit= 2
```

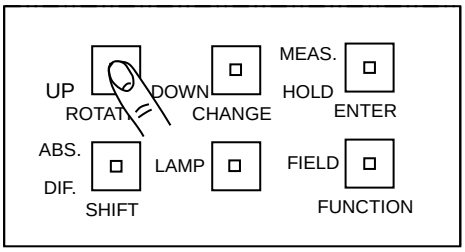
2 To set the parameters, press the [CHANGE] switch. The parameter which can be changed blinks.

```
*RS-232C Parameters*
Baud rate= 9600
Length=8 Parity=NONE
Stop bit= 2
```



3 Press the [ROTATION] switch to change "Baud rate" to "38 400".

```
*RS-232C Parameters*
Baud rate= 9600
Length=8 Parity=NONE
Stop bit= 2
```

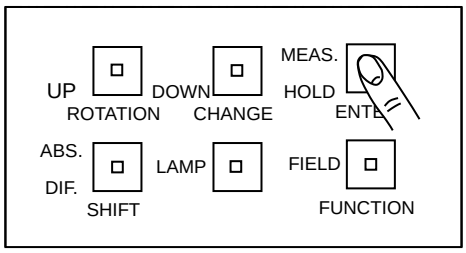


"Baud rate" is changed in the following order:

38400 → 4800 → 9600 → 19200

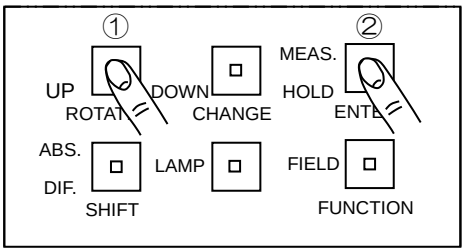
4 Press the [ENTER] switch, and the "Baud rate" will be decided. The cursor moves to "Length".

```
*RS-232C Parameters*
Baud rate=38400
Length=8 Parity=NONE
Stop bit= 2
```



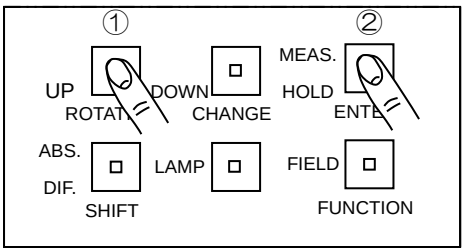
5 Press the [ROTATION] switch to change "Length" to "7" and press the [ENTER] switch. The cursor moves to "Parity"

```
*RS-232C Parameters*
Baud rate=38400
Length=7 Parity=NONE
Stop bit= 2
```



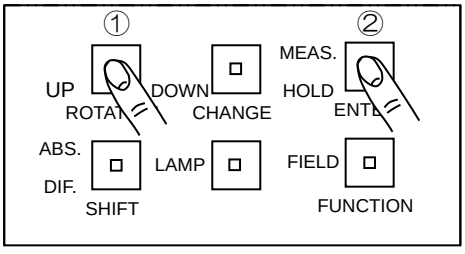
6 Press the [ROTATION] switch to change "Parity" to "ODD" and press the [ENTER] switch. The cursor moves to "Stop bit".

```
*RS-232C Parameters*
Baud rate=38400
Length=7 Parity=ODD
Stop bit= 2
```



7 Press the [ROTATION] switch to change "Stop bit" to "1" and press the [ENTER] switch. The cursor disappears. The setting has been completed.

```
*RS-232C Parameters*
Baud rate=38400
Length=7 Parity=ODD
Stop bit= 1
```



3.9 Data Communication Methods

Select whether to use the CS-900A software for communicating with a personal computer.

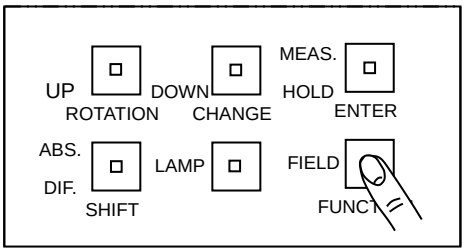
This instrument has two output methods of measurement data.
One method is the data error checking method with handshaking (CS900 Type) for communication with the CS-900A, the accessory software of the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR. The other is a simple data transmission (Normal Type) used in our conventional products. The details will be explained in "ST command" of "Communication commands".
The setting method with the function mode will be explained here.

Note

The RS-232C Parameters screen is not displayed if the PC Connection method is set to USB.

1 Switch to the function mode to display the [COMM] -[CS900 ON/OFF].

☞ '3.1.2 Entering/Returning from the Function Mode'




```
*    CS900  ON/OFF   *
    *CS900 Type
```

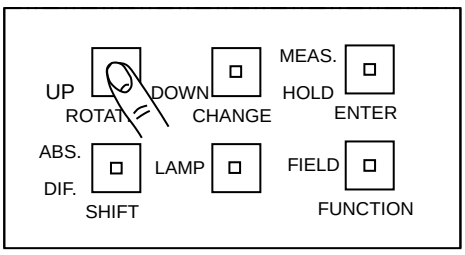
2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the communication method.
The value cycles as follows:

CS900 Type → Normal Type

4 Press the [ENTER] switch to accept the displayed value.

```
*    CS900  ON/OFF   *
*Normal Type
```



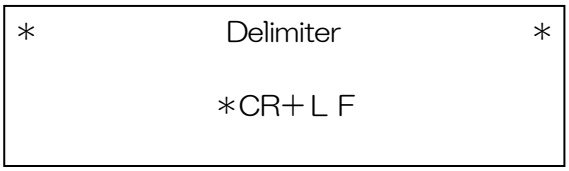
3.10 Remote Command Terminal Codes

Set the command terminal code for use when communicating with a PC.

Use the following procedure to set the code:

1 Switch to the function mode to display the [COMM]-[Delimiter].

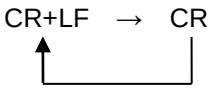
☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired value.

The value cycles as follows:



4 Press the [ENTER] switch to accept the displayed value.

3.11 Using a Correction Factor

Select whether to use a correction factor.

A correction factor is used to correct the measurement values. (A measurement value is multiplied by the correction factor.) There are two types of correction factors as described below.

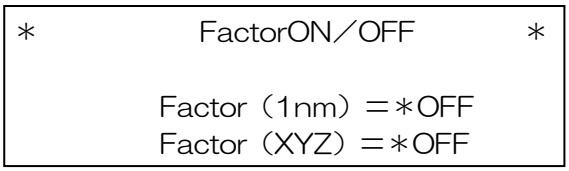
Factor (1 nm): Corrects one spectral data per 1 nm. There is one correction factor group. Set ON or OFF to use or not to use the correction factor.

Factor (XYZ): Corrects a tristimulus XYZ value. There is one correction factor group. Set ON or OFF to use or not to use the correction factor.

Use the following procedure to set the correction factors:

1 Switch to the function mode to display the [FACTOR]-[Factor ON/OFF].

☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.
The right portion of the “Factor (1 nm)” will blink.

3 Press the [ROTATION] switch to select the desired value.
Each time the switch is pressed, the value changes between ON and OFF.

Note

To skip the “Factor (1 nm)” without changing it, proceed to step 4 without pressing the [ROTATION] switch.

4 Press the [ENTER] switch to accept the setting for the factor (1 nm).

Note

If the [ENTER] switch is pressed after selecting the setting for the “Factor (XYZ)”, the next setting item screen will be displayed.
Correction Factor Input Screen

☞ ’3.12 Displaying and Editing the Correction Factor’

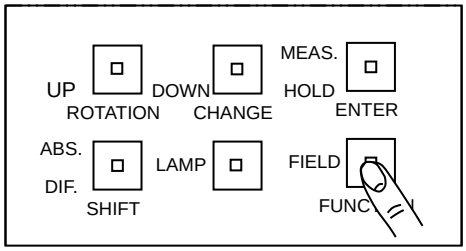
3.12 Displaying and Editing the Correction Factor

In the function mode, you can set whether the correction factors are used or not and set the correction factors of tristimulus values XYZ.

■ Setting whether the correction factors are used or not

1 Switch to the function mode to display the [FACTOR]-[FACTOR ON/OFF].

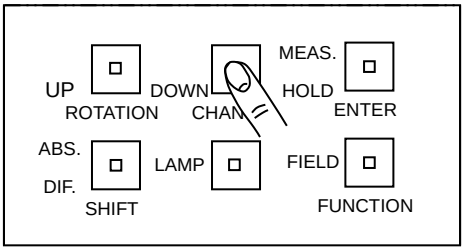
☞ '3.1.2 Entering/Returning from the Function Mode'




```
*   Factor  ON/OFF    *

   Factor (1nm) =*OFF
   Factor (XYZ) =*OFF
```

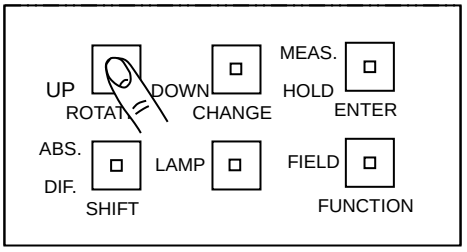
2 To change the setting, press the [CHANGE] switch. The right part of "Factor (1 nm) =" blinks.

```
*   Factor  ON/OFF    *

   Factor (1nm) =*OFF
   Factor (XYZ) =*OFF
```



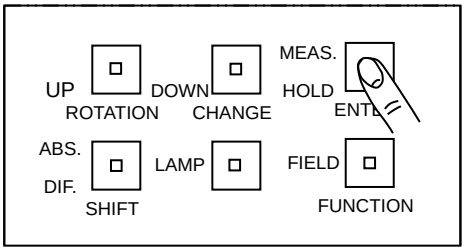
3 When the [ROTATION] switch is pressed in this condition, the blinking item is changed,

OFF → ON



4 Press the [ENTER] switch to decide the setting. The right part of "Factor (XYZ) =" blinks.

```
*   Factor  ON/OFF    *

   Factor (1nm) =*OFF
   Factor (XYZ) =*OFF
```



5 When the [ROTATION] switch is pressed in this condition, the blinking item is changed,

OFF → ON

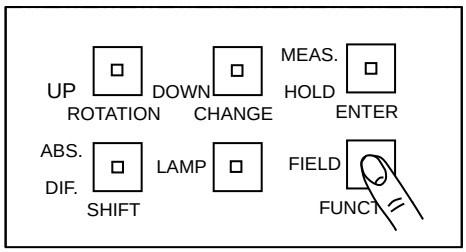
6 Press the [ENTER] switch to decide the setting.

■ Input of correction factors (XYZ)

Input the correction factors. The data for X, Y and Z are inputted.

1 Switch to the function mode to display the [FACTOR]-[X Y Z factor].

☞ '3.1.2 Entering/Returning from the Function Mode'

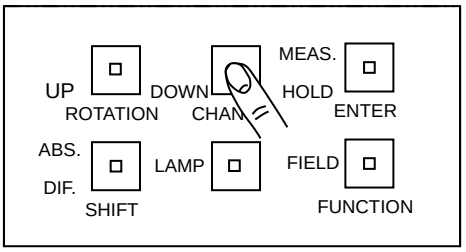


Note

If “Factor (XYZ) =” is set to OFF, this setting screen is not displayed.

2 To input data, press the [CHANGE] switch. Here, input data to "X". The data in the position to be inputted disappears and its head is lit.

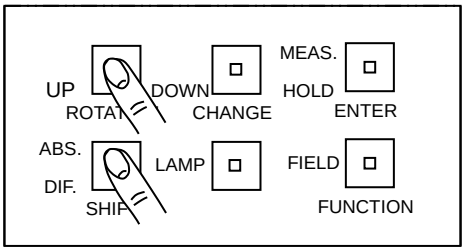
```
*      X Y Z Factor      *
X=
Y=  1. OOOE+OO
Z=  1. OOOE+OO
```



3 Input the desirable value with the method of setting value.

Setting Method ☞ ‘3.1.3 Setting Values’

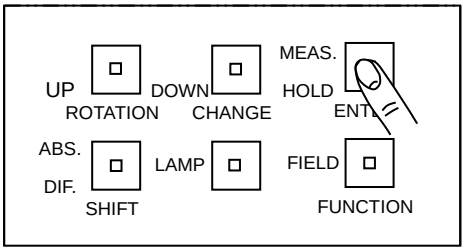
```
*      X Y Z Factor      *
X=  2. OO
Y=  1. OOOE+OO
Z=  1. OOOE+OO
```



4 After inputting the value, press the [ENTER] switch to decide the value.

The Y data in the position to be inputted disappears and its head blinks.

```
*   Factor ON/OFF      *
X=  2. OOOE+OO
Y=
Z=  1. OOOE+OO
```



5 To set the correction factor for X, Y and Z value, perform Step 3 and 4 repeatedly.

■ Setting the correction factors using CS-900A

1 Connect the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR to a PC with USB cable or RS-232C cable.

☞'1.3.2 Connecting the Personal Computer'

☞'3.7 PC Connection Method'

☞'3.8 RS-232C Parameters'

2 Transmit the correction factors to the instrument with the accessory colorimetric program CS-900A and store them. Refer to the instruction manual of the colorimetric program CS-900A for the details.

Note

Refer to "KW[n]" command, if the user makes a program.

☞'4.1.7 KW[n] Command'

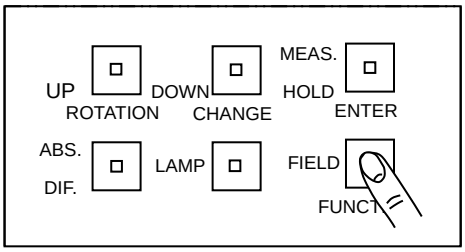
3.13 CIE Color Matching Function (Visual field)

Select the color matching function which is used to calculate the colorimetric value, the XYZ colorimetric system $\bar{x}(\lambda)$ $\bar{y}(\lambda)$ $\bar{z}(\lambda)$ based on the 2° visual field or the XYZ colorimetric system $\bar{x}10(\lambda)$ $\bar{y}10(\lambda)$ $\bar{z}10(\lambda)$ based on the 10° visual field.

Use the following procedure to set the color matching function(Visual field):

1 Switch to the function mode to display the [FACTOR]-[CIE Type Select].

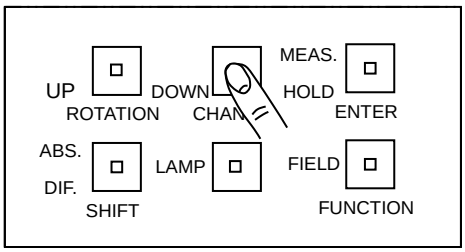
☞ '3.1.2 Entering/Returning from the Function Mode'




```
* CIE Type select *

   CIE Type= * 2
```

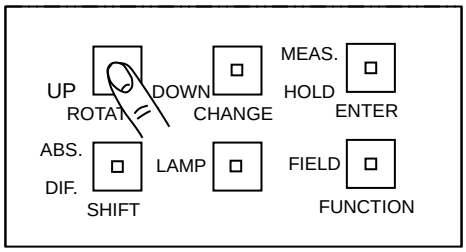
2 To change the setting, press the [CHANGE] switch. And "*"mark blinks.

```
* CIE Type select *

   CIE Type= * 2
```



3 Press the [ROTATION] switch to change the visual field.

```
* CIE Type select *

   CIE Type= *10
```



4 Press the [ENTER] switch to decide the visual field.

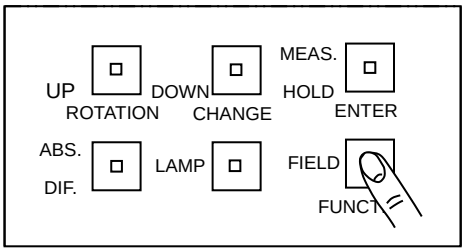
3.14 CIE Color Matching Function (Type)

Select the color matching function which is used to calculate the colorimetric value, the CIE1931 or CIE170-2:2015.

Use the following procedure to set the color matching function(type):

1 Switch to the function mode to display the [FACTOR]-[Color Match Type].

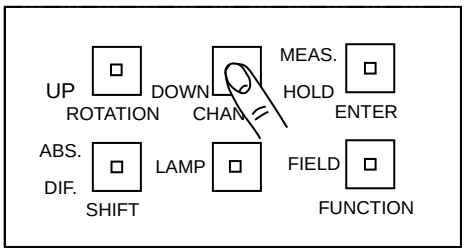
☞ '3.1.2 Entering/Returning from the Function Mode'




```
＊ Color Match Type ＊

    Type= ＊CIE1931
```

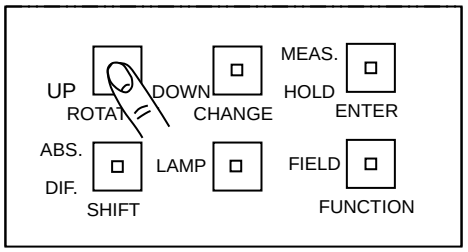
2 To change the setting, press the [CHANGE] switch. And “＊”mark blinks.

```
＊ Color Match Type ＊

    Type= ＊CIE1931
```



3 Press the [ROTATION] switch to change the color matching function type.

```
＊ Color Match Type ＊

    Type= ＊CIE170−2
```



4 Press the [ENTER] switch to decide the color matching function type.

3.15 Measurement Averaging

Set whether to average measurements.

Normal Meas : Do not use averaged measurements.

Average Meas : Use averaged measurements.

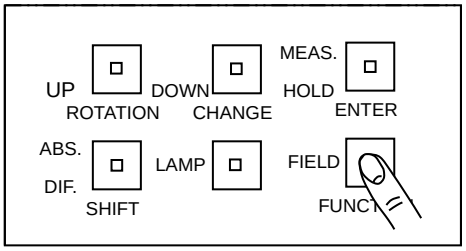
Measurement averaging allows the average value over multiple measurements to be set as the measurement value to increase precision for measurements of light sources with low luminance. Note that the higher the number of measurements is used, the longer time the measurement process will take.

Measurement time = Integral time * (Average count + 1) + Integral time + Shutter operation time + Processing time

Setting whether average measurement is used or not

1 Switch to the function mode to display the [MEASURE]-[AverageMeas ON/OFF].

☞ '3.1.2 Entering/Returning from the Function Mode'




```
＊AverageMeas ON／OFF＊

    ＊Normal Meas
```

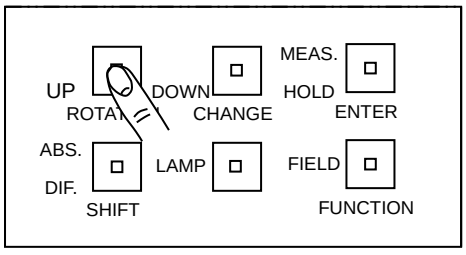
2 To change the setting, press the [CHANGE] switch.

Press the [ROTATION] switch to select the desired value.

The value cycles as follows:

Normal Meas → Average Meas

```
＊AverageMeas ON／OFF＊

    ＊Average Meas
```



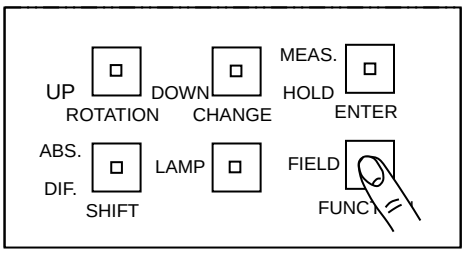
Note

When remote mode measurement and measurement mode are MANU mode, averaged measurement is disabled.

3.15.1 Averaging Count

1 Switch to the function mode to display the [MEASURE]-[Average Time].

☞ '3.1.2 Entering/Returning from the Function Mode'



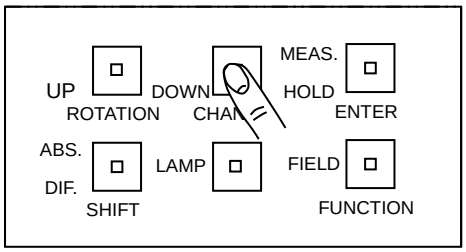

```
* Average Time *

   Average = 5
```

Note

This setting screen is not displayed, if measurement averaging is set to “Normal Meas”.

2 To input data, press the [CHANGE] switch.

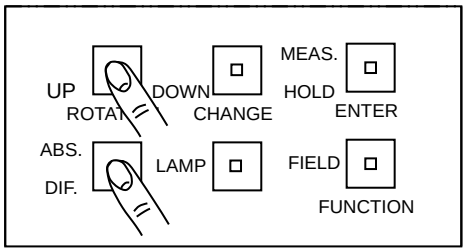
```
*Average Time *

  Average =
```



3 Input the desirable value with the method of setting value. Available range is 1 to 20.

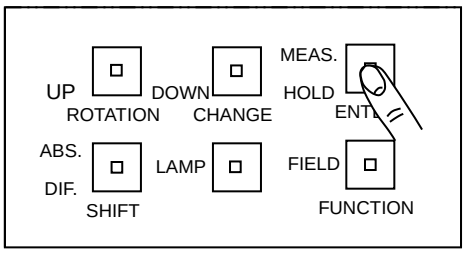
Setting Method ☞ ‘3.1.3 Setting Values’

```
* Average Time *

   Average = 10
```



4 Press the [ENTER] switch to decide the value.

```
*Average Time *

  Average =   10
```



3.16 Selection of "Over Range" Detection in MANU

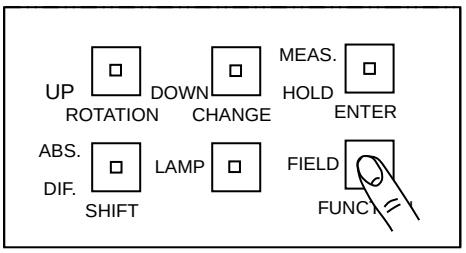
In SR-LEDW/SR-UL2/SR-UL1R/SR-3AR, if the "over range" error occurs, measurement is stopped.

If “OFF” is set, measurement is performed without detecting the “over range” error.

Setting

1 Switch to the function mode to display the [MEASURE]-[MANU OVER ON/OFF].

☞ '3.1.2 Entering/Returning from the Function Mode'




```
* MANU OVER ON/OFF *

    MANU OVER  = ON
```

Note

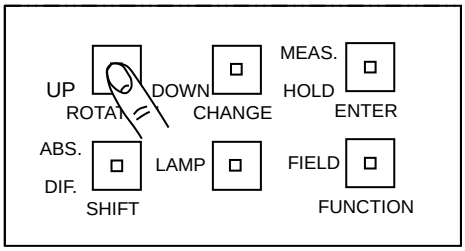
· The initial condition is the “ON”

· This setting screen is not displayed, except that the measurement mode is set to the “MANU” mode.

2 To change the setting, press the [CHANGE].

If press the [ROTATION] switch, ON/OFF is changed to each

```
* MANU OVER ON/OFF *

    MANU OVER  = OFF
```



3 Press the [ENTER] switch to decide the value.

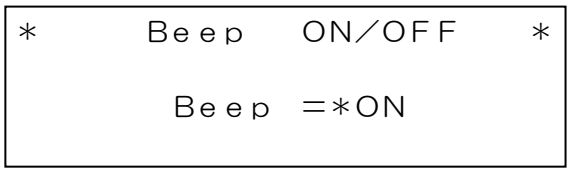
3.17 Buzzer

Set whether the buzzer should sound.

Use the following procedure to set the buzzer:

1 Switch to the function mode to display the [* Beep ON/OFF *] screen.

☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired value.
Each time the switch is pressed, the value changes between “ON” (sound) and “OFF” (not sound).

4 Press the [ENTER] switch to accept the setting for the buzzer.

3.18 Luminance Display Format

Set whether to show the measurement luminance number in a decimal or exponential format.
Use the following procedure to set the format.

1 Switch to the function mode to display the [DISPLAY]-[Luminance Format].

☞ '3.1.2 Entering/Returning from the Function Mode'

```
* Luminance Format *

        *Decimal
```

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired value.
The value cycles as follows:

Decimal → Exponential

4 Press the [ENTER] switch to accept the displayed value.

3.18.1 Luminance Display Format

Set the number of digits to show for the measured luminance.
Use the following procedure to set the number of digits:

1 Switch to the function mode to display the [DISPLAY]-[Luminance Decimal].

☞ '3.1.2 Entering/Returning from the Function Mode'

```
* Luminance Decimal *
Integer = 7
Decimal = 2
ex.  123500.00
```

Note

This setting screen is not displayed, except that the luminance display format is set to the "Decimal" mode.

2 Press the [CHANGE] switch.

3 Set the number of digits in the integer and decimal portions of the measured value. The range is 6 to 10 digits for the integer portion and 0 to 3 digits for the decimal portion. Note that total number of digits cannot exceed 9.

☞ '3.1.3 Setting values'

4 Press the [ENTER] switch to accept the displayed values.

3.19 Maintenance Reminder Screen

Set the behavior of the maintenance reminder screen. This screen displays the number of months elapsed since purchase or the last calibration test.

There are two settings:

ON: Proceed to the next screen after the buzzer sounding in 5 seconds.

OFF: The screen does not appear but proceeds to the next screen.

Note

The display of elapsed time since purchase or calibration test is the same.

Display ☞ '1.4 Maintenance Reminder Screen'

Use the following procedure to set the behavior

1 Switch to the function mode to display the [MAINTAIN]-[Maintenance Display].

☞ '3.1.2 Entering/Returning from the Function Mode'

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired value.
Each time the switch is pressed, the value changes between on and off.

4 Press the [ENTER] switch to accept the displayed value.

3.20 Panel Light Control

It is possible to control the ON/OFF status of LCD screen and switch LED automatically.
When measuring with this function, low light emitted from LCD Screen or switch LED does not affect measurement. Finally, it is available to measure with high precision.

Use the following procedure to set.

1 Switch to the function mode to display the [DISPLAY]-[Auto Panel Light].

☞ '3.1.2 Entering/Returning from the Function Mode'

2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the desired value.
Each time the switch is pressed, the value changed between on and off.

4 Press the [ENTER] switch to accept the displayed value.

Note

This function can reduce power consumption.

3.21 Batch Deletion of Measurement and DIF Standard Data

Delete all measurement data and DIF. standard data in one batch.

Use the following procedure for batch deletion:

1 Switch to the function mode to display the [MAINTAIN]-[Memory AllClear].

☞ '3.1.2 Entering/Returning from the Function Mode'

```
＊  Memory AllClear ＊

CHANGE   :Meas Data
ROTATION:Std Sample
```

2 To delete all the measurement data, press the [CHANGE] switch. To delete all the DIF. standard data, press the [ROTATION] switch.

The batch data deletion screen will display.

```
＊Meas Data AllClear＊

SHIFT  : OK
CHANGE : NO
```

The above screen is for measurement data. The batch data deletion screen is similar.

3 Press the [SHIFT] switch.

All the measurement data will be deleted and the previous screen will display.

✸ **Remember!**	To leave the batch deletion screen without deleting, press the [CHANGE] switch without pressing the [SHIFT] switch. After the batch deletion, the deleted data cannot be restored. Be careful.

3.22 LowBattery Operation

Set the operation for Low Battery.
Set it according to the operation method and application.

✸ **Remember!**	If LowBattrey occurs, we recommend that you replace the battery immediately. Consult TOPCON TECHNOHOUSE or your retailer. When used in the LowBattrey state, some parameters may be initialized and affect the measured values, so be careful when using.

The operation are as follows.

Key Parameter ：You can not all of the operations involved in the measurement.
The operation continues by pressing the [FUNCTION] key, but after startup, only the function mode can be operated. This setting can be changed from the function mode.
Display when the power is ON.

```
Attention!!
Low Battery
Parameter :FUNCTION
```

Key Continue ：It can be measured.
The operation continues by pressing the [FUNCTION] key, and it is also possible to measure after startup. However, because some of the parameters are initialized, it requires a re-setting of the parameters.
Display when the power is ON.

```
Attention!!
Low Battery
Continue :FUNCTION
```

Auto Continue ：It can be measured.
After 3 seconds of Low Battery display, the operation continues automatically and it is also possible to measure after startup. However, because some of the parameters are initialized, it requires a re-setting of the parameters.
Display when the power is ON.

```
Attention!!
Low Battery
Auto Continue
```

The parameters initialized by LowBattery are as follows.

Affects measurement data ※1	Items	Initial value
	Measurement data history	0
	Measurement number	0
yes	Standard sample data	0
yes	Standard measurement data number	0
yes	High speed calibration data	0
yes	Measuring Field	2°
yes	Measurement Mode	AUTO
yes	FREQ(frequency) Mode frequency	50Hz
yes	MANU(Manual) Mode integral time	1000ms
yes	Selection of “Over Range” Detection in MANU	ON
yes	Measuring Speed	NORMAL SPEED
	Single or Auto Run	Single
yes	Integral time delay function	OFF
yes	Delay Time Setting	100ms
yes	Measurement Averaging	OFF
yes	Average Count	3
	Table Colors	xy/Lv
	Panel Light Control	ON
	Luminance Display Format	Exponential
	Luminance Display Format(Integer)	7
	Luminance Display Format(Decimal)	2
	Maintenance Reminder Screen function ※2	-
yes	Correction Factor(1nm) ※3	1

※1 There are items that affect the measured data.
If you want to continue using it in the low battery state, check and re-set each item.

※2 The function will be disabled because the year / month data will be reset.

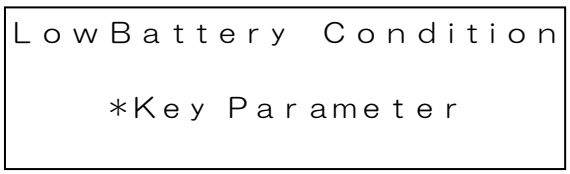
※3 SR-LEDW only.

Remember!	· If the power of this unit is turned off in the Low Battery state, the reset items will also return to the initial values. · When using in Highspeed mode, be sure to perform Highspeed calibration before using.

Use the following procedure to set the low battery operation:

1 Switch to the function mode to display the [MAINTAIN]-[LowBattery Condition].

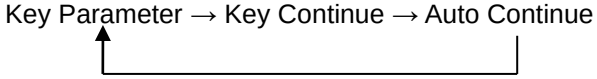
☞ '3.1.2 Entering/Returning from the Function Mode'



2 Press the [CHANGE] switch.

3 Press the [ROTATION] switch to select the communication method.

The value cycles as follows:



4 Press the [ENTER] switch to accept the displayed value.

Note

· To enable the setting, please restart the machine.

4. Communication with Personal Computer

4.1 Communication Commands

The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR can communicate with a personal computer. User commands for creating a program for communication with a personal computer are described in this section.

A list of the communication commands is shown below.

Communication command	Function
RM	Sets the instrument in the communication status (remote mode).
LM	Sets the instrument in the stand alone status (local mode)
ST	The instrument is in the measurement status. When measurement is done, return measurement results with text data.
SF	The instrument is in the measurement status. When integral time is calculated, it returns integral time with text data. When measurement is done, return measurement results with text data.
STB	Sets the instrument is in the measurement status. When measurement is done, it returns measurement results with binary data. Communication speed is faster than above “ST” command. It is available via USB divice only.
D0	Returns the colorimetric value and spectral radiance value.
D1	Returns only the colorimetric value.
A0	Set the measurement mode to AUTO mode
A1_#####	Set the measurement mode to FREQ mode. "#####" means frequency. Unit: Hz
A2_#####	Set the measurement mode to MANU mode. "#####" means integral time. Unit: ms
A3	Set the measurement mode to SYNC mode.
KW[n]_####	Writes the correction factors on the instrument. n: 0 ~ 400
KR[n]	Reads out the correction factors from the instrument. n:0 ~ 400
KX_#####	Writes the correction data for the tristimulus value X.
KY_#####	Writes the correction data for the tristimulus value Y.
KZ_#####	Writes the correction data for the tristimulus value Z.
KXR	Reads the correction data from the tristimulus value X.
KYR	Reads the correction data from the tristimulus value Y.
KZR	Reads the correction data from the tristimulus value Z.
DR [n]	Reads out the measurement data stored by the instrument.
K[＊]1 K[＊]2	Changes the setting for the correction factor in the instrument. K[＊]1: For spectrum K[＊]2: For tristimulus values ＊= O: Changes the correction factor to “valid”. ＊= N: Changes the correction factor to “invalid”.

KOR	Reads the current correction factor setting from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR. KOR1:Reads out whether the current correction factor setting for spectrum is the enable/disable state. KOR2: Reads out whether the current correction factor setting for tristimulus value is the enable/disable state. 1: Enable 0: Disable
CIE_#	Change the CIE Color Matching function (visual field) setting. For the pound sign (#), use 0 for a 2° visual field and 1 for a 10° visual field.
CIER	Reads the CIE Color Matching function (visual field) setting.
LDF#	Changes the luminance display format setting. For the pound sign (#), use 0 for decimal and 1 for exponencial.
LDFR	Reads the luminance display format setting.
LDD_#_#	Sets the number of display digits for the luminance display format. Use 10 to 6 for the first pound sign (#) for the integer portion of the number and 0 to 3 for the second pound sign for the decimal portion.
LDDR	Reads the setting for the number of digits in the luminance display format.
FLD1	Changes the measuring field to the 2.0 position.
FLD2	Changes the measuring field to the 1.0 position.
FLD3	Changes the measuring field to the 0.2 position.
FLD4	Changes the measuring field to the 0.1 position.
FLDR	Reads the current measuring field setting.
NL_####	Integral time delay function: Input the delay time.
ND	Integral time delay function: ON
NF	Integral time delay function: OFF
HS	Sets the measuring speed to the high speed
HS2	Sets the measuring speed to the high speed 2
HS3	Sets the measuring speed to the high speed 3
NS	Sets the measuring speed to the normal speed
HCL	Start the calibration in High Speed mode ※Perform the calibration when select High Speed mode.
HSR	Reads the current measuring speed mode. Response to the HSR command 0:High speed 1:Normal speed 2:High speed 2 3:High speed 3
WHO	Reads the name of the luminance meter.
SRL	Reads the manufacturing number.
VER	Reads the program version.
FX	Starts the measurement to calculate optimum inner-filter and integral time setting in FIX mode. When the measurement complete, the optimum inner-filter type and integral time is retuned and the values are also set on the instrument. (SR-LEDW only）
FO	Sets to FIX INTEG mode（SR-LEDW only）
FG	Reads current FIX INTEG mode setting（SR-LEDW only）
FS_###_#	Sets inner-filter type and integral time in FIX INTEG mode. (SR-LEDW only） The left side of # means integral time[ms](50 -120,000), right side means inner-filter (1 - 5)
FXQ_###_#	Set the measurement mode to FIX FREQ mode and inner-filter type, frequency in FIX FREQ mode. The left side of # means frequency [Hz](1.5 -250), right side means inner-filter (1 – 3 or 5)

IMD_#	Change the data communication methods. For the pound sign (#), use 0 for normal type and 1 for CS900 type.
IMDR	Reads the data communication methods.
STCT_#	The instrument is in the measurement status. When measurement is done, the measured data is returned with comma separated text data. For the pound sign (#), set the measurement data type from 1 to 8. 1: Luminance, Chromaticity xy 2: Luminance, Chromaticity u'v' 3: Tristimulus values XYZ 4: Tristimulus values XYZ, Chromaticity xy 5: Tristimulus values XYZ, Chromaticity u'v' 6: Correlated color temperature, Deviation 7: Spectral radiance(380nm – 780nm) 8: Wavelength, Maximum Spectral radiance
CMF_#	Change the CIE Color Matching function (Type) setting. For the pound sign (#), use 0 for CIE1931 and 1 for CIE170-2:2015.
CMFR	Reads the CIE Color Matching function (Type).
CXL	The instrument is stops measuring. If the instrument is measuring, immediate measurement is stopped. Measurement data is not returned. If it is not during measurement, a reception confirmation command is returned.

"_" shows space. "####" means a numerical value.

When the computer transmits the communication command, the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR returns "OK" as the reception check command. When the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR receives an improper command, it returns "NO".

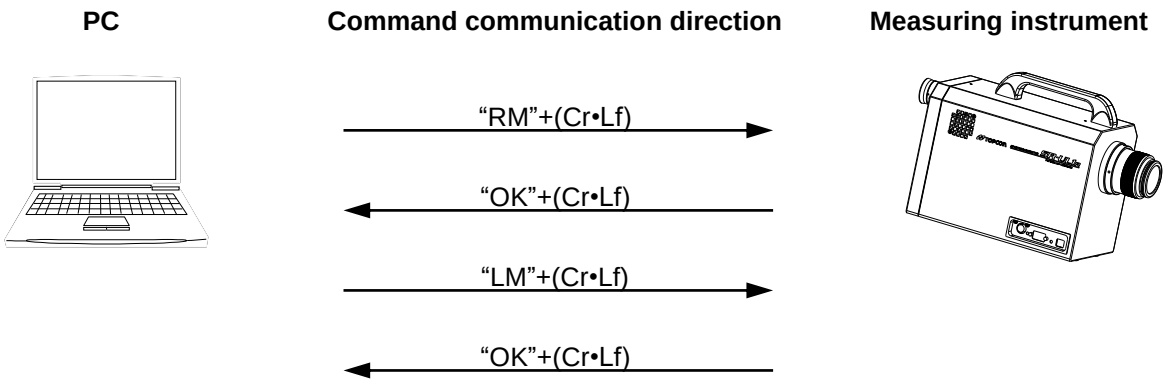
4.1.1 RM and LM Command

By these commands, the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR is set to remote status (remote mode) or stand alone status (local mode).

RM: Sets the remote mode.

LM: Sets the local mode.

When the power is turned on, the local mode is set. When the instrument operates for communication, send the "RM" command first and then change to the remote mode.



4.1.2 ST Command

"ST" command

The measurement starts when this command is transmitted to the instrument.

When measurement is ended, the measured data is returned with text data from the instrument.

① **Transmission from computer to the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR**

After activating the circuit of RS-232C, the computer transmits the character line "ST" (ASCII code 53H 54H) and subsequently Cr (0Dh) and Lf (0Ah).

② **Check of reception in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR**

When the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR receives "ST"+(Cr•Lf), it returns "OK"+(Cr•Lf) as a check command and the measurement starts.

Note

· In this manual, Cr· Lf was used as the delimiter but Cr is usable too.

☞'3.10 Remote Command Terminal Codes'

③ **Communication of measurement data**

After measurement, the instrument transmits the measuring conditions and measurement data.

The delimiter (Cr•Lf) is added to the last of each data line and then the data is transmitted.

After all the data is transmitted, the ending code "END" is transmitted.

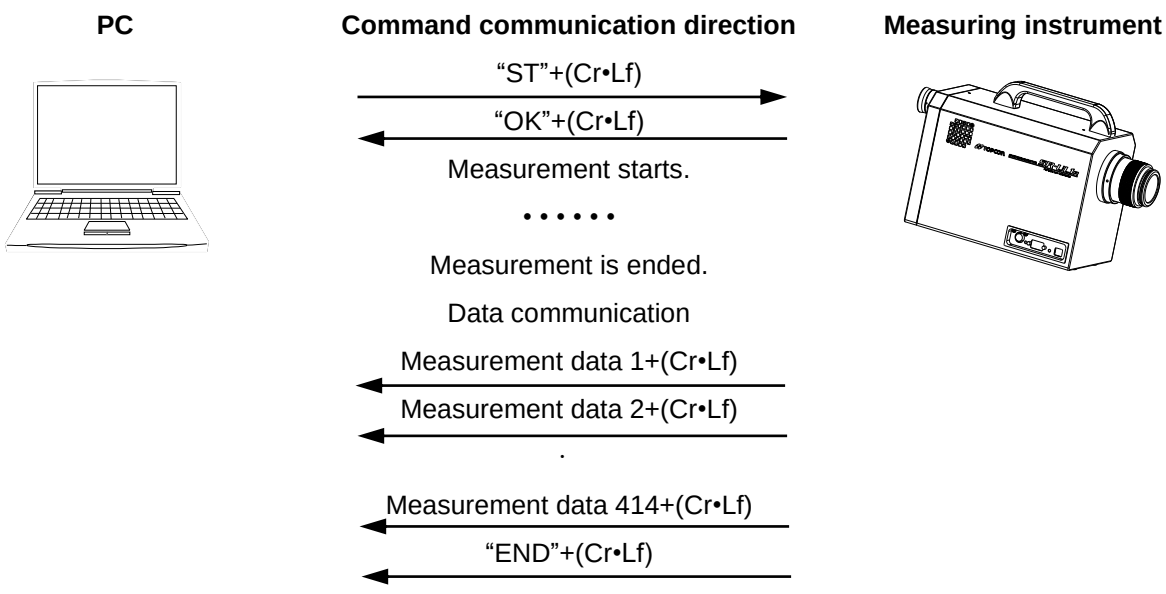
Measurement Output Format ☞ '4.2.1 Remote Measurement Output Format'

The communication method differs depending on the settings.

Setting Communication Method ☞'3.9 Data Communication Methods'

(1) Normal Type

When this method is selected, the data of "0x60" and "0x15" are not checked as compared with "(2) CS900 Type". The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR keeps sending data until "END".



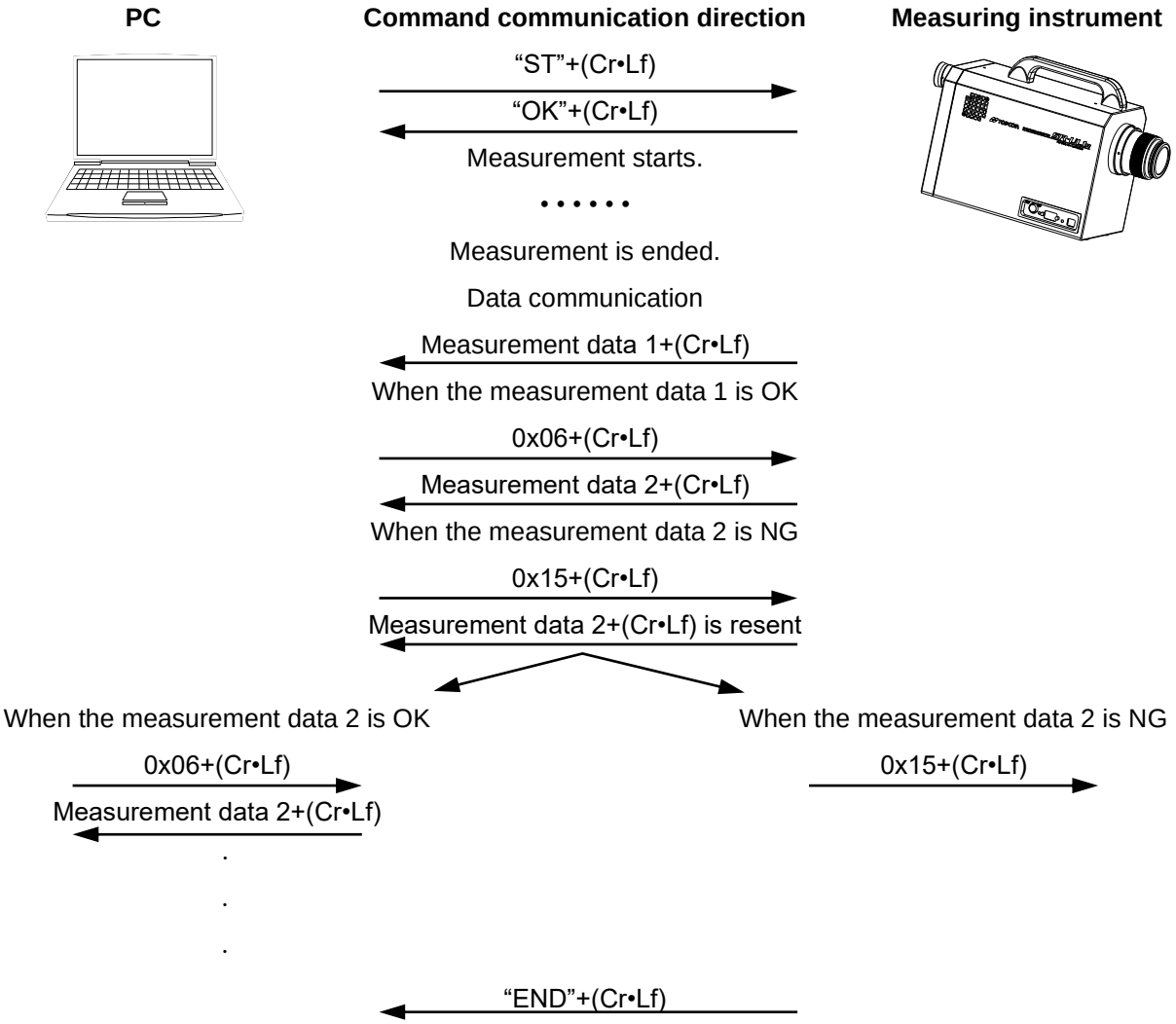
(2) CS900 Type

When this method is selected, each time 1 data is sent from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR, CS-900A sends the following data.

If data is correct, "0x06+(Cr•Lf)" is sent.

If data is wrong, "0x15+(Cr•Lf)" is sent.

When CS-900A sends "0x15+(Cr•Lf)", the data is sent again. Resending of data is done once for 1 data. If the wrong data is sent twice continuously, "END+(Cr•Lf)" is outputted and the communication is ended.



4.1.3 SF Command

"SF" command

The measurement starts when this command is transmitted to the instrument.

When measurement is ended, the measured data is returned with text data from the instrument.

① **Transmission from computer to the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR**

After activating the circuit of RS-232C, the computer transmits the character line "SF" (ASCII code 53H 46H) and subsequently Cr (0Dh) and Lf (0Ah).

② **Check of reception in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR**

When the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR receives "SF"+(Cr•Lf), it returns "OK"+(Cr•Lf) as a check command and the measurement starts.

Note

· In this manual, Cr· Lf was used as the delimiter but Cr is usable too.

☞'3.10 Remote Command Terminal Codes'

③ **Communication of integral time**

After calcuration of integral time is completed, the instrument transmits the integral time.

④ **Communication of measurement data**

After measurement, the instrument transmits the measuring conditions and measurement data.

The delimiter (Cr•Lf) is added to the last of each data line and then the data is transmitted.

After all the data is transmitted, the ending code "END" is transmitted.

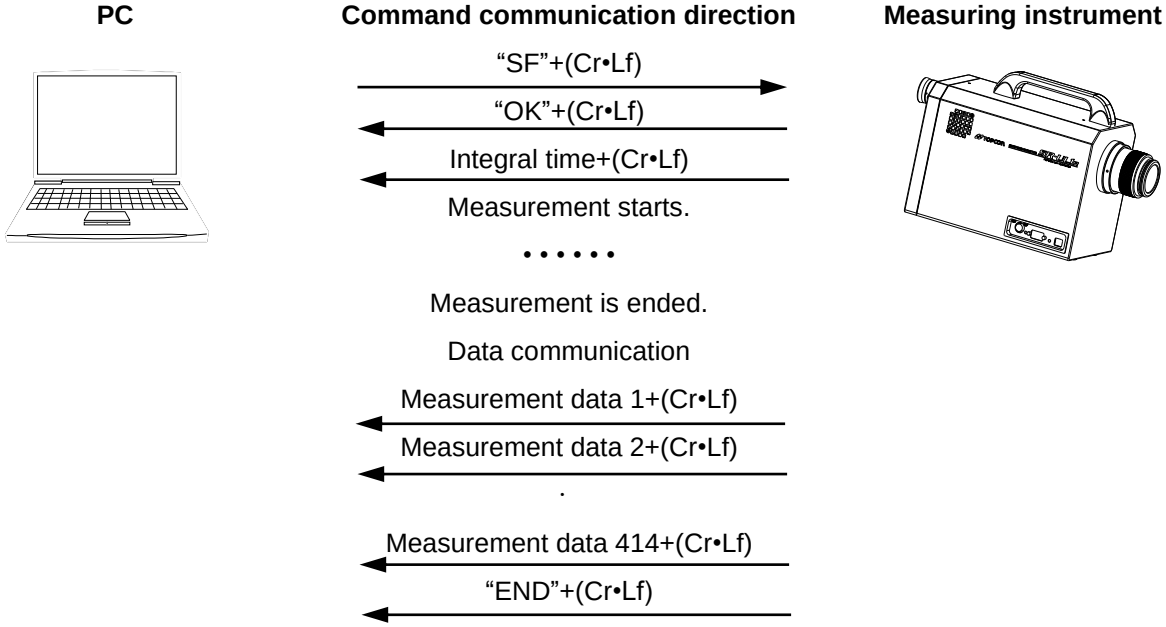
Measurement Output Format ☞ '4.2.1 Remote Measurement Output Format'

The communication method differs depending on the settings.

Setting Communication Method ☞'3.9 Data Communication Methods'

(1) Normal Type

When this method is selected, the data of "0x60" and "0x15" are not checked as compared with "(2) CS900 Type". The SR-LEDW/SR-UL2/SR-UL1R/SR-3AR keeps sending data until "END".



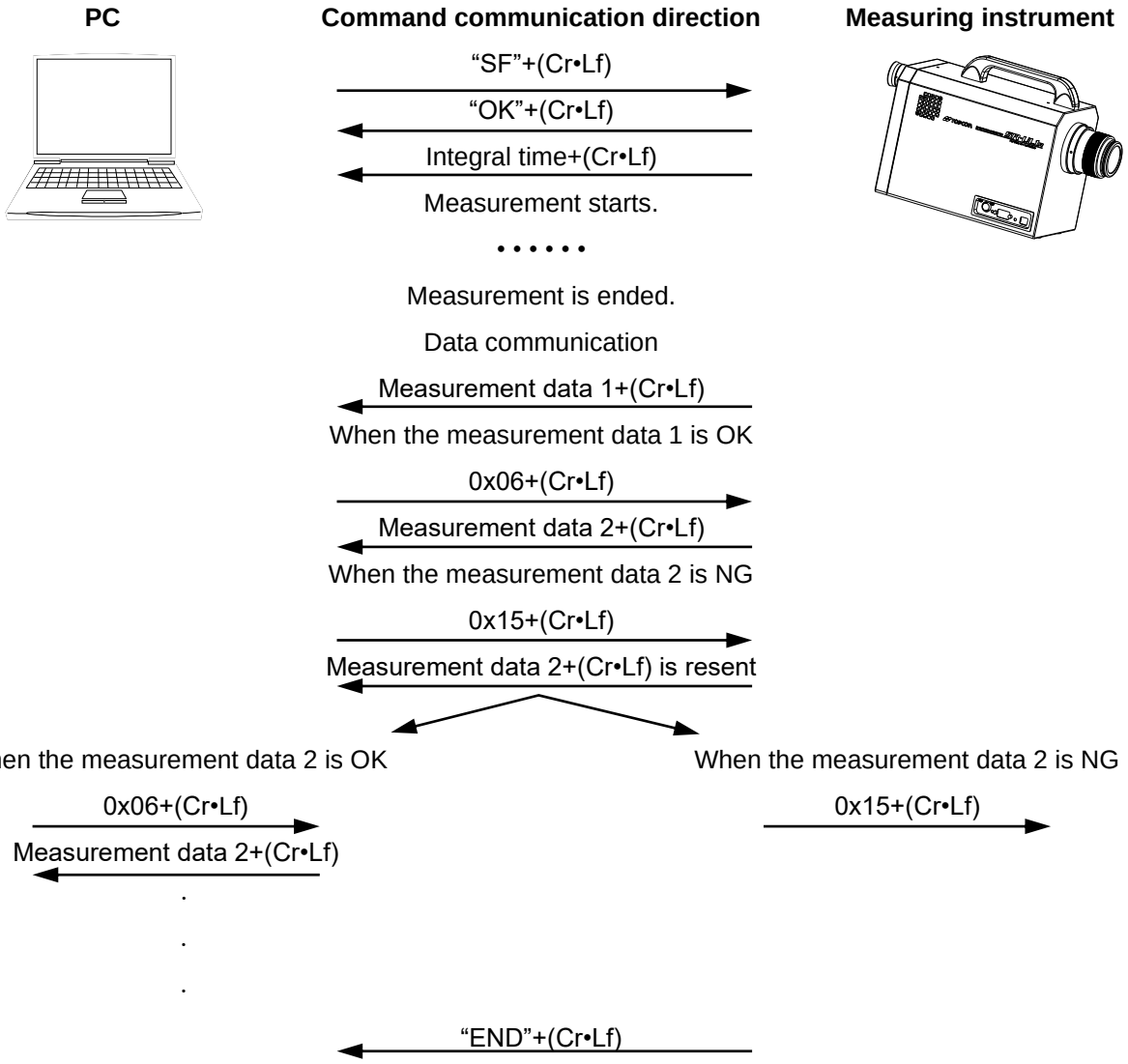
(2) CS900 Type

When this method is selected, each time 1 data is sent from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR, CS-900A sends the following data.

If data is correct, "0x06+(Cr•Lf)" is sent.

If data is wrong, "0x15+(Cr•Lf)" is sent.

When CS-900A sends "0x15+(Cr•Lf)", the data is sent again. Resending of data is done once for 1 data. If the wrong data is sent twice continuously, "END+(Cr•Lf)" is outputted and the communication is ended.



4.1.4 STB Command

"STB" command

The measurement starts when this command is transmitted to the instrument.

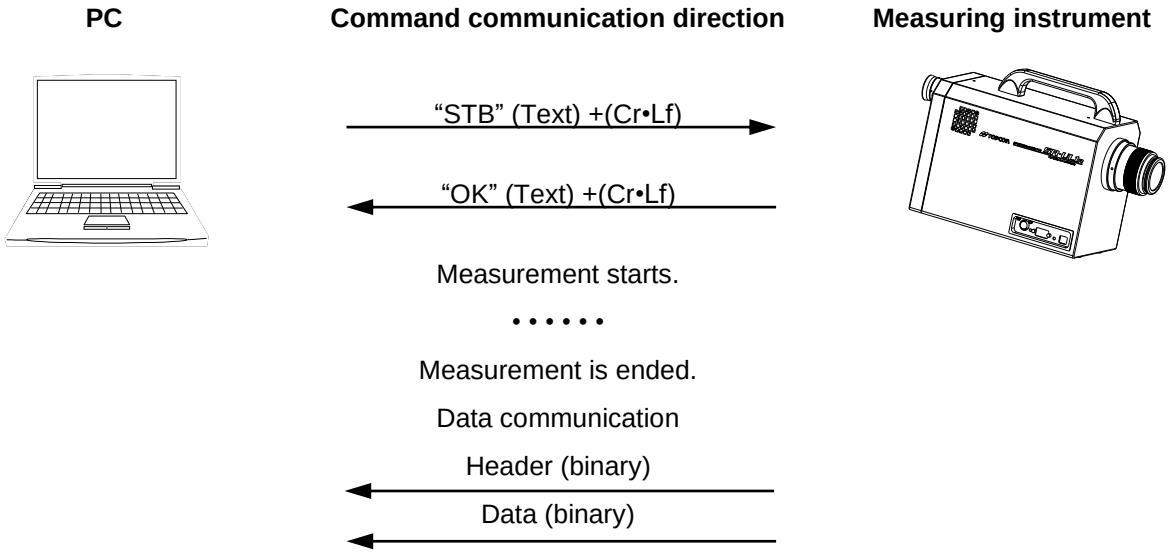
When measurement is ended, the measured data is returned with binary data (big endia) from the instrument. The difference from ST commend is as follows;

Measurement Output Format ☞ '4.2.1 Remote Measurement Output Format'

1.Communication speed is faster than ST command

2. STB command does not have resent function.

> · Measured data of spectral radiance is returned at all time for STB command even if "D1" command is transmitted.



4.1.5 D0 and D1 Command

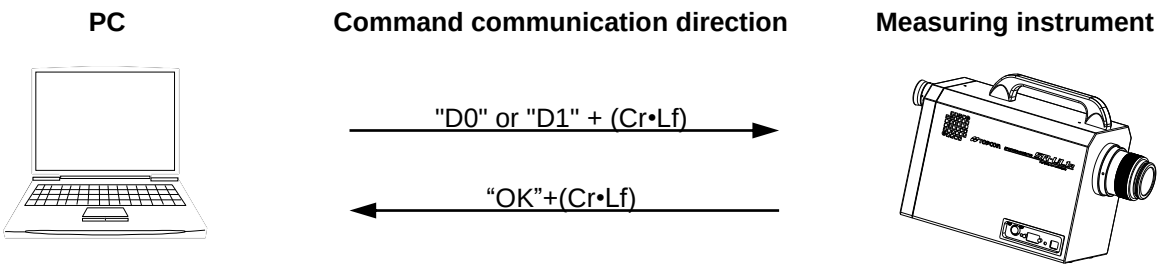
With these commands, the format of the output data is set.

D0 : All the data with the spectral radiance data.

D1 : All the data without the spectral radiance data

Refer to "4.2 Output formats" for the details.

When the power is turned on, "D0" is set.

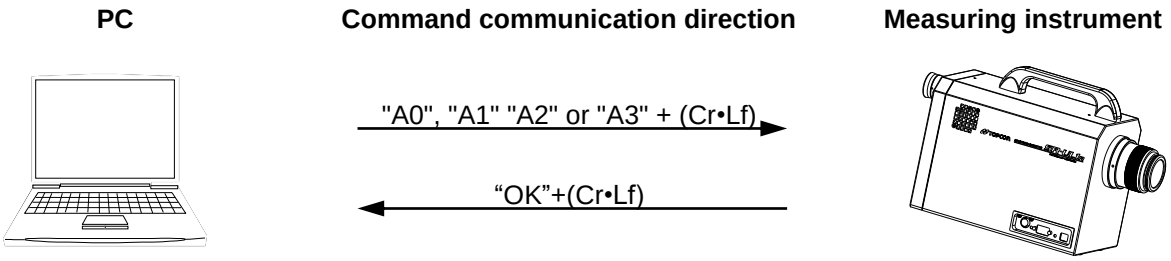


4.1.6 A0, A1, A2 and A3 Command

With these commands, the measurement mode of the instrument is changed.

This setting is stored although the power is turned OFF. If an “ST” command is sent without sending one of these commands, measurement is carried out using the measurement mode set before the “ST” command was sent.

Command	Measurement mode			
A0 :	AUTO			
A1_##### :	FREQ	"_" is space.	"#####" is frequency.	1.5~250 Hz
A2_##### :	MANU	"_" is space.	"#####" is integral time.	
			10-120000ms :SR-LEDW	
			20-120000ms :SR-UL2,SR-UL1R	
			20-15000ms :SR-3A	
A3 :	SYNC			



4.1.7 KW[n] Command

The correction factors are stored in the instrument. One of 0~400 is inputted to “n” and it corresponds to every 1nm interval in the range of 380 nm~780 nm. The correction factor can be inputted for a single wavelength and “KW [n]_#.###” is transmitted.

When the instrument receives the correction factors, it returns “OK” as the reception check command.

Example)

KW0_1.000+(Cr•Lf) _: Shows space.

Input the correction factor 1.000 to “n=0 (380 nm)”.

KW0 : 380 nm

KW1 : 381 nm

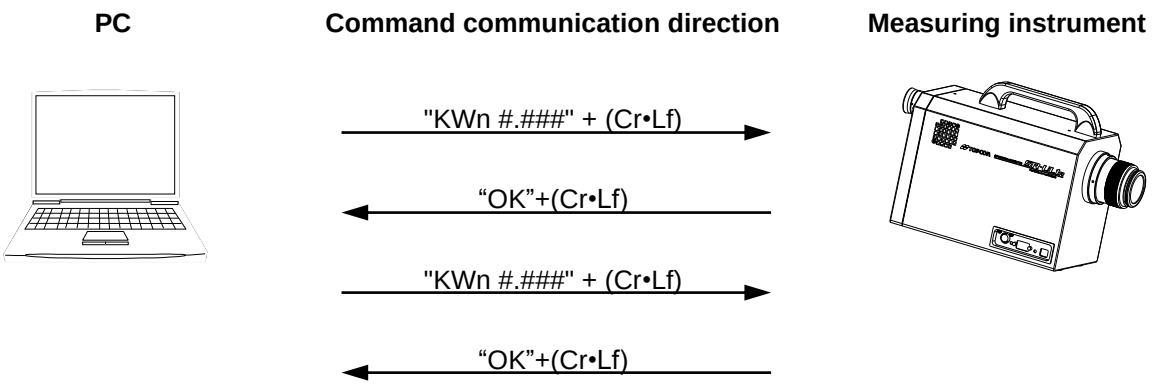
KW2 : 382 nm

• • • • • •

• • • • • •

KW399 : 779 nm

KW400 : 780 nm



4.1.8 KR[n] Command

The correction factors stored by the instrument are read out. One of 0~400 is inputted to “n” and it corresponds to every 1nm interval in the range of 380 nm~780 nm.

KR0 : 380 nm

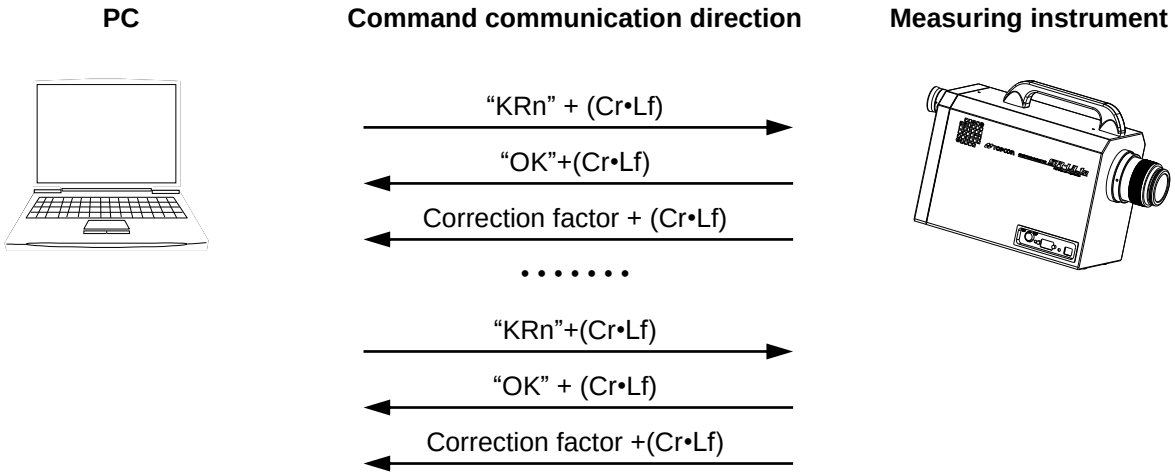
KR1 : 381 nm

KR2 : 382 nm

• • • • • •

KR399 : 779 nm

KR400 : 780 nm



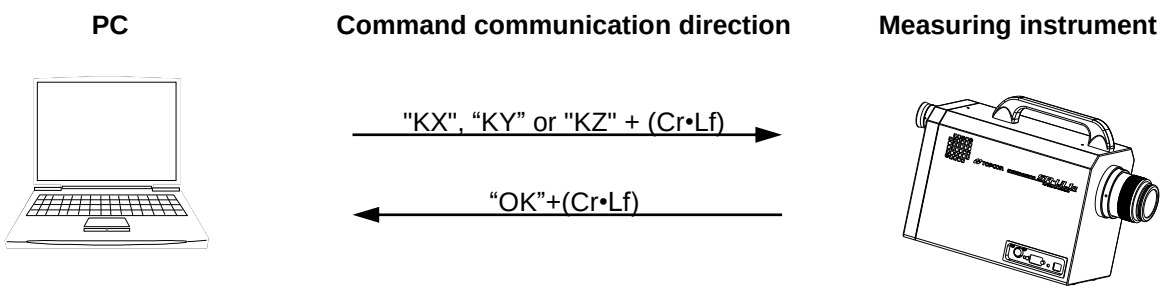
4.1.9 KX, KY and KZ Command

With these commands, the correction factors for tristimulus values XYZ are stored in the instrument.

KX_##### : "_" is space. "#####" is correction factor.

KY_##### : "_" is space. "#####" is correction factor.

KZ_##### : "_" is space. "#####" is correction factor.



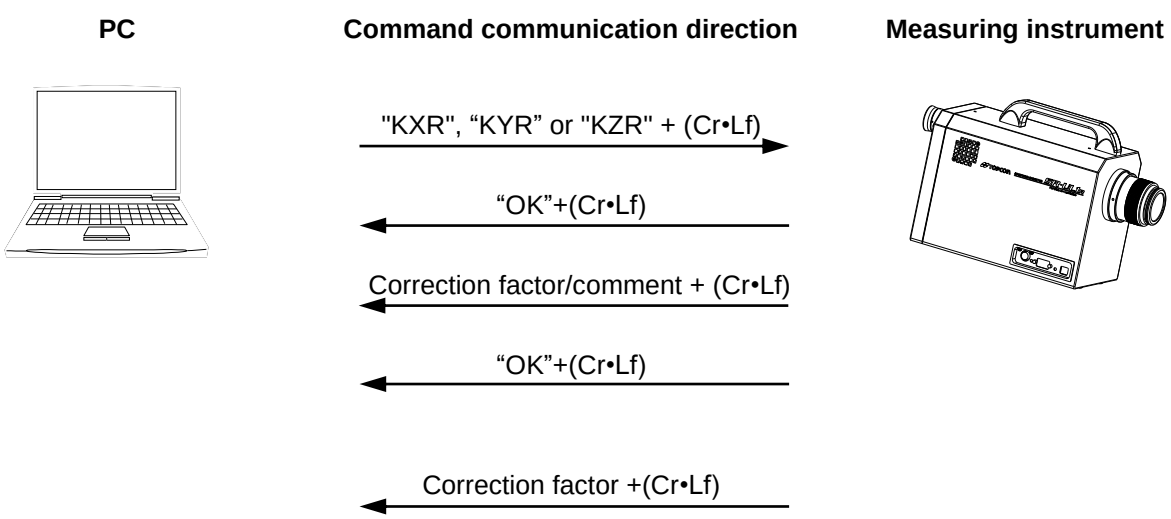
4.1.10 KXR, KYR and KZR Command

Reads comments for the tristimulus values and correction factors for the tristimulus values X, Y and Z from SR-LEDW/SR-UL2/SR-UL1R/SR-3AR

KXR_##### : "_" is space. "#####" is correction factor.

KYR_##### : "_" is space. "#####" is correction factor.

KZR_##### : "_" is space. "#####" is correction factor.

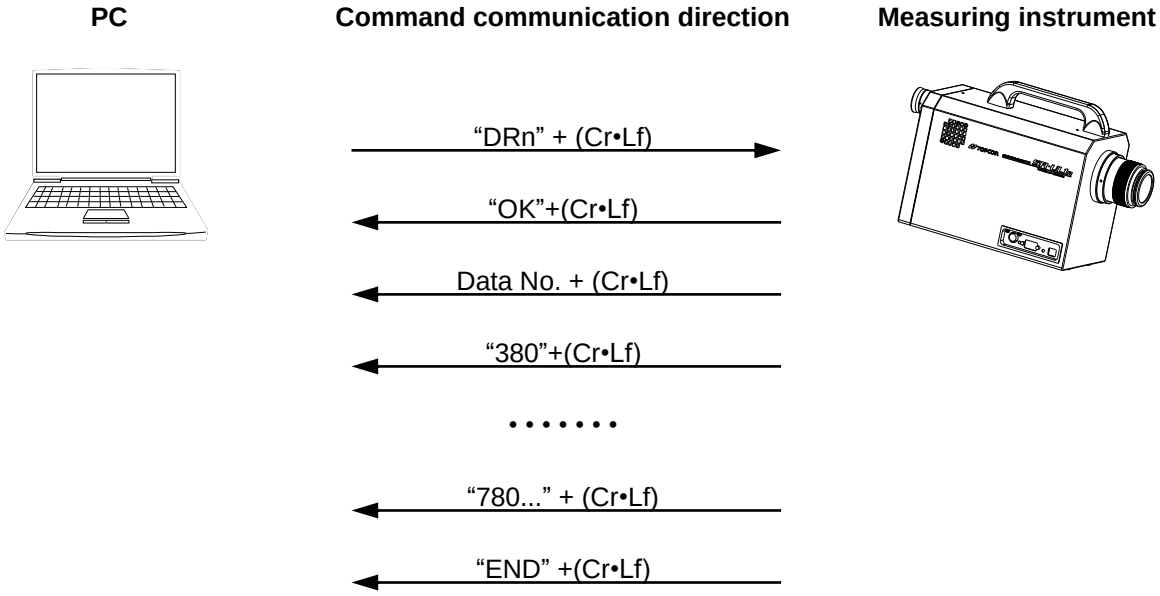


4.1.11 DR[n] Command

The local measurement is completed and the measurement data stored by the instrument is read out by the computer.

"n" is specified with 1 ~ 50. ☞ '1.3.2 Connecting the Personal Computer'

☞ '4.2.2 Output Format for Reading out the Internal Stored Data'



4.1.12 KO1/KO2/KN1/KN2 Command

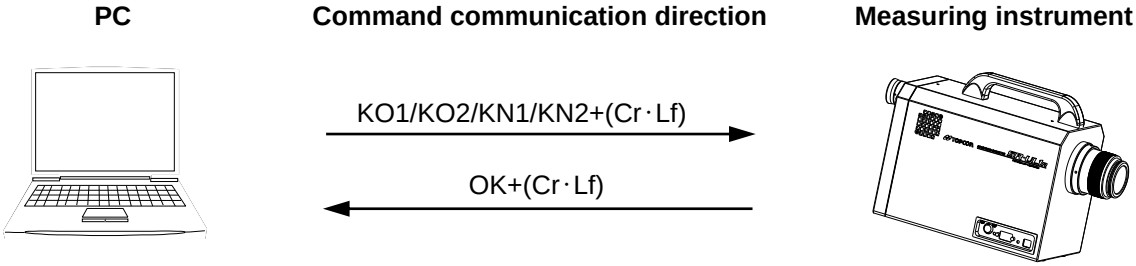
Change the use of the correction factors in the instrument.

KO1 : Changes the setting to use the correction factor for spectrum in the instrument.

KO2 : Changes the setting to use the correction factor for tristimulus values in the instrument.

KN1 : Changes the setting not to use the correction factors for spectrum in the instrument.

KN2 : Changes the setting not to use the correction factors for tristimulus values in the instrument.



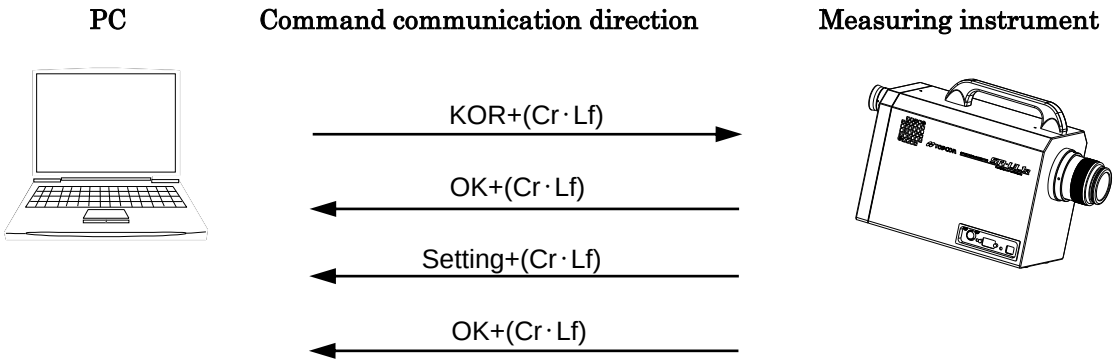
4.1.13 KOR Command

Reads the current correction factor setting from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

KOR1:Reads out whether the current correction factor setting for spectrum is the enable/disable state.

KOR2: Reads out whether the current correction factor setting for tristimulus value is the enable/disable state.

1 : Enable 0: Disable

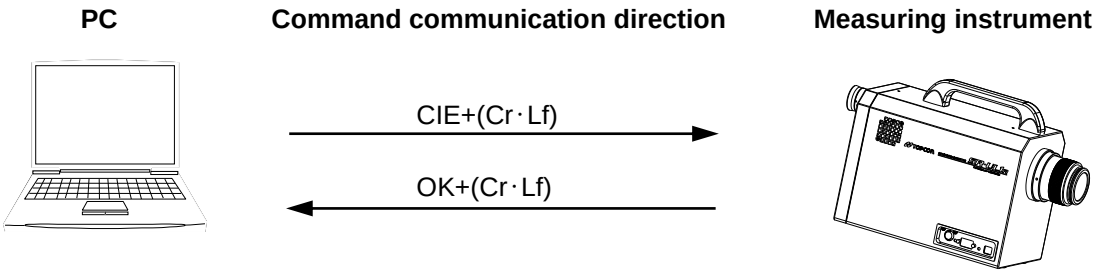


4.1.14 CIE Command

Sets the CIE Color Matching Function (visual field) setting in the SR-LEDW/SR-UL2/SR-UL1R/ SR-3AR.

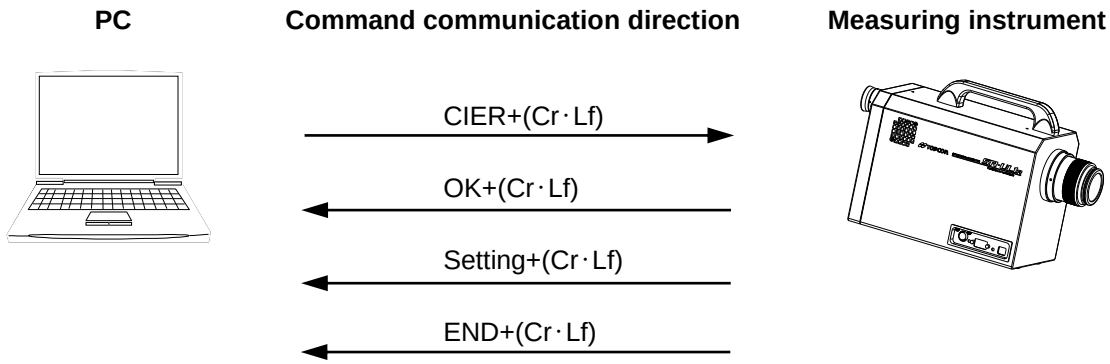
CIE_#: The pound sign (#) is the CIE Color Matching function setting, either 2 or 10.

For the pound sign (#), use 0 for a 2° visual field and 1 for a 10° visual field.



4.1.15 CIER Command

Reads the CIE Color Matching function (visual field) setting from the SR-LEDW/SR-UL2/ SR-UL1R/SR-3AR.



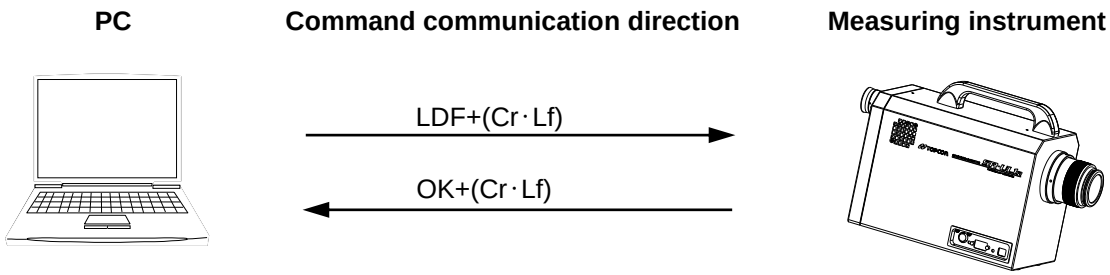
4.1.16 LDF Command

Changes the luminance display format setting in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

LDF#: The pound sign (#) is the format.

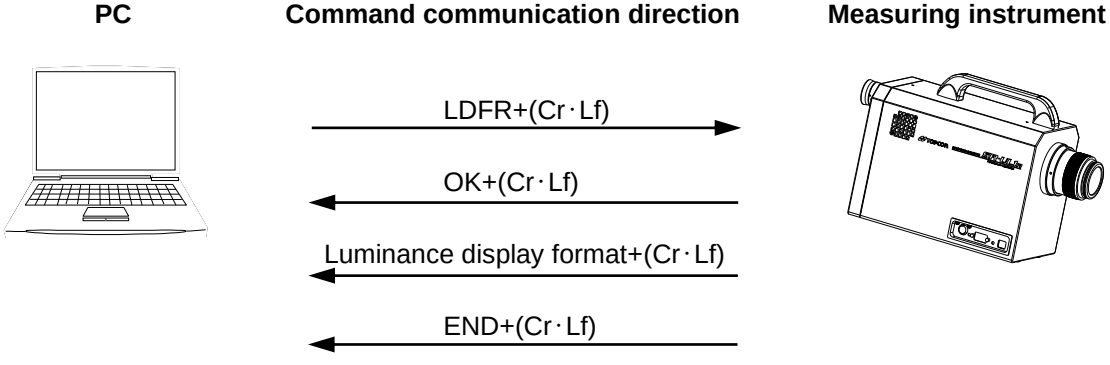
0: Decimal

1: Exponential



4.1.17 LDFR Command

Reads the luminance display format setting from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.



4.1.18 LDD Command

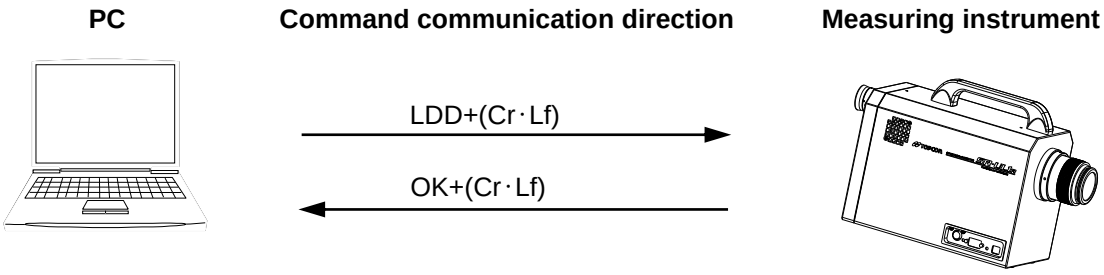
Sets the number of display digits for the luminance display format in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

LDD_#_#: The pound signs (#) indicate the number of digits displayed.

Use 6 to 10 for the first pound sign (#) for the integer portion of the number

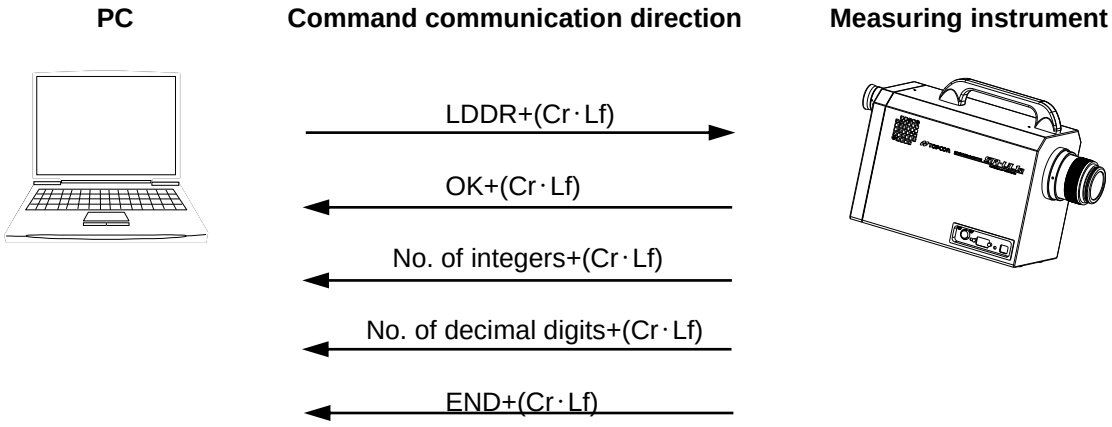
and 0 to 3 for the second pound sign for the decimal portion

Note that the total number of digits including the decimal point cannot exceed 10.



4.1.19 LDDR Command

Reads the setting for the number of digits of the luminance display format from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.



4.1.20 FLD1, FLD2, FLD3 and FLD4 Command

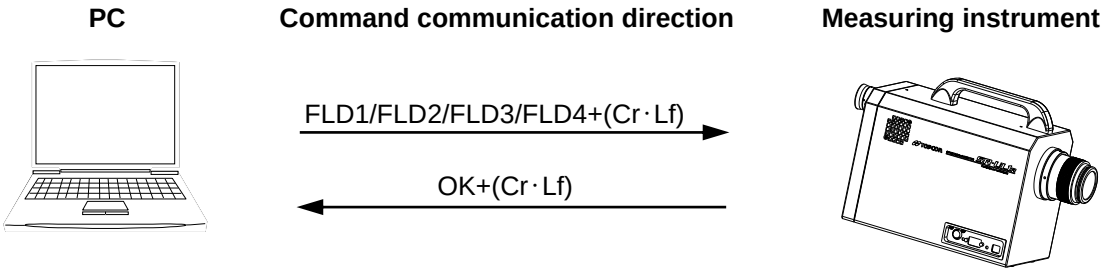
Changes the measuring field setting in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

FLD1: Change the measuring field to the 2.0 position.

FLD2: Change the measuring field to the 1.0 position.

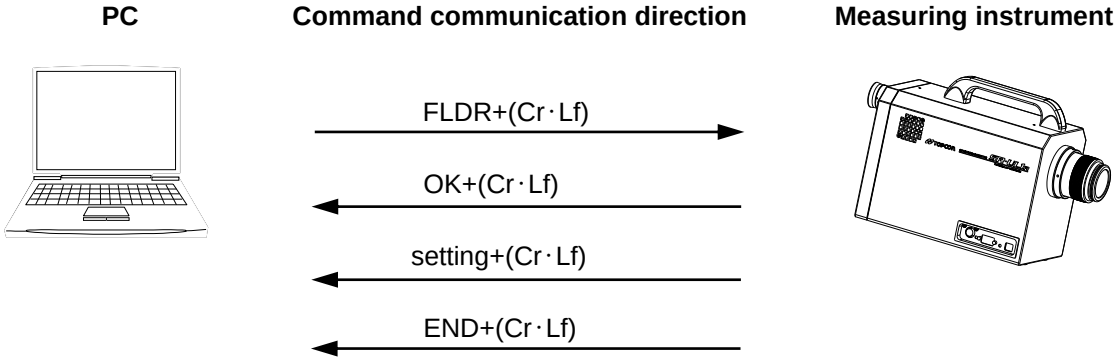
FLD3: Change the measuring field to the 0.2 position.

FLD4: Change the measuring field to the 0.1 position.



4.1.21 FLDR Command

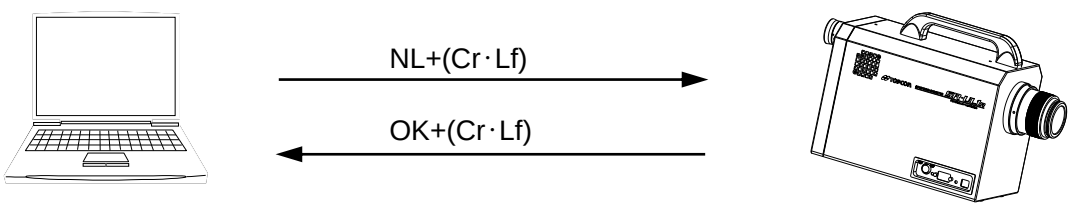
Reads the current measuring field setting from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.



4.1.22 NL Command

Sets the integral time for the integral time delay function in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

NL_#### : The sign (#) is the integral time from 50 to 3 000 ms.

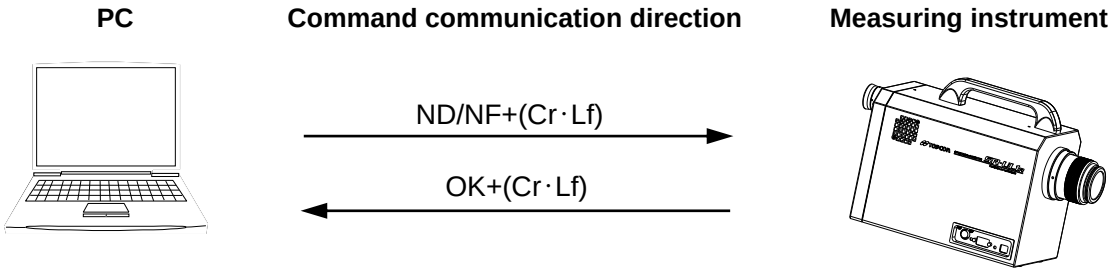


4.1.23 ND and NF Command

Turn the integral time delay function in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR on and off.

ND： Activates the integral time delay function.

NF： Deactivates the integral time delay function.



4.1.24 HS/HS2/HS3/NS Command

With these commands, the measuring speed of the instrument is changed.

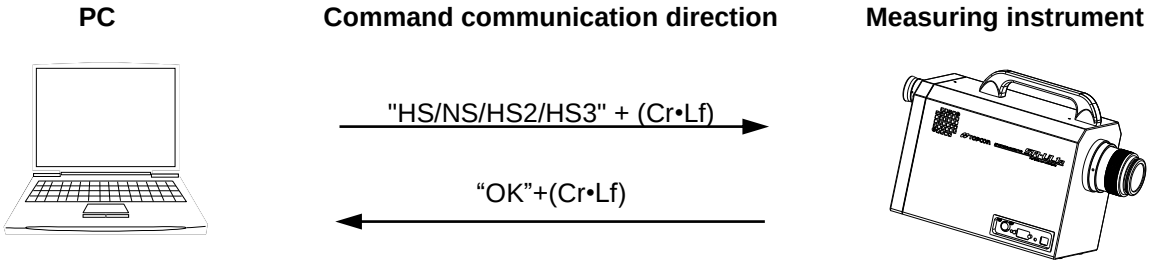
NS : Changes the measuring speed to normal mode

HS : Changes the measuring speed to high speed mode.

HS2 : Changes the measuring speed to high speed mode 2.

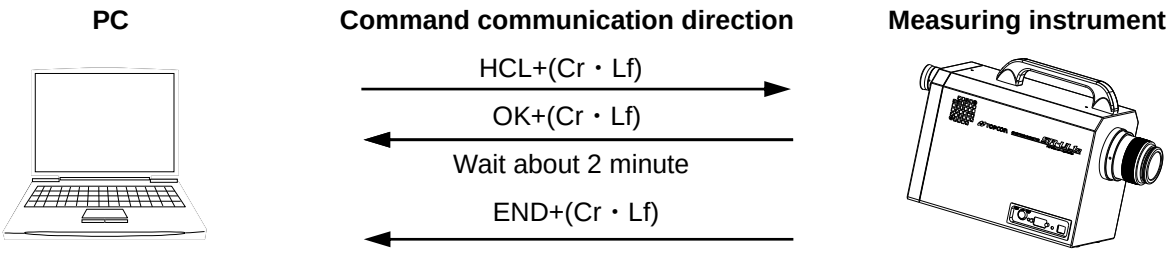
HS3 : Changes the measuring speed to high speed mode 3.

※ Perform HCL command, refer to 4.1.28, when select High Speed mode.



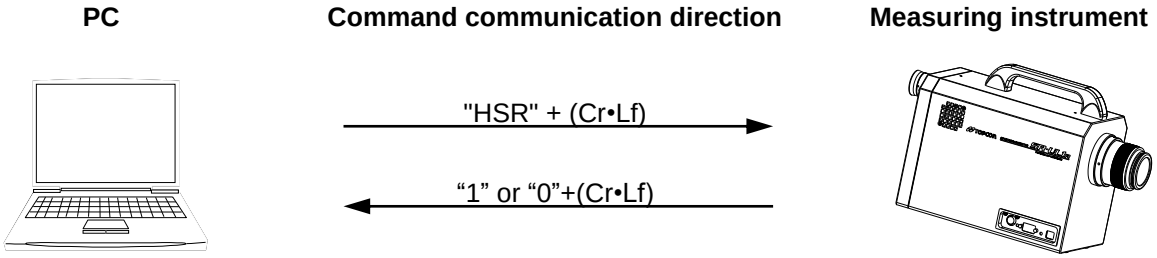
4.1.25 HCL Command

Starts the calibration when select High Speed or High Speed 2, High Speed 3 mode in 4.1.28 HS/HS2/HS3/NS Command. Close the finder shutter and follow the procedure as below



4.1.26 HSR Command

With these commands, the measuring speed of the instrument is read.

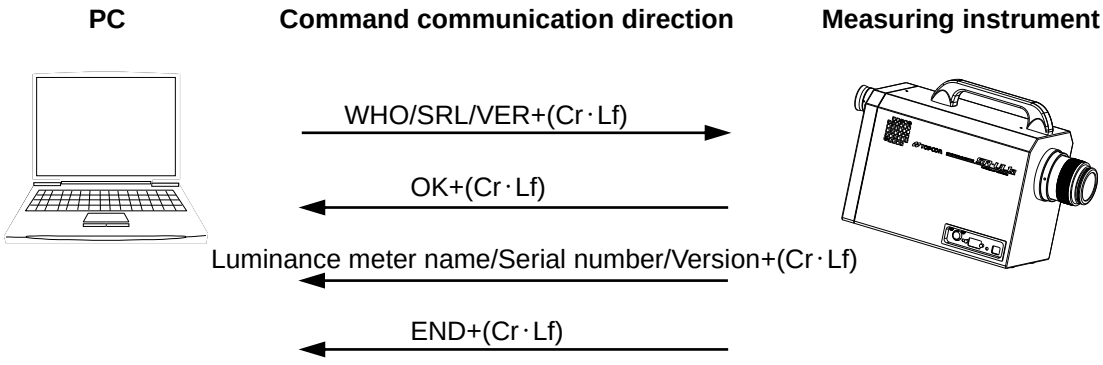


Response to the HSR command

0: Normal speed mode 1:High speed mode 2 2:High speed mode 2 3:High speed mode 3

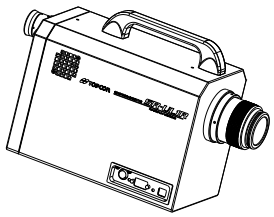
4.1.27 WHO, SRL and VER Command

Reads the luminance meter name, serial number and program version from the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.



4.1.28 FX Command

Starts the measurement to calculate the optimum inner-filter and integral time setting in FIX INTEG mode. When the measurement complete, the optimum inner-filter type and integral time is retuned and the values are also set on the instrument. （SR-LEDW only）

PC	Command communication direction	Measuring instrument
	FX + (Cr・Lf) → ← OK + (Cr・Lf) Integral time+ (Cr・Lf) ← Inner-filter+ (Cr・Lf) ← END” + (Cr・Lf) ←	

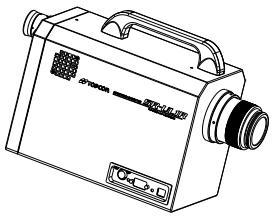
Remember!	This measurement should be conducted at the same condition as the actual measurement in measurement angle, object and measurement distance.

Remember!	The integral time and inner-filter setting in FIX INTEG mode are erased when the power off.

4.1.29 FO Command

Sets to FIX INTEG mode（SR-LEDW only）

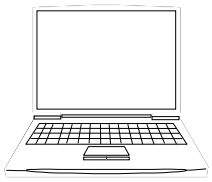
This setting is stored even after the power off

PC	Command communication direction	Measuring instrument
	FO+(Cr・Lf) → ← “OK”+(Cr・Lf)	

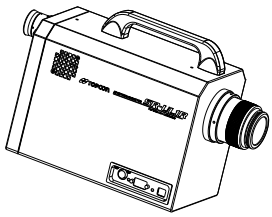
4.1.30 FG Command

Reads current setting in FIX INTEG mode.（SR-LEDW only）

PC **Command communication direction** **Measuring instrument**



”FG” + (Cr・Lf) →
“OK” + (Cr・Lf) ←
Integral time+ (Cr・Lf) ←
Inner-filter+ (Cr・Lf) ←
“END” + (Cr・Lf) ←



- Integral time ： [ms]unit
- Inner-filter type ： 1 → FILTER１
  ２ → FILTER２
  ３ → FILTER３
  ４ → FILTER４
  ５ → FILTER５

4.1.31 FS Command

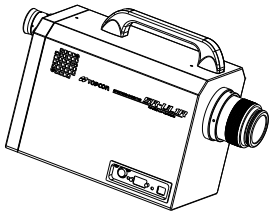
Sets inner-filter type and integral time in FIX INTEG mode. (SR-LEDW only）
The left side of # means integral time [ms](50 -120,000),
right side means inner-filter (1 - 5)

FS_###_# ： The left side of # means integral time[ms](50 -120,000).
The right side means inner-filter (1-5)

PC **Command communication direction** **Measuring instrument**

”FS_Integral time_Filter type” + (Cr・Lf) →

OK+(Cr･Lf) ←

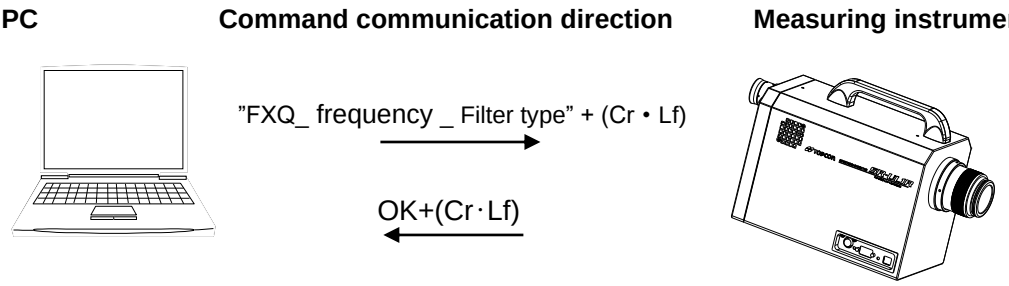


Remember!	The integral time and inner-filter setting in FIX INTEG mode are erased when the power off.

4.1.32 FXQ Command

Set the measurement mode to FIX FREQ mode and inner-filter type, frequency in FIX FREQ mode.

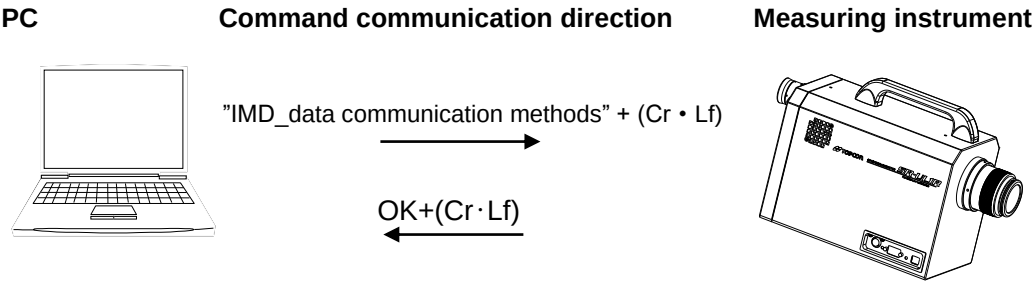
FXQ_###_# : The left side of # means frequency [Hz](1.5 -250).
The right side means inner-filter (1-3 or 5)



4.1.33 IMD Command

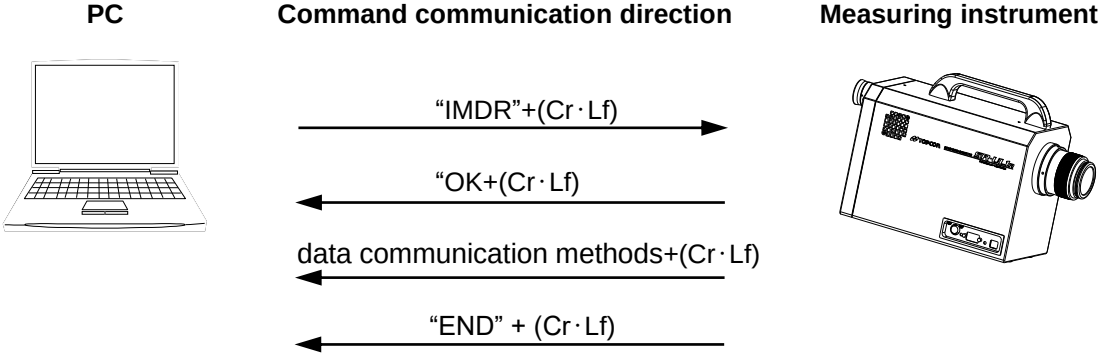
Sets the data communication methods

IMD_# : The pound sign (#) is 0 or 1.
0: Normal type
1: CS900 type



4.1.34 IMDR Command

Reads the data communication methods.



4.1.35 STCT Command

"STCT" command

The measurement starts when this command is transmitted to the instrument.

When measurement is done, the measured data is returned with comma separated text data from the instrument.

Note

In this manual, Cr•Lf was used as the delimiter but Cr is usable too.

☞'3.10 Remote Command Terminal Codes'

Communication of measurement data

After measurement, the instrument transmits the measuring conditions and measurement data.

The delimiter (Cr•Lf) is added to the last of each data line and then the data is transmitted.

After all the data is transmitted, the ending code "END" is transmitted.

Measurement Output Format ☞ '4.2.1 Remote Measurement Output Format'

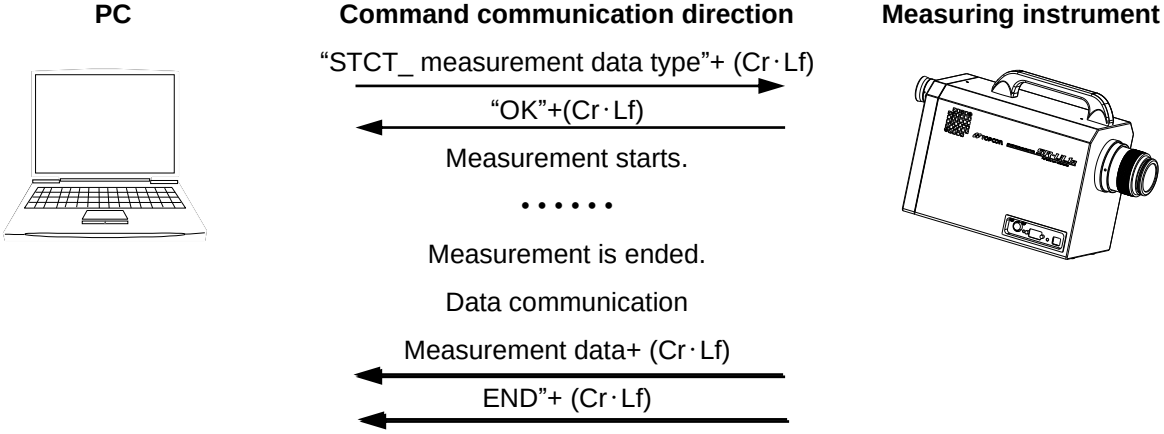
The communication method differs depending on the settings.

Setting Communication Method ☞'3.9 Data Communication Methods'

Set the measurement data type.

STCT_# : The pound sign (#) is measurement data type 1 to 8.

1: Luminance, Chromaticity xy	2: Luminance, Chromaticity u'v'
3: Tristimulus values XYZ	4: Tristimulus values XYZ, Chromaticity xy
5: Tristimulus values XYZ, Chromaticity u'v'	6: Correlated color temperature, Deviation
7: Spectral radiance (380nm – 780nm)	8: Wavelength, Maximum Spectral radiance

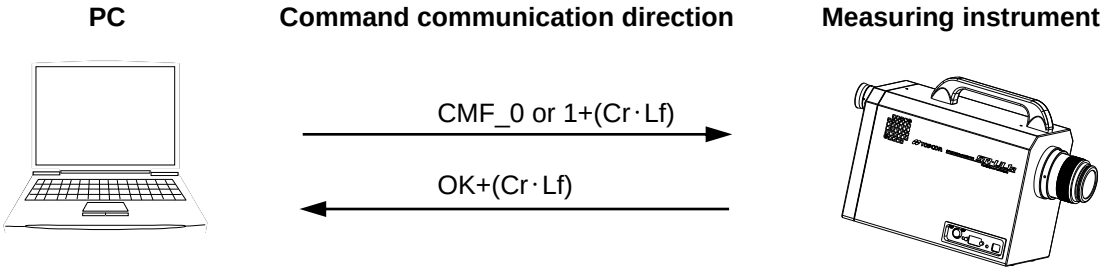


4.1.36 CMF Command

Sets the CIE Color Matching Function (Type) setting in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR.

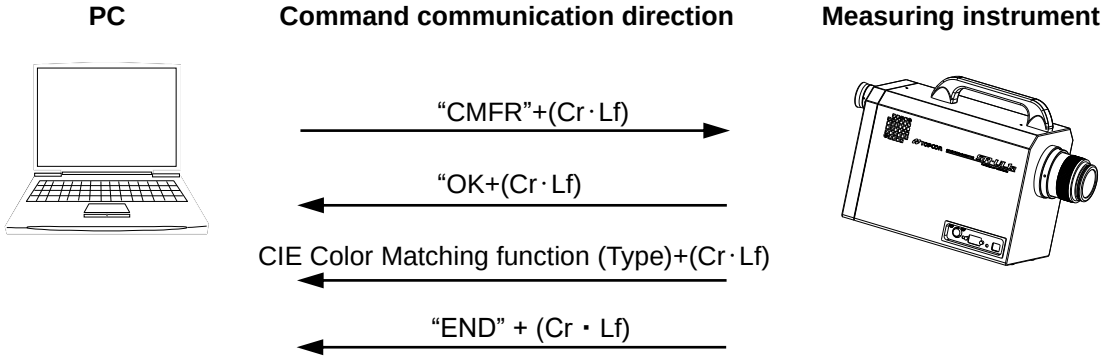
CMF_#: The pound sign (#) is the CIE Color Matching function setting, either CIE1931 or CIE170-2:2015.

For the pound sign (#), use 0 for a CIE1931 and 1 for a CIE170-2:2015.



4.1.37 CMFR Command

Reads the CIE Color Matching function (Type) setting from the SR-LEDW/SR-UL2/SR-UL1R/ SR-3AR.

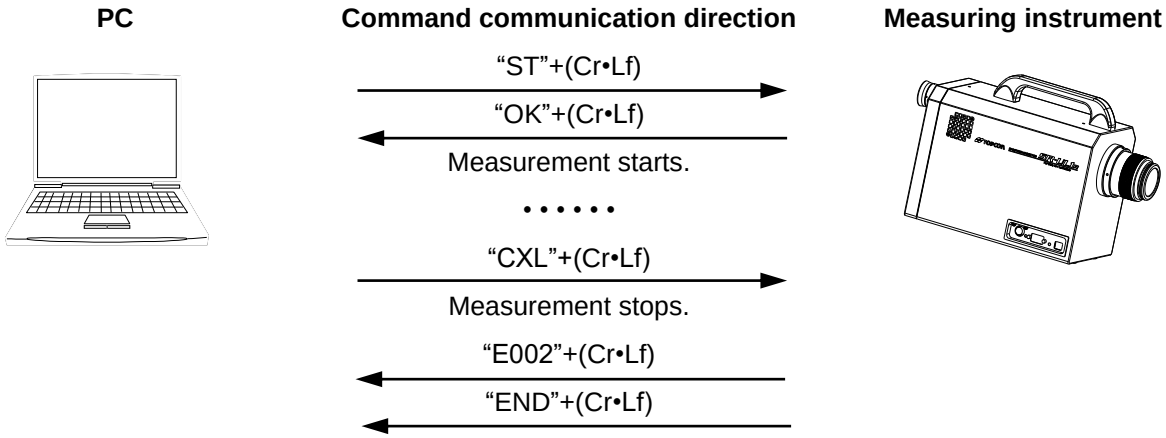


4.1.38 CXL Command

If this command is sent during measurement, the instrument stops the immediate measurement and sends an error code.

Measurement data during measurement is not sent. If the measurement is not in progress, a reception confirmation command is sent.

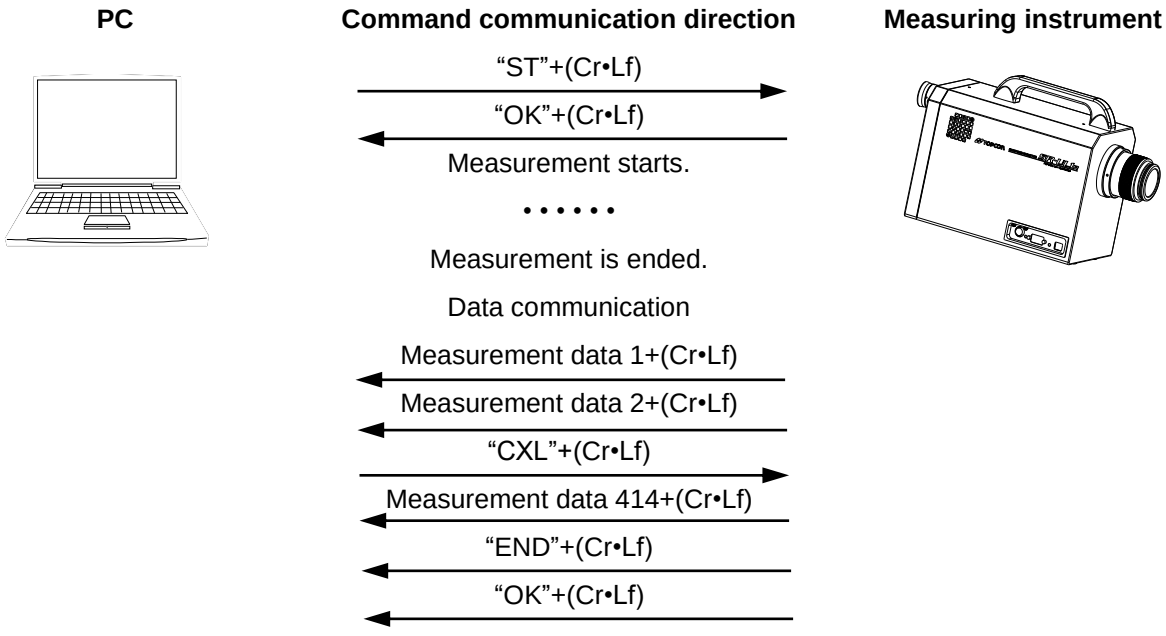
①Measuring



Note

If this instrument receives this command while measuring data is being sent, it will send a confirmation command after measurement data has been sent. Commands are not accepted during measurement data transmission.

②Transmitting measurement data



4.2 Output Formats

4.2.1 Remote Measurement Output Format

(1) “ST” Command

When the measurement is conducted by order of ST command, the measured data is returned with text data from the instrument as follows;

Line No.	Output data	Remarks
1.	2	Measuring field (degree)
2.	100	Integral time (milli-second)
3.	9.335E-01	Radiance ($W•m^{-2}•sr^{-1}$)
4.	1.490E+02	Luminance (cd/m^2)
5.	1.631E+02	Tristimulus values X
6.	1.490E+02	Tristimulus values Y
7.	5.374E+01	Tristimulus values Z
8.	0.4458	Chromaticity x
9.	0.4073	Chromaticity y
10.	0.2549	Chromaticity u’
11.	0.5240	Chromaticity v’
12.	2882	Correlated color temperature (K)
13.	0.0002	Deviation
14.	380 2.141231E-04	Wavelength (nm), Spectral radiance ($W•m^{-2}•nm^{-1}•sr^{-1}$)
15.	381 2.420037E-04	
…	. . . . .	
413.	779 4.325765E-03	
414.	780 4.294558E-03	
415.	END	Data end command

* When measurement is done in the spectral radiance mode (D0 ST), the data from the first line to the 415th line in the above table are returned.
* When measurement is done in the colorimetry mode (D1 ST), the data from the first line to the 13th line and the data of the 415th line in the above table are returned.

(2) “SF” Command

When the measurement is conducted by order of ST command, the measured data is returned with text data from the instrument as follows;

Line No.	Output data	Remarks
1.	100	Integral time (milli-second)
2.	2	Measuring field (degree)
3.	100	Integral time (milli-second)
4.	9.335E-01	Radiance ($W•m^{-2}•sr^{-1}$)
5.	1.490E+02	Luminance (cd/m^2)
6.	1.631E+02	Tristimulus values X
7.	1.490E+02	Tristimulus values Y
8.	5.374E+01	Tristimulus values Z
9.	0.4458	Chromaticity x
10.	0.4073	Chromaticity y
11.	0.2549	Chromaticity u’
12.	0.5240	Chromaticity v’
13.	2882	Correlated color temperature (K)
14.	0.0002	Deviation
15.	380 2.141231E-04	Wavelength (nm), Spectral radiance ($W•m^{-2}•nm^{-1}•sr^{-1}$)
16.	381 2.420037E-04	
…	. . . . .	
414.	779 4.325765E-03	
415.	780 4.294558E-03	
416.	END	Data end command

* When measurement is done in the spectral radiance mode (D0 ST), the data from the first line to the 416th line in the above table are returned.
* When measurement is done in the colorimetry mode (D1 ST), the data from the first line to the 14th line and the data of the 416th line in the above table are returned.

(3) “STB” Command

When the measurement is conducted by order of STB command, the measured data is returned with binary data (big endia) from the instrument.

Measurement Output Format ☞ ‘4.2.1 Remote Measurement Output Format’

Note

· Measured data of spectral radiance is returned at all time for STB command even if “D1” command is transmitted.

1 Header

Header have necessary information to receive data.

Initial bite	Function	Data type	Size	Qty of element	Remark
1	Size of data	Unsigned integer	4	1	
5	Checksome data	Unsigned integer	1	1	
		Data size	5B(Bite)		

Checksome data：The value from which 1 byte of lower rank of the total that has added data in turm from first by the byte unit was picked out.

2 Data (When finish measurement）

Initial bite	Function	Data type	Size	Qty of element	Remarks
1	Measurement angle	Unsigned integer	1	1	1:2°,2:1°,3:0.2°,4:0.1°
2	Integral time	Floating point	4	1	
6	Radiance	Floating point	4	1	
10	Luminance	Floating point	4	1	
14	Tristimulus values X	Floating point	4	1	
18	Tristimulus values Y	Floating point	4	1	
22	Tristimulus values Z	Floating point	4	1	
26	Chromaticity x	Floating point	4	1	
30	Chromaticity y	Floating point	4	1	
34	Chromaticity u’	Floating point	4	1	
38	Chromaticity v’	Floating point	4	1	
42	Correlated Color temperature Tc	Floating point	4	1	If TC can not be calculated, instrument send a value of -1
46	Deviation duv	Floating point	4	1	If TC can not calculated, instrument send a value of -1.
50	Wave length	Unsigned integer	2	1	380nm (fix)
52	Spectral Radiance	Floating point	4	1	Spectral Radiance at 380nm
56	Wave length	Unsigned integer	2	1	381nm (fix)
58	Spectral Radiance	Floating point	4	1	Spectral Radiance at 381nm
⋮					

Initial bite	Function	Data type	Size	Qty of element	Remarks
2450	Wave length	Unsigned integer	2	1	780 (fix)
2452	Spectral Radiance	Floating point	4	1	Spectral Radiance at 780nm
2456	“END”+Cr+Lf Fix	Character code	1	5	
		Data size	2460B		

3 Data (When error happen）

Initianl bite	Function	Data type	Size	Qty of element	Remark
1	Error code	Character code	1	4	
5	“END”+(Cr·Lf)	Character code	1	5	
		Data size	9		

Error code ☞’5.2 Error Code in communication’

(4) “STCT” Command

When the measurement is conducted by order of STCT command, the measured data is returned with comma separated text data from the instrument as follows;

Type	Output data	Remarks
1	1.490E+02,0.4458,0.4073+(Cr·Lf) “END”+(Cr·Lf)	Luminance, Chromaticity x, y Data end command
2	1.490E+02,0.2549,0.5240+(Cr·Lf) “END”+(Cr·Lf)	Luminance, Chromaticity u’, v’ Data end command
3	1.631E+02,1.490E+02,5.374E+01+(Cr·Lf) “END”+(Cr·Lf)	Tristimulus values X, Y, Z Data end command
4	1.631E+02,1.490E+02,5.374E+01, 0.4458,0.4073+(Cr·Lf) “END”+(Cr·Lf)	Tristimulus values X, Y, Z, Chromaticity x, y Data end command
5	1.631E+02,1.490E+02,5.374E+01, 0.2549,0.5240+(Cr·Lf) “END”+(Cr·Lf)	Tristimulus values X, Y, Z, Chromaticity u’, v’ Data end command
6	2882,0.0002+(Cr·Lf) “END”+(Cr·Lf)	Correlated color temperature (K), Deviation Data end command
7	2.141231E-04,2.420037E-04·····, 4.325765E-03,4.294558E-03+(Cr·Lf) “END”+(Cr·Lf)	Spectral radiance (380nm to 780nm) Data end command
8	554, 4.294558E-03+(Cr·Lf) “END”+(Cr·Lf)	Wavelength position, Maximum Spectral radiance Data end command

*When measurement is done in the colorimetry mode (D1 STCT), the data end command "END" returned.

4.2.2 Output Format for Reading out the Internal Stored Data

Output format of the data which was measured in the local mode and stored in the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR the measured data is returned with text from the instrument.

Line No.	Output data	Remarks
1.	n	Data number
2.	2	Measuring field (degree)
3.	100	Integral time (milli-second)
4.	9.335E-01	Radiance ($W \cdot m^{-2} \cdot sr^{-1}$)
5.	1.490E+02	Luminance (cd/m^2)
6.	1.631E+02	Tristimulus values X
7.	1.490E+02	Tristimulus values Y
8.	5.374E+01	Tristimulus values Z
9.	0.4458	Chromaticity x
10.	0.4073	Chromaticity y
11.	0.2549	Chromaticity u’
12.	0.5240	Chromaticity v’
13.	2882	Correlated color temperature (K)
14.	0.0002	Deviation
15.	380 2.141231E-04	Wavelength (nm), Spectral radiance ($W \cdot m^{-2} \cdot nm^{-1} \cdot sr^{-1}$)
16.	381 2.420037E-04	
…	. . . . .	
414.	779 4.325765E-03	
415.	780 4.294558E-03	
416.	END	Data end command

4.3 USB Driver Installation

The procedure for installing the USB Driver in the PC is as follows.

1 Place the CS-900A CD-ROM in the CD-ROM drive.

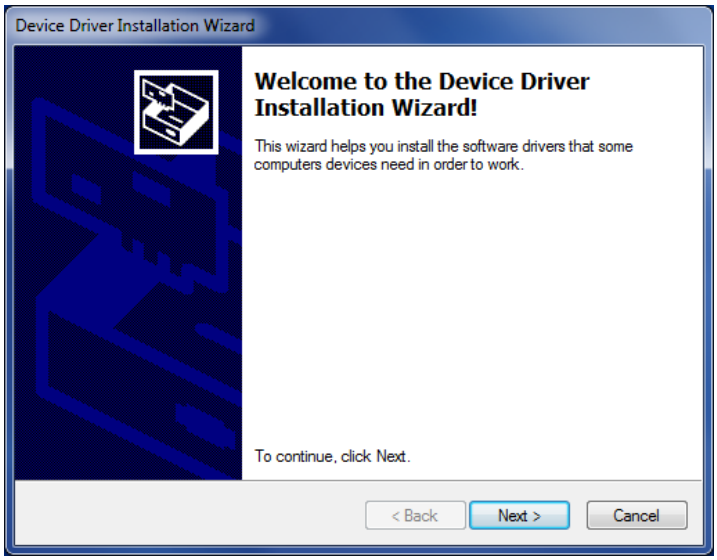
2 Select and double-click the “dpinst.exe” file in [¥USB_Driver¥{os name}¥ {x86} or {x64}] folder in the CD-ROM via Explorer.

For example, in the case of Windows10/11(64bit),
it becomes {USB_DRIVER¥Windows10¥x64}.

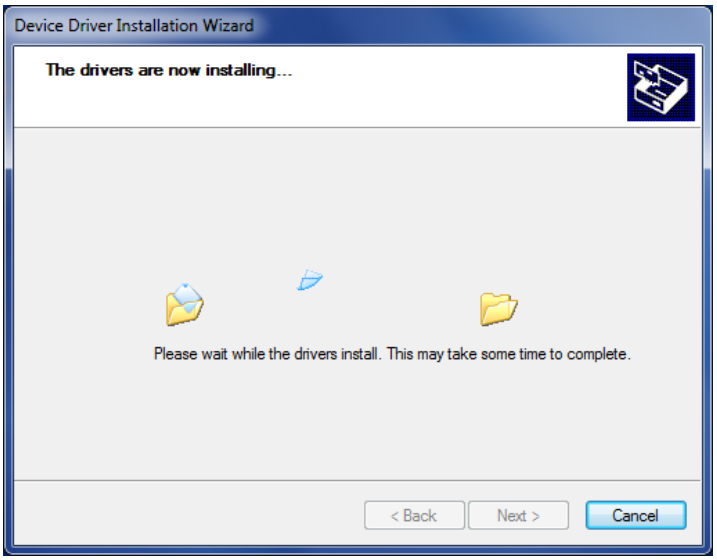
OS	Windows® 10 Pro (32bit／64bit) Windows® 11 Pro (64bit)

3 The User Account Control Dialog appears. Click [OK] button.

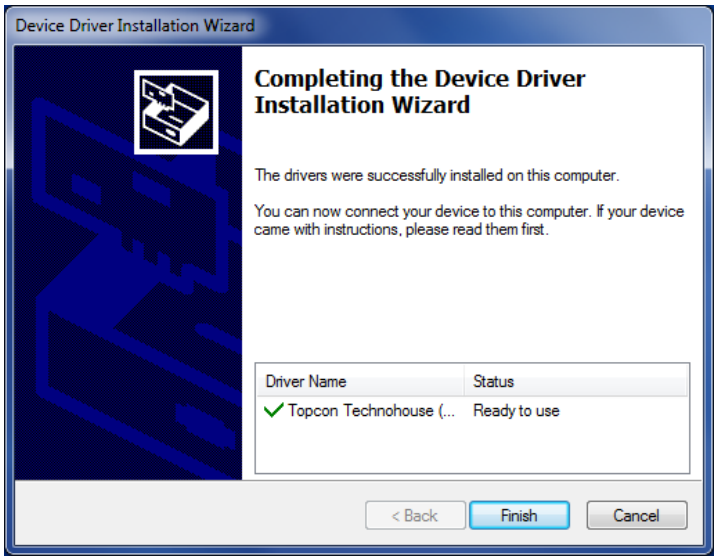
4 The Device Driver Installation Wizard appears. Click [Next] button.



5 The following dialog will be displayed, start installing the USB Driver.



6 After installation of USB Driver, The following dialog will be displayed. Click the [Finish] button.



5. Error Display

5.1 Error Display on the Instrument

Error display	Contents	Remedial measure
Attention!! Temperature Not set Please Power OFF	Because the instrument's inside is hot, the protection circuit works. Turn off the power.	Turn off the power first. Leave the instrument in the environment meeting the use condition (SR-3A: 0-30 °C, SR-LEDW/ SR-UL2/SR-UL1R:0-35 °C) for about 30 minutes and then turn on its power.
Attention!! Low Battery Parameter :FUNCTION ①Continue : FUNCTION ②Auto Continue	The power of the backup battery is low. If you want to continue,press the [FUNCTION] switch. ①if you want tocontinue,press the [FUNCTION] switch. ②No operation	The power of the measurement data backup battery is low and so the data stored in the instrument are deleted. Check the Low Battery operation settings. ☞'3.22 LowBattery Operation'
*** ERROR *** E001 Over Range hit any key	The measuring range is exceeded. Hit any key.	Lower the brightness of the object, set a smaller measuring field or insert the neutral density filter.
*** ERROR *** E004 Sync Error hit any key	Can not receive the external sync. signal. Hit any key.	The status of receiving the external sync. signal is abnormal. It is necessary to check the sync. signal generator or the connection of BNC cable.
*** ERROR *** EXXX Comm Error	E005 ~ E007 The communication error occurred.	There is an communication error. Check the communication condition.
*** ERROR *** E010 Fix Mode Measure NG hit any key	The combination of the measuring field in FIX *** mode and Shutter is inappropriate. ※E901 will occur at the same time.	FIX *** mode Shutter Check the settings.
*** ERROR *** E9XX XXXXXXXXXXXX hit any key	E900 ~ E999 The internal error occurred. Hit any key. ※If E010 is also occurring, take the action of E010.	There is an internal error. Contact TOPCON TEHCNOHOUSE or your retailer.

- If an error is still displayed though you take the above remedial measure, it is necessary to repair the instrument. Contact TOPCON TECHNOHOUSE or your retailer.

5.2 Error Code in Communication

One of the following error messages is transmitted to the computer if an error occurs in the instrument while measuring when it is connected to the computer.

Error code	Description
E001	Range over error This code is returned when the brightness of the object exceeds the measuring range of the instrument. Lower the brightness of the object, set a smaller measuring field or insert the neutral density filter.
E002	Measurement was stopped because the [MEAS./HOLD] switch was pressed on the main unit or a measurement cancel command was received during remote measurement.
E004	The status of receiving the external sync. signal is abnormal. It is necessary to check the sync. signal generator or BNC cable.
E010	The combination of the measuring field in FIX *** mode and Shutter is inappropriate. FIX *** mode Shutter Check the settings.
E900 ~ E999	There is an internal error. Contact TOPCON TEHCNOHOUSE or your retailer. ※In the case of E901, it may occur together with E010. If E010 is also displayed on the main unit, check the Shutte setting in FIX *** mode

6. Appendix

Specifications and Performance

- SR-LEDW

Optical system

Objective lens:	Focal distance	f = 82 mm F 2.5
Eyepiece lens:	Finder visual field	5 °
	Vision adjusting range	±5 diopt

Spectroscope

Spectrum wavelength width:	5~8 nm
Spectral diffraction:	Polychrome meter
Dispersive element:	Diffraction grating

Optical receiving element:

Electronic cooling linear array sensor

Measuring field:

2°, 1°, 0.2°, 0.1° with electronic adjustment

Measuring distance:

350 mm~∞ (Distance from the end of the objective lens metal fixture)

Measuring wavelength range:

380 nm~780 nm

Sampling interval:

1 nm

Measurement mode:

Auto/Manual (Frequency/Integral time), and external vertical synchronous signal input

Measurement diameter

(Unit: mmø)

Measuring field	Measuring distance (mm)							
	350	400	500	600	800	1000	2000	5000
2°	10.0	11.7	15.1	18.6	25.4	32.2	66.4	169
1°	4.99	5.84	7.55	9.26	12.7	16.1	33.2	84.4
0.2°	1.00	1.17	1.51	1.86	2.54	3.22	6.64	16.9
0.1°	0.50	0.59	0.76	0.93	1.27	1.61	3.32	8.44

* The measuring distance is the distance from the end of the objective lens metal fixture.

* The values of this table are design reference values and they are sometimes a little different from the actual values.

Measuring functions

The following measurements can be done by using the display modes.

- x, y, Lv (x, y: Chromaticity, Lv: Luminance cd/m^2)
- u', v', Lv (u', v': Chromaticity, Lv: Luminance cd/m^2)
- X, Y, Z (X, Y, Z: Tristimulus values)
- Tc, duv, Lv (Tc: Correlated color temperature K, duv: Deviation, Lv: Luminance cd/m^2)
- Le (Le: Radiance W/sr·m^2)

2°/10° visual field can be switched by setting in the function mode.

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			Normal speed mode	High speed mode
Accuracy ensuring range (against the standard light A)		2°	0.0005~ 1 500 000 cd/㎡	0.005~ 1 500 000 cd/㎡
		1°	0.0015~ 4 500 000 cd/㎡	0.015~ 4 500 000 cd/㎡
		0.2°	0.0375~ 5 000 000 cd/㎡	0.375~ 5 000 000 cd/㎡
		0.1°	0.15 ~ 2 000 000 cd/㎡	1.5 ~ 2 000 000 cd/㎡
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	Every measuring angle	±2%	
	Chromaticity *1	2°	xy ±0.002	xy ±0.003(0.005~0.05cd/㎡) xy ±0.002(0.05~ cd/㎡)
		1°		xy ±0.003(0.015~0.15cd/㎡) xy ±0.002(0.15~ cd/㎡)
		0.2°		xy ±0.003(0.375~4 cd/㎡) xy ±0.002(4 ~ cd/㎡)
		0.1°		xy ±0.003(1.5 ~15 cd/㎡) xy ±0.002(15 ~ cd/㎡)
Repeatability	Luminance *2	2°	1.5%(0.0005~0.005cd/㎡) 0.4%(0.005~0.1 cd/㎡) 0.3%(0.1 ~ cd/㎡)	1.5%(0.005~0.05cd/㎡) 0.4%(0.05~1 cd/㎡) 0.3%(1 ~ cd/㎡)
		1°	1.5%(0.0015~0.015cd/㎡) 0.4%(0.015~0.3 cd/㎡) 0.3%(0.3 ~ cd/㎡)	1.5%(0.015~0.15cd/㎡) 0.4%(0.15~3 cd/㎡) 0.3%(3 ~ cd/㎡)
		0.2°	1.5%(0.0375~0.4cd/㎡) 0.4%(0.4 ~7.5cd/㎡) 0.3%(7.5 ~ cd/㎡)	1.5%(0.375~ 4cd/㎡) 0.4%(4 ~ 75cd/㎡) 0.3%(75 ~ cd/㎡)
		0.1°	1.5%(0.15 ~1.5cd/㎡) 0.4%(1.5 ~30cd/㎡) 0.3%(30 ~ cd/㎡)	1.5%(1.5 ~ 15cd/㎡) 0.4%(15 ~300cd/㎡) 0.3%(300 ~ cd/㎡)
	Chromaticity *3	2°	0.005 (0.0005 ~0.005 cd/㎡) 0.0015(0.005~0.1 cd/㎡) 0.0005(0.1 ~ cd/㎡)	0.005 (0.005 ~0.05 cd/㎡) 0.0015(0.05~1 cd/㎡) 0.0005(1 ~ cd/㎡)
		1°	0.005 (0.0015~0.015cd/㎡) 0.0015(0.015~0.3 cd/㎡) 0.0005(0.3 ~ cd/㎡)	0.005 (0.015~0.15cd/㎡) 0.0015(0.15~3 cd/㎡) 0.0005(3 ~ cd/㎡)
		0.2°	0.005 (0.0375~0.4 cd/㎡) 0.0015(0.4 ~7.5 cd/㎡) 0.0005(7.5 ~ cd/㎡)	0.005 (0.375~4 cd/㎡) 0.0015(4 ~75 cd/㎡) 0.0005(75 ~ cd/㎡)
		0.1°	0.005 (0.15 ~1.5cd/㎡) 0.0015(1.5~30 cd/㎡) 0.0005(30 ~ cd/㎡)	0.005 (1.5 ~15cd/㎡) 0.0015(15~300 cd/㎡) 0.0005(300 ~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			High speed 2 mode	High speed 3 mode
Accuracy ensuring range (against the standard light A)		2°	0.005~ 1 500 000 cd/㎡	0.05~ 1 500 000 cd/㎡
		1°	0.015~ 4 500 000 cd/㎡	0.15~ 4 500 000 cd/㎡
		0.2°	0.375~ 5 000 000 cd/㎡	3.75~ 5 000 000 cd/㎡
		0.1°	1.5 ~ 2 000 000 cd/㎡	15 ~ 2 000 000 cd/㎡
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	Every measuring angle	±2%	
	Chromaticity *1	2°	xy ±0.002	xy ±0.003(0.05~0.5 cd/㎡) xy ±0.002(0.5~ cd/㎡)
		1°		xy ±0.003(0.15~1.5 cd/㎡) xy ±0.002(1.5~ cd/㎡)
		0.2°		xy ±0.003(3.75~40 cd/㎡) xy ±0.002(40~ cd/㎡)
		0.1°		xy ±0.003(15 ~150 cd/㎡) xy ±0.002(150~ cd/㎡)
Repeatability	Luminance *2	2°	1.5%(0.005~0.05 cd/㎡) 0.4%(0.05~1 cd/㎡) 0.3%(1~ cd/㎡)	1.5%(0.05~0.5 cd/㎡) 0.4%(0.5~10 cd/㎡) 0.3%(10~ cd/㎡)
		1°	1.5%(0.015~0.15 cd/㎡) 0.4%(0.15~3 cd/㎡) 0.3%(3~ cd/㎡)	1.5%(0.15~1.5 cd/㎡) 0.4%(1.5~30 cd/㎡) 0.3%(30~ cd/㎡)
		0.2°	1.5%(0.375~4 cd/㎡) 0.4%(4~75 cd/㎡) 0.3%(75~ cd/㎡)	1.5%(3.75~ 40 cd/㎡) 0.4%(40~750 cd/㎡) 0.3%(750~ cd/㎡)
		0.1°	1.5%(1.5~15 cd/㎡) 0.4%(15~300 cd/㎡) 0.3%(300~ cd/㎡)	1.5%(15~150 cd/㎡) 0.4%(150~3000 cd/㎡) 0.3%(3000~ cd/㎡)
	Chromaticity *3	2°	0.005 (0.005 ~0.05 cd/㎡) 0.0015(0.05~1 cd/㎡) 0.0005(1~ cd/㎡)	0.005 (0.05~0.5 cd/㎡) 0.0015(0.5~10 cd/㎡) 0.0005(10~ cd/㎡)
		1°	0.005 (0.015~0.15 cd/㎡) 0.0015(0.15~3 cd/㎡) 0.0005(3~ cd/㎡)	0.005 (0.15~1.5 cd/㎡) 0.0015(1.5~30 cd/㎡) 0.0005(30~ cd/㎡)
		0.2°	0.005 (0.375~4 cd/㎡) 0.0015(4~75 cd/㎡) 0.0005(75~ cd/㎡)	0.005 (3.75~40 cd/㎡) 0.0015(40~750 cd/㎡) 0.0005(750~ cd/㎡)
		0.1°	0.005 (1.5~15 cd/㎡) 0.0015(15~300 cd/㎡) 0.0005(300~ cd/㎡)	0.005 (15~150 cd/㎡) 0.0015(150~3000 cd/㎡) 0.0005(3000~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.

Communication time

Remote via USB device STB Command Spectral radiance mode	Approx. 1 sec
Remote via USB device ST Command Spectral radiance mode	Approx. 2.8 sec
Remote via USB device Colorimetry mode	Approx. 0.6 sec
Remote via RS232C device Colorimetry mode	Approx. 0.8 sec
Remote via RS232C device Spectral radiance mode	Approx. 10.7 sec

*Measurement is conducted under following condition

- Object White LED
- Luminance About3,000cd/m2
- Measurement angle 2°
- Integral time 100ms
- Measurement mode FIX
- Measurement speed mode HIGH SPEED
- RS-232C parameter 9600bps_7bit_ODD_1 bit

*Communication time is depend on measurement

Temperature characteristic
Within ±3 % against luminance value
(The luminance of 20 °C should be standard in the range of 5°C ~30 °C.)

Polarized light characteristic
Luminance 1% or less Spectral radiance 2% or less(400~780nm)

Warm-up time
40 minutes or above
No warm-up time needed under following conditions.
Measuring field:2°
Luminance of object to be measured is 1cd/m2 or above
Operating conditions is 23°C

Calibration standard
TOPCON TECHNOHOUSE calibration standard (Standard light A / 23° C ± 3°C / 50 % ± 15 %RH)

Display
Dot matrix LC display (20 characters × 4 lines) with lighting

Interface
USB 2.0 (Full speed: 12 Mbps)
RS-232C
Communication speed: 4800/9600/19200/38400 BPS
Data length: 7 bit/8 bit
Parity: EVEN/ODD/NONE
Stop bit: 1 bit/2 bit

Power supply:
Provided AC adapter

Power consumption:
Approx. 36 W

Operation conditions:
Temperature: 5°C~30 °C Humidity: 80 %RH or less

Storing conditions:
Temperature: -10°C~50 °C Humidity: 80 %RH or less

External dimensions:
Approx. 150 mm (width) × 239 mm (height) × 406 mm (length)

Weight:
Approx. 5.5 kg (only main body)

FCC Compliance Information

This device complies with Part 15 of FCC Rules. Operation is subject to the following twoconditions:
(1) the device may not cause interference, and
(2) the device must accept anyinterference, including interference that may cause undesired operation of this device.
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expence.

Republic of Korea	KC:Class A	해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다 A급 기기 (업무용 방송통신기자재) 이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다

EU Battery Directive

This symbol is applicable to EU members states only.

Battery users must not dispose of batteries as unsorted general waste, but treat properly.
If a chemical symbol is printed bebeath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:
Hg: mercury(0.0005%), Cd: cadmium(0.002%), Pb: lead(0.004%)

These ingredients may be seriously hazardous to human and the global environment.

This product contains a backup battery cell.
You cannot replace batteries by yourself. When you need to replace and/or dispose batteries, contact your local deadler.

- SR-UL2

Optical system

Objective lens:	Focal distance	f = 82 mm F 2.5
Eyepiece lens:	Finder visual field	5 °
	Vision adjusting range	±5 diopt

Spectroscope

Spectrum wavelength width:	5~8 nm
Spectral diffraction:	Polychrome meter
Dispersive element:	Diffraction grating

Optical receiving element:

Electronic cooling linear array sensor

Measuring field:

2°, 1°, 0.2°, 0.1° with electronic adjustment

Measuring distance:

350 mm~∞ (Distance from the end of the objective lens metal fixture)

Measuring wavelength range:

380 nm~780 nm

Sampling interval:

1 nm

Measurement mode:

Auto/Manual (Frequency/Integral time), and external vertical synchronous signal input

Measurement diameter

(Unit: mmø)

Measuring field	Measuring distance (mm)							
	350	400	500	600	800	1000	2000	5000
2°	10.0	11.7	15.1	18.6	25.4	32.2	66.4	169
1°	4.99	5.84	7.55	9.26	12.7	16.1	33.2	84.4
0.2°	1.00	1.17	1.51	1.86	2.54	3.22	6.64	16.9
0.1°	0.50	0.59	0.76	0.93	1.27	1.61	3.32	8.44

* The measuring distance is the distance from the end of the objective lens metal fixture.

* The values of this table are design reference values and they are sometimes a little different from the actual values.

Measuring functions

The following measurements can be done by using the display modes.

- x, y, Lv (x, y: Chromaticity, Lv: Luminance cd/m^2)
- u', v', Lv (u', v': Chromaticity, Lv: Luminance cd/m^2)
- X, Y, Z (X, Y, Z: Tristimulus values)
- Tc, duv, Lv (Tc: Correlated color temperature K, duv: Deviation, Lv: Luminance cd/m^2)
- Le (Le: Radiance W/sr·m^2)

2°/10° visual field can be switched by setting in the function mode.

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			Normal speed mode	High speed mode
Accuracy ensuring range (against the standard light A)		2°	0.0005~ 3 000 cd/㎡	0.005~ 3 000 cd/㎡
		1°	0.0015~ 9 000 cd/㎡	0.015~ 9 000 cd/㎡
		0.2°	0.0375~ 70 000 cd/㎡	0.375~ 70 000 cd/㎡
		0.1°	0.15 ~300 000 cd/㎡	1.5 ~300 000 cd/㎡
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	Every measuring angle	±2%	
	Chromaticity *1	2°	xy ±0.002 xy ±0.0013 *4	xy ±0.003(0.005~0.05cd/㎡) xy ±0.002(0.05~ cd/㎡)
		1°		xy ±0.003(0.015~0.15cd/㎡) xy ±0.002(0.15~ cd/㎡)
		0.2°		xy ±0.003(0.375~4 cd/㎡) xy ±0.002(4 ~ cd/㎡)
		0.1°		xy ±0.003(1.5 ~15 cd/㎡) xy ±0.002(15 ~ cd/㎡)
Repeatability	Luminance *2	2°	1.5%(0.0005~0.005cd/㎡) 0.4%(0.005~0.1 cd/㎡) 0.3%(0.1 ~ cd/㎡)	1.5%(0.005~0.05cd/㎡) 0.4%(0.05~1 cd/㎡) 0.3%(1 ~ cd/㎡)
		1°	1.5%(0.0015~0.015cd/㎡) 0.4%(0.015~0.3 cd/㎡) 0.3%(0.3 ~ cd/㎡)	1.5%(0.015~0.15cd/㎡) 0.4%(0.15~3 cd/㎡) 0.3%(3 ~ cd/㎡)
		0.2°	1.5%(0.0375~0.4cd/㎡) 0.4%(0.4 ~7.5cd/㎡) 0.3%(7.5 ~ cd/㎡)	1.5%(0.375~ 4cd/㎡) 0.4%(4 ~ 75cd/㎡) 0.3%(75 ~ cd/㎡)
		0.1°	1.5%(0.15 ~1.5cd/㎡) 0.4%(1.5 ~30cd/㎡) 0.3%(30 ~ cd/㎡)	1.5%(1.5 ~ 15cd/㎡) 0.4%(15 ~300cd/㎡) 0.3%(300 ~ cd/㎡)
	Chromaticity *3	2°	0.005 (0.0005 ~0.005 cd/㎡) 0.0015(0.005~0.1 cd/㎡) 0.0005(0.1 ~ cd/㎡)	0.005 (0.005 ~0.05 cd/㎡) 0.0015(0.05~1 cd/㎡) 0.0005(1 ~ cd/㎡)
		1°	0.005 (0.0015~0.015cd/㎡) 0.0015(0.015~0.3 cd/㎡) 0.0005(0.3 ~ cd/㎡)	0.005 (0.015~0.15cd/㎡) 0.0015(0.15~3 cd/㎡) 0.0005(3 ~ cd/㎡)
		0.2°	0.005 (0.0375~0.4 cd/㎡) 0.0015(0.4 ~7.5 cd/㎡) 0.0005(7.5 ~ cd/㎡)	0.005 (0.375~4 cd/㎡) 0.0015(4 ~75 cd/㎡) 0.0005(75 ~ cd/㎡)
		0.1°	0.005 (0.15 ~1.5cd/㎡) 0.0015(1.5~30 cd/㎡) 0.0005(30 ~ cd/㎡)	0.005 (1.5 ~15cd/㎡) 0.0015(15~300 cd/㎡) 0.0005(300 ~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.
*4 SPEC. SR-UL2S

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			High speed 2 mode	High speed 3 mode
Accuracy ensuring range (against the standard light A)		2°	0.005~ 3 000 cd/㎡	0.05~ 3 000 cd/㎡
		1°	0.015~ 9 000 cd/㎡	0.15~ 9 000 cd/㎡
		0.2°	0.375~ 70 000 cd/㎡	3.75~ 70 000 cd/㎡
		0.1°	1.5 ~300 000 cd/㎡	15 ~300 000 cd/㎡
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	Every measuring angle	±2%	
	Chromaticity *1	2°	xy ±0.002 xy ±0.0013 *4	xy ±0.003(0.05~0.5 cd/㎡) xy ±0.002(0.5~ cd/㎡)
		1°		xy ±0.003(0.15~1.5 cd/㎡) xy ±0.002(1.5~ cd/㎡)
		0.2°		xy ±0.003(3.75~40 cd/㎡) xy ±0.002(40~ cd/㎡)
		0.1°		xy ±0.003(15 ~150 cd/㎡) xy ±0.002(150~ cd/㎡)
Repeatability	Luminance *2	2°	1.5%(0.005~0.05 cd/㎡) 0.4%(0.05~1 cd/㎡) 0.3%(1~ cd/㎡)	1.5%(0.05~0.5 cd/㎡) 0.4%(0.5~10 cd/㎡) 0.3%(10~ cd/㎡)
		1°	1.5%(0.015~0.15 cd/㎡) 0.4%(0.15~3 cd/㎡) 0.3%(3~ cd/㎡)	1.5%(0.15~1.5 cd/㎡) 0.4%(1.5~30 cd/㎡) 0.3%(30~ cd/㎡)
		0.2°	1.5%(0.375~4 cd/㎡) 0.4%(4~75 cd/㎡) 0.3%(75~ cd/㎡)	1.5%(3.75~ 40 cd/㎡) 0.4%(40~750 cd/㎡) 0.3%(750~ cd/㎡)
		0.1°	1.5%(1.5~15 cd/㎡) 0.4%(15~300 cd/㎡) 0.3%(300~ cd/㎡)	1.5%(15~150 cd/㎡) 0.4%(150~3000 cd/㎡) 0.3%(3000~ cd/㎡)
	Chromaticity *3	2°	0.005 (0.005 ~0.05 cd/㎡) 0.0015(0.05~1 cd/㎡) 0.0005(1~ cd/㎡)	0.005 (0.05~0.5 cd/㎡) 0.0015(0.5~10 cd/㎡) 0.0005(10~ cd/㎡)
		1°	0.005 (0.015~0.15 cd/㎡) 0.0015(0.15~3 cd/㎡) 0.0005(3~ cd/㎡)	0.005 (0.15~1.5 cd/㎡) 0.0015(1.5~30 cd/㎡) 0.0005(30~ cd/㎡)
		0.2°	0.005 (0.375~4 cd/㎡) 0.0015(4~75 cd/㎡) 0.0005(75~ cd/㎡)	0.005 (3.75~40 cd/㎡) 0.0015(40~750 cd/㎡) 0.0005(750~ cd/㎡)
		0.1°	0.005 (1.5~15 cd/㎡) 0.0015(15~300 cd/㎡) 0.0005(300~ cd/㎡)	0.005 (15~150 cd/㎡) 0.0015(150~3000 cd/㎡) 0.0005(3000~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.
*4 SPEC. SR-UL2S

Communication time

Remote via USB device STB Command	Approx. 0.9 sec
Remote via USB device ST Command	Approx. 2.2 sec
Remote via RS232C device STCommand	Approx. 7.1 sec

*Communication time is depend on measurement

Temperature characteristic
Within ±3 % against luminance value
(The luminance of 20 °C should be standard in the range of 5°C ~30 °C.)

Polarized light characteristic
Luminance 1% or less Spectral radiance 2% or less(400~780nm)

Warm-up time
40 minutes or above
No warm-up time needed under following conditions.
Measuring field:2°
Luminance of object to be measured is 1cd/m2 or above
Operating conditions is 23°C

Calibration standard
TOPCON TECHNOHOUSE calibration standard (Standard light A / 23° C ± 3°C / 50 % ± 15 %RH)

Display
Dot matrix LC display (20 characters × 4 lines) with lighting

Interface
USB 2.0 (Full speed: 12 Mbps)
RS-232C

Communication speed:	4800/9600/19200/38400 BPS
Data length:	7 bit/8 bit
Parity:	EVEN/ODD/NONE
Stop bit:	1 bit/2 bit

Power supply:
Provided AC adapter

Power consumption:
Approx. 36 W

Operation conditions:
Temperature: 5°C~30 °C Humidity: 80 %RH or less

Storing conditions:
Temperature: -10°C~50 °C Humidity: 80 %RH or less

External dimensions:
Approx. 150 mm (width) × 239 mm (height) × 406 mm (length)

Weight:
Approx. 5.5 kg (only main body)

FCC Compliance Information

This device complies with Part 15 of FCC Rules. Operation is subject to the following twoconditions:
(1) the device may not cause interference, and
(2) the device must accept anyinterference, including interference that may cause undesired operation of this device.
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expence.

Republic of Korea	KC:Class A	해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다 A급 기기 (업무용 방송통신기자재) 이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다

EU Battery Directive

This symbol is applicable to EU members states only.

Battery users must not dispose of batteries as unsorted general waste, but treat properly.
If a chemical symbol is printed bebeath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:
Hg: mercury(0.0005%), Cd: cadmium(0.002%), Pb: lead(0.004%)

These ingredients may be seriously hazardous to human and the global environment.

This product contains a backup battery cell.
You cannot replace batteries by yourself. When you need to replace and/or dispose batteries, contact your local deadler.

- SR-UL1R

Optical system

Objective lens:	Focal distance	f = 82 mm F 2.5
Eyepiece lens:	Finder visual field	5 °
	Vision adjusting range	±5 diopt

Spectroscope

Spectrum wavelength width:	5~8 nm
Spectral diffraction:	Polychrome meter
Dispersive element:	Diffraction grating

Optical receiving element:

Electronic cooling linear array sensor

Measuring field:

2°, 1°, 0.2°, 0.1° with electronic adjustment

Measuring distance:

350 mm~∞ (Distance from the end of the objective lens metal fixture)

Measuring wavelength range:

380 nm~780 nm

Sampling interval:

1 nm

Measurement mode:

Auto/Manual (Frequency/Integral time), and external vertical synchronous signal input

Measurement diameter

(Unit: mmø)

Measuring field	Measuring distance (mm)							
	350	400	500	600	800	1000	2000	5000
2°	10.0	11.7	15.1	18.6	25.4	32.2	66.4	169
1°	4.99	5.84	7.55	9.26	12.7	16.1	33.2	84.4
0.2°	1.00	1.17	1.51	1.86	2.54	3.22	6.64	16.9
0.1°	0.50	0.59	0.76	0.93	1.27	1.61	3.32	8.44

* The measuring distance is the distance from the end of the objective lens metal fixture.

* The values of this table are design reference values and they are sometimes a little different from the actual values.

Measuring functions

The following measurements can be done by using the display modes.

- x, y, Lv (x, y: Chromaticity, Lv: Luminance cd/m^2)
- u', v', Lv (u', v': Chromaticity, Lv: Luminance cd/m^2)
- X, Y, Z (X, Y, Z: Tristimulus values)
- Tc, duv, Lv (Tc: Correlated color temperature K, duv: Deviation, Lv: Luminance cd/m^2)
- Le (Le: Radiance W/sr·m^2)

2°/10° visual field can be switched by setting in the function mode.

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			Normal speed mode	High speed mode
Accuracy ensuring range (against the standard light A)		2°	0.001~ 3 000 cd/㎡	0.01~ 3 000 cd/㎡
		1°	0.003~ 9 000 cd/㎡	0.03~ 9 000 cd/㎡
		0.2°	0.075~ 70 000 cd/㎡	0.75~ 70 000 cd/㎡
		0.1°	0.3 ~300 000 cd/㎡	3 ~300 000 cd/㎡
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	Every measuring angle	±2%	
	Chromaticity *1	2°	xy ±0.002	xy ±0.003(0.01~0.05cd/㎡) xy ±0.002(0.05~ cd/㎡)
		1°		xy ±0.003(0.03~0.15cd/㎡) xy ±0.002(0.15~ cd/㎡)
		0.2°		xy ±0.003(0.75~4 cd/㎡) xy ±0.002(4 ~ cd/㎡)
		0.1°		xy ±0.003(3 ~15 cd/㎡) xy ±0.002(15 ~ cd/㎡)
Repeatability	Luminance *2	2°	1.5%(0.001~0.005cd/㎡) 0.4%(0.005~0.1 cd/㎡) 0.3%(0.1 ~ cd/㎡)	1.5%(0.01~0.05 cd/㎡) 0.4%(0.05~1 cd/㎡) 0.3%(1 ~ cd/㎡)
		1°	1.5%(0.003~0.015cd/㎡) 0.4%(0.015~0.3 cd/㎡) 0.3%(0.3 ~ cd/㎡)	1.5%(0.03~0.15 cd/㎡) 0.4%(0.15~3 cd/㎡) 0.3%(3 ~ cd/㎡)
		0.2°	1.5%(0.075~0.4 cd/㎡) 0.4%(0.4 ~7.5 cd/㎡) 0.3%(7.5 ~ cd/㎡)	1.5%(0.75~ 4 cd/㎡) 0.4%(4 ~ 75 cd/㎡) 0.3%(75 ~ cd/㎡)
		0.1°	1.5%(0.3 ~1.5 cd/㎡) 0.4%(1.5 ~30 cd/㎡) 0.3%(30 ~ cd/㎡)	1.5%(3 ~ 15cd/㎡) 0.4%(15 ~300 cd/㎡) 0.3%(300 ~ cd/㎡)
	Chromaticity *3	2°	0.005 (0.001 ~0.005 cd/㎡) 0.0015(0.005~0.1 cd/㎡) 0.0005(0.1 ~ cd/㎡)	0.005 (0.01 ~0.05 cd/㎡) 0.0015(0.05~1 cd/㎡) 0.0005(1 ~ cd/㎡)
		1°	0.005 (0.003~0.015cd/㎡) 0.0015(0.015~0.3 cd/㎡) 0.0005(0.3 ~ cd/㎡)	0.005 (0.03~0.15 cd/㎡) 0.0015(0.15~3 cd/㎡) 0.0005(3 ~ cd/㎡)
		0.2°	0.005 (0.075~0.4 cd/㎡) 0.0015(0.4 ~7.5 cd/㎡) 0.0005(7.5 ~ cd/㎡)	0.005 (0.75~4 cd/㎡) 0.0015(4 ~75 cd/㎡) 0.0005(75 ~ cd/㎡)
		0.1°	0.005 (0.3 ~1.5 cd/㎡) 0.0015(1.5~30 cd/㎡) 0.0005(30 ~ cd/㎡)	0.005 (3 ~15 cd/㎡) 0.0015(15~300 cd/㎡) 0.0005(300 ~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			High speed 2 mode	High speed 3 mode
Accuracy ensuring range (against the standard light A)		2°	0.01~ 3 000 cd/㎡	0.1~ 3 000 cd/㎡
		1°	0.03~ 9 000 cd/㎡	0.3~ 9 000 cd/㎡
		0.2°	0.75~ 70 000 cd/㎡	7.5~ 70 000 cd/㎡
		0.1°	3 ~ 300 000 cd/㎡	30 ~ 300 000 cd/㎡
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	Every measuring angle	±2%	
	Chromaticity *1	2°	xy ±0.002	xy ±0.003(0.1~0.5 cd/㎡) xy ±0.002(0.5~ cd/㎡)
		1°		xy ±0.003(0.3~1.5 cd/㎡) xy ±0.002(1.5~ cd/㎡)
		0.2°		xy ±0.003(7.5~40 cd/㎡) xy ±0.002(40~ cd/㎡)
		0.1°		xy ±0.003(30 ~150 cd/㎡) xy ±0.002(150~ cd/㎡)
Repeatability	Luminance *2	2°	1.5%(0.01~0.05 cd/㎡) 0.4%(0.05~1 cd/㎡) 0.3%(1~ cd/㎡)	1.5%(0.1~0.5 cd/㎡) 0.4%(0.5~10 cd/㎡) 0.3%(10~ cd/㎡)
		1°	1.5%(0.03~0.15 cd/㎡) 0.4%(0.15~3 cd/㎡) 0.3%(3~ cd/㎡)	1.5%(0.3~1.5 cd/㎡) 0.4%(1.5~30 cd/㎡) 0.3%(30~ cd/㎡)
		0.2°	1.5%(0.75~4 cd/㎡) 0.4%(4~75 cd/㎡) 0.3%(75~ cd/㎡)	1.5%(7.5~ 40 cd/㎡) 0.4%(40~750 cd/㎡) 0.3%(750~ cd/㎡)
		0.1°	1.5%(3~15 cd/㎡) 0.4%(15~300 cd/㎡) 0.3%(300~ cd/㎡)	1.5%(30~150 cd/㎡) 0.4%(150~3000 cd/㎡) 0.3%(3000~ cd/㎡)
	Chromaticity *3	2°	0.005 (0.01 ~0.05 cd/㎡) 0.0015(0.05~1 cd/㎡) 0.0005(1~ cd/㎡)	0.005 (0.1~0.5 cd/㎡) 0.0015(0.5~10 cd/㎡) 0.0005(10~ cd/㎡)
		1°	0.005 (0.03~0.15 cd/㎡) 0.0015(0.15~3 cd/㎡) 0.0005(3~ cd/㎡)	0.005 (0.3~1.5 cd/㎡) 0.0015(1.5~30 cd/㎡) 0.0005(30~ cd/㎡)
		0.2°	0.005 (0.75~4 cd/㎡) 0.0015(4~75 cd/㎡) 0.0005(75~ cd/㎡)	0.005 (7.5~40 cd/㎡) 0.0015(40~750 cd/㎡) 0.0005(750~ cd/㎡)
		0.1°	0.005 (3~15 cd/㎡) 0.0015(15~300 cd/㎡) 0.0005(300~ cd/㎡)	0.005 (30~150 cd/㎡) 0.0015(150~3000 cd/㎡) 0.0005(3000~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.

Communication time

Remote via USB device STB Command	Approx. 0.9 sec
Remote via USB device ST Command	Approx. 2.2 sec
Remote via RS232C device STCommand	Approx. 7.1 sec

*Communication time is depend on measurement

Temperature characteristic
Within ±3 % against luminance value
(The luminance of 20 °C should be standard in the range of 5°C ~30 °C.)

Polarized light characteristic
Luminance 1% or less Spectral radiance 2% or less(400~780nm)

Warm-up time
40 minutes or above
No warm-up time needed under following conditions.
Measuring field:2°
Luminance of object to be measured is 1cd/m2 or above
Operating conditions is 23°C

Calibration standard
TOPCON TECHNOHOUSE calibration standard (Standard light A / 23° C ± 3°C / 50 % ± 15 %RH)

Display
Dot matrix LC display (20 characters × 4 lines) with lighting

Interface
USB 2.0 (Full speed: 12 Mbps)
RS-232C

Communication speed:	4800/9600/19200/38400 BPS
Data length:	7 bit/8 bit
Parity:	EVEN/ODD/NONE
Stop bit:	1 bit/2 bit

Power supply:
Provided AC adapter

Power consumption:
Approx. 36 W

Operation conditions:
Temperature: 5°C~30 °C Humidity: 80 %RH or less

Storing conditions:
Temperature: -10°C~50 °C Humidity: 80 %RH or less

External dimensions:
Approx. 150 mm (width) × 239 mm (height) × 406 mm (length)

Weight:
Approx. 5.5 kg (only main body)

FCC Compliance Information

This device complies with Part 15 of FCC Rules. Operation is subject to the following twoconditions:
(1) the device may not cause interference, and
(2) the device must accept anyinterference, including interference that may cause undesired operation of this device.
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expence.

Republic of Korea	KC:Class A	해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다 A급 기기 (업무용 방송통신기자재) 이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다

EU Battery Directive

This symbol is applicable to EU members states only.

Battery users must not dispose of batteries as unsorted general waste, but treat properly.
If a chemical symbol is printed bebeath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:
Hg: mercury(0.0005%), Cd: cadmium(0.002%), Pb: lead(0.004%)

These ingredients may be seriously hazardous to human and the global environment.

This product contains a backup battery cell.
You cannot replace batteries by yourself. When you need to replace and/or dispose batteries, contact your local deadler.

- SR-3AR

Optical system

Objective lens:	Focal distance	f = 82 mm F 2.5
Eyepiece lens:	Finder visual field	5 °
	Vision adjusting range	±5 diopt

Spectroscope

Spectrum wavelength width:	5~8 nm
Spectral diffraction:	Polychrome meter
Dispersive element:	Diffraction grating

Optical receiving element:

Electronic cooling linear array sensor

Measuring field:

2°, 1°, 0.2°, 0.1° with electronic adjustment

Measuring distance:

350 mm~∞ (Distance from the end of the objective lens metal fixture)

Measuring wavelength range:

380 nm~780 nm

Sampling interval:

1 nm

Measurement mode:

Auto/Manual (Frequency/Integral time), and external vertical synchronous signal input

Measurement diameter

(Unit: mmø)

Measuring field	Measuring distance (mm)							
	350	400	500	600	800	1000	2000	5000
2°	10.0	11.7	15.1	18.6	25.4	32.2	66.4	169
1°	4.99	5.84	7.55	9.26	12.7	16.1	33.2	84.4
0.2°	1.00	1.17	1.51	1.86	2.54	3.22	6.64	16.9
0.1°	0.50	0.59	0.76	0.93	1.27	1.61	3.32	8.44

* The measuring distance is the distance from the end of the objective lens metal fixture.

* The values of this table are design reference values and they are sometimes a little different from the actual values.

Measuring functions

The following measurements can be done by using the display modes.

- x, y, Lv (x, y: Chromaticity, Lv: Luminance cd/m^2)
- u', v', Lv (u', v': Chromaticity, Lv: Luminance cd/m^2)
- X, Y, Z (X, Y, Z: Tristimulus values)
- Tc, duv, Lv (Tc: Correlated color temperature K, duv: Deviation, Lv: Luminance cd/m^2)
- Le (Le: Radiance W/sr·m^2)

2 °/10 ° visual field can be switched by setting in the function mode.

* The indicated accuracy is the value when shipped.

<table>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2">Measuring field</td><td colspan="2">Measuring speed</td></tr>
<tr><td>Normal speed mode</td><td>High speed mode</td></tr>
<tr><td colspan="2" rowspan="4">Accuracy ensuring range
(against the standard light A)</td><td>2°</td><td colspan="2">0.1~ 3 000 cd/㎡</td></tr>
<tr><td>1°</td><td colspan="2">0.3~ 9 000 cd/㎡</td></tr>
<tr><td>0.2°</td><td colspan="2">7.5~ 70 000 cd/㎡</td></tr>
<tr><td>0.1°</td><td colspan="2">30 ~300 000 cd/㎡</td></tr>
<tr><td rowspan="13">Accuracy</td><td>Wavelength</td><td>-</td><td colspan="2">±0.3 nm (against the specified bright line of mercury)</td></tr>
<tr><td rowspan="4">Luminance
*1</td><td>2°</td><td rowspan="4">±2%</td><td>±5%(0.1~0.5cd/㎡)
±2%(0.5~ cd/㎡)</td></tr>
<tr><td>1°</td><td>±5%(0.3~1.5cd/㎡)
±2%(1.5~ cd/㎡)</td></tr>
<tr><td>0.2°</td><td>±5%(7.5 ~40cd/㎡)
±2%(40~ cd/㎡)</td></tr>
<tr><td>0.1°</td><td>±5%(30~150cd/㎡)
±2%(150~ cd/㎡)</td></tr>
<tr><td rowspan="4">Chromaticity
*1</td><td>2°</td><td rowspan="4">xy ±0.002</td><td>xy ±0.005 (0.1~0.5cd/㎡)
xy ±0.002(0.5~ cd/㎡)</td></tr>
<tr><td>1°</td><td>xy ±0.005 (0.3~1.5cd/㎡)
xy ±0.002(1.5~ cd/㎡)</td></tr>
<tr><td>0.2°</td><td>xy ±0.005 (7.5~40 cd/㎡)
xy ±0.002(40 ~ cd/㎡)</td></tr>
<tr><td>0.1°</td><td>xy ±0.005 (30 ~150 cd/㎡)
xy ±0.002(150~ cd/㎡)</td></tr>
<tr><td rowspan="8">Repeatability</td><td rowspan="4">Luminance
*2</td><td>2°</td><td colspan="2" rowspan="4">0.3%</td></tr>
<tr><td>1°</td></tr>
<tr><td>0.2°</td></tr>
<tr><td>0.1°</td></tr>
<tr><td rowspan="4">Chromaticity
*3</td><td>2°</td><td rowspan="4">0.0005</td><td>0.0008(0.1~0.5 cd/㎡)
0.0005(0.5~ cd/㎡)</td></tr>
<tr><td>1°</td><td>0.0008(0.3~1.5 cd/㎡)
0.0005(1.5~ cd/㎡)</td></tr>
<tr><td>0.2°</td><td>0.0008(7.5 ~40 cd/㎡)
0.0005(40~ cd/㎡)</td></tr>
<tr><td>0.1°</td><td>0.0008(30 ~150 cd/㎡)
0.0005(150~ cd/㎡)</td></tr>
</table>

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.

* The indicated accuracy is the value when shipped.

		Measuring field	Measuring speed	
			Normal speed mode	High speed mode
Accuracy ensuring range (against the standard light A)		2°	1 ~ 3 000 cd/㎡	
		1°	3 ~ 9 000 cd/㎡	
		0.2°	75 ~ 70 000 cd/㎡	
		0.1°	300~300 000 cd/㎡	
Accuracy	Wavelength	-	±0.3 nm (against the specified bright line of mercury)	
	Luminance *1	2°	±2%	±5%(1~5 cd/㎡) ±2%(5~ cd/㎡)
		1°		±5%(3~15 cd/㎡) ±2%(15~ cd/㎡)
		0.2°		±5%(75 ~400 cd/㎡) ±2%(400~ cd/㎡)
		0.1°		±5%(300~1500 cd/㎡) ±2%(1500~ cd/㎡)
	Chromaticity *1	2°	xy ±0.002	xy ±0.005(1~5 cd/㎡) xy ±0.002(5~ cd/㎡)
		1°		xy ±0.005(3~15 cd/㎡) xy ±0.002(15~ cd/㎡)
		0.2°		xy ±0.005(75~400 cd/㎡) xy ±0.002(400~ cd/㎡)
		0.1°		xy ±0.005(300 ~1500cd/㎡) xy ±0.002(1500~ cd/㎡)
Repeatability	Luminance *2	2°	0.3%	
		1°		
		0.2°		
		0.1°		
	Chromaticity *3	2°	0.0005	0.0008(1~5 cd/㎡) 0.0005(5~ cd/㎡)
		1°		0.0008(3~15 cd/㎡) 0.0005(15~ cd/㎡)
		0.2°		0.0008(75~400 cd/㎡) 0.0005(400~ cd/㎡)
		0.1°		0.0008(300~1500 cd/㎡) 0.0005(1500~ cd/㎡)

*1 Against the standard light A and color matching function type CIE1931.
*2 For continuous 10 measurements, standard deviation is calculated twice.
*3 For continuous 10 measurements, max. value - min. value.

Communication time

Remote via USB device STB Command	Approx. 0.9 sec
Remote via USB device ST Command	Approx. 2.2 sec
Remote via RS232C device STCommand	Approx. 7.1 sec

* Communication time is depend on measurement

Temperature characteristic
Within ±3 % against luminance value
(The luminance of 20 °C should be standard in the range of 5 °C ~35 °C.)

Polarized light characteristic
Luminance 1 % or less Spectral radiance 2 % or less(400~780nm)

Calibration standard
TOPCON TECHNOHOUSE calibration standard (Standard light A / 23 °C ± 3 °C / 50 % ± 15 %RH)

Display
Dot matrix LC display (20 characters × 4 lines) with lighting

Interface
USB 2.0 (Full speed: 12 Mbps)
RS-232C
Communication speed: 4800/9600/19200/38400 BPS
Data length: 7 bit/8 bit
Parity: EVEN/ODD/NONE
Stop bit: 1 bit/2 bit

Power supply:
Provided AC adapter

Power consumption:
Approx. 34 W

Operation conditions:
Temperature: 5 °C~35 °C Humidity: 80 %RH or less

Storing conditions:
Temperature: -10 °C~50 °C Humidity: 80 %RH or less

External dimensions:
Approx. 150 mm (width) × 239 mm (height) × 406 mm (length)

Weight:
Approx. 5.5 kg (only main body)

FCC Compliance Information

This device complies with Part 15 of FCC Rules. Operation is subject to the following twoconditions:
(1) the device may not cause interference, and
(2) the device must accept anyinterference, including interference that may cause undesired operation of this device.
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expence.

Republic of Korea	KC:Class A	해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다 A급 기기 (업무용 방송통신기자재) 이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다

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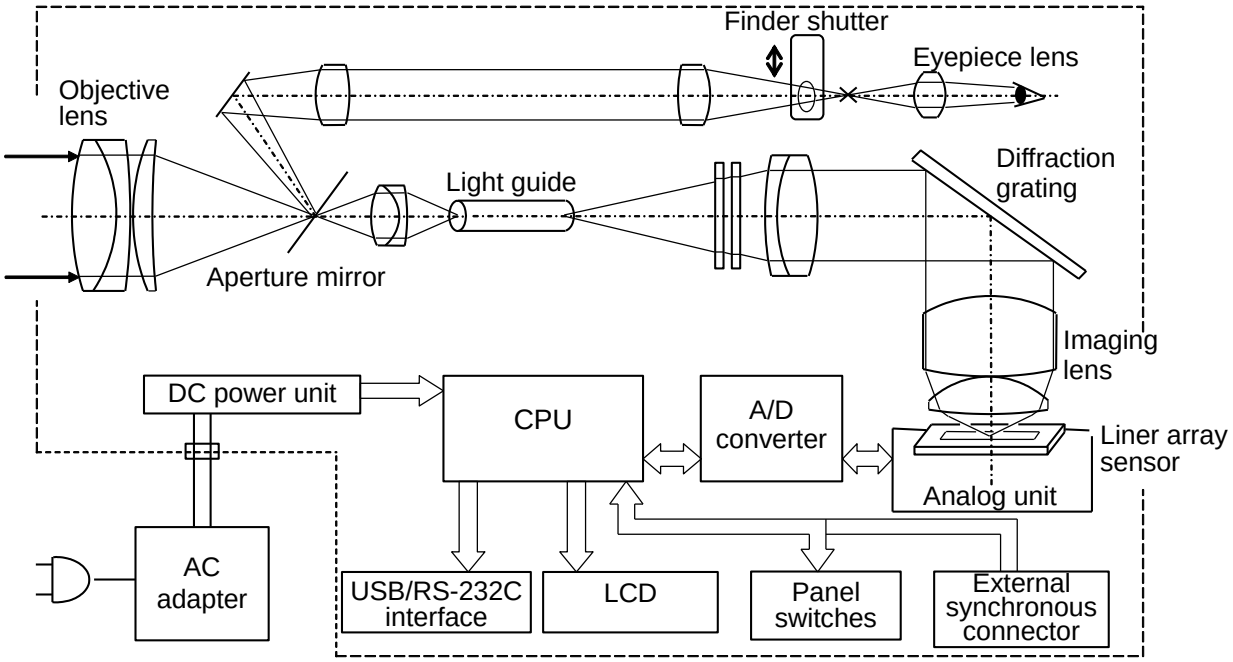
Hg: mercury(0.0005%), Cd: cadmium(0.002%), Pb: lead(0.004%)

These ingredients may be seriously hazardous to human and the global environment.

This product contains a backup battery cell.
You cannot replace batteries by yourself. When you need to replace and/or dispose batteries, contact your local deadler.

Block Diagram



SR-LEDW/SR-UL2/SR-UL1R/SR-3AR Mathematical Formulas

The following formulas are applied by the SR-LEDW/SR-UL2/SR-UL1R/SR-3AR for each data.

Spectral radiance Le (λ)

$$L_{samp}(\lambda) = \frac{L_{ref}(\lambda)}{D_{ref}(\lambda)} \times D_{samp}(\lambda) \quad [\text{ W / sr·m}^2\text{·nm }]$$

$L_{samp}(\lambda)$: Spectral radiance of the object [W/ sr·m²·nm]

$L_{ref}(\lambda)$: Spectral radiance of the perfect reflecting diffuser under standard light A 100π lux [W/ sr· m²·nm]

$D_{ref}(\lambda)$: Output of the photoelectric element when measuring the perfect reflecting diffuser under standard light A 100π lux

$D_{samp}(\lambda)$: Output of the photoelectric element when measuring the object.

Radiance Le

$$Le = \sum_{\lambda 1}^{\lambda 2} L_{samp}(\lambda)\Delta\lambda$$

λ1 : Measuring start wavelength 380 nm

λ2 : Measuring end wavelength 780 nm

Δλ : Δλ =1

Tristimulus values X, Y, Z Luminance Lv

Observation visual field 2°

$$X = K\sum_{\lambda 1}^{\lambda 2} \bar{x}(\lambda) L_{samp}(\lambda)\Delta\lambda$$

$$L_v = Y = K\sum_{\lambda 1}^{\lambda 2} \bar{y}(\lambda) L_{samp}(\lambda)\Delta\lambda$$

$$Z = K\sum_{\lambda 1}^{\lambda 2} \bar{z}(\lambda) L_{samp}(\lambda)\Delta\lambda$$

$\bar{x}(\lambda)$, $\bar{y}(\lambda)$, $\bar{z}(\lambda)$: Color matching functions in CIE 1931 standard colorimetric system

K : Parameter 683 lm/W

λ1 : Measuring start wavelength 380 nm

λ2 : Measuring end wavelength 780 nm

Δλ : Δλ = 1

Observation visual field 10°

$$X_{10} = K\sum_{\lambda 1}^{\lambda 2} \bar{x}_{10}(\lambda)\, L_{samp}(\lambda)\Delta\lambda$$

$$Y_{10} = K\sum_{\lambda 1}^{\lambda 2} \bar{y}_{10}(\lambda)\, L_{samp}(\lambda)\Delta\lambda$$

$$Z_{10} = K\sum_{\lambda 1}^{\lambda 2} \bar{z}_{10}(\lambda)\, L_{samp}(\lambda)\Delta\lambda$$

$\bar{x}10\ (\lambda)$, $\bar{y}10\ (\lambda)$, $\bar{z}10\ (\lambda)$: Color matching functions in CIE 1964 auxiliary standard colorimetric system

K: Parameter 683 lm/W

$\lambda 1$: Measuring start wavelength 380 nm

$\lambda 2$: Measuring end wavelength 780 nm

$\Delta\lambda$: $\Delta\lambda$=1

* "Y" of the observation visual field 2° is used for the luminance Lv of the observation visual field 10°.

Chromaticity coordinates

Observation visual field 2°

"xy" chromaticity coordinates in XYZ colorimetric system

$$x = \frac{X}{X+Y+Z} \qquad y = \frac{Y}{X+Y+Z}$$

"u'v'" chromaticity coordinates in UCS colorimetric system

$$u' = \frac{4X}{X+15Y+3Z} \qquad v' = \frac{9Y}{X+15Y+3Z}$$

Observation visual field 10°

"$x_{10}y_{10}$" chromaticity coordinates in XYZ colorimetric system

$$x_{10} = \frac{X_{10}}{X_{10}+Y_{10}+Z_{10}} \qquad y_{10} = \frac{Y_{10}}{X_{10}+Y_{10}+Z_{10}}$$

"u'v'" chromaticity coordinates in UCS colorimetric system

$$u'_{10} = \frac{4X_{10}}{X_{10}+15Y_{10}+3Z_{10}} \qquad v'_{10} = \frac{9Y_{10}}{X_{10}+15Y_{10}+3Z_{10}}$$

Correlated color temperature and deviation

To calculate the correlated color temperature and deviation, use the spectral distribution of the JIS Z 8725 light source and the measurement method of the correlated color temperature.

Correlated color temperature display range: 1563 K≦Tc≦100 000 K

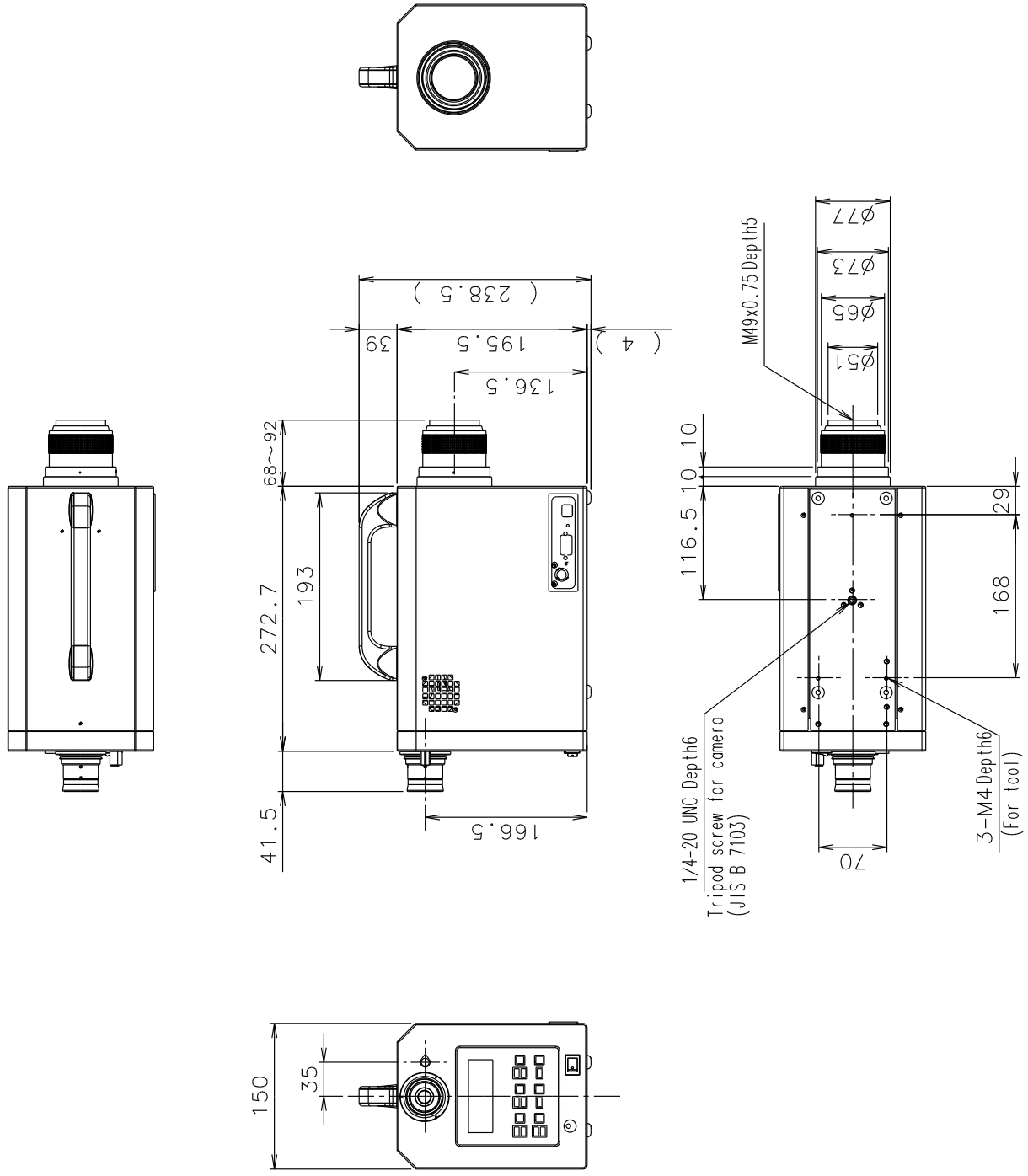
Deviation display range: -0.02≦duv≦0.02

Deviation means the distance from the black body radiation locus on CIE 1960 UCS chromaticity diagram.

External Dimension Diagram

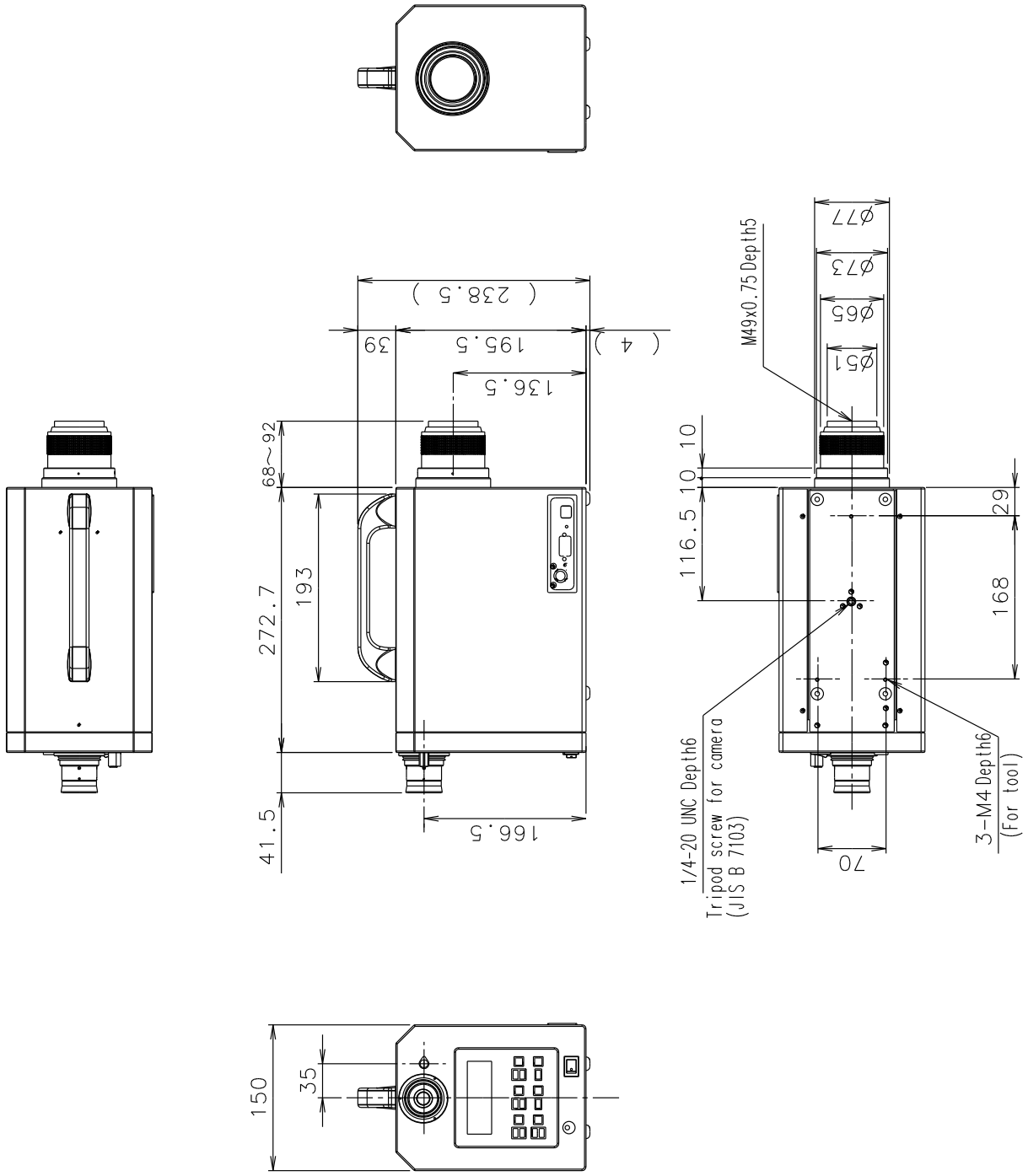
· SR-LEDW/SR-UL2/SR-UL1R

Request	Use only specified screws when using the tripod screw and screw holes for jig attachment. Do not tighten the screws any more than necessary. Doing so might cause internal breakage.



· SR-3AR

Request	Use only specified screws when using the tripod screw and screw holes for jig attachment. Do not tighten the screws any more than necessary. Doing so might cause internal breakage.



Warranty

Warranty Period

One year from the date of shipment

Repairs during the Warranty Period

Failure occurs to the instrument when the instrument has been operated according to the instruction manual and, the failure caused by design or manufacture will be repaired free of charge.

Repairs after Warranty Period

Repair after the warranty period is carried out if possible and have to be paid in full by the user.

Maintenance Period

The repair parts (*1) are retained by us for eight years (*2) after purchase.

The repairable period is this period that parts are kept in stock.

Even after the storage period has elapsed, there are cases in which repair may be possible, so contact the dealer or TOPCON TECHNOHOUSE Corporation.

(*1) Maintence and repair parts are parts that are necessary to maintain the function of the product.

(*2) We make our most effort to keep maintenance and repair parts in stock for the complete storage period, however, due to some unexpected occurrence, the storage period may have to be shortened.

Disposal

When disposing of the product, do so acoording to the local gorvernment ordinance regarding disposal and recycling.

Perchlorate Material – special handling may apply.

See http://www.dtsc.ca.gov/hazardouswaste/perchlorate/

Note; This is applicable to California, U.S.A only

When you ask for service, advice us of the following data.

· Manufacturing serial number	Located on the Name plate on the bottom of the device.
· Period of use	The date of purchase of the instrument, and date of last calibration.
· Operating conditions	Type of light source measured, device settings, measurement values, measurement state, etc.
· Problem	Decription of the trouble as much detail as possible.

Make inquiries to the address indicated on the base of the instruction manual.

SPECTRORADIOMETER

SR-LEDW
SR-UL2
SR-UL1R
SR-3AR

Contact informaion:

TOPCON TECHNOHOUSE CORPORATION

75-1 Hasunuma-cho, Itabashi-ku, Tokyo 174-8580 Japan

◆ **Inquiries regarding the product**

Tel +813(3558) 2666 Fax +813(3558) 4661

◆ **Inquiries regarding repairs and maintenance**

Tel +813(3558) 2710 Fax +813(3558) 3011

Spectro Radiometer SR-LEDW/SR-UL2/SR-UL1R/SR-3AR

Instruction Manual

Date of Issue of 1st edition Aug., 2007

23th edition Dec., 2022

TOPCON TECHNOHOUSE CORPORATION

75-1 Hasunuma-cho, Itabashi-ku, Tokyo 174-8580 Japan