

# User Calibration Software

## CM-S20w

### Instruction Manual



Make sure to read  
this before use.



KONICA MINOLTA



## Safety Precautions

Before you using this software, we recommend that you thoroughly read this manual as well as the instruction manuals of your PC and the spectrophotometer.

## Formal designations of application software used in this manual

(Designation in this manual)	(Formal designation)
Windows, Windows 7	Microsoft® Windows® 7 Professional Operating System
Windows, Windows 8.1	Microsoft® Windows® 8.1 Pro Operating System
Windows, Windows 10	Microsoft® Windows® 10 Pro Operating System

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# Introduction

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## <User Calibration Software CM-S20w>

When performing color management using multiple colorimeters and “out of standard” data occurs, this result may be due to the inter-instrument agreement between colorimeters or to the coating of test specimens (or both).

When conducting strict color management using multiple instruments, it is necessary to eliminate any influence due to the inter-instrument agreement between colorimeters as far as possible, thereby enabling focus only on the coating of test specimens.

The CM-S20w user calibration software is designed for calibration of the CM-512m3A spectrophotometer, in order to minimize the influence of inter-instrument agreement.

Using the CM-S20w, the correction coefficient between the master instrument and working instrument is determined for each color, and then set for the used device. Using this correction coefficient at the time of measurement reduces the influence of inter-instrument agreement, thereby enabling more precise data to be obtained.

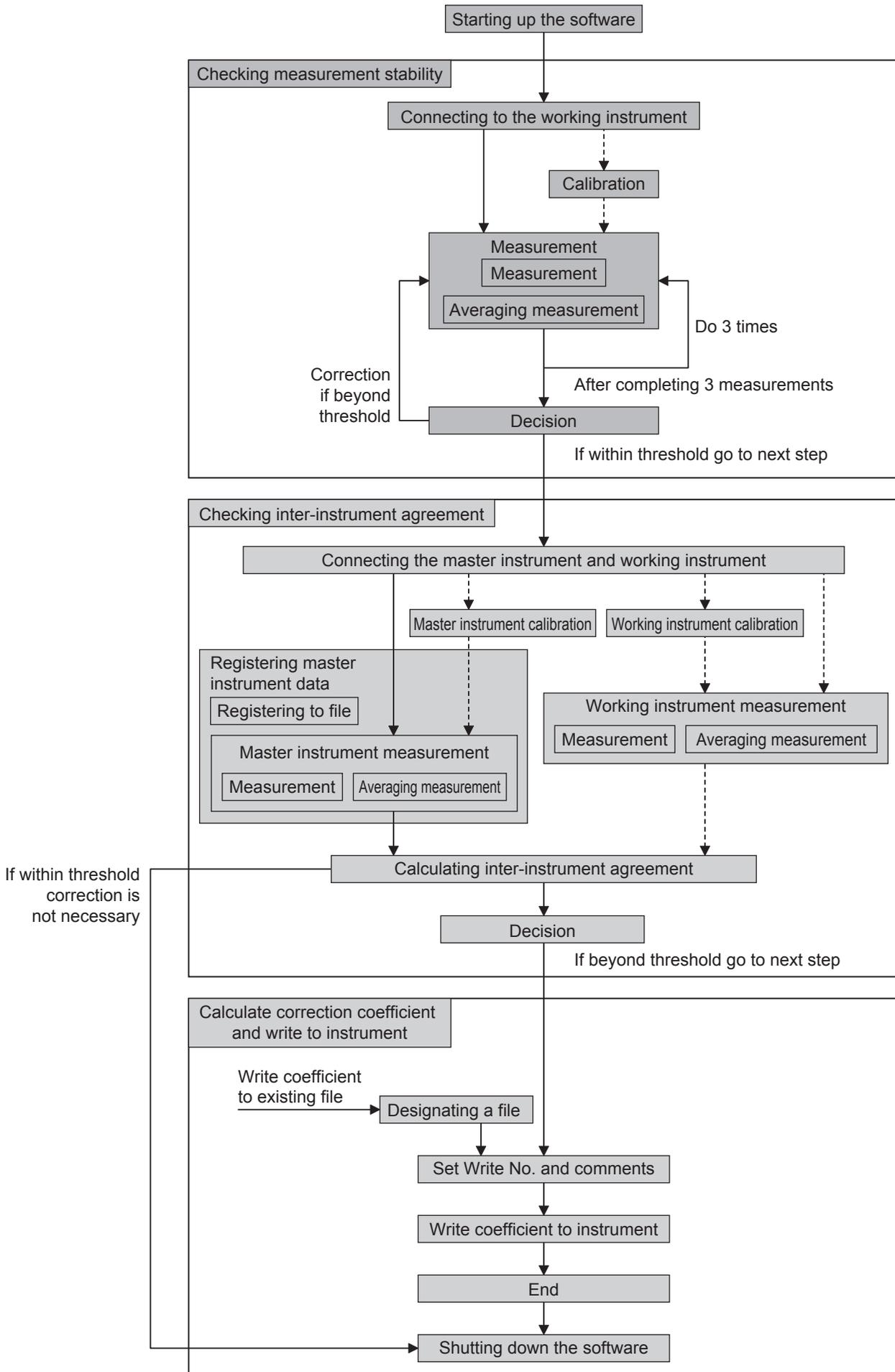
Note that the CM-512m3, which is the previous version of the CM-512m3A, can also be used as the master instrument.

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# Operation Flow



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## **<Step 1> Checking measurement stability**

For user calibration to function effectively, it is necessary to conduct stable measurements by using a jig, averaging measurements, or other method.

Here, we check the stability of measurements. If the variance  $\Delta E^*$  from three measurements is less than a threshold value (default value: 0.2), you can proceed to the next step.

If the variation does not satisfy the condition, user calibration may not be functioning properly (correction makes inter-instrument agreement bigger rather than smaller), so you cannot proceed to the next step.

## **<Step 2> Checking the inter-instrument agreement between two instruments**

Measure the standard color plate using the master instrument (CM-512m3A or CM-512m3) and working instrument (CM-512m3A) to determine the inter-instrument agreement.

If the inter-instrument agreement  $\Delta E^*$  is greater than a threshold value (default value: 0.5), user calibration is considered necessary.

Proceed to the next step.

When inter-instrument agreement condition is satisfied, there is no more need for user calibration.

Complete the operation.

## **<Step 3> Calculating the correction coefficient and write it to the instrument**

The correction coefficient is calculated from the value of inter-instrument agreement.

The correction coefficient is written to the working instrument (CM-512m3A). Since you can specify a User Calibration No. and set color names or comments to the number, it is possible to check the color written to the working instrument later.

If a correction coefficient for each color is set in the working instrument, user calibration functions effectively, so write correction coefficients for the standard color plates for the number of target colors on the production line. Up to 30 colors can be set. (Do not set correction coefficients for color plates that are not targets on that particular line.)

# Starting up the Software

## 0-1. Starting up the software

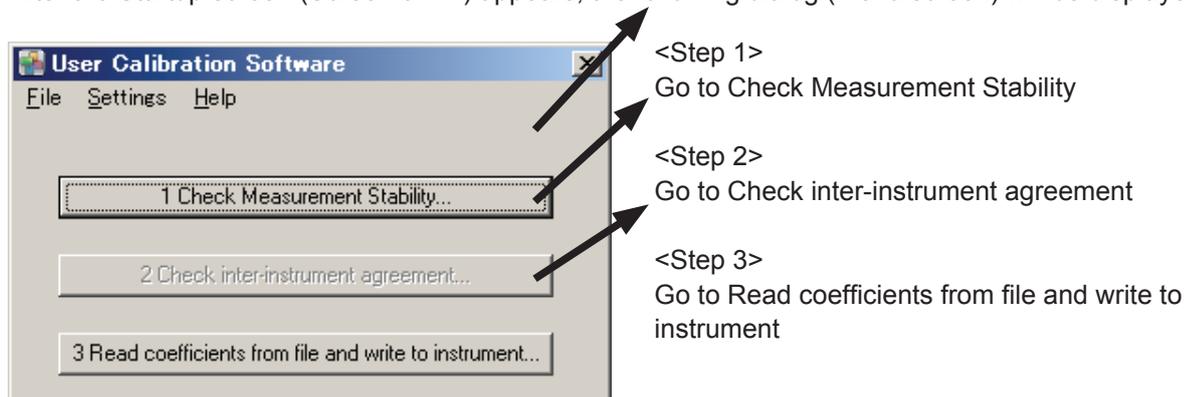
For information on installing the CM-S20w software, refer to the Installation Guide.

Select the CM-S20w icon registered with the Start menu (or the Start screen). When the CM-S20w software starts, the following splash screen appears.



Screen 0-1-1

After the Startup screen (Screen 0-1-1) appears, the following dialog (Menu screen) will be displayed.



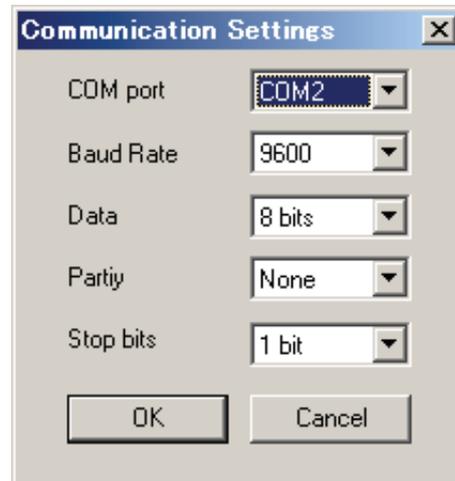
Screen 0-1-2

## 0-2. Communication settings

This screen is used to set serial port operation conditions for communication with the CM-512m3A (or CM-512m3).

Select **Communication Settings** from **Settings** on the menu bar, from the Menu screen (Screen 0-1-2). The following dialog is displayed.

- Set each item and then press the **OK** button.
- The next time you start up the software these settings will be maintained.



Screen 0-2-1

## 0-3. Field of view and light source settings

The CM-S20w uses a 10° (observer) field of view and a D65 light source (illuminant).

While the CM-S20w is connected, the CM-512m3A (or CM-512m3) observer and illuminant settings are 10° and D65, respectively.

## 0-4. Measurement button

Pressing the **Measurement** button displayed on the screen executes measurement with the CM-S20w. While the CM-S20w is connected, the measurement button of the CM-512m3A (or CM-512m3) is inactive.

# <Step 1>

## Checking measurement stability

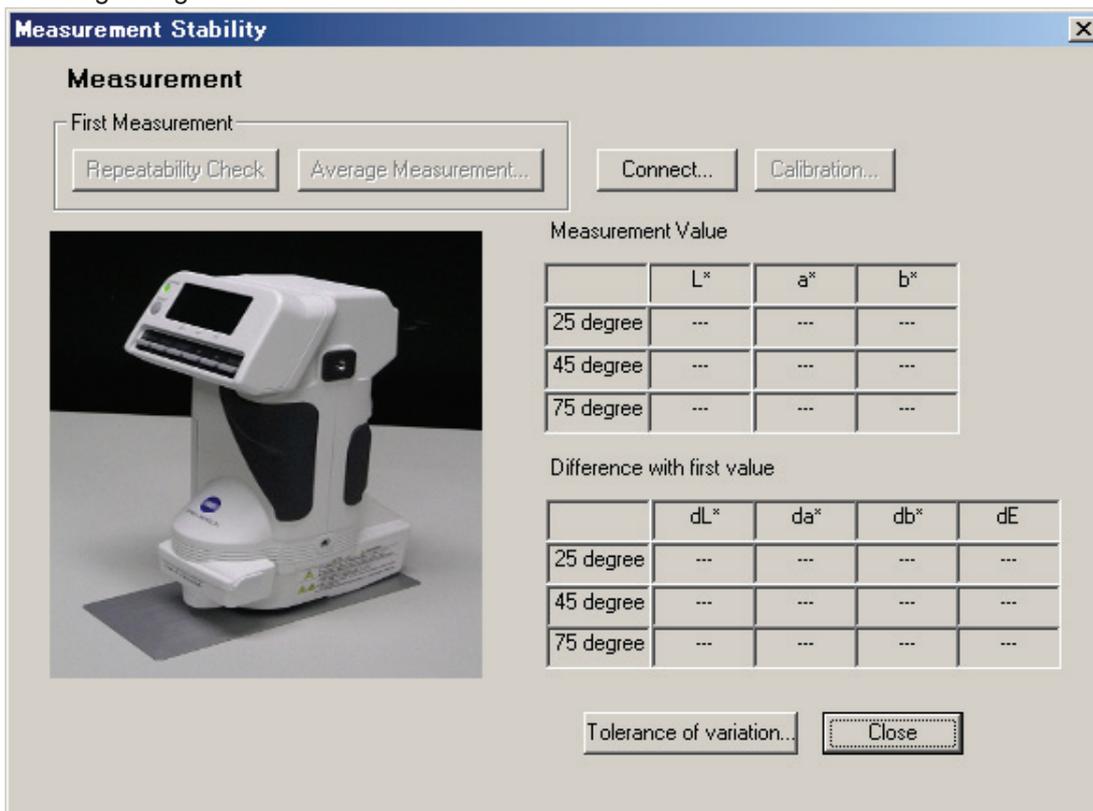
For user calibration to function effectively, it is necessary to conduct stable measurements by using a jig, by averaging measurements, or by some other method.

Here, we check the stability of measurements. If the variance  $\Delta E^*$  from three measurements is less than a threshold value (default value: 0.2), you can proceed to the next step.

If the variance does not satisfy the condition, user calibration may not be functioning properly (correction makes inter-instrument agreement bigger rather than smaller), so you cannot proceed to the next step.

### 1-1. Connecting the working instrument

Press the the **1 Check Measurement Stability** button on the Menu screen (Screen 0-1-2) to display the following dialog.



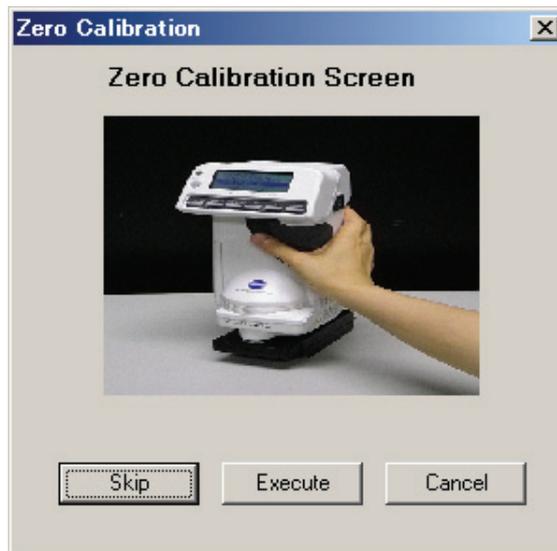
Screen 1-1-1

Connect the working instrument (CM-512m3A) and press the **Connect** button.

## 1-2. Perform calibration (as necessary)

Press the the **Calibration** button on the Measurement Stability screen (Screen 1-1-1) to display the following dialog.

- To skip zero calibration press the **Skip** button.
- Press the **Execute** button to execute zero calibration. The White Calibration Screen will then be displayed.



Screen 1-2-1

- Press the **Execute** button to execute white calibration. The display will then revert to the Measurement Stability screen (Screen 1-1-1).

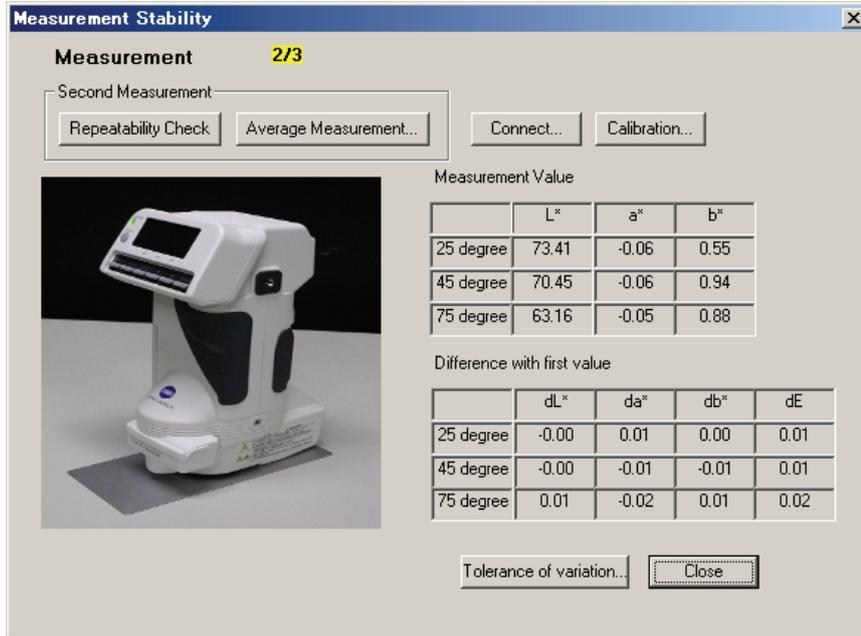


Screen 1-2-1

### 1-3. After measurement the measurement stability is determined

Set the standard color plate to be measured and then press the **Repeatability Check** button on the Measurement Stability screen.

The measurement value will be displayed on the **Measurement Value** button.

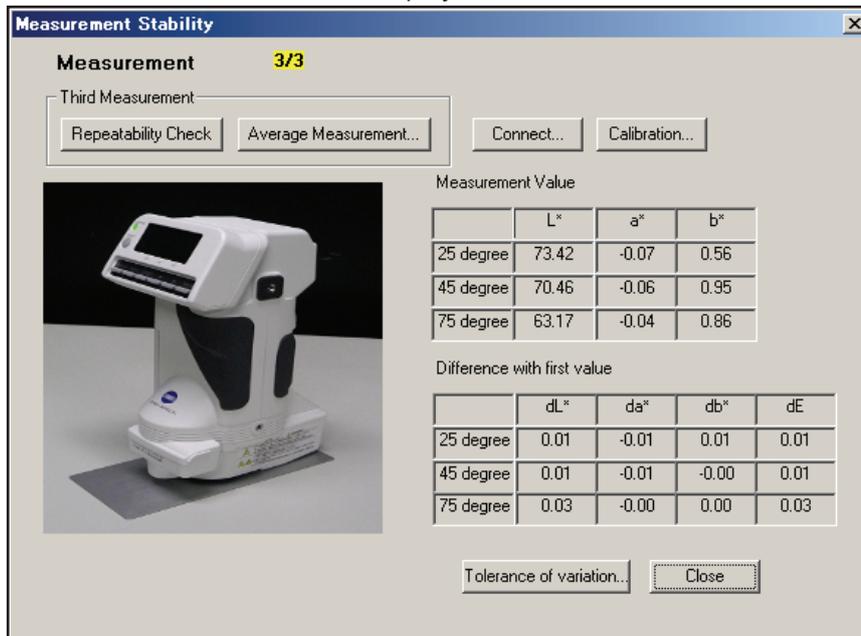


Screen 1-3-1

Next, the second measurement is performed.

Before making the second and third measurements, reset the instrument by lifting it up once. Now check the measurement stability.

The measurement values are displayed in the **Measurement Value** list, and the color difference relative to the first measurement value is displayed under **Difference with first value**.



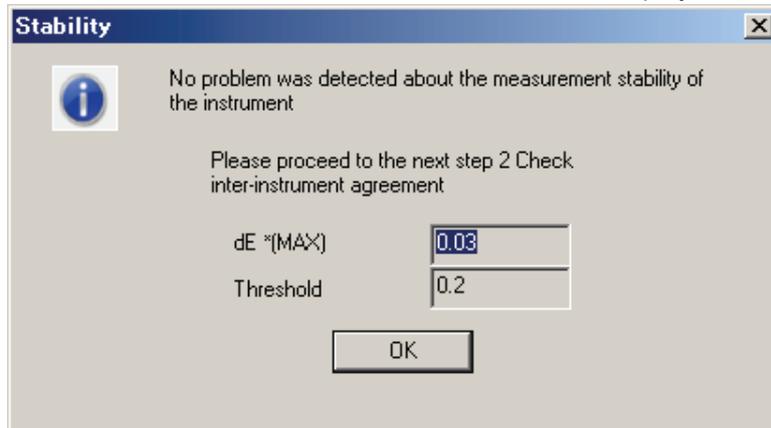
Screen 1-3-2

Next, the third measurement is performed.

Before making the second and third measurements, reset the instrument by lifting it up once. Now check the measurement stability.

When the third measurement is completed, measurement stability is determined based on whether the maximum value of  $\Delta E^*$  (variance) of the second and third measurement values relative to the first measurement value is less than the specified threshold value (default value: 0.2).

Max.  $\Delta E^*$  indicates the maximum value of  $\Delta E^*$  at field of view (observer) values of 25°, 45°, and 75°. If less than the threshold value, Screen 1-3-3 will be displayed.



Screen 1-3-3

- If the variance does not satisfy the condition, user calibration may not be functioning properly (correction makes inter-instrument agreement bigger rather than smaller), so you cannot proceed to the next step. (The **2 Check inter-instrument agreement** button on the Menu screen (Screen 0-1-2) does not work.)
- Repeat steps 1-3 (or 1-4) until measurement stability is achieved.
- The data of the three measurements is saved as a Repeatability measurement results file.
- For details of the format and location of the saved file, see “File Formats” below.

Press the **OK** button to return to the Measurement Stability screen (Screen 1-1-1).

Press the **Close** button on the Measurement Stability screen (Screen 1-1-1) to return to the Menu screen.

## 1-4. Manual averaging measurements

It is possible to conduct manually averaged measurements of individual measurements performed individually using the Measurement Stability screen (Screen 1-1-1). Instead of the Repeatability Check button, press the Average Measurement button. The following dialog is displayed.

	L*	a*	b*
25 degree	73.41	-0.06	0.55
45 degree	70.45	-0.06	0.95
75 degree	63.38	-0.05	0.89

	L*	a*	b*
25 degree	0.00	0.00	0.00
45 degree	0.00	0.00	0.00
75 degree	0.11	0.00	0.01

Screen 1-4-1

- Each time the **Measure** button is pressed a measurement is performed and the average data and standard deviation are displayed on the screen.
- Press the **Finish** button to return to the Measurement Stability screen (Screen 1-3-1), and the averaged data is then displayed in the list of measurement values.
- Up to 30 measurements can be made for averaging. After 30 measurements are made the display will revert to the Measurement screen (Screen 1-3-1), even if the **Finish** button is not pressed, and the averaged measurement results will be displayed under **Measurement Value**.
- After the third measurement Screen 1-3-3 will be displayed.

## 1-5. Changing the threshold value

The default value for the threshold of variation (max.  $\Delta E^*$ ) for deciding measurement stability is 0.2, but this value can be changed.

Press the **Tolerance of variation** button on the Measurement Stability screen (Screen 1-1-1) to display the following dialog.

Threshold which decides PASS or FAIL with Reproducible Measurement      dE \*(MAX)      0.2

Threshold value to judge PASS or FAIL with Instrument Error Measurement      dE \*(MAX)      0.5

Screen 1-5-1

- Input range: 0.01-5.00  
However, should be less than half of the threshold value of the inter-instrument agreement.
- See steps 2-8 and 2-9 for details regarding the threshold values for inter-instrument agreement.

Enter the threshold value then press the **OK** button. The confirmation screen will be displayed. Press the **OK** button to confirm the threshold value. The display will then revert to the Measurement Stability screen (Screen 1-1-1).

# <Step 2>

## Checking the inter-instrument agreement between two instruments

Measure the standard color plates using the master instrument (CM-512m3A or CM-512m3) and the working instrument (CM-512m3A) to determine the inter-instrument agreement.

If the inter-instrument agreement  $\Delta E^*$  is greater than a threshold value (default value: 0.5), user calibration is considered necessary.

Proceed to the next step.

When inter-instrument agreement condition is satisfied, there is no more need for user calibration.

Complete the operation.

### 2-1. Connecting the master instrument

Press the the **2 Check inter-instrument agreement** button on the Menu screen (Screen 0-1-2) to display the following dialog.

**Instrument error confirmation**

**Check inter-instrument agreement**

Connect... Calibration...

Standrad Data

	L*	a*	b*
25 degree	---	---	---
45 degree	---	---	---
75 degree	---	---	---

Sample Data

	L*	a*	b*
25 degree	---	---	---
45 degree	---	---	---
75 degree	---	---	---

Variance Data

	dL*	da*	db*	dE
25 degree	---	---	---	---
45 degree	---	---	---	---
75 degree	---	---	---	---

Buttons: Register using file..., Register master instrument data..., Measurement with working instrument..., Inter-instrument agreement calculation..., Write Coefficient..., Tolerance of inter-instrument agreement..., Reset, Close

Screen 2-1-1

- Connect the master instrument (CM-512m3A or CM-512m3) and press the **Connect** button.

## 2-2. Calibrating the master instrument (as necessary)

Press the **Calibration** button on the Instrument error confirmation screen (Screen 2-1-1) and perform calibration as in step 1-2.

When calibration is completed, the display will revert to the Instrument error confirmation screen (Screen 2-1-1).

## 2-3. Making measurements with the master instrument

Press the **Register master instrument data** button on the Instrument error confirmation screen (Screen 2-1-1) to display the following dialog.



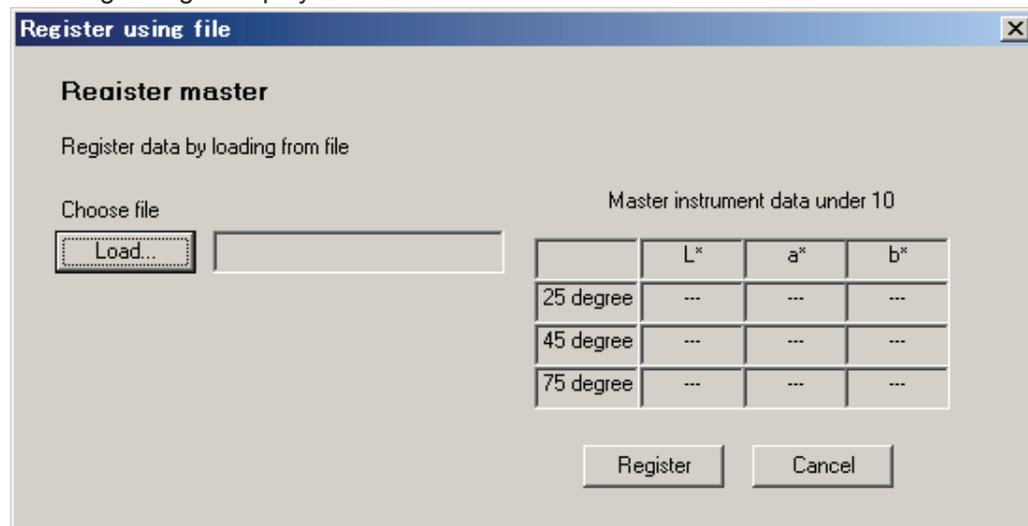
Screen 2-3-1

- Set the standard color plate to be measured and then press the **Measurement** button on Screen 2-3-1.
- When performing manual averages, press the **Average Measurement** button instead of the **Measurement** button, and perform the measurements as in steps 1-4.
- When measurement is complete, the measurement values are displayed under **Standard Data** list on the Instrument error confirmation screen (Screen 2-1-1), and the file for registering master instrument data will be saved.
- For details of the format and location of the saved file, see “File Formats” below.

## 2-4. Registering master instrument data by reading a file

Registering master instrument data can be done by reading from a file rather than each time a measurement is done.

Press the **Register using file** button instead of the **Register master instrument data** button. The following dialog is displayed.



Screen 2-4-1

- Press the **Load** button to display the File selection screen. Select the file for registering master instrument data.
- For details of the file formats that can be read, see “File Formats” below.
- If reading is successful, the data will be displayed under **Master instrument data under 10** list.
- Press the **Register** button to display the data under **Standard Data** list on the Instrument error confirmation screen (Screen 2-1-1).

## 2-5. Connecting the working instrument

Connect the working instrument (CM-512m3A) and press the **Connect** button on the Instrument error confirmation screen (Screen 2-1-1).

- By pressing the **Connect** button, the connected working instrument will be identified by Body No. If this identification does not work, an error will occur when writing the correction coefficient (Step 3).

## 2-6. Calibrating the working instrument (as necessary)

Press the **Calibration** button on the Instrument error confirmation screen (Screen 2-1-1) and perform calibration as in step 2-2.

When calibration is completed, the display will revert to the Instrument error confirmation screen (Screen 2-1-1).

## 2-7. Making measurements with the working instrument

Press the **Measurement with working instrument** button on the Instrument error confirmation screen (Screen 2-1-1) to display the following dialog.



Screen 2-7-1

- Set the standard color plate to be measured and then press the **Measurement** button on Screen 2-7-1.
- To perform manual averages, press the **Average Measurement** button instead of the **Measurement** button, and perform the measurements as in steps 1-4.
- When measurement is completed, the measurement data is displayed under **Sample Data** list on the Instrument error confirmation screen (Screen 2-1-1).

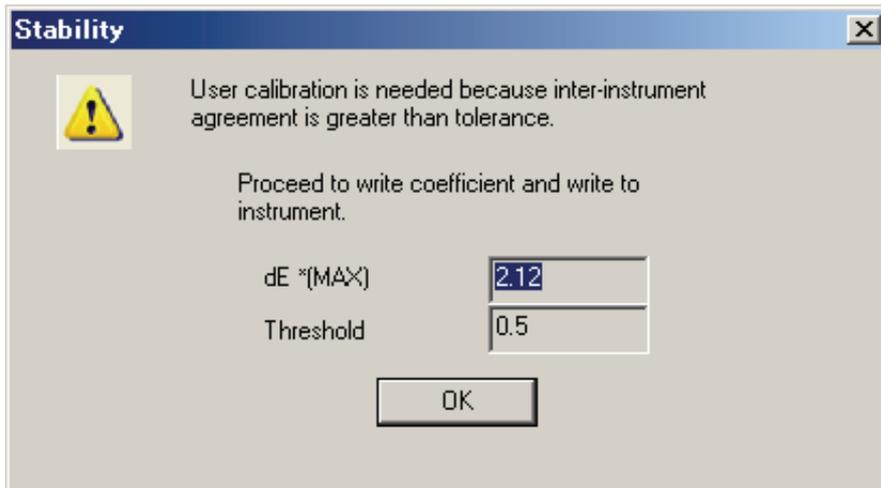
## 2-8. Calculating inter-instrument agreement to decide whether user calibration is necessary

When master instrument data and working instrument data is registered, the **Inter-instrument agreement calculation** button of Variance Data on the Instrument error confirmation screen (Screen 2-1-1) will become active.

When the **Inter-instrument agreement calculation** button is pressed, the max.  $\Delta E^*$  value will be determined from the results of the standard color plate measurements with the master instrument and working instrument.

Then, if the inter-instrument agreement is greater than the threshold value (default value: 0.5), user calibration is considered necessary to correct the inter-instrument agreement.

Max.  $\Delta E^*$  indicates the maximum value of  $\Delta E^*$  at field of view (observer) values of 25°, 45°, and 75°. If higher than the threshold value, Screen 2-8-1 will be displayed.



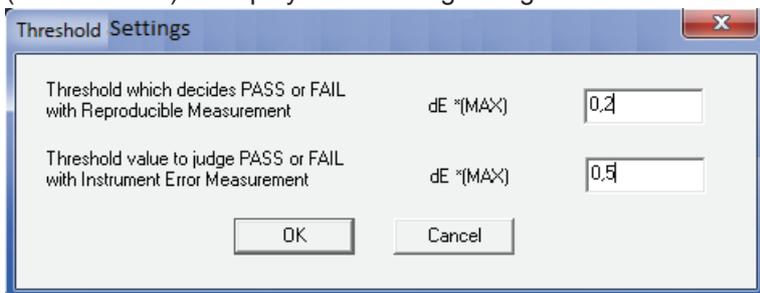
Screen 2-8-1

- When inter-instrument agreement condition is satisfied, there is no more need for user calibration. Complete the operation.
- The data of the master instrument and working instrument are saved as an Inter-instrument agreement measurement results file.
- For details of the format and location of the saved file, see “File Formats” below.
- Press the **OK** button to return to the Instrument error confirmation screen (Screen 2-1-1). The calculated values are displayed under **Variance Data** list.
- If the inter-instrument agreement is high, press the **Write Coefficient** button to write the coefficient and proceed to the screen (Screen 3-1-1).
- Press the **Close** button on the Instrument error confirmation screen (Screen 2-1-1) to return to the Menu screen (Screen 0-1-2).

## 2-9. Changing the threshold value

The default value for the threshold of inter-instrument agreement (max.  $\Delta E^*$ ) for deciding whether user calibration is necessary is 0.5, but this value can be changed.

Press the **Tolerance of inter-instrument agreement** button on the Instrument error confirmation screen (Screen 2-1-1) to display the following dialog.



Screen 2-9-1

- Input range: 0.01-5.00  
However, should be twice or more than the value of the threshold for variance.
- See steps 1-3 and 1-5 for details regarding the threshold values for inter-instrument variance.

Enter the threshold value then press the **OK** button. The confirmation screen will be displayed. Press the **OK** button to confirm the threshold value. The display will then revert to the Instrument error confirmation screen (Screen 2-1-1).

# <Step 3>

## Calculating the correction coefficient and write it to the instrument

The correction coefficient is calculated from the value of inter-instrument agreement.

The correction coefficient is written to the working instrument (CM-512m3A). Since you can specify a user calibration no. and to set color names or comments to the number, it is possible to check the color written to the working instrument later.

If the correction coefficient for each color is set in the working instrument, the user calibration functions effectively, so write correction coefficients for the standard color plates for the number of target colors on the production line.

Up to 30 colors can be set. (Do not set correction coefficients for plates that are not targets on that particular line.)

### 3-1. Calculating and writing correction coefficients to the working instrument

Press the **Write Coefficient** button on the Instrument error confirmation screen (Screen 2-1-1) (or press the **OK** button on the Coefficient Writing screen (Screen 3-3-1)), to confirm the correction coefficient written to the working instrument, and display the next dialog.

**Correction coefficient, write**

**Following User calibration data will be written.**

Specify the calibration data No and select the [Write] button.

Master color plate data under 10 observer / D65 illuminant measured by working instrument

	L*	a*	b*
25 degree	70.98	-0.01	0.37
45 degree	69.98	-0.04	0.97
75 degree	63.15	-0.04	0.93

Delete Calibration Coefficients...

Comment

Write

Write No	Comment
001	456
002	456
003	AAA
004	
005	
006	ASDF
007	ABC1
008	WER

Write Cancel

Screen 3-1-1

The values of the calculated correction coefficients to be written are displayed under “**Master color plate data under 10 observer / D65 illuminant measured by working instrument.**”

If there are correction coefficients already written to the working instrument, comments are displayed along with **Write** list.

Enter a **Comment** and select a User Calibration No. for the working instrument to which the data is to be written from the **Write** list. Then press the **Write** button.

Comments must be numerical

Note that if lowercase roman characters are entered they will be converted to uppercase for display on the CM-512m3A.

If the correction coefficients are successfully written to the working instrument, the Completion screen will be displayed.

Press the **OK** button to return to the original screen (Instrument error confirmation screen (Screen 2-1-1) or Menu screen (Screen 0-1-2)). The written data will be displayed under **Write**.

The written data is saved as a user calibration coefficients results file.  
For details of the format and location of the saved file, see “File Formats” below.

If the correction coefficient for each color is set in the working instrument, the user calibration functions effectively, so write the correction coefficients for the standard color plates for the number of target colors on the production line by repeating steps 2 and 3-1.  
Up to 30 colors can be set. (Do not set correction coefficients for plates that are not targets on that particular line.)

Press the **Cancel** button to return to the Menu screen (Screen 0-1-2) or Instrument error confirmation screen (Screen 2-1-1).

### 3-2. Deleting unneeded correction coefficients written to the working instrument

If correction coefficients corresponding to standard color plates of colors that are not targeted on the particular production line are written to the working instrument, delete these from the working instrument. From the **Write No.** list of the Correction coefficient, write screen (Screen 3-1-1) select the User Calibration No. to be deleted and press the **Deleting calibration coefficients** button. A confirmation dialog will then be displayed.

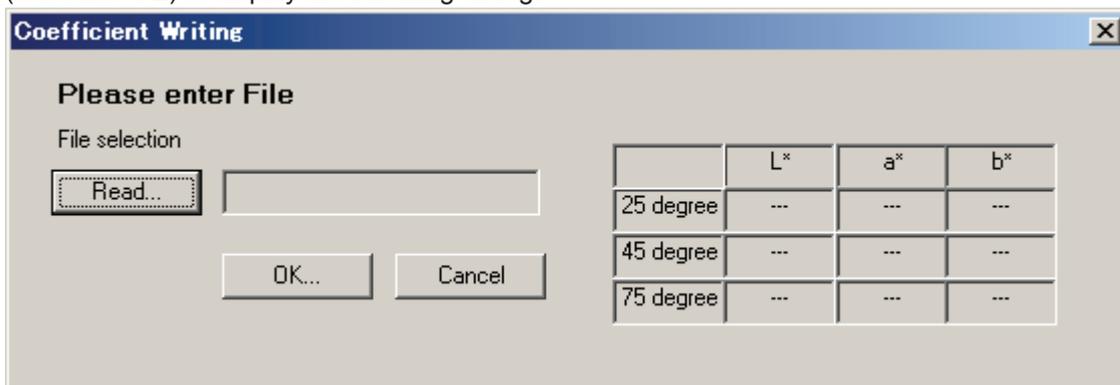
Press the **OK** button to return to the Correction coefficient, write screen (Screen 3-1-1) to delete the correction coefficients corresponding to the selected No.

### 3-3. Writing correction coefficients that have been read from a file to the working instrument

It is also possible to call correction coefficients that are saved in files and write them to the working instrument.

In the case of different correction coefficients used on separate production lines, it is not necessary to make measurements again to determine inter-instrument agreement, which is very convenient.

Press the the **3 Read coefficients from file and write to instrument** button on the Menu screen (Screen 0-1-2) to display the following dialog.



Screen 3-3-1

Press the **Read** button to display the File selection screen. Select a user calibration coefficient results file. For details of the file formats that can be read, see “File Formats” below.

If reading is successful, the data will be displayed.

# File Formats

- Files are all CSV text files.
- Files are saved in the “Documents\KONICA MINOLTA\CM-S20w\Data” folder.
- Monitoring conditions for L\*a\*b\* calculated from spectral reflectivity are for 10° (observer) field of view and D65 light source.
- The format of each file is given below, with the values in the shaded parts.

## 1. Repeatability measurement results file (file name: Reproducibilityresult\_yyyymmdd\_hhmmss.csv)

Date of measurement	xxxxxxx								
Body No.	xxxxxxx								
1st	400 nm	410 nm	420 nm	...	700 nm	L*	a*	b*	
25°									
45°									
75°									
2nd	400 nm	410 nm	420 nm	...	700 nm	L*	a*	b*	ΔE*ab
25°									
45°									
75°									
3rd	400 nm	410 nm	420 nm	...	700 nm	L*	a*	b*	ΔE*ab
25°									
45°									
75°									

## 2. Inter-instrument agreement measurement results file (file name: InstrumentalErrorConfirmationResult\_yyyymmdd\_hhmmss.csv)

Date of measurement	xxxxxxx								
Master instrument body No.	xxxxxxx								
Working instrument body No.	xxxxxxx								
Master instrument	400 nm	410 nm	420 nm	...	700 nm	L*	a*	b*	
25°									
45°									
75°									
Working instrument	400 nm	410 nm	420 nm	...	700 nm	L*	a*	b*	ΔE*ab
25°									
45°									
75°									

**3. User calibration coefficient results file**  
 (file name: UserCalibrationCoefficientResult\_yyyymmdd\_hhmmss.csv)

Date of measurement	xxxxxxx								
Body No.	xxxxxxx								
Comment	xxxxxxx								
Written data									
	400 nm	420 nm	440 nm	•••	700 nm				
25°									
45°									
75°									
Calibration coefficient									
25°									
45°									
75°									
Reference data									
1 Repeatability measurement									
1st	400 nm	410 nm	420 nm	•••	700 nm	L*	a*	b*	
25°									
45°									
75°									
2nd	400 nm	410 nm	420 nm	•••	700 nm	L*	a*	b*	$\Delta E^*ab$
25°									
45°									
75°									
3rd	400 nm	410 nm	420 nm	•••	700 nm	L*	a*	b*	$\Delta E^*ab$
25°									
45°									
75°									
2 Standard color plates data									
Master instrument	400 nm	410 nm	420 nm	•••	700 nm	L*	a*	b*	
25°									
45°									
75°									
Working instrument	400 nm	410 nm	420 nm	•••	700 nm	L*	a*	b*	$\Delta E^*ab$
25°									
45°									
75°									

**4. Master instrument data registering file**  
 (file name: StandardInstrumentdata\_yyyymmdd\_hhmmss.csv)

Date of measurement	xxxxxxx								
Master instrument body No.	xxxxxxx								
Master instrument	400 nm	410 nm	420 nm	•••	700 nm	L*	a*	b*	
25°									
45°									
75°									



KONICA MINOLTA