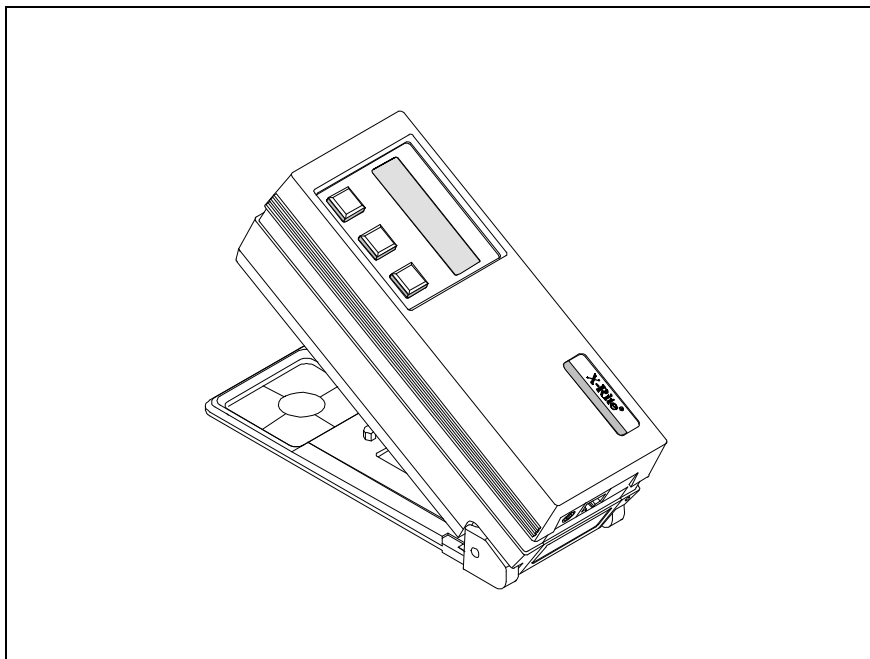


X-Rite[®] CDM



Color Difference Meter

Operation Manual

WARNING: Shielded interface cables must be used in order to maintain compliance with the desired FCC and European emission requirements.

ACHTUNG: Um das Produkt innerhalb der FCC (Vereinigten Staaten) und den europäischen Emissions-Richtlinien zu halten, müssen geschirmte Schnittstellenkabel verwendet werden.

AVISO: Para satisfacer las deseadas regulaciones de emisión para Europa y el FCC, se debe utilizar los cables de interfaz protegidos contra las interferencias electromagnéticas.

AVERTISSEMENT: Des câbles d'interface blindés doivent être utilisés afin de se conformer aux règlements d'émission européens et de FCC (Etats-Unis).

AVVISO: Per conformare con i desiderati regolamentazioni di emissione per Europa ed il FCC, utilizzare i cavi d'interfaccia protetti contro l'interferenze elettromagnetiche.

USE ONLY: AA NiCad batteries that are 600/700mAh rated, six required. Other types may burst causing personal injury.

AUFGEPAßt: Verwenden Sie nur AA NiCad Akkus von 600/700mAh (Milliamper/Stunde) Nennstrom (6 Stück erforderlich). Mit anderen Akkus läuft die Gefahr von Explosion und Verletzung.

ATENCIÓN: Use solamente las pilas de AA NiCad (se requiere seis) con condiciones de funcionamiento normales 600/700mAh (horas miliamperios). Es posible que los otros tipos puedan estallar y causar daños corporales.

ATTENTION: Utiliser seulement les batteries NiCad à courant nominal de 600mAh (milliampère/heure) (6 pièces nécessaire). Il y a danger d'explosion et de blessures avec les autres types.

ATTENZIONE: Usare solamente gli accumulatori al AA NiCad (si richiede sei) con le condizioni di funzionamento normali 600/700mAh (ore milliamperi). E possibile che altri tipi possano scoppiare e causare danno personale.

CAUTION: Operational hazard exists if AC adaptor other than X-Rite SE30-61 (115V) or SE30-62 (230V) is used.

VORSICHT: Es besteht Betriebsgefahr bei der Verwendung von einem Adapter außer X-Rite SE30-61 (115 U) oder SE30-62 (230 U).

AVISO: No use otro adaptador C.A. que no sea la pieza X-Rite SE30-61 (115V) o SE30-62 (230V), por el riesgo de mal funcionamiento del equipo.

ATTENTION: Ne pas utiliser d'adaptateur autre que SE30-61 (115V) ou SE30-62 (230V) de X-Rite au risque de mauvais fonctionnement de l'appareil.

AVVISO: Non usare un altro adattatore C.A. che non è del pezzo X-Rite SE30-61 (115V) o SE30-62 (230V), per il rischio di malfunzionamento dell'apparecchio.

WARNING: This instrument is not for use in explosive environment.

WARNUNG: Das Gerät soll in einer explosiven Umgebung NICHT verwendet werden.

ADVERTENCIA - NO use este aparato en los ambientes explosivos.

ATTENTION: Cet instrument NE DOIT PAS être utilisé dans un environnement explosif.

AVVERTIMENTO - NON usare questo apparecchio in ambienti esplosivi.

FCC

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 a 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 expense.

Canada

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Dear Customer:

Congratulations! We at X-Rite, Incorporated are proud to present you with an X-Rite Color Difference Meter (CDM). This instrument represents the very latest in microcontrollers, integrated circuits, fiber optics, and display technology. As a result, your X-Rite CDM is a rugged and reliable instrument whose performance and design exhibit the qualities of a finely engineered instrument, which is not surpassed.

To fully appreciate and protect your investment, we suggest that you take the necessary time to read and fully understand this manual. As always, X-Rite stands behind your unit with a one year limited warranty, and a dedicated service organization. If the need arises, please don't hesitate to call us.

Thank you for your trust and confidence.

*Ted Thompson
Chairman of the Board, CEO*

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Proprietary Notice

The information contained in this manual is derived from patent and proprietary data of X-Rite, Incorporated. This manual has been prepared expressly for the purpose of assisting in the use and general maintenance of this instrument.

Publication of this information does not imply any rights to reproduce or use this manual for purposes other than installing, operating, or maintaining this instrument. No part of this manual may be reproduced, transcribed, transmitted, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, electronic, magnetic, mechanical, optical, manual, or otherwise, without the prior written permission of an officer of X-Rite, Incorporated.

These provisions are intended to state all of the rights and responsibilities between X-Rite, Incorporated and the customer. They supersede all warranties, expressed or implied, and whether of merchantability, fitness or otherwise. The remedies contained in this manual are exclusive. Customer and X-Rite, Incorporated waive all other remedies, including but not limited to consequential damages.

This instrument is covered by one or more of the following U.S. and foreign patents: U.S. patent #4,080,075, #4,591,978, and other patents pending.

Copyright © 1991 by X-Rite, Incorporated
"ALL RIGHTS RESERVED"

Limited Warranty

X-Rite, Incorporated warrants each unit manufactured to be free of defects in material and workmanship (excluding Ni-Cad batteries) for a period of twelve months. **THERE ARE NO WARRANTIES OF MERCHANTABILITY OR FITNESS. THIS WARRANTY OBLIGATION IS LIMITED TO SERVICING THE UNIT RETURNED TO X-RITE, INCORPORATED or AN AUTHORIZED SERVICE DEALER FOR THAT PURPOSE.** The unit shall be returned with transportation charges prepaid. If the fault has been caused by misuse or abnormal conditions of operations, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested. Always include serial number in any correspondence concerning the unit. The serial number is located on the bottom housing.

X-Rite, Incorporated offers a repair program for instruments out of warranty. For more information, contact X-Rite Instrument Services Department.

This agreement shall be interpreted in accordance with the laws of the State of Michigan and jurisdiction and venue shall lie with the courts of Michigan as selected by X-Rite, Incorporated.

General Description

The X-Rite CDM is a tristimulus reflection colorimeter, with spectral response closely matching the CIE standard observer under illuminant D₆₅ and for the 10° observer. The instrument operates as a color difference meter.

The CDM stores a single reference against which all subsequent measurements are compared. The CDM has four basic "Functions" or modes of operation. The functions are:

"SIMPLE COMPARE"

Simple comparison of any measured sample to the measured reference.

"PASS/FAIL"

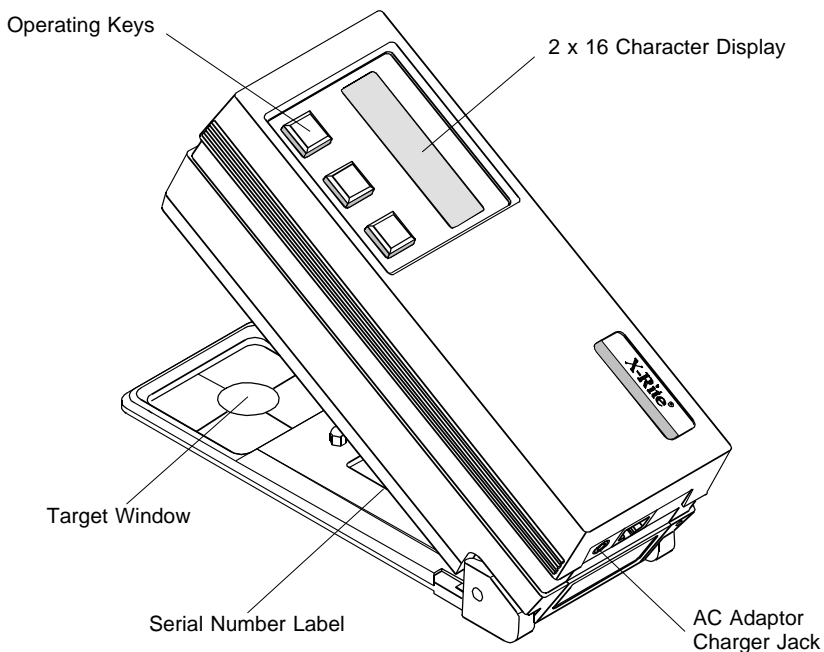
Simple comparison with tolerancing. Tolerancing method and limits are user defined in 1 of 25 stored "Setups."

"555 SHADE TAG"

Simple 555 shade tagging based on a measured reference and user defined shade size and range information, contained in 1 of 25 stored "Setups."

"555 & PASS/FAIL"

A combination of functions (Pass/Fail & 555 Shade Tag) that allows shade tagging of all samples that fall within the tolerance limits.



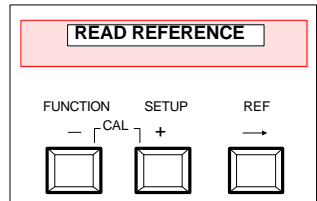
User Interface

This section will familiarize you with the typographical conventions, display functions, and general terms used in this manual.

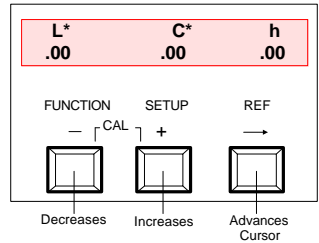
-
- In the text portion of this manual the CDM keys are shown with brackets on both sides and in boldface. Ex., **[FUNCTION]**, **[SETUP]**, and **[REF]**.
-

- When a key is to be momentarily pressed, the statement "press" will be used. Ex., Press **[REF]**.
-

- Information that will appear in the display window will be shown with quotation marks on each side and in boldface. Ex., "**READ REFERENCE**"



-
- The symbols - and + shown on the display label are used for value adjustments. Pressing [+] key increments and [-] decrements the values. The [->] key advances the cursor.



-
- A "hand" indicates important notes and possible operations that need to be performed before the normal operation.



-
- When a procedure is continued on the next page an arrow will appear in the bottom right hand corner of the page.



What To Do First!



See how to unlock the shoe and charge the batteries...read *Section 1 - Getting Started*.



See how the positioning of the instrument during measurement affects the reading...read *Section 2 - Positioning Techniques*.



Calibrate your instrument...read *Section 5 - Calibration*.



Learn about the options in the operation setup and how to configure them...read *Section 3 - Operation Setup*.



Set the system options in the instrument...read *Section 6 - Setting System Options*.



Learn the basic functions...read *Section 4 - Operation*.

1.

Getting Started

1.1

Packaging Check List

After removing the instrument from the shipping carton, inspect for possible damage. If any damage is noted, contact the transportation company immediately. Do nothing more until the carrier's agent has inspected the damage.

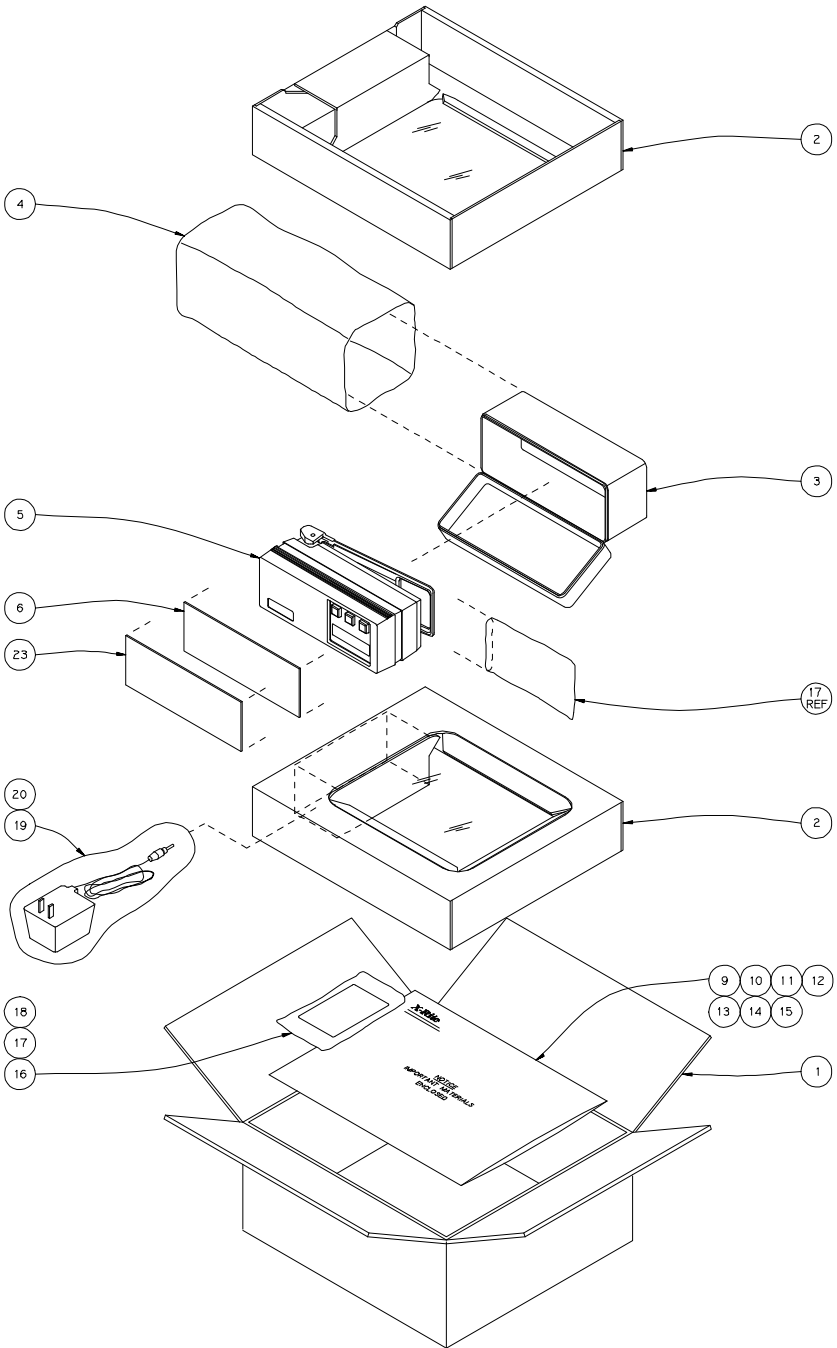
If damage is not evident, check and make sure that all items are included (Refer to the parts list below, and following page for the packaging illustration).

Your unit was packaged in a specially designed carton to assure against damage. If reshipment is necessary, the instrument should be packaged in the original carton. If the original carton is not available, a new one can be obtained from X-Rite Inc. Refer to the packaging drawing on the following page (items 1 and 2).

PACKAGING PARTS LIST

23	1	1	1	1	972-601	REFERENCE GUIDE
22	1	1	-	-	SD43-22	UL LISTING LABEL
21						
20	1	1	1	1	SD65-13	PLASTIC BAG
19	-	-	1	1	SE30-62	AC/DC ADAPTOR 230 VAC 50/60 Hz
	1	1	-	-	SE30-61	AC/DC ADAPTOR 115 VAC 50/60 Hz
18	1	-	1	-	SD43-27	LABEL
17	2	1	2	1	SD65-03	PLASTIC BAG
16	1	-	1	-	968-61-04	4mm APERTURE ATTACHMENT
15	1	-	1	-	968-121-04	4mm TARGET WINDOW
14	1	1	1	1	SD01-11	CHARGING NOTE
13	1	1	1	1	SD01-10	IMPORTANT NOTICE "SERVICE"
12	1	1	1	1	SD01-16	POSITION NOTICE
11	1	1	1	1	SD01-04	WARRANTY REGISTRATION
10	1	1	1	1	972-500	OPERATION MANUAL
9	1	1	1	1	SD68-10	ENVELOPE
8						
7						
6	1	1	1	1	972-62-01	CALIBRATION REFLECTION STANDARD
5	-	1	-	1	972L-00-01	COLORIMETER ASS'Y - 20mm
	1	-	1	-	972-00-01	COLORIMETER ASS'Y - 8mm
4	1	1	1	1	SD65-10	PLASTIC BAG
3	1	1	1	1	418-67-01	CARRYING CASE
2	2	2	2	2	SD200-880-06	CARTON INSERT
1	1	1	1	1	SD200-880-01	CARTON
ITEM	972 QTY	972L QTY	972X QTY	972LX QTY	PART NUMBER	DESCRIPTION
PARTS LIST						

PACKAGING



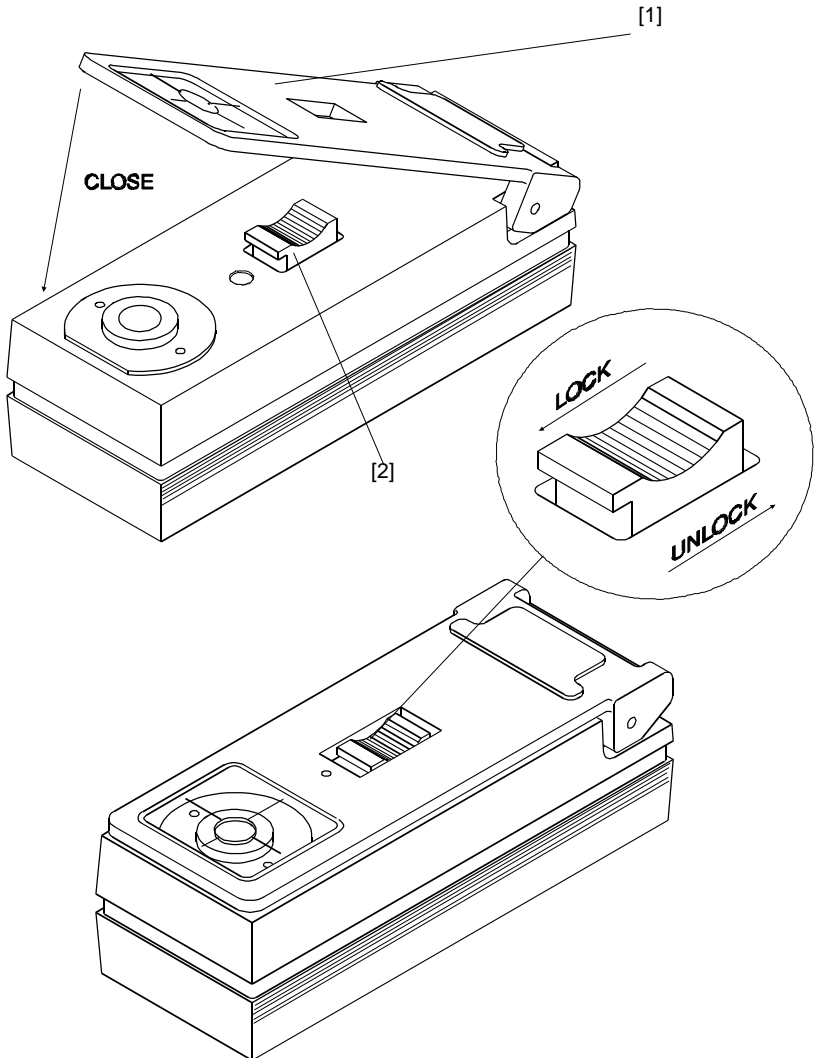
The shoe can be locked next to the housing for ease of storage.

Unlocking Shoe

1. Hold shoe [1] against unit.
2. Slide black lock button [2] on bottom of unit towards the back until it stops, then slowly release shoe [1].

Locking Shoe

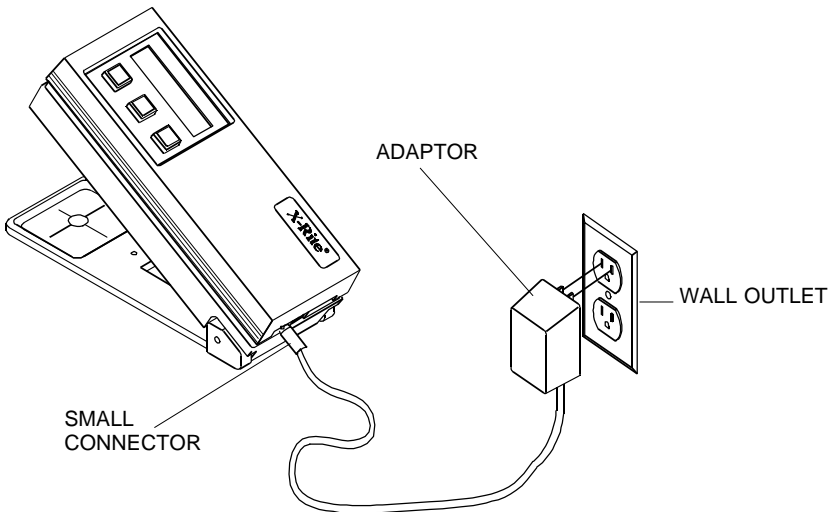
1. Hold shoe [1] against unit.
2. Slide black lock button [2] towards the front until it stops, then release shoe [1].





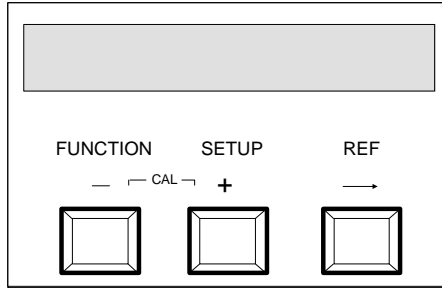
- > THE UNIT SHOULD BE CHARGED BEFORE USE. The unit can be operated while the batteries are being charged. Before using make sure the voltage indicated on the AC adaptor complies with the AC line voltage in your area. If not contact your X-Rite dealer.
- > The unit should be fully charged in 14 hours. Note: If your unit has not been used for several weeks recharge for approximately 24 hours.
- > Charging the batteries for less than 14 hours will reduce the operating time of the unit.
- > The best method to obtain the maximum battery life is to:
 - Always run the unit down to the point where the "BATTERIES LOW" message is displayed, then charge the unit.
 - Periodically (once a month) the instrument should be operated until the "**BATTERIES MUST BE CHARGED**" message appears, then fully charged.
 - Leaving the unit plugged into the AC wall outlet for extended periods of time (over 48 hours) may shorten the battery life.
 - If you are going to store the unit for an extended period of time (over 6 months), the Ni-Cad batteries should be removed from the unit.

1. Plug the small connector end of the adaptor into back of unit.
2. Plug the adaptor into AC wall outlet.



- > This unit retains calibration, setup values, and other data when the unit turns off after 45 seconds of non-use (in battery operation), or if the Ni-Cad batteries are discharged.

During battery operation power is applied automatically when a measurement is taken or if a key is pressed. It automatically shuts off (within 45 seconds) if no keys are pressed or no further measurements are taken. The unit will not automatically shut off if the AC adaptor is connected.

**[FUNCTION]**

- Used to select "Simple Compare", "Pass/Fail", "555 Shade Tag", & "555 & Pass/Fail."
- Selects calibration when pressed together with **[SETUP]** key.
- Used to decrease numeric values when defining limits in Operation Setup.
- Advances through various steps in Operation Setup and System Options.

[SETUP]

- Used to access the Operation Setup.
- Selects calibration when pressed together with **[FUNCTION]** key.
- Used to increase numeric values when defining limits in Operation Setup.

[REF]

- Used to access the reference measurement operation.
- Used to advance the cursor and select options in Operation Setup.
- Selects various options in System Options.
- Used to "abort" in Calibration procedure.

2. Positioning Techniques

The variety of items the CDM can measure is almost endless. However, in order to obtain accurate and repeatable measurements, the bottom of the shoe must be:

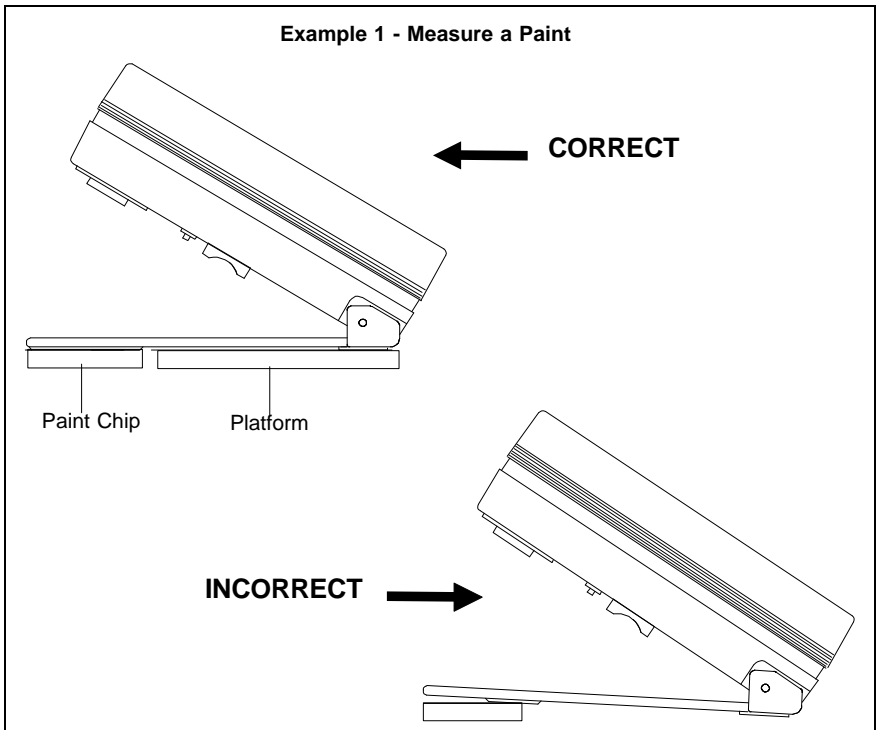
- ▬▬▬ *Parallel* with the surface to be measured if the surface is *flat*.
- ▬▬▬ *Tangent* to the surface to be measured if the surface is *curved*.

The reason for this is that any movement during measurement can cause the reading to vary. To obtain the most accurate and repeatable measurements, there are a few guide rules you can follow.

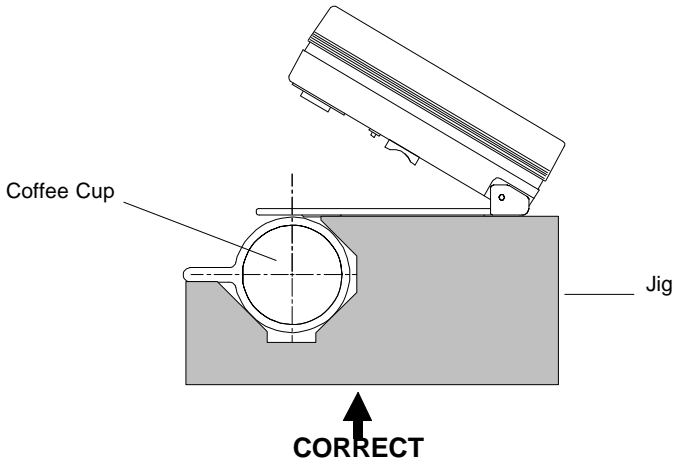
If the item to be measured is smaller than the shoe, you may want to make a platform (the same height of the item) for the instrument to sit on. If the item to measure is curved, you may want to make a jig for the item to rest in.

Shown below and on the next page are some examples of methods used to accomplish this. Example 1 shows a platform for measuring a paint chip. Example 2 shows a jig being used to measure a cup. Example 3 shows a jig being used for measuring a small knob.

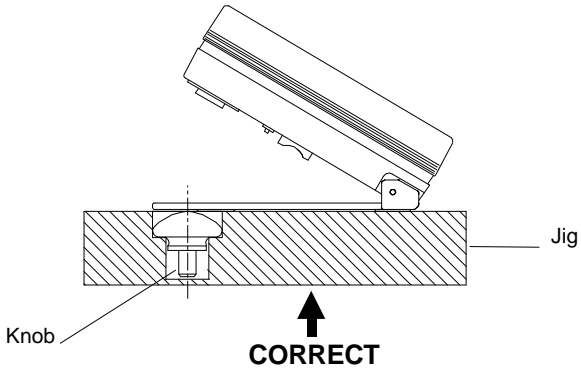
Note: A Spectrophotometer Stand is available from X-Rite (P/N 968-80). The stand can hold objects that are a maximum of 4" in width, or 2" to the center of the object. Refer to Appendix A3 for further information about this mounting fixture.



Example 2 - Measure a Coffee Cup



Example 3 - Measure a Small Knob



3. Operation Setup

3.1 Setup Definition

The CDM will store up to 25 individual "setups" with user selected options. This allows the measurement of a wide range of samples with different tolerancing needs. Simply call up the proper setup number and measuring a reference. The setup operation allows you to: select the setup number; define color space; set pass/fail limits; set shade size and range; and select measurement averages for each setup number.

After the setup data is defined, the data can be locked for each setup number (except setup #1). This will avoid any inadvertent or unauthorized changes from occurring. Refer to Section 6.2 for setup locking details.

Refer below and to the following pages for an explanation of each available option.

Setup # - There are two options (load & define) that can be initially accessed in the first menu of the setup number. Load is used to set in the instrument the selected setup number data. Define option is used to access the various setup options described below.

Color Space - Is used to set the measurement space for each setup number. The available options are: $L^*a^*b^*$, $L^*C^*h^\circ$, and CMC.

$L^*a^*b^*$ is based on the opponent-colors theory of color vision that states: a color cannot be both green and red at the same time, or blue and yellow at the same time. as a result, single values can be used to describe the red/green and the yellow/blue attributes. When a color is displayed in $L^*a^*b^*$, "L*" defines lightness, "a*" denotes the red/green value, and "b*" the yellow/blue value.

$L^*C^*h^\circ$ color space is calculated from $L^*a^*b^*$. The "L*" defines lightness, "C*" specifies chroma, and "h*" denotes hue angle. $L^*C^*h^\circ$ sometimes offers an advantage over $L^*a^*b^*$ in that it's easy to relate to the earlier system that are based on physical samples, like the Munsell color space.

CMC is an acronym for the **Colour Measurement Committee of the Society of Dyers and Colourists**. CMC equations are mathematical modifications to the formula used to calculate small color differences or color error (DE) in CIE $L^*a^*b^*$ color space. The purpose of the CMC equations is to appropriately distort the scaling of the $L^*C^*H^*$ (Lightness, Chroma, & Hue) components for the DE (color error) calculation. This provides a much better agreement between human visual assessment and instrumental measurement of small color differences.



A single CMC DE tolerance value describes, in L*a*b* color space, an ellipsoid around the standard color where the semi-axes correspond to the Lightness, Chroma, and Hue of the standard. This ellipsoid represents the "volume of acceptability" for that given color standard with a DE_{CMC} less than or equal to the given tolerance. For any given tolerance, the ellipsoid will vary in both size and shape depending on the position of the standard in L*a*b* color space. It is this automatic adjustment to the "volume of acceptability", compensating throughout the color space making CMC tolerancing so desirable, for matching human sensitivity to color difference. The CMC equation is summarized as follows:

The volume of acceptance is defined by $DE_{CMC} \leq cf$ where:

$$DE_{CMC} = \left[\left(\frac{\Delta L}{1.5 S_L} \right)^2 + \left(\frac{\Delta C}{c S_C} \right)^2 + \left(\frac{\Delta H}{S_H} \right)^2 \right]^{.5}$$

Where S_L , S_C , S_H are the semi-axes lengths for a 1.0 DE_{CMC} ellipsoid. (If complete equations for generating DE_{CMC} are desired, see AATCC TEST Method 173-1989.)

The CMC adjustment menu consists of the three parameters that can be set: Commercial factor (*cf*), Lightness factor (*l*), and Chromaticity factor (*c*).

- The commercial factor is the tolerance limit that each sample is not to exceed. (e.g., if $cf = 1.00$ then any sample which has a ΔE value greater than 1.00 would be commercially unacceptable.) The "*cf*" will have to be adjusted to meet the requirements of each measuring situation. For example, the color match of formal clothing may require a "*cf*" of .50 or less. However, a "*cf*" of 2.00 or more may be an adequate color match when measuring blue denim. A starting point value of .90 for "*cf*" is recommended.
- The lightness factor is normally set to 2.00 (default) but other values may be required when surface characteristics differ dramatically. This value of "*l*" should be assumed best for textile measurement until actual results indicate a need for adjustment. Increasing "*l*" or "*c*" will increase the tolerance to variations of the lightness or chroma components of the color error respectively.

For the textile industry it is unlikely that the chromaticity factor normally will require any adjustment from the default setting of 1.00.



Pass/Fail Limits - Are individual limits set on each attribute of $L^*a^*b^*$, $L^*C^*h^\circ$, and CMC. Or, a single limit may be placed on the delta E value of the selected color space. The limits can be set from .01 to 9.99. The limit for each attribute can also be turned "Off" by advancing past 9.99.

Shade Size - Are dimensions placed on the color space attributes which represent a three dimensional box in space. These boxes are layered nine deep in all three directions. At the center is the reference (555) box. The values that are placed on the selected color space will determine the size of each reference (555) box.


Shade Range - Determines the range of 555 shade tag boxes to be used and displayed. The range can be set from 1 to 9 in the 3 dimensional space.

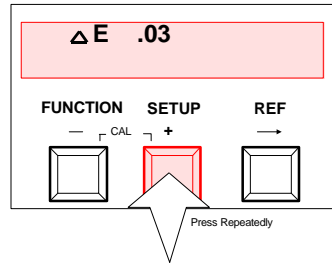
Averaging - ~~Allows you to enter the number of measurements the~~
instrument will make (1-5) at various locations on a sample, to obtain an average value.

Refer to Section 3.2 for procedure to set these options.


To set desired options:

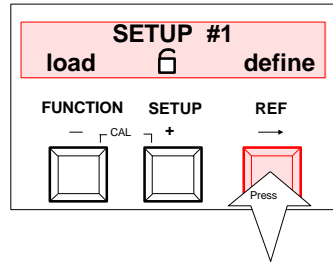
1) Repeatedly press **[SETUP]** to select the setup # requiring definition.

 > There is approx. 3 seconds allowed between depressions of the "SETUP" key before the display returns to normal operation.



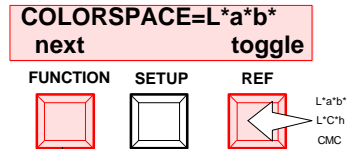
2) Press **[REF]** to access the setup options.

 > Pressing **[FUNCTION]** will load the selected setup # data into the unit Sec. See Section 4 for more detail.
> If the lock icon is closed, setup #'s 2-25 can not be changed.




3) Select Color Space.

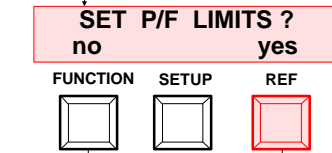
- Press **[REF]** to page through "L*a*b*", "L*C*h°", and "CMC."
- Press **[FUNCTION]** to save selection and advance to Pass/Fail Limit.



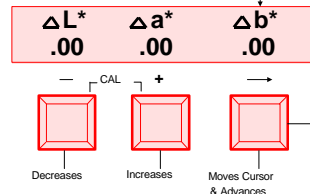
4) Set Pass/Fail Limits.


- Press **[REF]** to indicate Yes, you do want to Set P/F Limits.

 > Pressing **[FUNCTION]** will bypass P/F Limit setup and advance to the next setup option.



- Press the **[→]** key to select desired attribute to edit.
- Press the **[−]** key to decrease the selected value.
- Press the **[+]** key to increase selected value.



 > A default value of "1.00" for each attribute of L*a*b* & L*C*h° can easily be set by simultaneously pressing the **[FUNCTION]** and **[SETUP]** keys.

> To set the delta E pass/fail value, simultaneously press the **[FUNCTION]**

Continued
On Next
Page



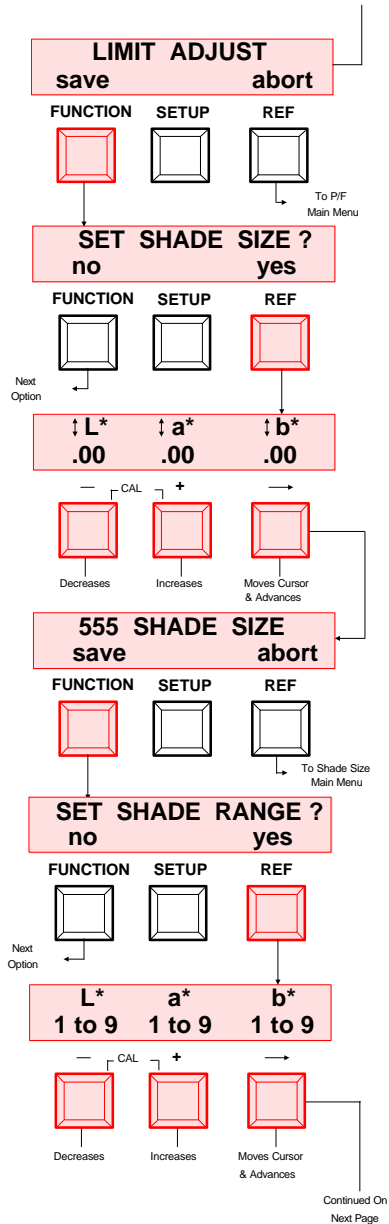
- When the cursor is under the last attribute (far right), press [→] one more time to advance to the next menu.
- Press [FUNCTION] to save P/F limits and advance to next option.

5) Set Shade Size.

- Press [REF] to indicate Yes, you do want to set Shade Size.
- Pressing [FUNCTION] will bypass Shade Size setup and advance to next option.
- Press the [→] key to select desired attribute to edit.
- Press the [-] key to decrease the selected value.
- Press the [+] key to increase selected value.
- When the cursor is under the last attribute (far right), press [→] one more time to advance to the next menu.
- Press [FUNCTION] to save Shade Size and advance to next option.



> Pressing [FUNCTION] will bypass Shade Size setup and advance to next option.



6) Set Shade Range (1 - 9).

- Press [REF] to indicate Yes, you do want to set Shade Range.
- Pressing [FUNCTION] will bypass Shade Range setup and advance to next option.
- Press the [→] key to select desired attribute to edit.
- Press the [-] key to decrease the selected value.
- Press the [+] key to increase selected value.



> Pressing [FUNCTION] will bypass Shade Range setup and advance to next option.



- When the cursor is under the last attribute (far right), press [→] one more time to advance to the next menu.
- Press **[FUNCTION]** to save Shade Range and advance to next option.

7) Set Averaging (1 - 5).

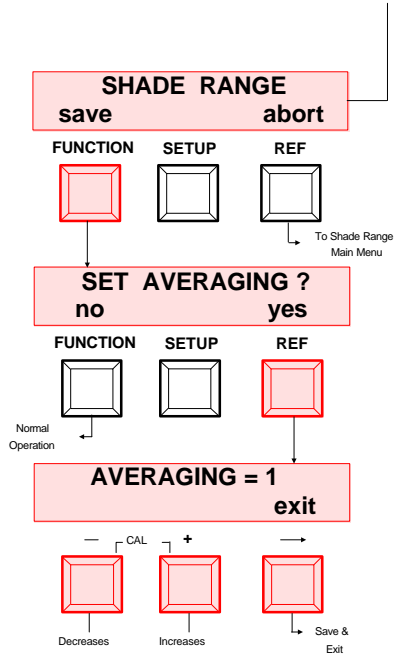
- Press **[REF]** to indicate Yes, you want to set averaging.
- Press **[FUNCTION]** will exit operation setup and return the display to normal operation.
- Press the [-] key to decrease the averaging number.
- Press the [+] key to increase the averaging number.
- Press **[REF]** to saving averaging number and return the display to normal operation.



> Press **[FUNCTION]** will exit operation setup and return the display to normal operation.



> The setup procedure may be exited at any time by closing the shoe (taking a measurement). Setup changes that were made before exiting will be saved.



4.1 Reference Measurement

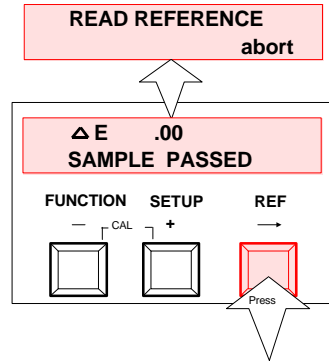
The instrument will store one reference at a time. Each time a new setup # is selected from the database, a new reference must be measured.



> A new reference must be measured whenever the instrument is calibrated.

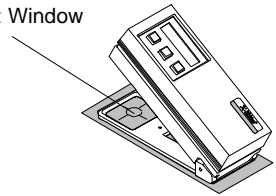
To measure a reference:

- 1) Press the [REF] key to enter reference function. If the [REF] key is pressed again, the reference function will be aborted and no reference changes will occur.

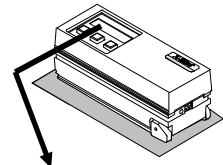


- 2) Center target window over reference to be measured.

Target Window



- 3) Lower unit to target window and hold compressed. **"READING REFERENCE"** is displayed. Release unit after **"READING COMPLETE"** is displayed.



**READING
REFERENCE**

**READING
COMPLETE**

**REFERENCE
UPDATED**

- 4) The reference data is entered and the instrument is ready for sample measurements.

4.2 Simple Compare & Pass/Fail Operation

Simple compare will display the sample differences from the reference. Pass/fail will display the differences and indicate a pass fail signal dependent on the tolerances assigned in setup.

There is one of three display options that can be setup in operation selection (Sec. 6.2). What is displayed during sample measurement for simple compare and pass/fail indications depends on what was selected as an option. Below is a description of each of these options and data that is displayed.

Deltas = Off (Delta E only)

This method will only display the delta E value after a simple compare measurement. During a pass/fail measurement, the delta E value and pass/fail indication will display.

Example 1: This example shows the information displayed on a simple compare and pass/fail.

<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>ΔE .49 SAMPLE PASSED L*a*b* or L*C*h°</p> </div>	Passed Samples	<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>\hat{E} .33 SAMPLE PASSED CMC</p> </div>
<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>ΔE 2.35 SAMPLE FAILED L*a*b* or L*C*h°</p> </div>	Failed Samples	<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>\hat{E} 1.49 SAMPLE FAILED CMC</p> </div>

Deltas = Numbers (All Values)

The simple compare option will display the delta E value and all values for the selected color space (L*a*b*, etc.). The same data will display with the pass/fail function selected, except pass/fail indication will be displayed prior to the measurement values.

Example 2: The first part of this example shows the display of samples that passed. the second part of this example illustrates the different display methods of samples that did not pass. If a sample has a delta E of 10.0 or greater, only the delta E value will display. This is because the delta E value is so far off no other information is considered usable.

<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>ΔE .03 ΔL^* - .01 Δa^* - .01 Δb^* - .02</p> <p>L*a*b*</p> </div>	Passed Samples	<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>\hat{E} .05 \hat{L}^* - 1.32 \hat{C}^* +.01 \hat{H}^* - .05</p> <p>CMC</p> </div>
<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>ΔE 2.13 ΔL^* - 1.32 ΔC^* - .70 ΔH^* - 1.52</p> </div> <p>L*C*h° (failed under 10. delta E)</p>	Failed Samples	<p style="font-size: small;">Delta E value</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: auto;"> <p>ΔE 50.65 ERROR TOO LARGE !</p> <p>L*a*b* (failed over 10. delta E)</p> </div>

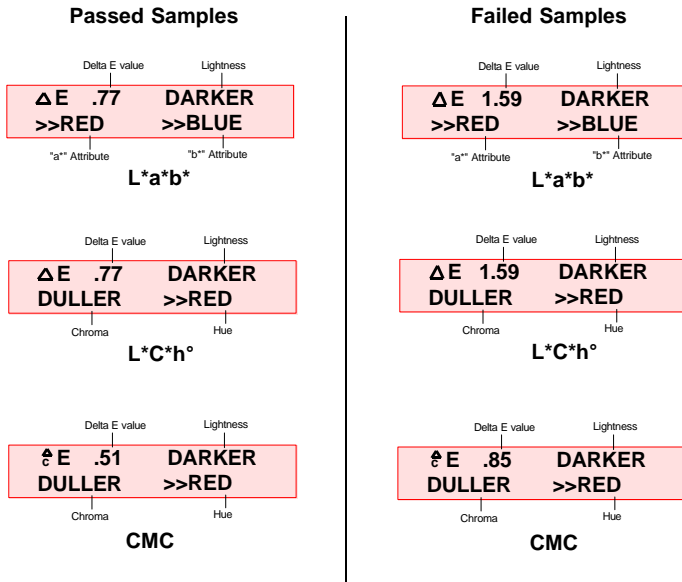


Deltas = Words (Color Direction Indication)

The simple compare option will display the delta E value and color direction between reference and sample. The color information that is displayed depends on what color space is selected in setup (see example 3 below). The Pass/Fail function will display the same data as the simple compare with pass/fail indication displayed before the measurement data. If a measurement passes or fails is determined by the limits that are set in the setup procedure.

Example 3: The first part of this example shows samples that passed. The second part of this example illustrates the different display methods of samples that did not pass.

The "L*" attribute for L*a*b* or L*C*h° will display either "LIGHTER" or "DARKER" direction from the reference. The "a*" and "b*" attributes for L*a*b* and the "h°" (hue) attribute for L*C*h° will display as ">>RED", ">>GRN", ">>BLU", or ">>YEL." This is an indication of what color direction the attribute is towards. For L*C*h°, the "C*" (chroma) attribute will display as "BRIGHTER" or "DULLER."



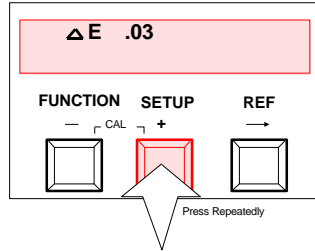
The Simple compare and Pass/Fail measurement procedure shown on the following pages will guide you through the entire measurement sequence. The example is setup with the deltas off (only delta E) and in L*a*b* color space.



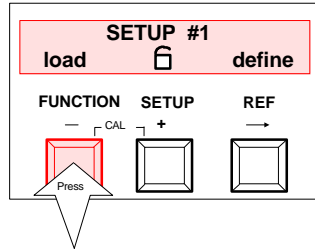
Measurement sequence is as follows:

- 1) Measure a reference (see Section 4.1).

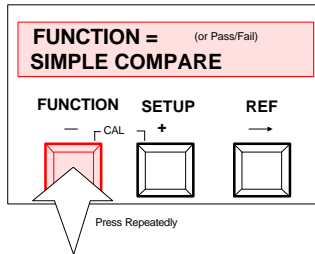
- 2) Repeatedly press **[SETUP]** to select desired setup number.



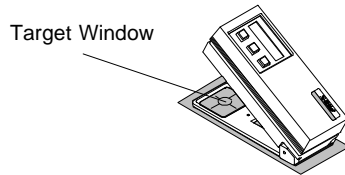
- 3) Press **[FUNCTION]** to load into the unit the selected setup # data.



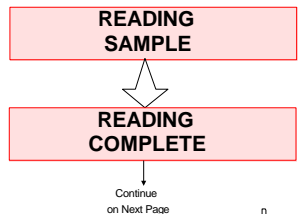
- 4) Repeatedly press **[FUNCTION]** to select "SIMPLE COMPARE" or "PASS/FAIL" indication.



- 5) Center target window over sample to be measured.



- 6) Lower unit to target window and hold compressed. "READING SAMPLE" is displayed. Release unit after "READING COMPLETE" is displayed.

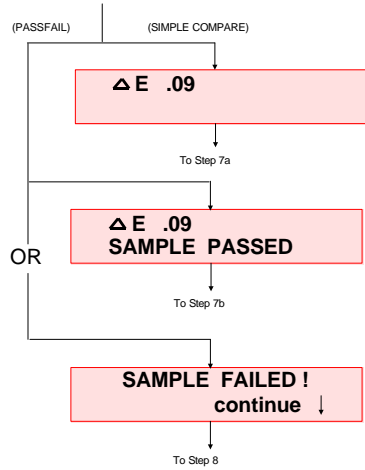


Simple Compare

- Delta E value is displayed (refer to Step 7a).

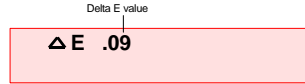
Pass/Fail

- If "SAMPLE PASSED" is displayed (3 short beeps), sample is ok, advance to Step 7b.
- If "SAMPLE FAILED" is displayed (1 long beep), sample is bad, advance to Step 8.



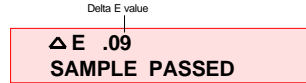
7a) The sample delta E value is displayed.

- Continue with additional measurements.



7b) The sample delta E value and passed indication is displayed.

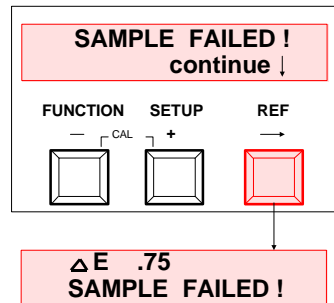
- Continue with additional measurements.



Sample Failed Only!

8) "SAMPLE FAILED" will display when the sample measured exceeds the predefined pass/fail values selected in setup.

- Press [REF] to continue.
- The failed delta E value is displayed.
- Continue with additional samples.



> The displayed samples pass/fail status can be viewed again by pressing the [FUNCTION] key. This is only necessary if Deltas is set to "Numbers" or "Words" in Operation Selection (sec. 6.2).

4.3 555 Shade Tag and Pass/Fail Operation

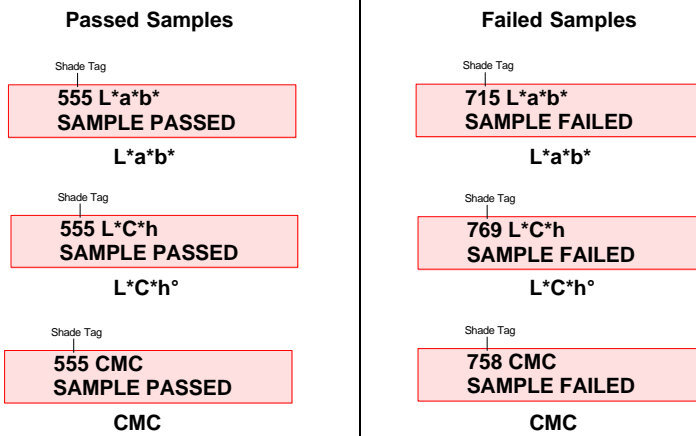
555 Shade tagging allows a means of expressing usable information on different variation of shaded samples. These samples are sorted and placed into selected shade groups. This allows the same color fabric, ceramics, etc., from different manufacture runs to be sorted in shade groups and used together in final use.

There are three different display options that can be setup in the operation selection (Sec. 6.2). What is displayed during sample measurement for 555 shade tag and 555 & pass/fail indication depends on what was selected as an option. Below is a description of each of these options and data that is displayed.

Deltas = Off (555 Tag only)

This method will only display the shade tag number and color space on a 555 shade tag measurement. During a 555 & pass/fail measurement, the shade tag number and pass/fail indication will display.

Example 1: The examples show information displayed on shade tag and 555 pass/fail measurements in available color spaces.

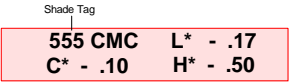
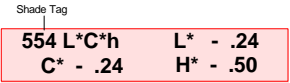


Deltas = Numbers (All Values)

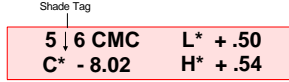
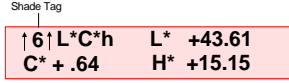
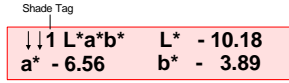
The shade tag function will display the shade tag number and difference values for the attributes of the selected color space (L*a*b*, etc.). The same data will display with the 555 & pass/fail function selected, except pass/fail indication will be displayed prior to the measurement values.

Example 2: The first part of this example shows samples that passed. The second part of this example illustrates the different display methods of samples that did not pass. If a shade tag number falls outside the specified shade range, an arrow will be displayed in the direction the color is off.

Passed Samples



Failed Samples

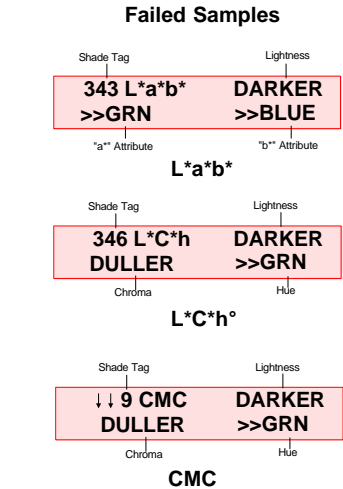
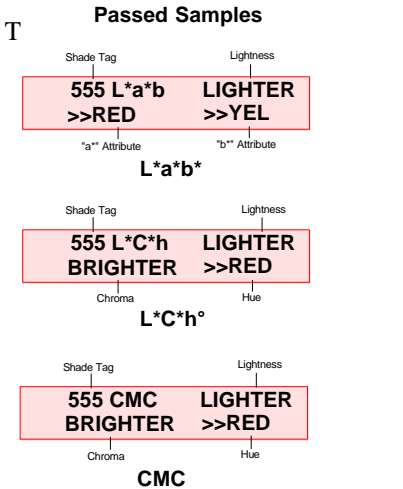


Deltas = Words (Color Direction Indication)

The shade tag option will display the shade tag number, color space, and color direction between reference and sample. The color information that is displayed depends on what color space is selected in setup (see examples below). The Pass/Fail function will display the same data as the shade tag with pass/fail indication before the measurement data. If a measurement passes or fails is determined by the shade box size and shade range set in the setup procedure.

Example 3: The first part of this example shows samples that passed. The second part of this example illustrates the different display methods for samples that did not pass. The "L*" attribute for L*a*b* or L*C*h° will display either "LIGHTER" or "DARKER" direction from the reference. The "a*" and "b*" attributes for L*a*b* and the "h°" (hue) attribute for L*C*h° will display as ">>RED", ">>GRN", ">>BLU", or ">>YEL." This is an indication of what color direction the attribute is towards. For L*C*h°, the "C*" (chroma) attribute will display as "BRIGHTER" or "DULLER."

555 Shade Tag & Pass/Fail Operation



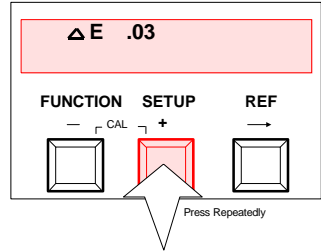
T
h
e
S
h
a
d
e
T
a
g
a
n
d
5
5

5 & Pass/Fail measurement procedure shown below will guide you through the entire measurement sequence. The example shown is setup with the deltas off and in L*a*b* color space.

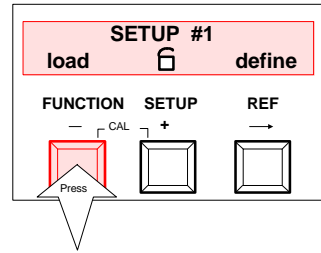
Measurement sequence is as follows:

1) Measure a reference (see Section 4.1).

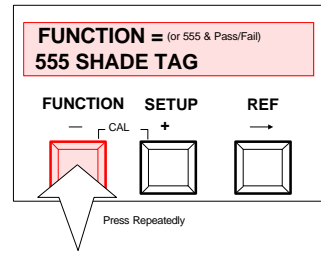
2) Repeatedly press **[SETUP]** to select desired setup number.



3) Press **[FUNCTION]** to load into unit the selected setup # data.

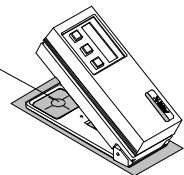


4) Repeatedly press **[FUNCTION]** to select "555 SHADE TAG" or "555 & PASS/FAIL" indication.



5) Center target window over sample to be measured.

Target Window



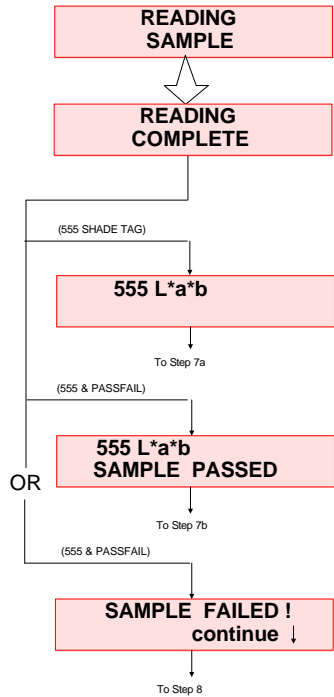
6) Lower unit to target window and hold compressed. "READING SAMPLE" is displayed. "READING COMPLETE" is displayed. Release unit after "READING COMPLETE" is displayed.

555 Shade Tag

- Shade tag number and color space is displayed (refer to Step 7a).

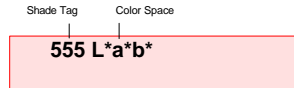
555 & Pass/Fail

- If "SAMPLE PASSED" is displayed (3 short beeps), sample is ok, advance to step 7b.
- If "SAMPLE FAILED" is displayed (1 long beep), sample is out of tolerance, advance to step 8.



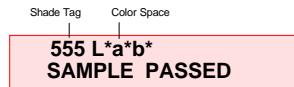
7a) Shade tag and color space is displayed.

- Continue with additional measurements.



7b) Shade number, color space & "SAMPLE PASSED" is displayed.

- Continue with additional measurements.



> The displayed samples pass/fail status can be viewed again by pressing the [FUNCTION] key. This is only necessary if Deltas is set to "Numbers" or "Words" in Operation Selection (sec. 6.2).



Sample Failed Only!

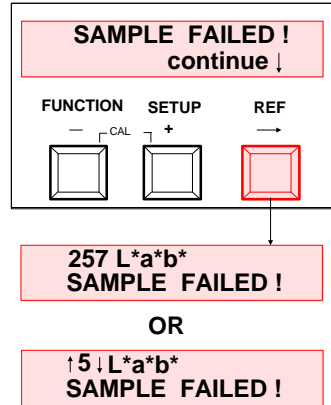
8) "SAMPLE FAILED" will display when the sample measured exceeds the predefined pass/fail limit.

- Press [REF] to continue.

Examples:

- Shade Tag 257: "2" represents the "L*" attribute, "5" represents the "a*" attribute, and "7" represents the "b*" attribute. The ideal match would be 555. The example shows that the "L*" attribute is too dark; the "a*" attribute is in tolerance; and the "b*" attribute is towards red.
- When the tag number (L*, a*, or b*) is out of the shade tag range (specified by the setup), an arrow will indicate the direction of the error. The ↑ indicates over and the ↓ indicates below.
- Continue with additional measurements.

> The displayed samples pass/fail status can be viewed again by pressing the [FUNCTION] key. This is only necessary if Deltas is set to "Numbers" or "Words" in Operation Selection (sec. 6.2).



The CDM should be calibrated to the X-Rite standard the first thing each day and every four hours of operation thereafter. However, a **"NEED CALIBRATION"** message will appear in the display if:

- The calibration procedure has not been performed for 24 hours.
- There is a 10°C change in temperature since the last calibration.
- Zero reflectance is measured improperly.
- The lamp output changes.

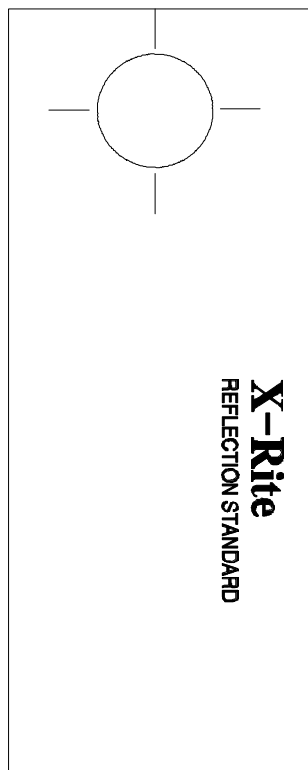
Whenever this message appears the calibration procedure should be performed before another measurement is taken to ensure accuracy.



> After the calibration procedure is performed, the current reference in the instrument is removed (set to zero). A new reference must be measured (Section 4.1) after calibration procedure.

Important Calibration Notes

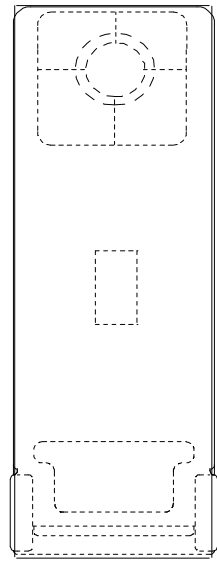
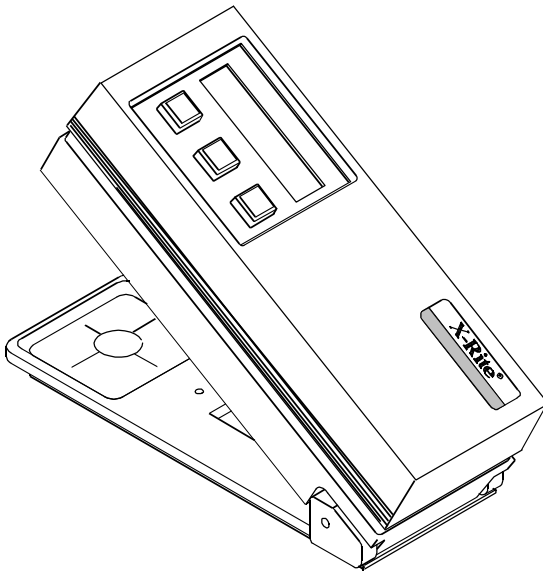
- Dirt or dust in the optics area will cause an inaccurate calibration reading. Refer to Section 7.2 for the optics cleaning procedure.
- **The ceramic Reflection Standard is dramatically affected by smudge marks, dust, and finger prints.** The standard should be cleaned using a mild soap and warm water solution, thoroughly rinsed with warm water, and wiped dry with a lint free cloth. You must let the standard dry completely before taking a calibration reading.
- If you are having linearity problems it's possible that there is dust in the optics or Zero Reflectance has drifted. If you improperly measure Zero Reflectance the unit can not automatically detect the drift. If you suspect this is the case, you should manually activate Read Zero Reflectance by performing Steps 1, 2, & 4 of Section 5.2.
- Do not move the CDM while taking a calibration measurement. If motion is detected an error message will be displayed and calibration aborted.



5.1 Positioning the Unit on the Standard

You must set the CDM on the white standard so that the maximum amount of the bottom rubber pad of the shoe resides on the standard, and the target is centered on the circle. If you do not, the unit may rock slightly and cause an erroneous reading of the standard.

- 1) Center the target window on the White circle, making sure that the rubber pad on the instrument is completely on the standard **and is flat**.

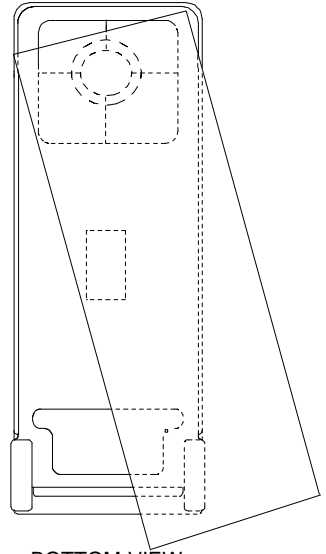
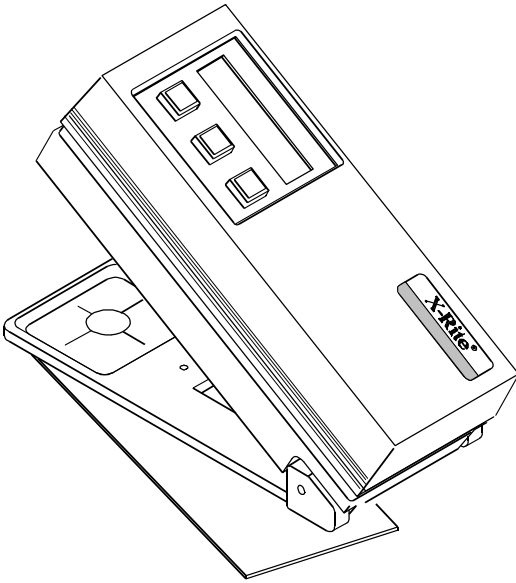


BOTTOM VIEW

- 2) Take the measurement.



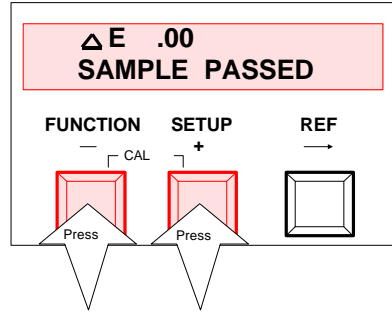
Shown below is an **IMPROPER METHOD** of measuring the standard.



INCORRECT!

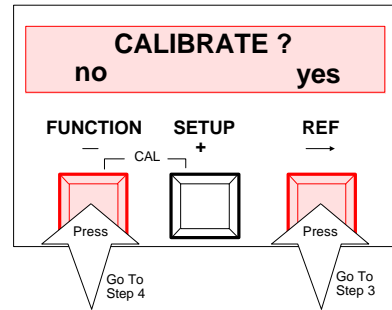
5.2 Calibrating to the White Standard

- 1) Press both **[FUNCTION]** and **[SETUP]** at the same time.

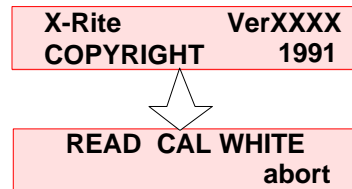


- 2) "**CALIBRATE ?**" is displayed. At this point you have two options:


- Press **[REF]** to enter the calibration measurement procedure (go to step 3). **This is standard operating procedure.**
- Or, press **[FUNCTION]** to bypass calibration and activate zero reflectance measurement. Go to Step 4 for this procedure.

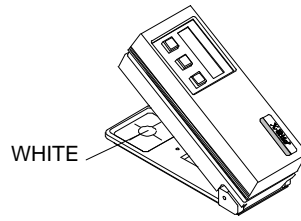


- 3a) "**READ CAL WHITE**" is displayed.




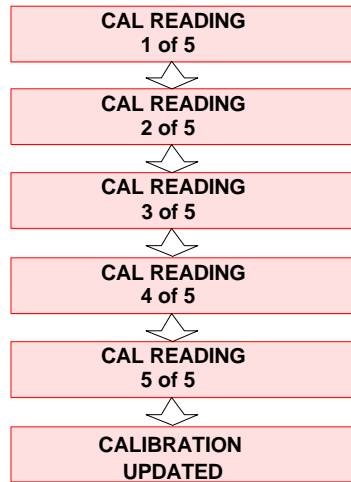
3b) Measure the **WHITE** patch on the standard. You must hold the unit depressed until all five readings have been completed.

-  > Carefully position the unit on the calibration plaque (refer to Section 5.1).

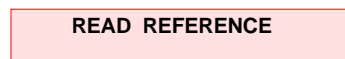


3c) "CAL READING 1 of 5" thru "CAL READING 5 of 5" is displayed; then "**CALIBRATION UPDATED.**" The procedure is finalized and the unit returns back to main menu.

-  > During the Cal Reading, the read head must remain down and stable or an error message may occur.
- > If "**PLEASE WAIT XX (1-30) SECONDS**" is displayed during calibration, continue to hold read head down until calibration readings are over. This will only occur if the calibration procedure is performed within 30 seconds of a previous measurement.
- > If "**READ ZERO REFL**" is displayed after reading the white spot, go to step 4. This will only occur if the calibration value for zero reflectance is incorrect.



3d) After calibration is complete, the display will automatically advance to "**READ REFERENCE.**"



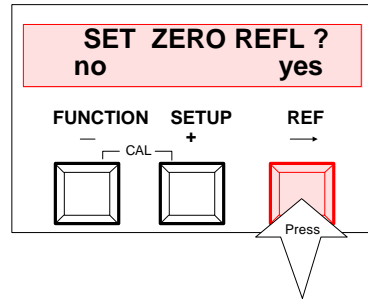
Measure new reference (refer to Section 4.1).



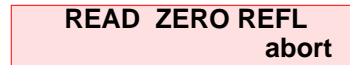
Zero Reflectance is defined as, "measuring air with no ambient light."

This can be accomplished by holding the unit depressed (take a reading with no return reflectance) in a dark room. In some cases, it is possible to just take a reading under a desk with no direct light.

- 4a) Press the [REF] key to activate zero reflectance measurement.



- 4b) Measure Zero Reflectance.



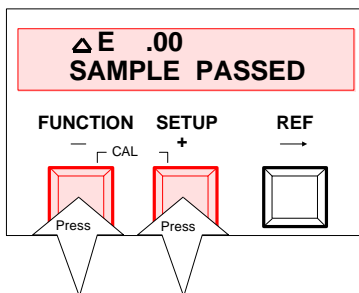
6. Setting System Options

6.1 Language Selection

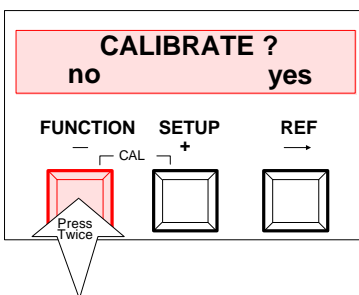
The language feature allows you to change the display format to one of several different languages.

To select desired language:

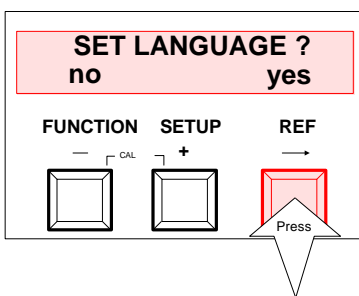
- 1) Press both **[FUNCTION]** and **[SETUP]** at the same time.



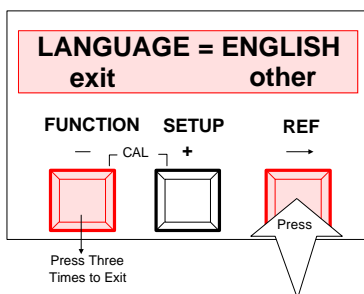
- 2) Select "NO", press the **[FUNCTION]** key twice to advance to language menu.



- 3) Select "YES", press the **[REF]** key to enter the language selection menu.



- 4) Press the **[REF]** key to select from available languages.
 - Press the **[FUNCTION]** key three times to set selected language and exit to normal operation.



The operation selection allows you to select the method in which a measurement will display, and the option of locking out the setup # data. Below is a description of these options.

DELTA S

The measurement data can be displayed three different ways. The available options are: Deltas = Off, Deltas = Numbers, and Deltas = Words.

- **Deltas Off** - will only display the delta E value (or shade tag) after a measurement is taken.
- **Deltas Numbers** - displays the delta E value (or Shade tag) and the selected color space attribute values (i.e., L*a*b*, etc.).
- **Deltas Words** - will display the delta E value (or Shade Tag) and the color direction between the reference and sample for L*a*b* or L*C*h°.

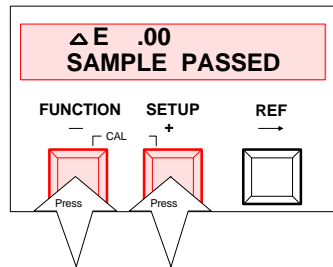
SETUP LOCK

The lock option allows all setup #'s (except setup # 1) to be locked. This will avoid any inadvertent or unauthorized changes from occurring. When the setups are locked, the options can still be viewed but no changes can be made.

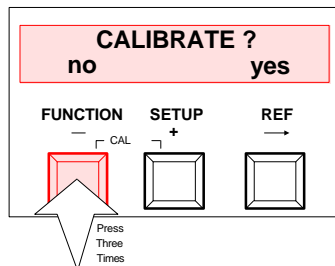
A lock icon will display closed when the setup options are **not** changeable.

To change operation options:

- 1) Press both **[FUNCTION]** and **[SETUP]** at the same time.

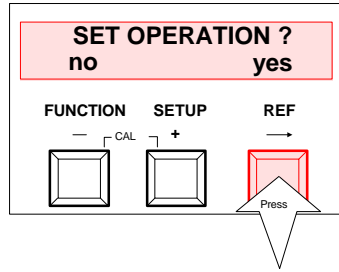


- 2) Select "NO", press the **[FUNCTION]** key three times to advance to Operation Menu.



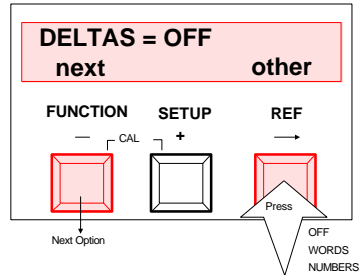
Continued

- 3) Select "Yes", press the [REF] key to enter operation selection menu.




- 4) Repeatedly press the [REF] key to page through "OFF", "WORDS", and "NUMBERS."

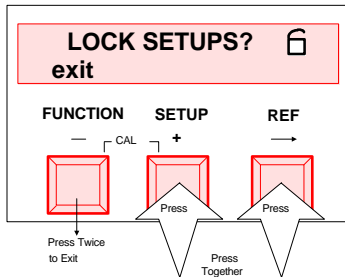
Press the [FUNCTION] key to advance to next option.



- 5) Press the [SETUP] and [REF] key at the same time. Lower instrument to the shoe to close read switch. Each time this procedure is performed, the display will alternate between "LOCK SETUPS?" and "UNLOCK SETUPS?".

 > A closed lock icon indicates setups are locked.

Press the [FUNCTION] key twice to save selections and exit.

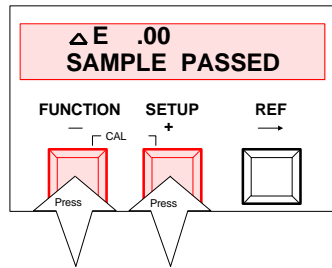


Your instrument comes equipped with a serial port that allows data to be transmitted to an external device. Listed below are the available options.

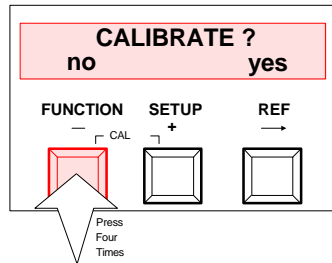
- **Label Length** - Label Length setting determines the amount of line spaces that are transmitted after a measurement.
- **CR with LF** - Carriage Return with Line Feed will send a carriage return with a line feed at the end of a line of data.
- **CR with NO LF** - Carriage Return with NO Line Feed will send just a carriage return at the end of a line of data.

To set I/O options:

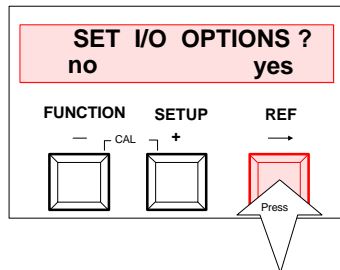
- 1) Press both **[FUNCTION]** and **[SETUP]** at the same time.



- 2) Select "NO", press the **[FUNCTION]** key four times to advance to I/O Options Menu.



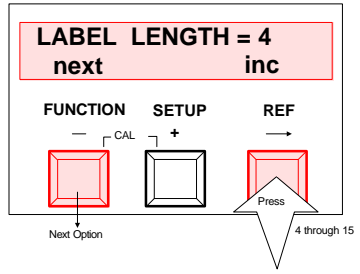
- 3) Select "Yes," press the **[REF]** key to enter I/O options menu.



Continued 

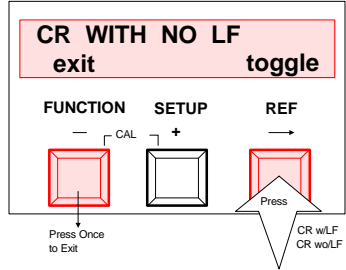
- 4) Repeatedly press the [REF] key to page through "LABEL LENGTH #'s" (4 - 15).

Press the [FUNCTION] key to advance to next option.



- 5) Press the [REF] key to toggle between "CR WITH LF" and "CR WITH NO LF."

Press the [FUNCTION] key to save selections and exit.



7.1. Troubleshooting

The X-Rite CDM is covered by a one year limited warranty (excluding ni-cad batteries) and should be referred to the factory or authorized service center for repair within the warranty period. Attempts to make repairs within this time frame may void the warranty.

X-Rite provides a factory repair service to their customers. Because of the complexity of the circuitry all circuit repairs should be referred to the factory or an authorized service center.

X-Rite will repair any CDM past warranty. Shipping costs to the factory or to an authorized service center shall be paid by the customer and the instrument shall be submitted in its original carton, as a complete unaltered unit.

CAUTION: DO NOT use any ketone solvents to clean the unit. This will cause damage to the cover.

IMPORTANT! ALWAYS CHECK TO SEE IF READ LAMP IS WORKING BEFORE TROUBLESHOOTING.

-----TROUBLESHOOTING CHART-----

- A. If a wrong reading exists:
 - 1. Recalibrate unit.
 - 2. Clean Optics.
 - 3 Contact authorized service center.

- B. Unit does not turn on.
 - 1. Check for low batteries.
 - 2. Contact authorized service center.

- C. Display not working.
 - 1. Check for low batteries.
 - 2. Contact authorized service center.

- D. Reading Drifts.
 - 1. Clean Optics.
 - 2. Recalibrate unit.
 - 3. Contact authorized service center.

- E. Unit will not calibrate properly.
 - 1. Dirty reference.
 - 2. Optics dirty.
 - 3. Contact authorized service center.

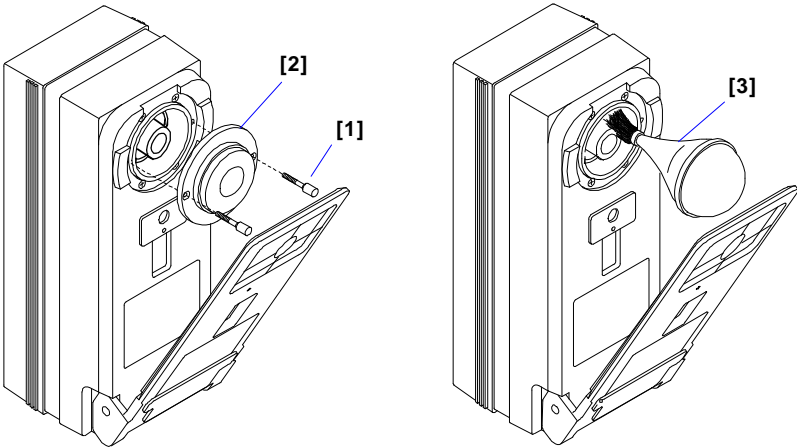
The target window and optics should be cleaned once a week in normal environments; and more often in dirty or dusty environments.

Target Window

1. Remove dust and lint from target window by wiping it with a clean, lint free cloth, slightly moistened with water.

Optics

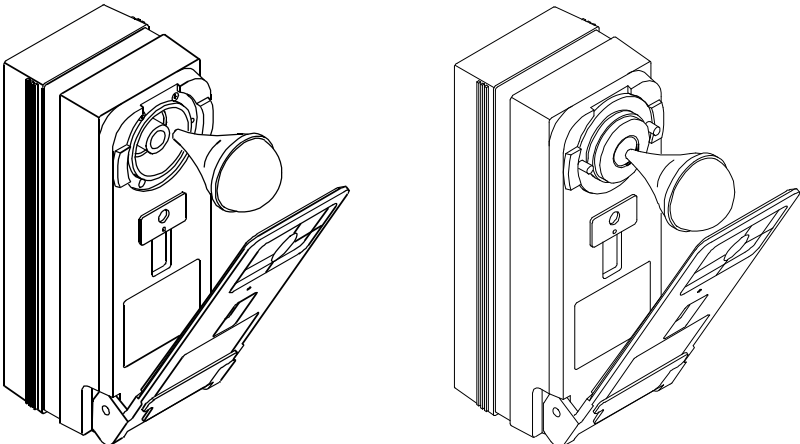
1. Unscrew the two thumb screws [1] and remove the nose piece [2].
Remove dust from aperture with camel hair brush or a camera lens cleaner [3].



2. Blow short bursts of air into the optics opening using a camera lens cleaner (with the brush removed) until all dust is removed. This can be done with the nose piece removed or attached.



WARNING! Do not use an air can that uses freon as a propellant.
Doing so could cause damage to the optics assembly.

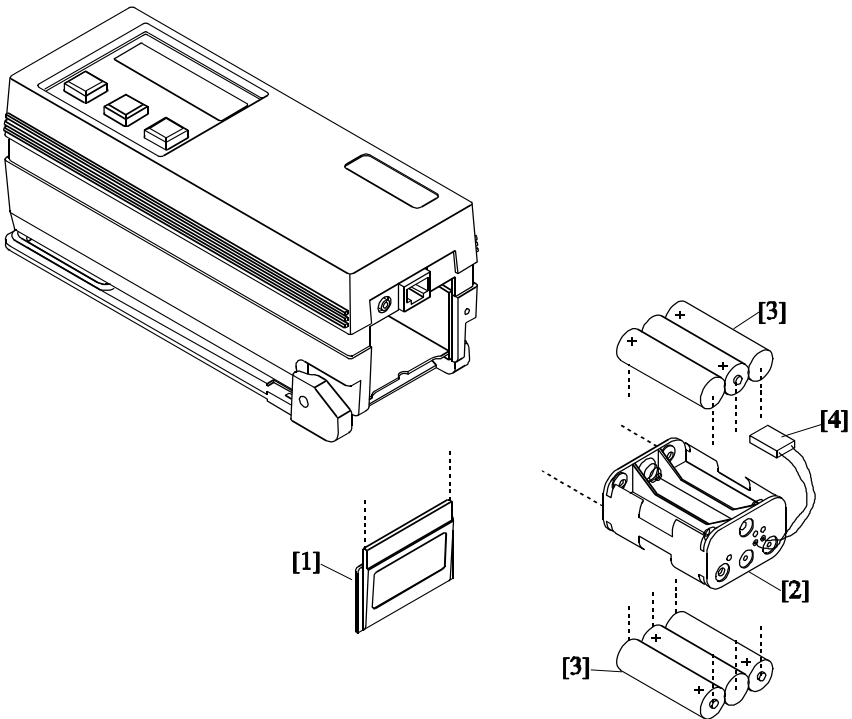


7.3.

Battery Replacement

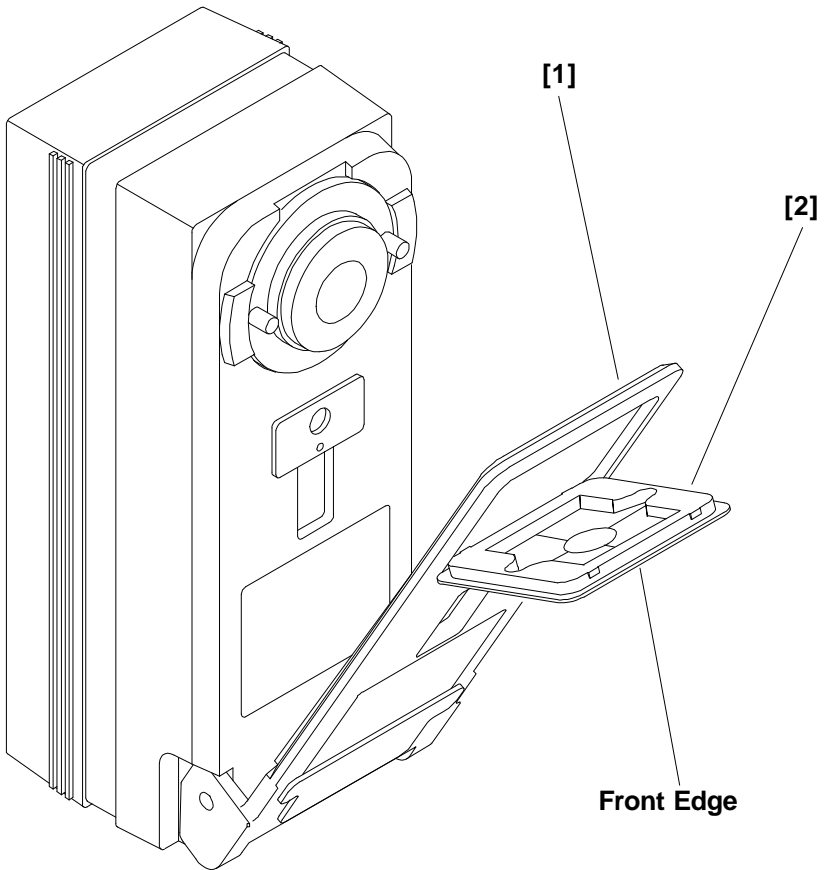
1. Set the CDM on it's side and lock shoe in place. The shoe must be locked.
2. Slide battery access door [1] toward bottom of unit and remove.
3. Disconnect plug [4] and pull battery pack [2] out of unit.
4. Remove old AA NI-CAD batteries [3], and install six fresh AA 600/700mAh rated NI-CAD batteries (recognizing proper polarity).
5. Slide battery pack [2] into unit, and reconnect battery plug [4].
Reinstall battery access door [1].
6. Unlock shoe.
7. Unit should be charged for 24 hours after new battery installation is performed.

Batteries P/N SE15-19 (6 Required)



7.4. Target Window Replacement

1. Remove old target window [2] by pushing downward from top of shoe [1].
2. Place the instrument on end and align the target window so that the word "front" runs parallel with the top edge of the shoe [1].
3. Insert one edge (top or bottom) of the new target window [2] in the opening of the shoe [1].
4. Place the other side of the target window [2] in the shoe [1] by snapping into position.



Due to the circuit complexity, alignment procedures, and test equipment required - **The read lamp should only be replaced by X-Rite or an authorized X-Rite Service Center.**

The lamp is monitored for intensity and failure warnings will be displayed if a problem occurs.

The lamp is covered by a one year limited warranty. Refer to the Limited Warranty statement on page iii.

Appendix

A1 Display Messages

Power-Up Messages

"MEMORY LOST" is displayed when the instrument determines that the data in the (battery backed up) RAM has been corrupted, if the internal lithium battery on the P.C.B. is bad, or if a new EPROM has been installed.

Operational Messages

"INVALID READING" is displayed when the unit is not held down long enough during a measurement.

"NEED CALIBRATION" is displayed if the calibration procedure is not performed for 24 hours, or if there is a 10°C change in temperature since the last calibration.

"READING COMPLETE" measurement has been taken and the instrument can be released.

Calibration Messages

"CALIBRATION - FAILED" is displayed when making a calibration measurement and something is wrong (invalid reading or data is out of range).

"CALIBRATION - NOT CHANGED" is displayed when the user decides to terminate the calibration procedure by pressing [REF].

"CALIBRATION - UPDATED" is displayed after the calibration procedure has been successfully completed.

"CAL ERROR ### - MOTION DETECTED" Calibration requires that the instrument remain motionless during the five measurements of the white spot. If the error persists and is not due to movement, the number that is displayed should be reported to X-Rite or an authorized service center.

Miscellaneous Messages

"BATTERIES LOW" indicates that the batteries are getting low and will soon need to be charged. It will only be displayed while the measurement is in progress. Once displayed you will have approximately 100-200 measurements remaining before charging is mandatory.

"BATTERIES MUST - BE CHARGED " indicates that the batteries are too low to operate the unit. It will be displayed until you begin the recharge cycle, thereafter, the unit will be functional and all previous data will be accessible.

"LAMP FAILURE" measurement lamp is bad. The lamp should be replaced by X-Rite or an authorized X-Rite service center. When this message occurs, you can get out of this condition by pressing **[SETUP]** then **[REF]** then **[SETUP]**; or waiting until the unit powers down.

"READING ERROR ## " reading error due to hardware problem. If this message persists the number that is displayed should be reported to X-Rite or an authorized service center.

"REFL. EXCEEDED" calculation of reflectance for at least one of the filters was more than 200%. This is usually caused by a bad calibration procedure. Recalibrate unit.

"THANKS! - I NEEDED THAT!" indicates that the charger has been plugged in and the batteries are being charged. This is in response to the message "BATTERIES MUST BE CHARGED".

"WEAK LAMP - REPLACE SOON" indicates that the lamp is getting weak and should be replaced in the near future. When this message occurs, you can get out of this condition by pressing **[SETUP]** then **[REF]** then **[SETUP]**; or waiting until unit powers down.

"X-Rite VER#### - COPYRIGHT 1991" is displayed when first activating calibration. #### represents the datecode of the software.

Measuring Function:	Simple Compare, Pass/Fail, 555 Shade Tag, and 555 & Pass/Fail Indication. Based on $L^*a^*b^*$, $L^*C^*h^\circ$, and CMC ΔE
Display:	2 row by 16 character Supertwist dot matrix LCD
Measuring Geometry:	0°/45°, fiber optic pickup, multi-sensor array
Measuring Area:	20mm
Receiver:	Blue enhanced silicon photodiodes
Light Source:	Gas filled tungsten lamp, approx. 2856°K (corrected for D ₆₅ illuminant)
Measurement Range:	0 to 200% reflectance
Spectral Response:	Closely matches CIE Standard Observer function for D ₆₅ illuminant and 10° observer. ($x\lambda$, $y\lambda$, $z\lambda$)
Short Term Repeatability:	0.10 ΔE_{CMC} on a white ceramic
Warm Up Time:	None
Measurements Per Charge:	Approx. 1000 typical
Measuring Time:	Approx. 2 seconds
Power Supply:	Six rechargeable AA NiCad batteries 7.2v total rated @ 600mAh (included)
Charge Time:	Approx. 14 hours
AC Adaptor Requirements:	972 90 - 130VAC, 50 - 60Hz, 18W Max. 972X 180 - 260VAC, 50 - 60Hz, 20W Max. 12VDC @ 700ma: Positive Tip
Operating Temp. Range:	50°-104°F (10°- 40°C)
Storage Temp. Range:	-4°-122°F (-20°- 50°C)
Weight:	2.3 lbs. (1.1kg)
Dimensions:	3.2" H x 3.0" W x 7.8" L (8.1cm H x 7.6cm W x 197c.m L)
Accessories Provided:	Calibration Standard Operation Manual AC Adaptor Carrying Case

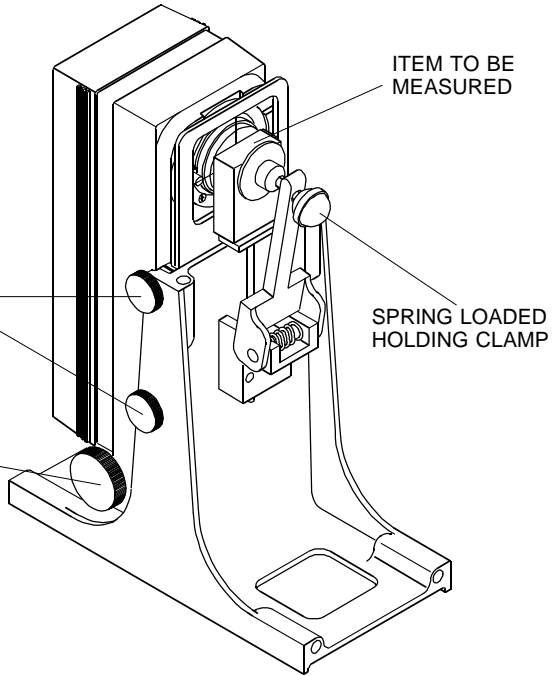
X-Rite standards are traceable to the National Institute of Standards and Technology.

This product covered by U.S. Patent #4,080,075, #4,591,978, and other patents pending.
Specifications and design subject to change without notice.

X-Rite has an optional mounting fixture available (P/N 968-80). The fixture can hold items that are a maximum of four inches wide, or two inches to the center of the object.

THE UNIT QUICKLY ATTACHES TO THE FIXTURE WITH THUMB SCREW ADJUSTMENTS

HOLDS UNIT CLOSED





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