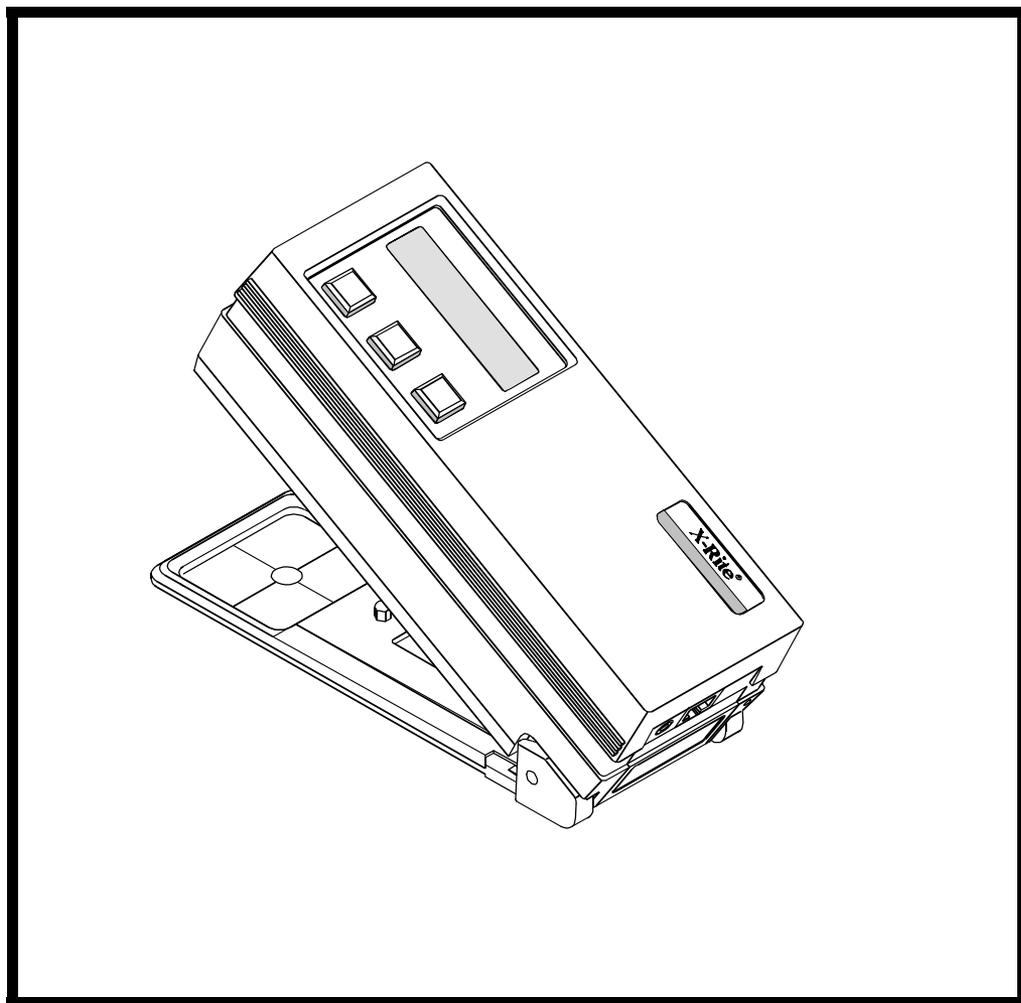


X-Rite® 978  
*0°/45° Spectrophotometer*



*User's Manual*

**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:** 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 (Milliampere/Stunde) Nennstrom (6 Stück erforderlich). Mit anderen Akkus läuft die Gefahr von Explosion und Verletzung.

**ATENCION:** 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.

**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.

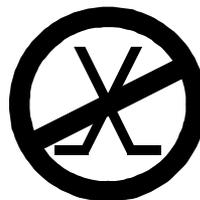
### Canada

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.

The Manufacturer: X-Rite, Incorporated  
Der Hersteller: 3100 44th Street, S.W.  
El fabricante: Grandville, Michigan 49418  
Le fabricant:  
Il fabbricante:

Declares that: Spectrophotometer  
gibt bekannt: 978  
advierde que:  
avertit que:  
avverte che:



is not intended to be connected to a public telecommunications network.  
an ein öffentliches Telekommunikations-Netzwerk nicht angeschlossen werden soll.  
no debe ser conectado a redes de telecomunicaciones públicas.  
ne doit pas être relié à un réseau de télécommunications publique.  
non deve essere connesso a reti di telecomunicazioni pubblici.

*Dear Customer:*

*Congratulations! We at X-Rite, Incorporated are proud to present you with an X-Rite 978 Spectrophotometer. This instrument represents the very latest in microcontrollers, integrated circuits, fiber optics, and display technologies. As a result, your X-Rite 978 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 and Chief Executive Officer*

## Proprietary Notice

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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.

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**Copyright © 1993 by X-Rite, Incorporated**  
**"ALL RIGHTS RESERVED"**

## Limited Warranty

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X-Rite, Incorporated warrants each unit manufactured to be free of defects in material and workmanship (excluding battery pack) for a period of twelve months. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested. The unit shall be returned with transportation charges prepaid.

**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.**

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

Always include serial number in any correspondence concerning the unit. The serial number is located on the bottom of the instrument.

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.

**CAUTION:** This instrument is not for use in explosive environments.

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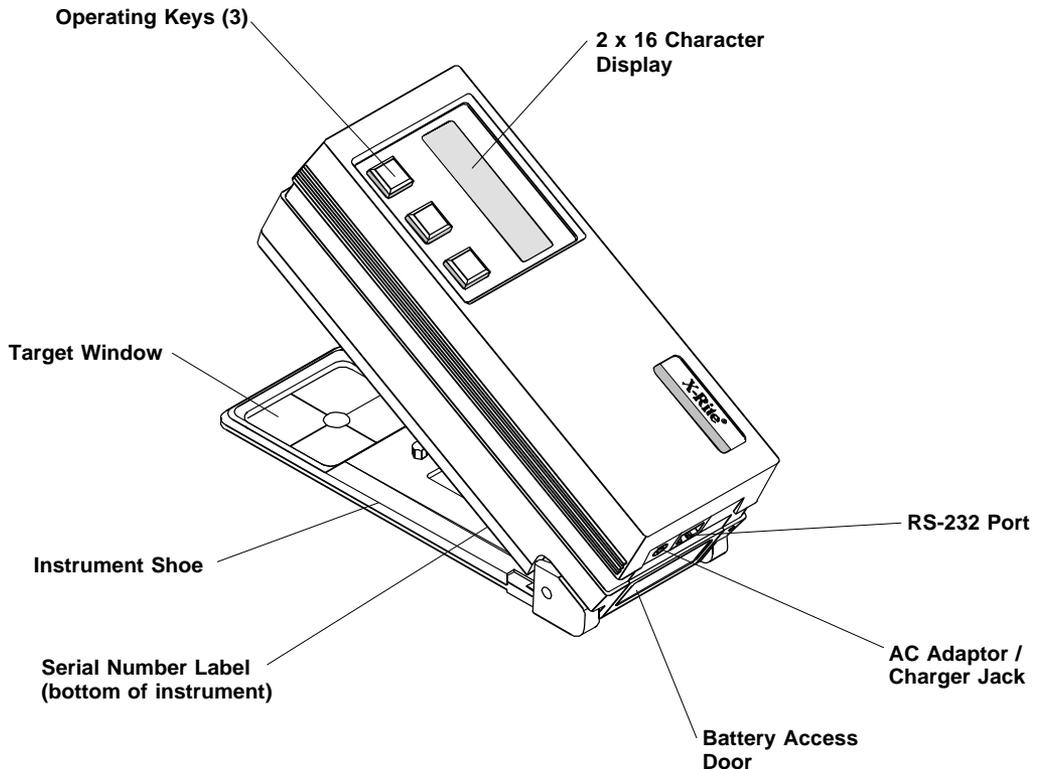
## General Description

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The X-Rite 978 is a reflection spectrophotometer that measures spectral reflectance from 400nm to 700 nm in 20nm intervals. The instrument has a 0° illumination angle, 45° viewing angle, and features a dual-beam, single light pulse compensation method to insure accuracy.

The 978 calculates colorimetric and spectrophotometric data. The 978 displays colorimetric data, and can output (to a printer or computer) colorimetric and spectral data. An optional software package, QA-Master, can collect, sort, view, and analyze L\*a\*b\* and spectral data.

The 978 will store up to 30 user defined setups. Each setup consists of a tolerancing method, tolerancing limits, reference measurement, and 555 shade sort options (shade size and range).



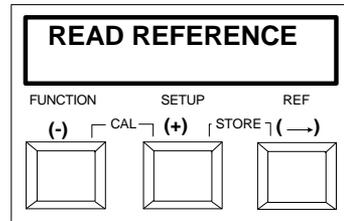
# User Interface

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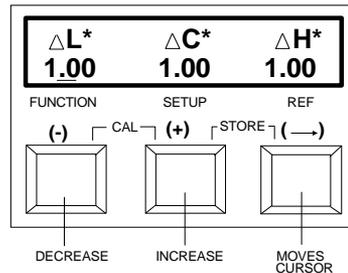
This information will familiarize you with the typographical conventions, display function, and general terms used in this manual.

- \* In the text portion of this manual the 978 key names are shown with brackets on both sides and in boldface (e.g., **[FUNCTION]**, **[SETUP]**, etc.).
- \* When a key is momentarily depressed, the word "press" will be used (e.g.; Press **[FUNCTION]**).

- \* Information that will appear in the display window will be shown with quotation marks on each side and in boldface (e.g.; "**READ REFERENCE**").



- \* The (-) and (+) symbols indicate which direction a value can be changed. The (→) symbol moves the cursor under the desired value to be edited.



- \* 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!

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This manual is organized into nine sections and four appendixes. In order to make the best use of your instrument, you are urged to read all nine sections. The appendixes can be referred to as necessary.

- Section 1** - shows what the packaging contains and explains how to unlock/lock the shoe, apply power, and charge the batteries properly.
- Section 2** - illustrates the proper positioning required for the instrument to obtain accurate and repeatable measurements.
- Section 3** - explains the QC functions of the instrument which includes: defining setups, loading a setup and reference measurement, and taking pass/fail and 555 shade tag measurements.
- Section 4** - describes the procedure for setting up and taking absolute color simple compare measurements.
- Section 5** - explains the procedure for selecting storage groups, and printing and deleting stored groups. Also explains the operation procedure for the optional Bar Code Reader (SP78-200).
- Section 6** - describes all the necessary steps required for calibrating your instrument.
- Section 7** - shows the different configuration options and how to set them for your particular requirements. The system configuration should be set prior to taking any measurements.
- Section 8** - covers basic maintenance of the instrument. Read through this section and see what it contains, then refer to it as required.
- Section 9** - explains how to attach the optional bar code reader to the instrument and the proper procedure for scanning bar codes.



**Appendix A** - lists the technical specifications of the instrument.

**Appendix B** - lists error messages that may occur during operation or calibration and the proper action to take.

**Appendix C** - lists optional accessories available from X-Rite or an Authorized Service Center.

**Appendix D** - describes the color check procedure used to track color measurement performance.



# SECTION 1

# GETTING STARTED

Subjects covered in Section 1 are:

- \* 1.1 Unpacking and Inspection
- \* 1.2 Unlocking and Locking the Shoe
- \* 1.3 Applying Power
- \* 1.4 Charging the Batteries
- \* 1.5 Function Selection

## 1.1 Unpacking and Inspection

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.

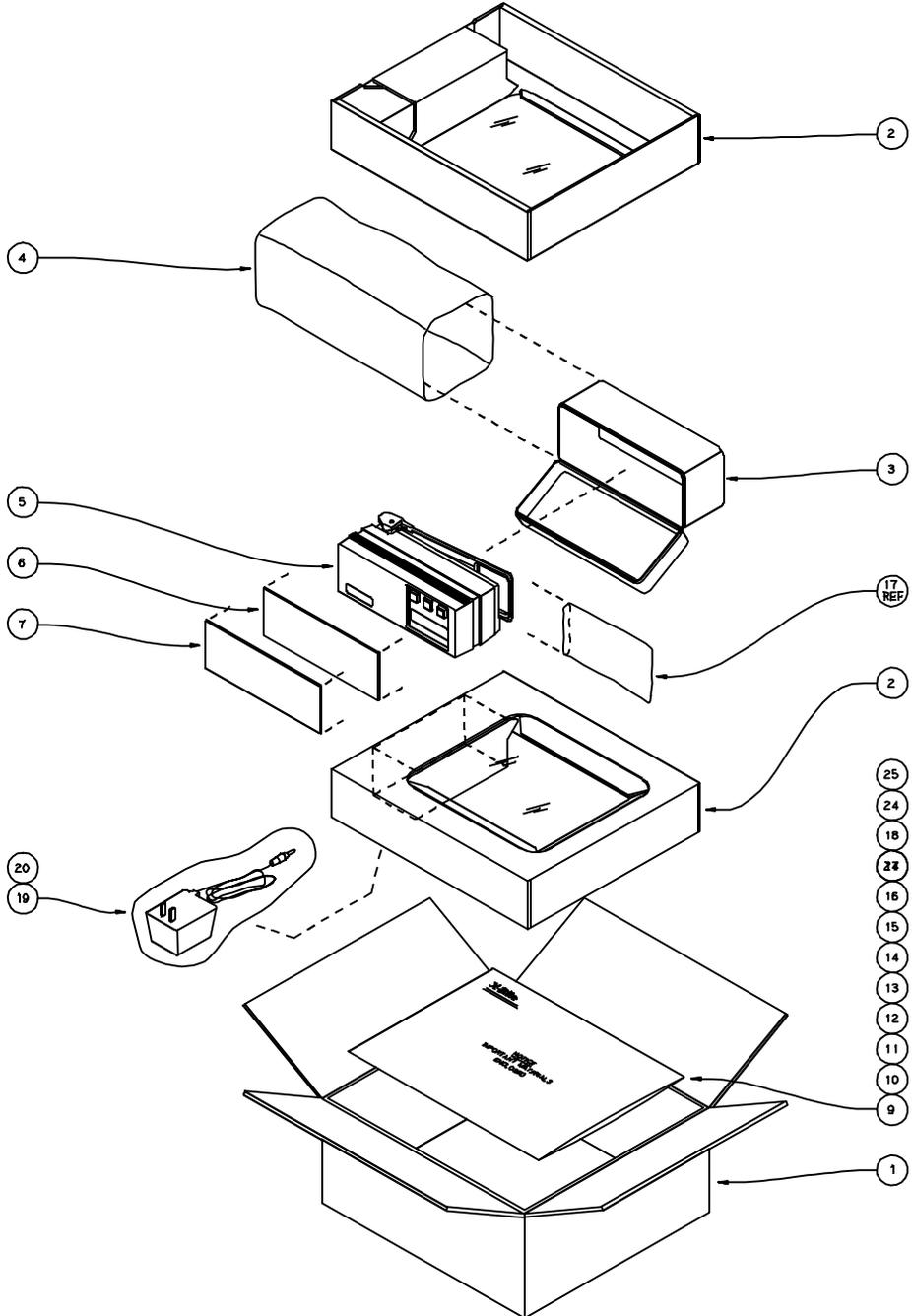
If damage is not evident, check and make sure that all items are included (refer to the parts list and the following page for packaging illustration).

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, Incorporated.

25	1	1	1	1	SD01-41	CERTIFICATE OF CALIBRATION
24	1	1	1	1	SD43-96B-6Z	REFLECTANCE LABEL
23	-	-	-	-	NOT USED	
22	1	1	-	-	SD43-22	UL LISTING LABEL
21	-	-	-	-	NOT USED	
20	1	1	1	1	SD65-13	PLASTIC BAG
19	-	-	1	1	SE30-62	AC/DC ADAPTOR 230 VAC 50/60 Hz
18	1	1	-	-	SE30-61	AC/DC ADAPTOR 115 VAC 50/60 Hz
17	2	1	2	1	SD43-27	LABEL
16	1	-	1	-	SD65-03	PLASTIC BAG
15	-	-	-	-	968-61-04	4mm APERTURE ATTACHMENT
14	-	-	-	-	968-121-20	20mm TARGET WINDOW
13	-	-	-	-	968-121-08	8mm TARGET WINDOW
12	1	-	1	-	968-121-04	4mm TARGET WINDOW
11	1	1	1	1	SD01-11	CHARGING NOTE
10	1	1	1	1	SD01-10	IMPORTANT NOTICE "SERVICE"
9	1	1	1	1	SD01-16	POSITION NOTICE
8	1	1	1	1	SD01-04	WARRANTY REGISTRATION
7	1	1	1	1	978-500	OPERATION MANUAL
6	1	1	1	1	SD68-10	ENVELOPE
5	-	-	-	-	NOT USED	
4	1	1	1	1	978-801	REFERENCE GUIDE
3	1	1	1	1	968-62	CALIBRATION REFLECTION STANDARD
2	-	1	-	1	978L-00-01	SPECTROPHOTOMETER ASSY-20mm
1	1	-	1	-	978-00-01	SPECTROPHOTOMETER ASSY- 8mm
	1	1	1	1	SD65-10	PLASTIC BAG
	1	1	1	1	418-87-01	CARRYING CASE
	2	2	2	2	SD200-880-06	CARTON INSERT
	1	1	1	1	SD200-880-01	CARTON
ITEM	978 QTY	978L QTY	978X QTY	978LX QTY	PART NUMBER	DESCRIPTION

**PARTS LIST**

# Packaging Illustration



## 1.2 Unlocking and Locking the Shoe

---

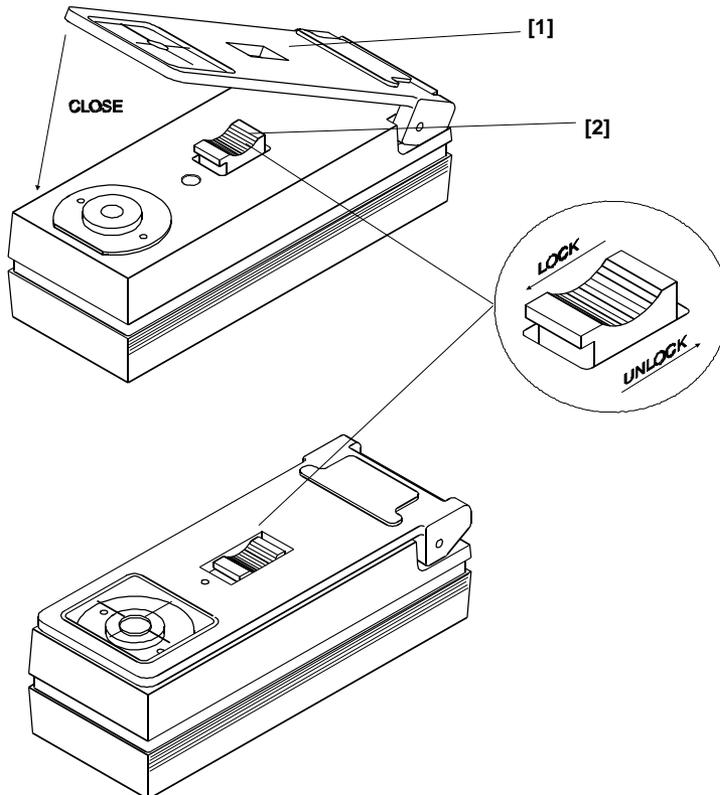
The instrument is shipped from the factory with the shoe in the locked position. The shoe should always be locked next to the instrument when it is stored.

*To Unlock Shoe:*

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

*To Lock Shoe:*

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



## 1.3 Applying Power

---

### *Battery Operation*

During battery operation power is applied automatically when a measurement is taken or if a key is pressed. The instrument automatically goes into a shut down mode to conserve battery life after 45 seconds of non-use.

### *AC Operation*

As long as the AC adaptor is connected to the instrument, the 978 will remain On.

## 1.4 Charging the Battery Pack

---

The 978 is powered by six nickel-cadmium batteries in a removable battery pack. The instrument's batteries should be charged before use. The unit can be operated while the batteries are being charged.

Before plugging in the AC adaptor, make sure that the voltage indicated on the adaptor complies with the AC line voltage in your area. If not, contact X-Rite or your Authorized Representative.

The instrument batteries should be fully charged in 14 hours and should provide approximately 1000 measurements. Charging the batteries for less than 14 hours will reduce the operating time of the unit. If the unit has not been used for several weeks, recharge for approximately 24 hours.

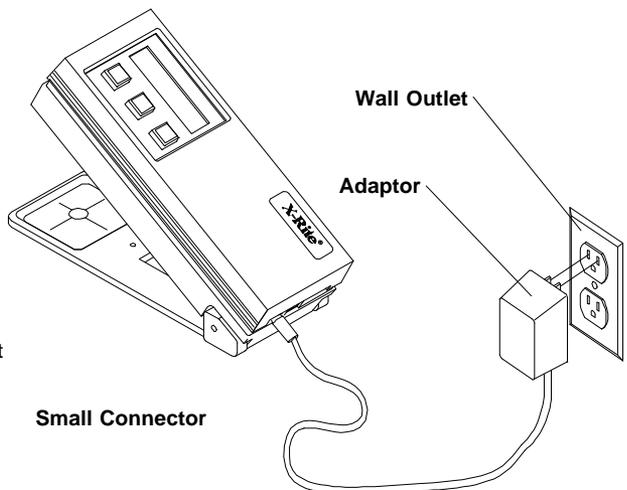
### Charging Tips

- \* Always run the unit down to the point where the **"BATTERIES LOW"** message is displayed. Then charge the unit before the next message **"CHARGE BATTERIES"** is displayed.
- \* Leaving the unit plugged into the AC wall outlet for extended periods of time (over 48 hours) may shorten the battery life.
- \* If the instrument is to be stored for an extended period of time (over 6 months), the battery pack should be removed from the unit.

### AC Adaptor Connection Procedure

1. Plug the small connector end of the AC adaptor into the adaptor jack on the back of the instrument or the battery pack.
2. Plug the adaptor into the AC wall outlet.

 The unit will not lose any of the preset information (i.e., cal, setups, etc.) if the battery pack is removed.



# 1.5 Function Selection

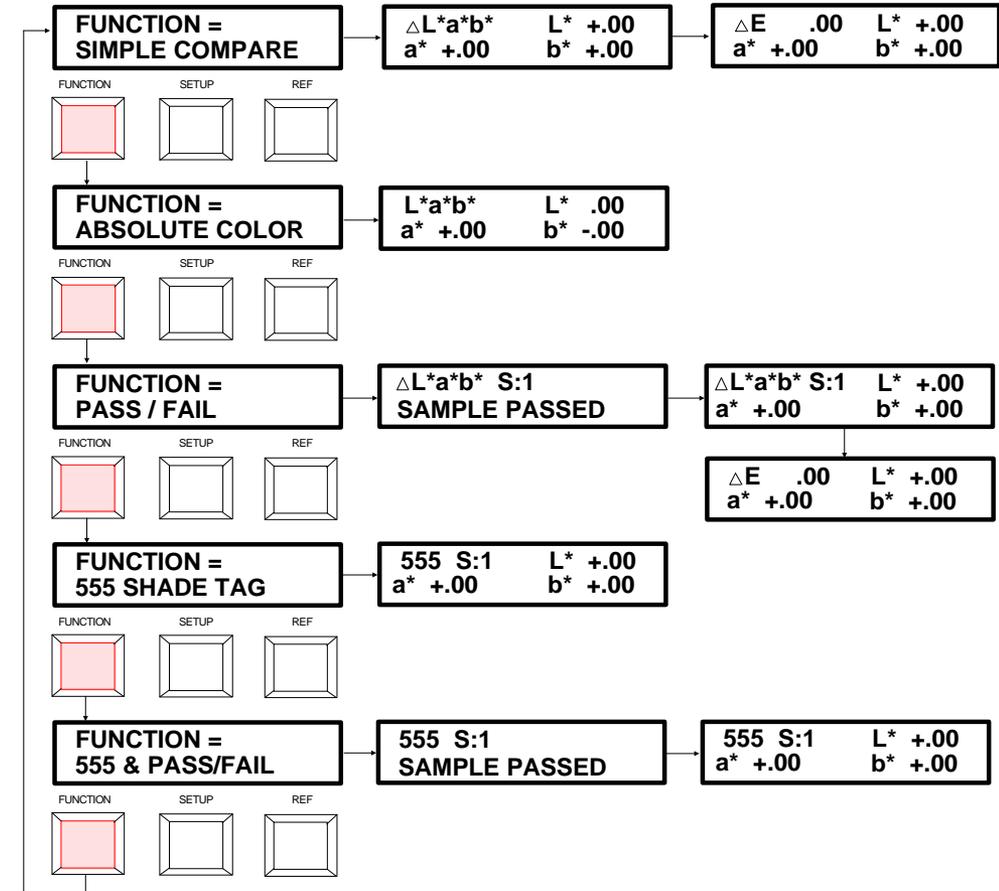
There are five measurement functions that can be accessed by pressing the "FUNCTION" key.

The "PASS/FAIL" and "555" functions are used for Textile QC operation and are covered in Section 3.

The "SIMPLE COMPARE" and "ABSOLUTE COLOR" functions can be used for scratch pad type measurements. These two functions are covered in Section 4.

- The desired function is selected by repeatedly pressing the [FUNCTION] key. The function name will display first, followed by the last measurement data. The data will display approx. 2-1/2 seconds after the key is released.

The function data displayed will vary depending the Deltas option selected (see Section 7.1). Shown below is the "Deltas=Numbers" setting which is the default.



## SECTION 2

# INSTRUMENT POSITIONING & MEASUREMENT TECHNIQUES

The variety of items that the 978 can measure is almost endless. However, in order to obtain accurate and repeatable measurements, the bottom of the shoe must be:

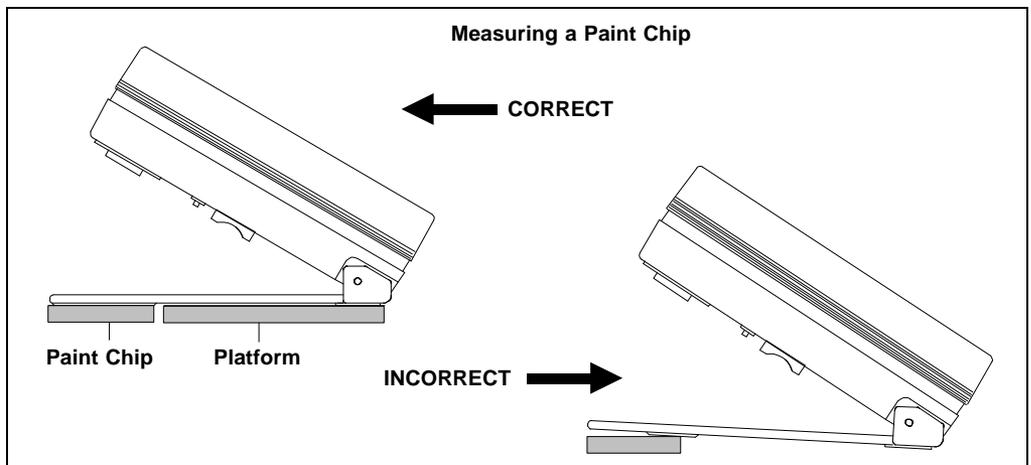
- \* Parallel with the surface to be measured if the surface is *flat*.
- \* Tangent to the surface to be measured if the surface is *curved*.

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 guidelines you can follow.

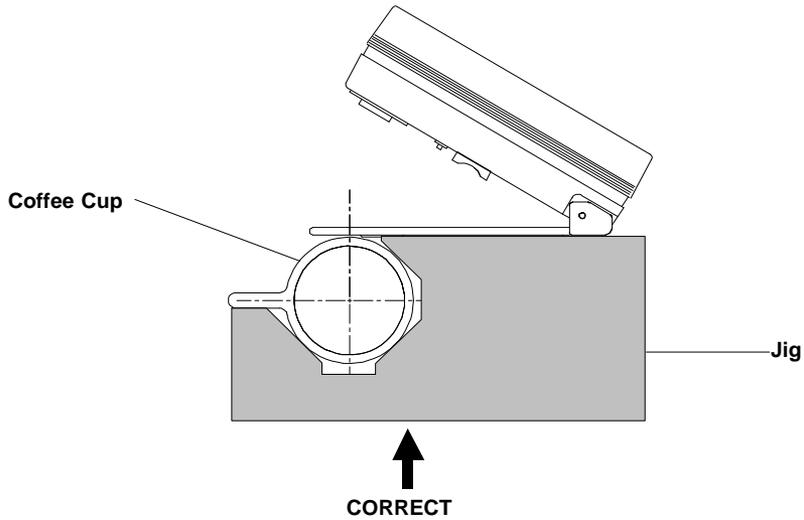
If the item to be measured is smaller than the shoe, you may want to make a platform (the same height of the item) for the instrument to sit on. If the item to measure is curved, you may want to make a jig for the item to rest in.

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.

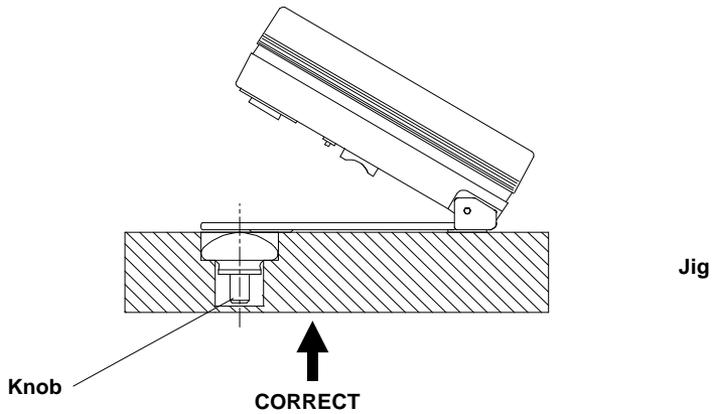
☞ A stand is available from X-Rite (P/N 968-80). The stand can hold objects that are a maximum of 4" inches in width, or 2" inches to the center of the object. Refer to Appendix C for further information about this mounting fixture.



**Example 2 - Measuring a Coffee Cup**



**Example 3 - Measuring a Small Knob**



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## **SECTION 3**

# **TEXTILE QC OPERATION**

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Subjects covered in Section 3:

- \* 3.1 Defining QC Setups
- \* 3.2 Loading QC Setup and Reference Entry
- \* 3.3 Pass/Fail and 555 Shade Tag Measurements

Pass/Fail function displays the difference (numerically or by words) between the reference and sample. After a measurement is taken, a pass or fail signal will then be indicated dependent on the tolerances assigned in the QC Setups.

555 Shade Tagging function allows a means of expressing usable information on different variations 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.

555 Shade Tagging & Pass/Fail function will indicate pass/fail status based on tolerances and display a shade tag number.

When Storage Mode is activated (see Sec. 5), QC measurements can be stored in selected groups and printed.

When the optional bar code reader is used, individual measurements can be tagged. The stored data can then be uploaded to X-Rite's QA-Master software package.

The "Deltas" option that is set in Operation Options (Sec. 7.1) allows measurement differences to be expressed numerically or by words which indicate color difference direction or intensity. The color difference direction and intensity may indicate that a sample is "lighter", ">>red" (more red), etc. than the sample.

## 3.1 Defining QC Setups

---



Setups must be defined in QA-Master if stored sample data is to be uploaded to QA-Master. Refer to Section 21 in QA-Master Reference Manual for procedure.

The 978 will store up to 30 individual "setups" with user defined options. This provides a very versatile instrument that can measure a broad range of samples with different tolerancing needs. Simply call up the proper setup number and measure a reference.

*The setup operation allows you to:*

- \* Select the setup number
- \* Define color space
- \* Set pass/fail limits
- \* Set shade size and range
- \* Select measurement averaging

After setups are defined, all setups with the exception of "#1" can be "locked out." This will help prevent any inadvertent or unauthorized changes from occurring. Refer to Section 7.1 for setup locking details.

The following descriptions cover all of the available setup options. The setup procedure will follow the descriptions.

### Setup Descriptions

**Color Space (space)** - Is used to select the color space the setup will use for calculating color differences used in pass/fail and shade sorting. The available options are:  $\Delta L^*a^*b^*$ ,  $\Delta L^*C^*H^*$ ,  $\Delta XYZ$ ,  $\Delta Lab$  (Hunter),  $\Delta Wht$ ,  $\Delta Yel$ , and  $\Delta Ecmc$ .

**$L^*a^*b^*$**  - 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. The "\*" denotes calculation per the CIE Colorimetry Publication 15.2.



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

**XYZ** - X, Y and Z are the CIE tristimulus values calculated per ASTM E308-90. X, Y and Z are used in calculating the other color spaces and indices. If the tristimulus values are equal for a given pair of samples, under a specified observer, illuminant, and geometry of illumination and view, the samples will visually match under these conditions.

**Lab** (Hunter) - is an opponent-colors based system similar to L\*a\*b\*, developed in 1942 by the late Richard Hunter.

**Whit** - whiteness index is used as a preference rating for how white a material should appear. Whiteness is calculated per ASTM E313 (We) and per CIE 15.2 (W).

**Yel** - the ASTM's E313 yellowness index (Ye) is used to determine the amount to which a sample color can shift away from an ideal white. The D1925 yellowness index (Yd) is used for measuring plastics.

**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\*C\*h° 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\*C\*h° 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\*C\*h° 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:

$$DE_{CMC} = \left[ \left( \frac{\Delta L}{1.0 S_L} \right)^2 + \left( \frac{\Delta C}{c S_C} \right)^2 + \left( \frac{\Delta H}{S_H} \right)^2 \right]^{.5}$$

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 ( $\iota$ ), 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  $\Delta E$  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 " $\iota$ " should be assumed best for textile measurement until actual results indicate a need for adjustment. Increasing " $\iota$ " 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.

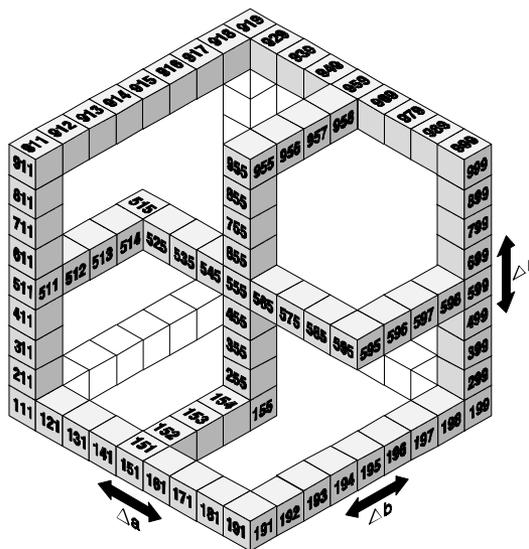
**Illuminant/Observer (illum)** - Is used to select the illum/obs combination that the setup will measure samples under. The available combinations are: C<sup>2</sup>, C<sup>10</sup>, D65<sup>2</sup>, D65<sup>10</sup>, D50<sup>2</sup>, D50<sup>10</sup>, A<sup>2</sup>, A<sup>10</sup>, F2<sup>2</sup>, F2<sup>10</sup>, F7<sup>2</sup>, F7<sup>10</sup>, F11<sup>2</sup>, F11<sup>10</sup>, F12<sup>2</sup>, and F12<sup>10</sup>.

**Pass/Fail Limits** - Are individual limits set on each attribute of the selected color space. In cases where the DE tolerance method is selected, only one value is entered. The limits can be set from .01 to 9.99. The limit for individual attributes can also be turned "Off" by advancing past 9.99.

**Shade Sort Size** - The shade sort size are dimensions placed on the color space attributes. The value represents a three dimensional box in space. These boxes are layered nine deep on each axis and at the center is the 555 reference box. This box represents your reference color. The value in the L\*, a\*, and b\* fields determine the reference box size. Enter a smaller value for a tighter tolerance. Values range from .01 to 9.99.

**Shade Sort 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 three dimensional space.

**The 555 Shade Sort Solid System**



**Averaging** - Is used to enter the number of readings (1 - 5) that the instrument will require to obtain a measurement.

✎ If "Auto Setup" is turned "ON" in Operation Options (Sec. 7.1), individual setup averages will not be allowed. The Setup will use the global averaging number that is selected in the Auto Setup option (see Sec. 7.1).

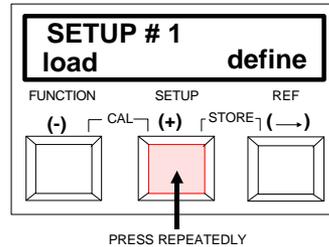
## Setup Entry Procedure

The following is a step-by-step procedure for defining the setups.

✎ "PASS/FAIL", "555 SHADE TAG", or "555 & PASS/FAIL" function must be selected in order to access QC Setup function.

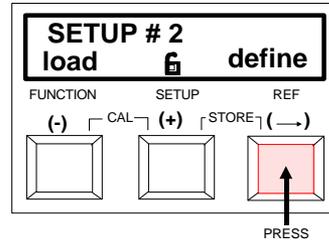
1) Repeatedly press **[SETUP]** to select the setup # requiring definition.

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



2) Press **[REF]** (define) key to define selected setup.

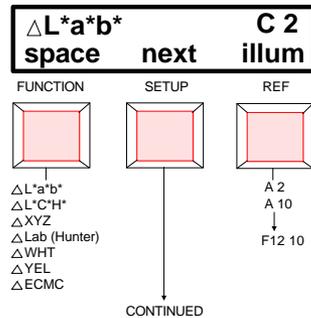
✎ Pressing **[FUNCTION]** will load the selected setup # data into the unit. See Section 3.2 for more detail. If the lock icon is closed, setup #'s 2-30 can not be changed.



3) Press **[FUNCTION]** (space) key to page through available color spaces.

4) Press **[REF]** (illum) key to page through available illum/obs combinations.

5) Press **[SETUP]** (next) key to save selections and advance to Pass/Fail Limits.



## 6) Set Pass/Fail Limits.

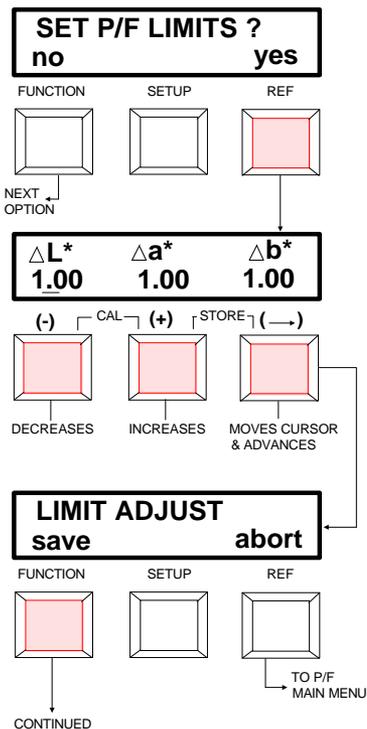
- \* Press **[REF]** (yes) key to indicate Yes, you do want to Set P/F Limits.

Pressing **[FUNCTION]** (no) key 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 can easily be set by simultaneously pressing the **[FUNCTION]** and **[SETUP]** keys when the cursor is under the attribute.  
To set the delta E pass/fail value, simultaneously press the **[FUNCTION]** and **[SETUP]** keys while the cursor is under the "L" attribute.

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

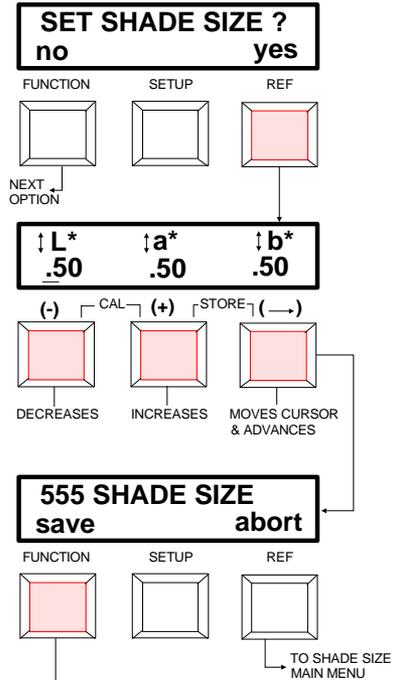


### 7) Set Shade Size.

- \* Press **[REF]** (yes) key to indicate Yes, you do want to set Shade Size.

 Pressing **[FUNCTION]** (no) key 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]** (save) key to save Shade Size and advance to next option.

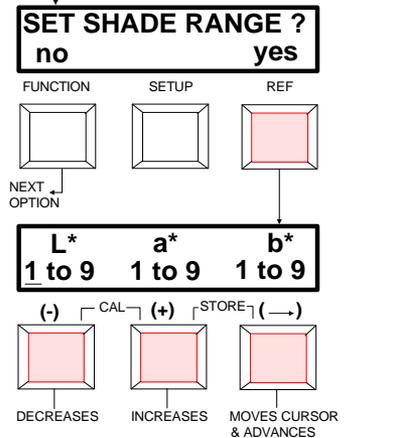


### 8) Set Shade Range (1 - 9).

- \* Press **[REF]** (yes) key 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.



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

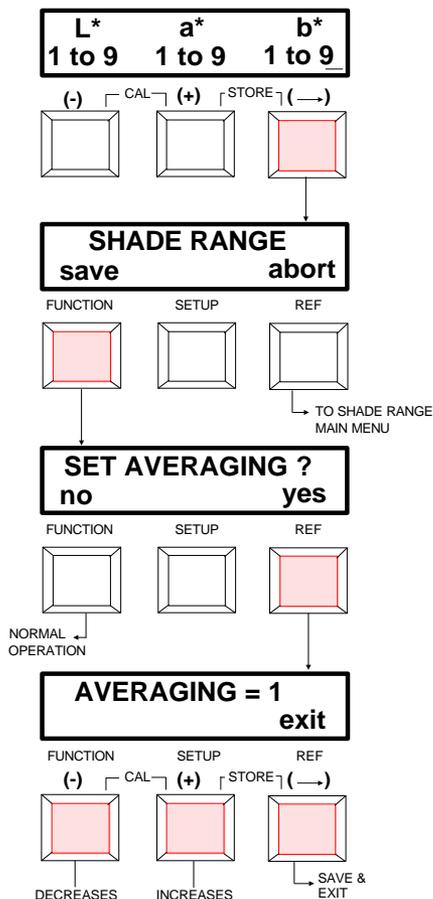
### 9) Set Averaging (1 - 5).

- \* Press [REF] (yes) key to indicate Yes, you do want to set Averaging.

☞ Pressing [FUNCTION] (no) key will exit setup and return the display to normal operation.

- \* Press the [-] key to decrease the average number.
- \* Press the [+] key to increase the average number.
- \* Press [ref] (exit) key to save averaging number and return the display to normal operation.

☞ The setup procedure may be exited at any time by closing the shoe to the instrument. Setup changes that were made before exiting will be saved.



## 3.2 Loading QC Setup and Reference Entry

The 978 will store a separate reference for each of 30 Setups. The reference will remain with the selected "Setup" until changed.

When the "AUTO SETUP" option in Sec. 7.1 is set to "OFF", references can be either measured or manually entered. When "AUTO SETUP" is set to "ON", references can only be measured. A reference is set after the Setup is "loaded" into the display.

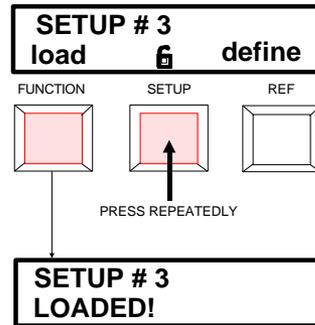
### Loading a QC Setup

Make sure that either "PASS/FAIL", "555 SHADE TAG", or "555 & PASS/FAIL" function is selected before attempting to load a Setup. Refer to Section 1.5 for function select information if required.

1) Repeatedly press [SETUP] to select the setup # to load.

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

Setup #'s can be decremented by pressing and holding the [SETUP] key, then pressing the [FUNCTION] key.



2) After desired setup is displayed, press [FUNCTION] (load) key to load setup.

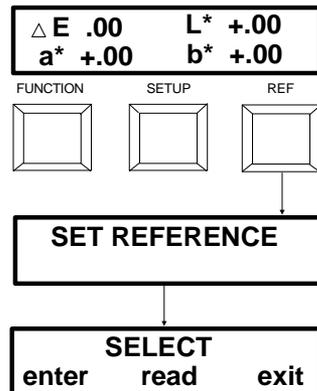
### Reference Measurement

After the desired Setup is loaded, a reference can be set.

1) Press the [REF] key to enter reference function.

"SET REFERENCE" is display then the reference menu.

- Continue with Step 2 to manually enter reference values, or advance to Step 3 to measure a reference.



## 2) Manual Reference Entry

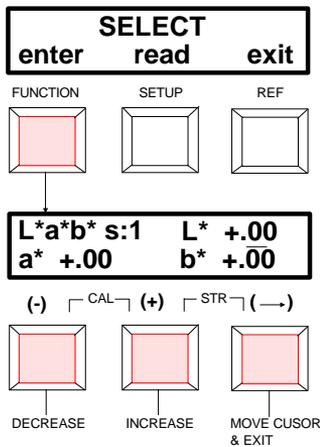
- Press the [FUNCTION] (enter) key.

☞ If "AUTO SETUP" is set to "ON" in Sec. 7.1, manual references *can not* be entered. "view" will display instead of "enter."

- Press [→] key to move cursor to desired attribute. The "arrow" key is also used to exit manually entry.

- Press the [+] key to increase value.

- Press the [-] key to decrease value.



## 3) Reference Measurement

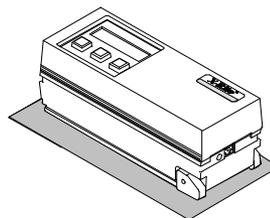
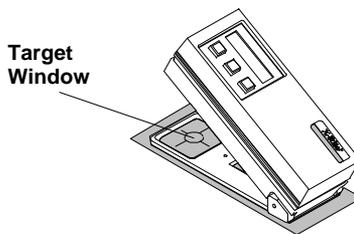
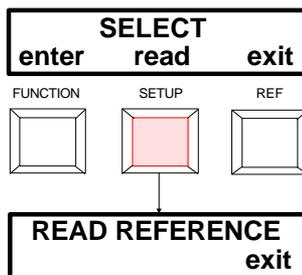
- Press the [SETUP] (read) key.

- Position target window over reference to be measured.

- Lower unit to target window and hold compressed.

"READING REFERENCE" is displayed. Release unit after "READING COMPLETE" is displayed.

☞ If an error message occurs during the measurement, try reading reference sample again. If error message still occurs, refer to Display Message in Appendix B.



4) The reference data is entered and the instrument automatically returns back to QC operation. Refer to Section 3.3 for QC measurement operation.

### 3.3 Pass/Fail and 555 Shade Tag Measurements \_\_\_\_\_

The 978 will display three QC measurement functions: pass/fail, 555 shade tag, and pass/fail & 555 shade tag. Once a measurement is taken, it can be viewed under any of the three measurement functions.

There are three methods that can be used to express the measured differences. The first method is by showing the differences numerically. The second method is by expressing the difference using words (see below). XYZ, Wht, and Yel will not display differences in words. The third method is Deltas turned "Off." This will cause only a Pass/Fail or 555 indication to display. Delta selection for "numbers", "words", or "off" is selected in Operation Options, Section 7.1.

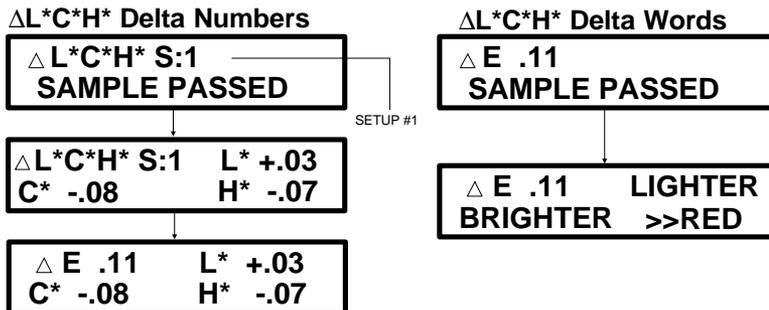
When delta words are used, the "L\*" attribute for L\*a\*b\* or L\*C\*H\* will display either "**LIGHTER**" or "**DARKER**" from the reference. The "a\*" and "b\*" attributes for L\*a\*b\* and the "H\*" (hue) attribute for L\*C\*H\* will display as ">>RED", ">>GRN", >>BLU", or ">>YEL." This is an indication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

- ➡ No words will display for an attribute that is less than "1/7th" of the Delta E value. A value less than this amount is considered insignificant compared to the total difference. If the delta value for any attribute is greater than 10.00, the display will change to numeric values.

#### Pass/Fail Only Function

The pass/fail function will indicate a pass or fail on the selected setup , and display the difference between the reference & sample.

#### Pass/Fail Display Examples

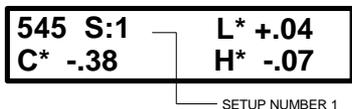


### 555 Shade Tag Only Function

The 555 shade tag function will display a 3 digit number (with 555 being the reference) based on the selected shade size and shade range parameters set.

#### 555 Shade Tag Display Examples

##### $\Delta L^*C^*H^*$ Delta Numbers



##### $\Delta L^*C^*H^*$ Delta Words



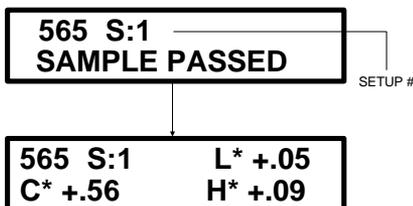
If an up arrow "↑" or down "↓" arrow appears in the place of a shade tag number, this indicates the direction that the tag number is out of range.

### Pass/Fail & 555 Shade Tag Function

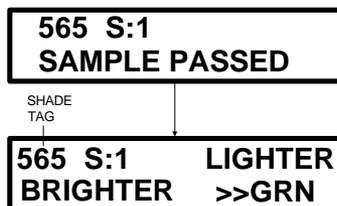
The pass/fail & 555 will display a shade tag number and pass or fail indication based on the tolerances set.

#### Pass/Fail & 555 Shade Tag Display Examples

##### $\Delta L^*C^*H^*$ Delta Numbers



##### $\Delta L^*C^*H^*$ Delta Words



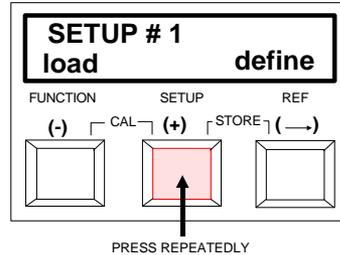
### To take a QC measurement:

➡ Defining Setups (Sec. 3.1) must be performed before continuing with this procedure.

If QC measurement are to be Stored in the instrument, refer to Section 5 for Storage selection procedure.

The following procedure will guide you through all the steps required to take a setup measurement. Measurement tagging using the optional bar code reader will be covered in Tagging and Storing Operation, Section 5.4.

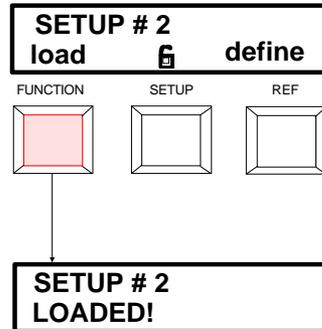
- 1) Make sure "PASS/FAIL", "555 SHADE TAG", or "555 & PASS/FAIL" is selected. Repeatedly press [SETUP] key to select setup.



- 2) Press [FUNCTION] (load) key to load the selected Setup.

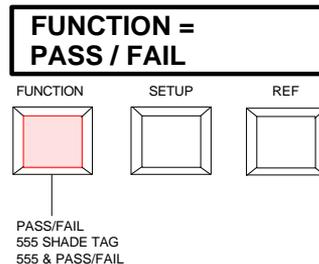
➡ The [FUNCTION] (load) key must be pressed within 3-sec. or the display will revert back to operation mode.

If a reference does not exist for the selected setup, refer to Section 3.2 for measurement procedure.

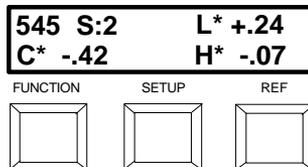


- 3) Press the [FUNCTION] key to select "PASS/FAIL", "555 SHADE TAG", or "555 & PASS/FAIL"

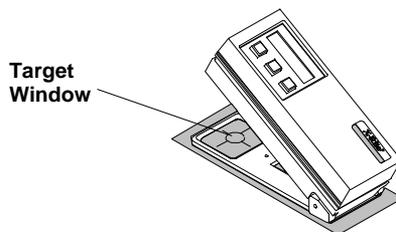
➡ The display function can be changed after a measurement is taken to view sample data in a different function.



The display will show the last measurement data with selected setup and function.

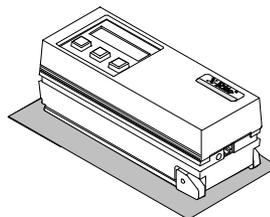


- 4) Position instrument on sample to measure.



- 5) Lower unit to target window and hold compressed.

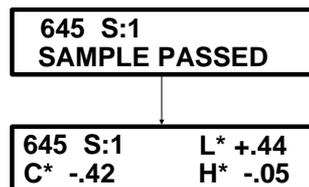
Release unit from sample after **"READING COMPLETE"** is displayed.



☞ If an error message occurs during the measurement, try reading sample again. If error message still occurs, refer to Display Message in Appendix B.

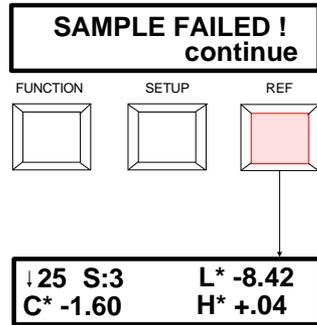
***Passed sample using delta numbers and pass/fail & 555 function***

- 3 short beeps will be heard to indicate passed sample.
- For shade "645", "6" represents the "L" attribute, "4" represents the "a" attribute, and "5" represents the "b" attribute.



### *Failed sample using delta numbers and pass/fail & 555 function*

- 1 long beep will be heard to indicate failed sample.
- When a tag number (L\*, a\*, or b\*) is out of range (depending on setting), an arrow will indicate the direction. The "↑" arrow indicates over and the "↓" arrow indicates below. The fail signal is based on tolerance values assigned to Setup #3.



☞ The [REF] (continue) key must be pressed to continue to next display screen, if "WAIT ON FAIL" option is set to "On." Refer to Section 7.1 Operation Options for more details.

---

### *Passed sample using delta words and pass/fail & 555 function*

- 3 short beeps will be heard to indicate passed sample.
- "Delta Words" is selected in Operation Options, Section 7. The sample passed, but is slightly "LIGHTER", "DULLER", and towards "RED."



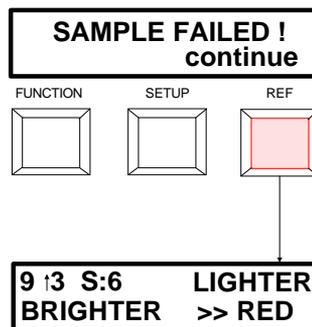
☞ If any attribute matches the reference exactly, no description will be given for that attribute.



### *Failed sample using delta words and pass/fail & 555 function*

- 1 long beep will be heard to indicate failed sample.
- The display indicates that the sample is "**LIGHTER**", "**BRIGHTER**", and towards "**RED.**"

☞ The [REF] (continue) key must be pressed to continue to next display screen, if "**WAIT ON FAIL**" option is set to "On." Refer to Section 7.1 Operation Options for more details.



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## SECTION 4

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# ABSOLUTE COLOR & SIMPLE COMPARE OPERATION

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Subjects covered in Section 4:

- \* 4.1 Absolute Color and Simple Compare Setup
- \* 4.2 Simple Compare Reference Entry
- \* 4.3 Absolute Color and Simple Compare Measurements

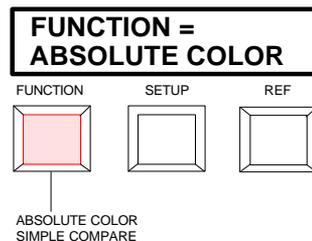
The 978 has two alternate measurement functions that can be selected: Absolute Color and Simple Compare. These two functions can be used for "scratch pad" measurement operation. The color space, illum/obs combination, and averaging can be set for these functions.

### 4.1 Absolute Color and Simple Compare Setup

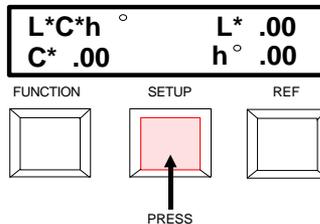
The color space, illum/obs, and averaging can be set for absolute color and simple compare measurements. The two functions share the same setup procedure. If a QC function is selected (i.e.; pass/fail, 555), the absolute color and simple compare settings will change to the last QC setup selected.

*To setup functions:*

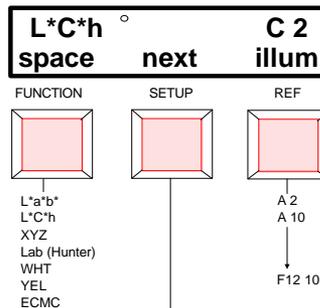
- 1) Press the [FUNCTION] key to select "ABSOLUTE COLOR" or "SIMPLE COMPARE."



2) Press the **[SETUP]** key to enter setup selection menu.

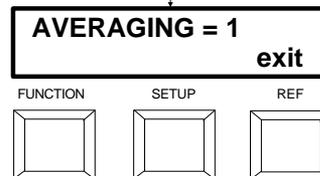


3) Press the **[FUNCTION]** (space) key to increment through available illuminant/observer combinations.



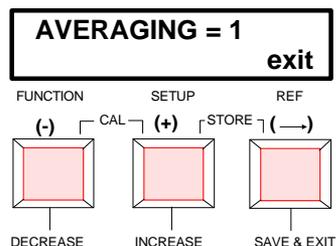
4) Press the **[REF]** (illum) key to increment through available illum/obs combinations.

5) Press the **[SETUP]** (next) key to save options and advance to measurement averaging selection.



6) Set Averaging (1 - 5).

- \* Press the **[-]** key to decrease the average number.
- \* Press the **[+]** key to increase the average number.
- \* Press **[ref]** (exit) key to save averaging number and return the display to normal operation.

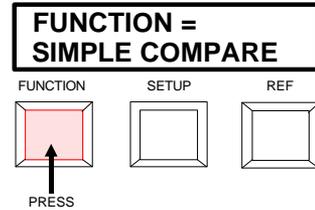


## 4.2 Simple Compare Reference Entry

A single reference can be measured or manually entered for the Simple Compare function. If a reference is set while Absolute Color is selected, the 978 will automatically switch the function to Simple Compare.

*To set a reference:*

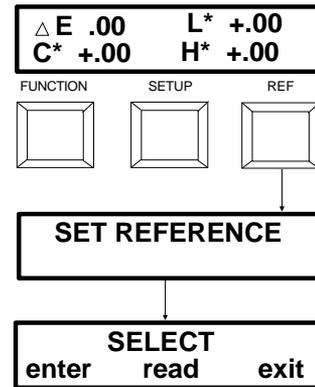
- 1) Press **[FUNCTION]** key to select "SIMPLE COMPARE."



- 2) Press **[REF]** key to enter reference function.

"SET REFERENCE" is displayed then the reference menu.

- Continue with Step 3 to manually enter reference values, or advance to Step 4 to measure a reference.

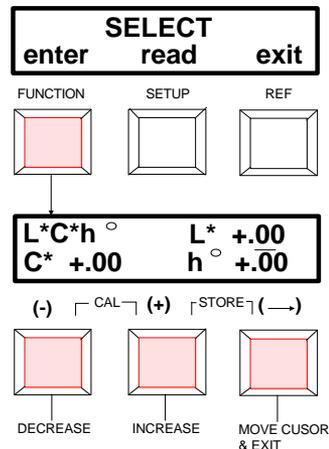


### 3) Manual Reference Entry

- Press the **[FUNCTION]** (enter) key.

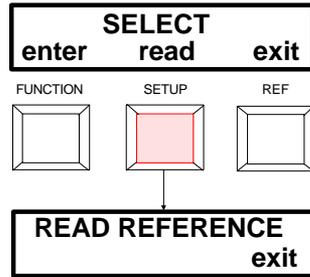
☞ If "AUTO SETUP" is set to "ON" in Sec. 7.1, manual references *can not* be entered. "view" will display instead of "enter."

- Press **[→]** key to move cursor to desired attribute. The "arrow" key is also used to exit manually entry.
- Press the **[+]** key to increase value.
- Press the **[-]** key to decrease value.



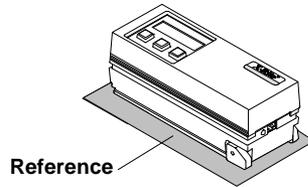
#### 4) Reference Measurement

- Press the [SETUP] (read) key.



- Position target window over reference to be measured. Lower unit to target window and hold compressed.

"READING REFERENCE" is displayed. Release unit after "READING COMPLETE" is displayed.



- ☞ If an error message occurs during the measurement, try reading reference sample again. If error message still occurs, refer to Display Message in Appendix B.

- 5) The reference data is entered and the instrument automatically returns back to Simple Compare function.

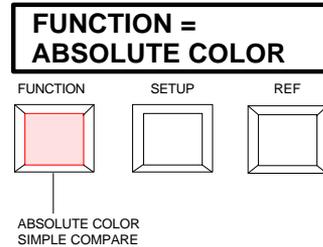
Refer to Section 4.3 for measurement operation.

## 4.3 Absolute Color and Simple Compare Measurements

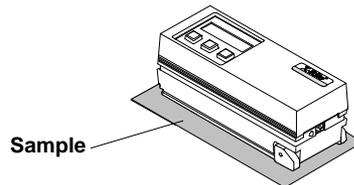
☞ If Absolute Color or Simple Compare measurements are to be stored in the instrument, refer to Section 5 for selection procedure.

*To take a measurement:*

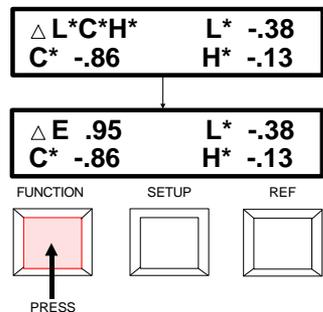
- 1) Press [FUNCTION] key to select "ABSOLUTE COLOR" or "SIMPLE COMPARE."



- 2) Position target window over sample to be measured. Lower the unit to the target window and hold compressed. "READING SAMPLE" is displayed. Release unit after "READING COMPLETE" is displayed.



- 3) The measurement data is displayed. The measurement data can be viewed in Simple Compare or Absolute Color by pressing the [FUNCTION] key and selecting function.



☞ The Simple Compare reference will be overwritten if a QC function (i.e.; pass/fail, etc.) is selected.



# SECTION 5

# STORAGE OPERATION

Subjects covered in Section 5:

- \* 5.1 Selecting Storage and Group Numbers
- \* 5.2 Printing Stored Measurements
- \* 5.3 Deleting Stored Measurements
- \* 5.4 Tagging and Storing Operation (Optional)

The 978 has the capability of storing measurement data. The stored data can be output to a printer or uploaded to X-Rite's QA-Master software package for analysis.

Stored sample measurements can also have scanned tags attached by use of the optional bar code reader (BCR). Group names can be assigned by scanning a tag. Individual measurements can have from 1 to 6 tags attached.

## 5.1 Selecting Storage and Group Number

The 978 can store a total of 300 measurements in 1 to 20 selected groups.

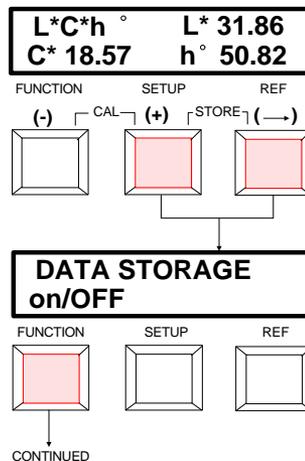
*To select storage mode and group number:*

- 1) Simultaneously press the [SETUP] key and [REF] key.

"DATA STORAGE" menu is displayed.

- 2) Press the [FUNCTION] (on/OFF) to activate storage mode.

 A key must be pressed within 3 seconds or the display will revert back to normal operation.



3) Press **[REF]** (group) key to enter group selection.

---

4) Press **[SETUP]** (next) to select desired group.

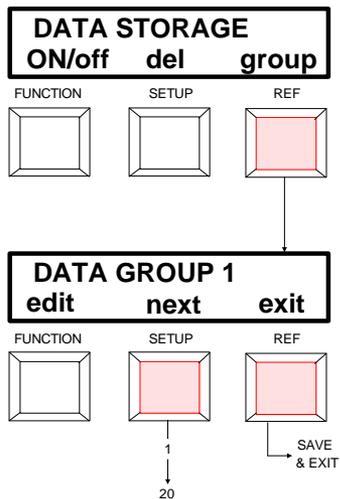
☞ Group numbers can be decremented by pressing and holding the **[SETUP]** key, then pressing **[FUNCTION]** key.

---

5) Press **[REF]** (exit) to save group selection and exit out of Data Storage mode.

---

6) All measurements taken in any function will now be stored in the selected group.



## 5.2 Printing Stored Measurements

The 978 has the ability to output stored measurement data directly to a serial printer or computer. The printout format options in Section 7.3 dictates what format data is output during a printout. Individual groups or all measurements can be printed.

*To print stored measurements:*

1) Refer to Section 7.2 and 7.3 to set I/O and Printout Options.

2) In Storage Mode, press the [REF] (group) key.

- The [SETUP] (del) key can be pressed if all groups are to be printed.

3) Press the [SETUP] (next) key to select individual group to print-out.

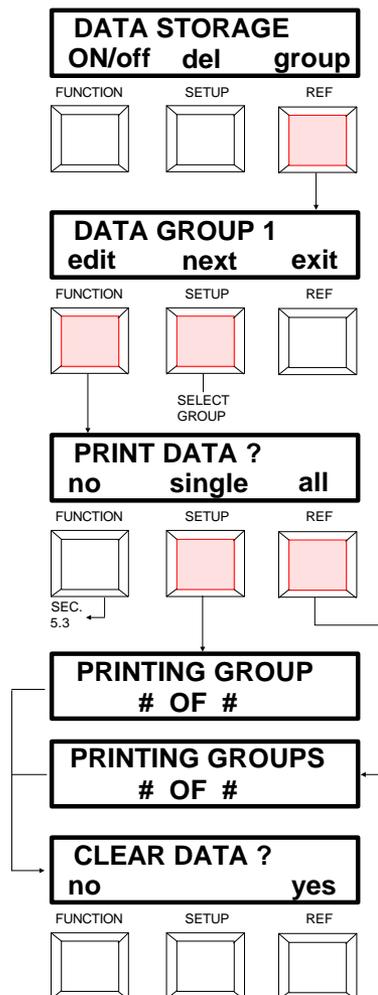
4) Press the [FUNCTION] (del) key to enter "PRINT DATA" menu.

5) Select printout type (single or all).

- Press [SETUP] (single) key to printout selected group data. Press [REF] (all) key to printout all stored data.

6) Press the [FUNCTION] (no) key to save stored data. Press [REF] (yes) key to clear stored data from the instrument.

 Refer to Section 5.3 for additional information on deletion procedures.



## 5.3 Deleting Stored Measurements

The 978 has three delete methods available.

- \* **Delete Last** will delete the last measurement taken.
- \* **Delete Group** removes all stored measurements in the selected group.
- \* **Delete All** will delete all stored measurements in all twenty groups.

### Delete Last

*To delete last measurement:*

- 1) At "DATA STORAGE" menu, press [SETUP] (del) key.

The "PRINT ALL DATA?" menu is displayed showing 10 readings.

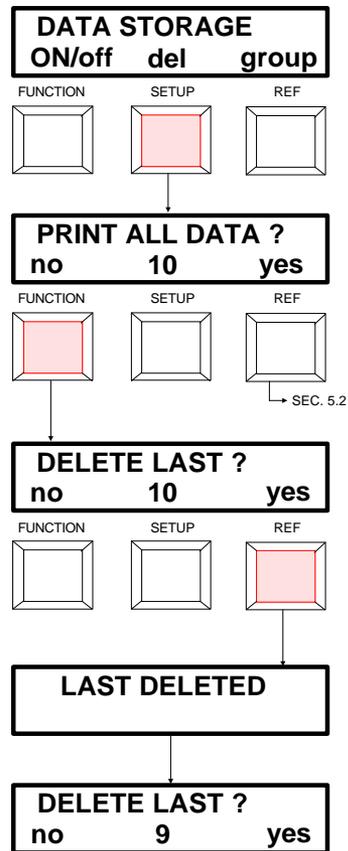
- 2) Press [FUNCTION] (no) key.

The "DELETE LAST?" menu is displayed showing 10 readings.

- 3) Press [REF] (yes) key to delete last measurement.

"LAST DELETED" then "DELETE LAST?" menu is displayed again showing 9 reading.

- 4) Additional measurements can be deleted by repeating Step 3.



## Delete Group

*To delete group measurements:*

- 1) At "DATA STORAGE" menu, press [REF] (group) key.

---

- 2) Press [SETUP] (next) key to select group number for deletion.

---

- 3) Press [FUNCTION] (edit) key.

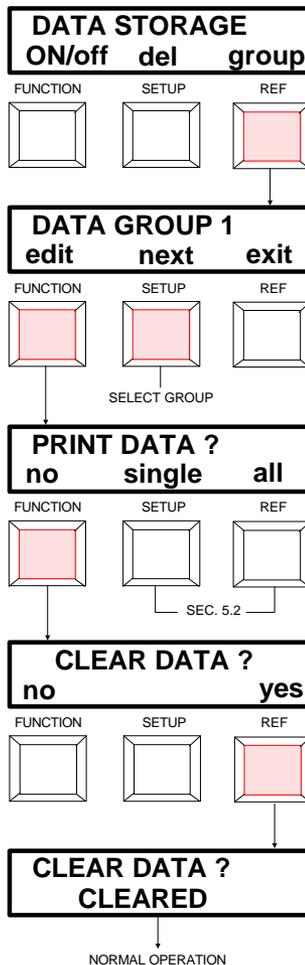
---

- 4) Press [FUNCTION] (no) key to access "CLEAR DATA" menu.

---

- 5) Press [REF] (yes) key to clear measurement data in the selected group.

The instrument will return to normal operation automatically.



## Delete All

*To delete all stored measurements:*

- 1) At "DATA STORAGE" menu, press [SETUP] (del) key.

The "PRINT ALL DATA?" menu is displayed showing 10 readings.

- 2) Press [FUNCTION] (no) key.

The "DELETE LAST?" menu is displayed showing 10 readings.

- 3) Press [FUNCTION] (no) key.

The "CLEAR ALL" menu is displayed showing 10 stored reading.

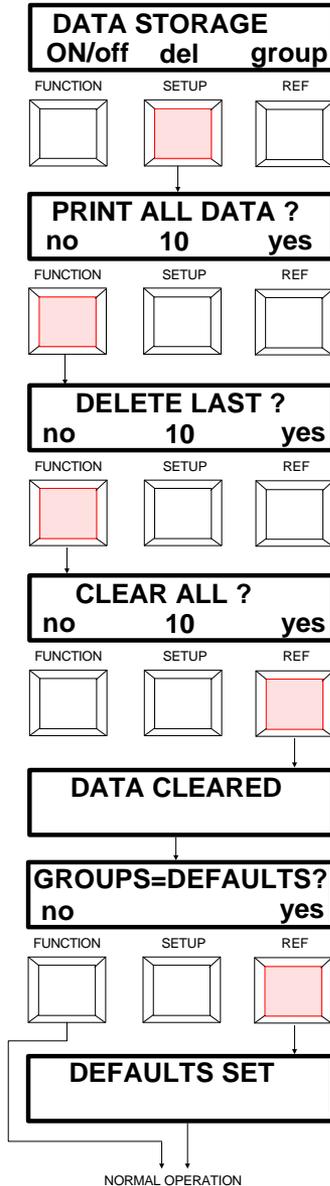
- 4) Press the [REF] (yes) key.

"DATA CLEARED" is displayed.

- 5) "GROUPS=DEFAULTS?" is displayed.

- Press [FUNCTION] (no) key to keep preset group names (i.e.; names set in X-Rite's QA-Master).
- Press [REF] (yes) key to reset name to factory defaults (i.e.; Data Group 1, etc.).

The instrument will return to normal operation automatically.



## 5.4 Tagging and Storing Operation (Optional)

☞ Tags are entered by scanning. If you intend to use the optional Bar Code Reader (BCR), we suggest that you read Section 9 before continuing with this tagging operation.

Tags are used as a method to label stored measurement samples for identification. The sample data can then be printed or uploaded to X-Rite's QA-Master® software program with tags applied. Refer to the last two pages of this Section for special features that exist when tags are used.

Individual measurements can have from 1 to 6 tags attached. There are three tag options to select from once a tag is scanned.

**Tag All** - This option will only appear on the instruments display when no measurement data is stored in the instrument. Any measurement that is taken after "all" is selected will have the scanned tag attached.

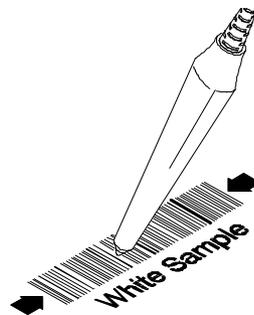
**Tag Group** - This option will only appear on the instruments display when a new group is selected that has no stored measurements. Any measurement taken in that group after "group" is selected will have the scanned tag attached. The first tag that is scanned under group will also be used as the group name on the instrument.

**Tag Next** - This option will store the scanned tag with the next sample that is measured.

When the stored measurement data from the instrument is uploaded to X-Rite's QA-Master software program, all tags that were attached will also transfer.

### *To tag and store a measurement:*

- 1) Make sure instrument is in "Storage Mode" and select "Group #" (see Section 5.1).
- 2) Select "Setup #" and/or "Function" that will be used (see Sec. 3.2 & Sec. 1.5).
- 3) Connect Bar Code Reader to I/O port if not already connected, and scan desired bar code. Refer to Section 9 to attach or if scan did not work correctly.



- 4) The bar code name should appear on the first line of the display.

### Tag All

- Press [REF] (yes) key if every measurement that is to be stored will receive the scanned tag. Press [FUNCTION] (no) key to advance to "TAG GROUP" option.

☞ "TAG ALL?" will not appear if any measurements have previously been stored.

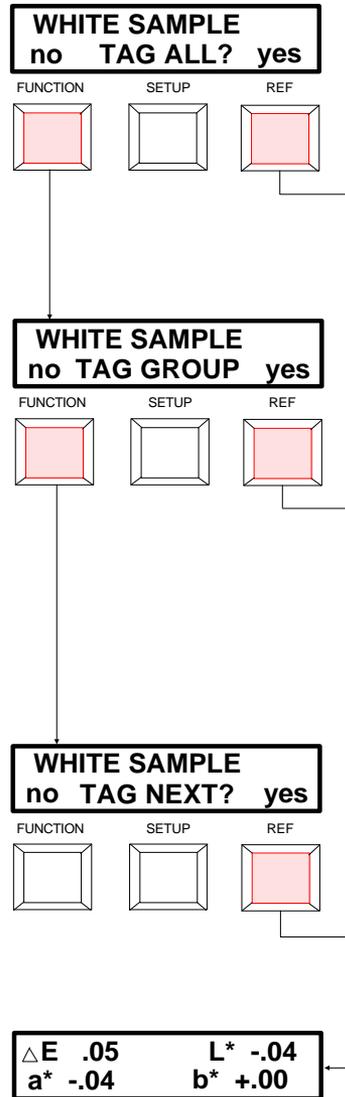
### Tag Group

- Press [REF] (yes) if all measurements in the selected group will have the same scanned tag. Press [FUNCTION] (no) key to advance to "TAG NEXT" option.

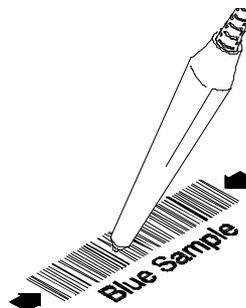
☞ If a group is not named and "TAG GROUP" is selected, the scanned tag name will take the place of the data group # in the instrument. "TAG GROUP" will not appear if any measurements have previously been stored in the group.

### Tag Next

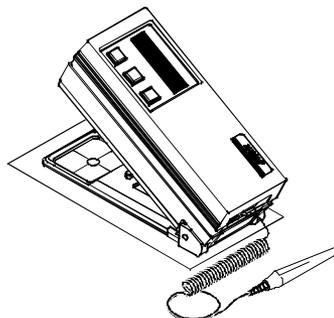
- Press [REF] (yes) if the measurement to follow will be the only sample with the scanned tag attached.
- A total of "6" tags can be attached to each measurement. The total of "6" tags includes combinations of "ALL", "GROUP", and "NEXT" tag selections.



- 5) Scan additional bar codes if more are required for "ALL", "GROUP", or "NEXT" samples.

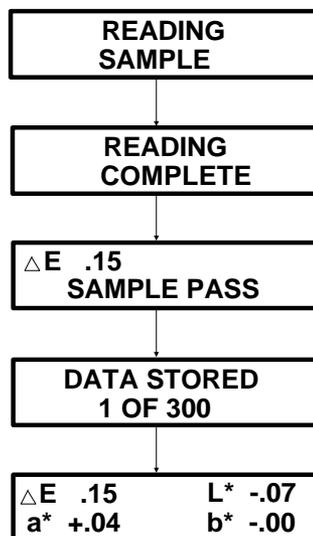


- 6) Take reading by lowering the unit to the target window on the sample.



- 7) Lift unit off of sample after "READING COMPLETE" is displayed.

The measurement is stored with the scanned tag.



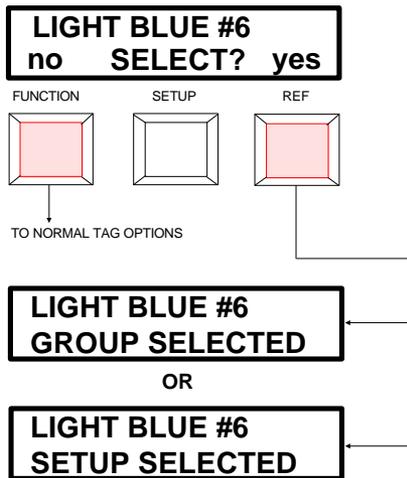
## QA-Master Group and Setup Name Special Feature

The 978 has a unique feature that allows the user to automatically switch to a "setup" or "group" that uses the same name as the scanned tag.

For example, if "Setup #5" is named "Light Blue #6" and the scanned tag has the same name, the 978 will display "**no SELECT? yes.**" Pressing the [REF] (yes) key allows you to switch to that setup if desired.

Downloaded "group names" work in the same manner.

Pressing [REF] (yes) key will switch the display to "**GROUP SELECTED**"



or "**SETUP SELECTED**" depending which has the same downloaded name.

Press [FUNCTION] (no) key will switch the display to the "TAG" options. Pressing this key will store the scanned tag with the originally selected "setup" or "group."

☞ The "setup" key and "group" key will only appear if tags that are scanned have the same names as downloaded "group names" or "setup names."

Avoid naming groups and setups the same. If a group and setup are named the same, the first "select" screen will be for the setup. Both select screens will look the same.

## QA-Master Sample Tagging Special Feature

Remotely measured samples have the ability to be assigned with Accept/Reject status using the BCR tagging option. This feature is desirable if the "Sample Data Control" window is used in QA-Master. Uploaded samples in QA-Master can be given the desired Accept/Reject status.

### Notes:

- \* To assign a sample with Accept/Reject status, a tag must be scanned with the respective name before the measurement is taken.
- \* The sample status **ACCEPT**, **REJECT**, or **UNDETERMINED** must be scanned in as capital letters.
- \* If a sample is assigned both "**ACCEPT**" and "**REJECT**" status, the sample will be uploaded as "**UNDETERMINED**."

Subjects covered in Section 6:

- \* 6.1 Positioning the Instrument on the White Standard
- \* 6.2 Calibration Procedure

The 978 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.

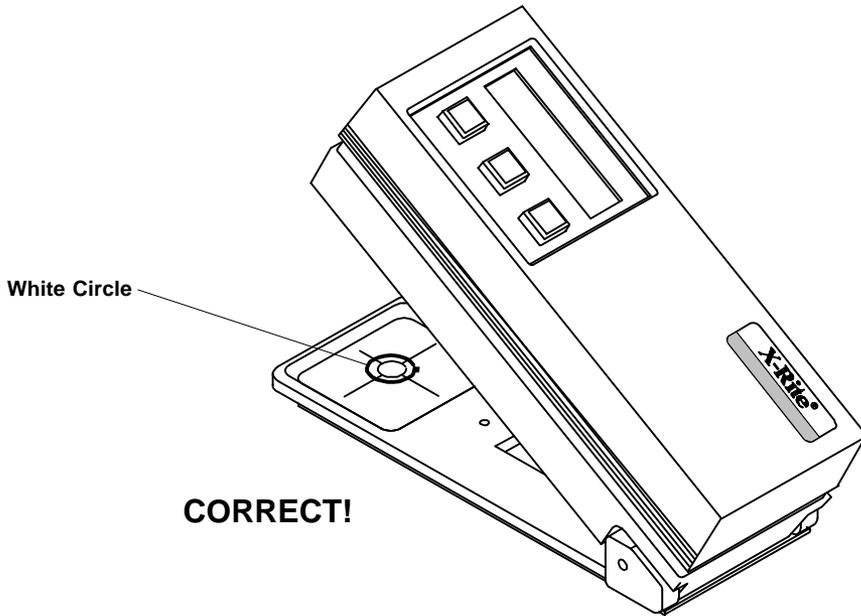
### *Calibration Notes*

- Dirt or dust in the optics area will cause an inaccurate calibration reading. Refer to Section 8.2 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. Refer to Read Zero Reflectance in Section 6.2.
- Do not move the 978 while taking a calibration measurement. If motion is detected an error message will be displayed and calibration aborted.

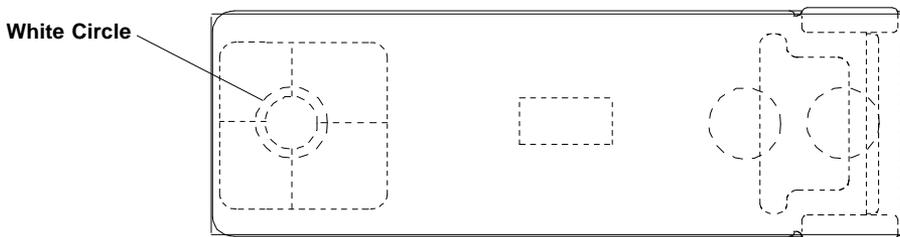
## 6.1 Positioning the Instrument on the White Standard

You must set the 978 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.

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



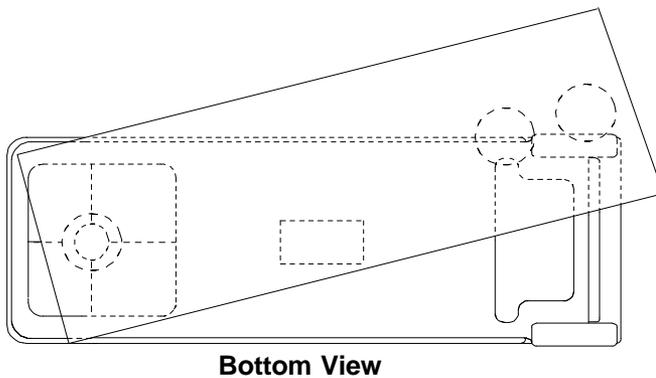
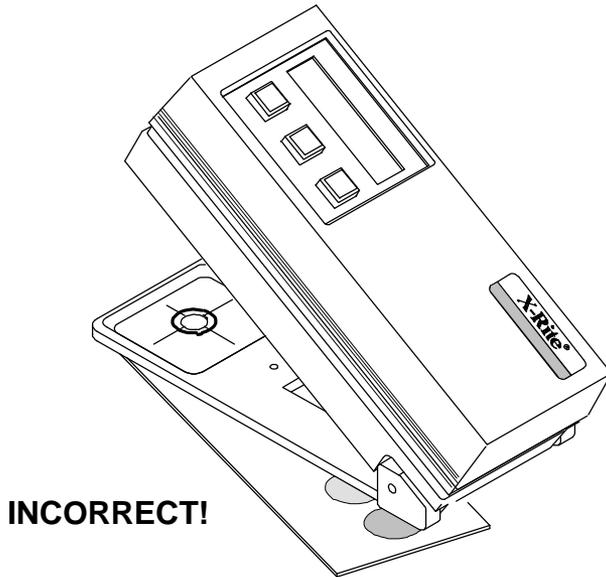
Rubber Pad



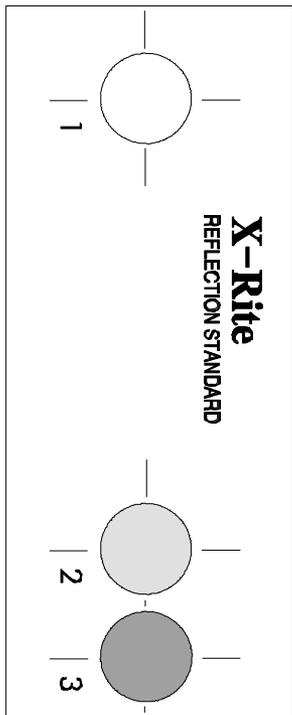
Bottom View



Shown below is an IMPROPER METHOD of measuring the standard.



## X-Rite Reflection Standard



### X-Rite

Reflection Standard  
 Part No. 968-100  
 Serial No. 000101  
 Date XX/XX/XX

WAVELENGTH [nm]	REFLECTANCE [%]
390	68.37
400	75.93
410	81.34
420	82.40
430	83.32
440	83.82
450	84.13
460	84.75
480	85.37
500	85.71
520	86.03
540	85.80
560	85.67
580	85.32
600	84.86
620	84.30
640	83.74
660	83.21
680	82.49
700	81.87
710	81.60

CALIBRATION CHECK			
Illuminant	C	2° Observer	
STEP	X	Y	Z
White	83.82	85.37	99.98

**IMPORTANT!**

The standard is dramatically affected by smudge marks and dust; and must be kept clean.

The Calibration Values for the white spot are affected by the environment and cleaning method of the standard.

The white spot has the XYZ values set at the factory. If the white spot does not measure correctly, it could be that the unit needs to be calibrated; there is dust in the optics; or the standard has smudge marks or is dirty.

The ceramic standard should be cleaned using a mild soap and warm water solution, thoroughly rinsed with warm water, and wiped dry with a clean, lint free cloth.

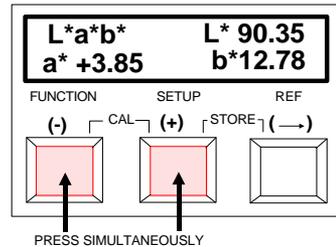
☞ If you lose your envelope, you can obtain the calibration values from the back page of this manual. Otherwise, you can contact X-Rite with the serial number of your standard and get the values.

## 6.2 Calibration Procedure

### Reading the White Standard

- 1) Make sure white calibration standard is clean (see Sec. 6.1).

- 2) Press **[FUNCTION]** key and **[SETUP]** key simultaneously.



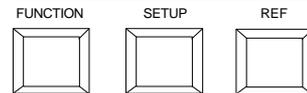
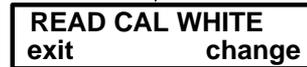
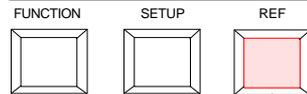
- 3) Press **[REF]** (yes) key to select calibration.

The copyright and software version are momentarily displayed.

"READ CAL WHITE" is displayed.

- ➔ Pressing the **[FUNCTION]** (exit) key will exit calibration procedure with no change occurring.

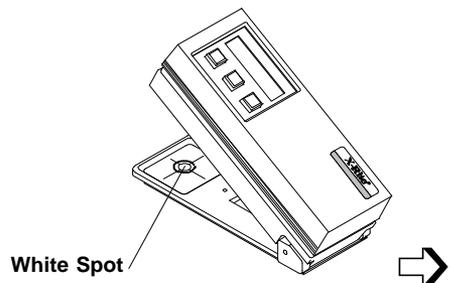
Pressing the **[REF]** (change) key will allow you to manually change the cal white spectral values (refer to end of this section for procedure).



SEE CHANGE CAL VALUES

- 4) Position the instrument on the white standard and take measurement. Refer to Section 6.1 for additional information.

- ➔ The instrument must be held depressed until all five readings have been completed.



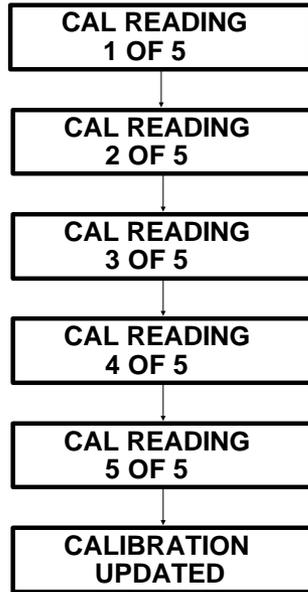
"CAL READING 1 OF 5" thru "CAL READING 5 OF 5" is displayed; then "CALIBRATION UPDATED." The procedure is finalized and the unit returns back to main menu.



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 REFLECTANCE" is displayed after reading the white spot, refer to zero reflectance procedure (next page). This will only occur if the calibration values for zero reflectance have drifted.



## Reading Zero Reflectance

The following procedure is only necessary if "**READ ZERO REFLECTANCE**" is displayed, or you want to manually activate Zero Reflectance Measurement.

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

This can be accomplished by holding the unit depressed (take a reading) in a dark room. In most cases, it is possible to just take a reading under a desk with no direct light. An optional Black Trap (part number SP68-105) can also be used to measure zero reflectance.

*To manually activate zero reflectance:*

- 1) At the **Calibrate?** menu, press **[FUNCTION]** (no) key.

---

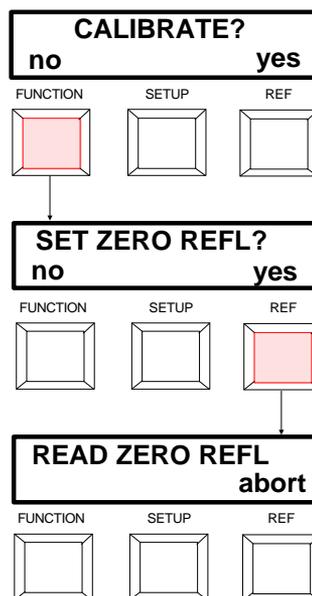
- 2) Press the **[REF]** (yes) key.

"**READ ZERO REFL**" is displayed.

---

- 3) Measure zero reflectance.

 Pressing the **[REF]** (abort) key will exit zero reflectance menu.



## Change Cal Spectral Values

The following procedure is only necessary when you want to calibrate to a different standard. Reflectance values from 390nm to 710nm can be changed.

*To change cal values:*

- 1) At the Calibrate? menu, press [REF] (yes) key to select calibration.

The copyright and software version are momentarily displayed.

"READ CAL WHITE" is displayed.

- 2) Press the [REF] (change) key.

"NEW CAL VALUES?" is displayed.

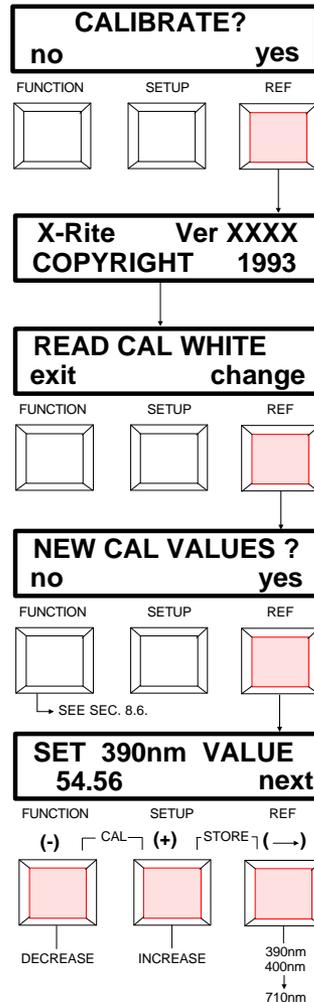
- 3) Enter New Cal Values.

- \* Press the [REF] (yes) key to indicate Yes, you do want to Set New Cal Values.

 Pressing [FUNCTION] (no) key will advance to changing aperture procedure (see Sec. 8.6).

- \* Press the [next] key to advance to next value.
- \* Press the [-] key to decrease value.
- \* Press the [+] key to increase value.

- 4) Press [REF] (next) key once more after 710nm is displayed to advance to white cal procedure. A cal procedure must be performed.



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# SECTION 7

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## SETTING SYSTEM CONFIGURATION

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The system configuration allows you to customize the instrument to meet your application requirements. The configuration should be set before any measurements are taken.

Subjects covered in Section 7 are:

- \* 7.1 Setting Operation Options
- \* 7.2 Setting I/O Options
- \* 7.3 Setting Printout Format Options

### 7.1 Setting Operation Options

---

There are three options that can be configured to meet your requirements. Below is a description of each feature followed by the selection procedure.

**Deltas** - When set to "Numbers", any  $\Delta L^*a^*b^*$ ,  $\Delta L^*C^*H^*$ , or  $\Delta E_{CMC}$  difference measurement will display deltas numerically. When set to "Words", any  $\Delta L^*a^*b^*$ ,  $\Delta L^*C^*H^*$ ,  $\Delta E_{CMC}$  difference measurement will display deltas as words (e.g., "brighter", "duller", ">>red", etc.). The "Off" setting will only display  $\Delta E$  or Shade Tag number.

**Lock Setups** - 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 occur. A lock icon will display closed when the setup options are *not* changeable.

**Auto Setup** - when "auto setup" is enabled, the 978 will automatically select the closest setup match when a sample is measured. The closest match is based on the "setup" reference and  $D_{65}^{\circ 10}$  illum/obs. Because illum/obs selection can vary between setups, a single illum/obs is used for "auto setup" operation. Once the closest match is found, the individual parameters (tolerance, illum/obs, etc.) of a setup will be



used (except averaging value). Enabling "auto setup" will allow you to select a global averaging measurement number (1- 5). The number selected will override any number selected for individual "setups." Because a measured reference is generated from a reflectance curve, manual reference entry is not allowed when "auto setup" is activated.

☞ If any manually entered references exist in the instrument, a "CLEAR MANUAL REFS" message will display if you attempt to turn on Auto Setup. Manual references must first be cleared before "auto setup" can be activated.

**Setup Limit** - determines the number of "setups" that are available. Up to "30" setups can be selected. The factory default setting is "30."

**Group Limit** - determines the number of "groups" that are available. Up to "20" groups can be selected. The factory default setting is "20."

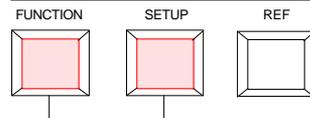
**Wait On Fail** - When the "Wait On Fail" option is set to "On", a key must be pressed on the instrument to continue with measurement operation. This occurs in pass/fail operation when a measurement fails. When the option is set to "Off", an error alarm will be heard on a failed measurement but no key depression is required.

*To configure operation options:*

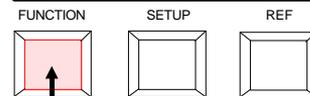
☞ The configuration can be exited at any time by pressing [FUNCTION] key and [SETUP] key simultaneously.

1) Press the [FUNCTION] key and [SETUP] key simultaneously.

$\Delta E$ .85	$L^*$ +.76
$a^*$ -.24	$b^*$ -.31



CALIBRATE ?		
no	yes	



PRESS TWO TIMES



2) Press [FUNCTION] (no) two times.

3) Press the [REF] (yes) key to enter Operation Options.

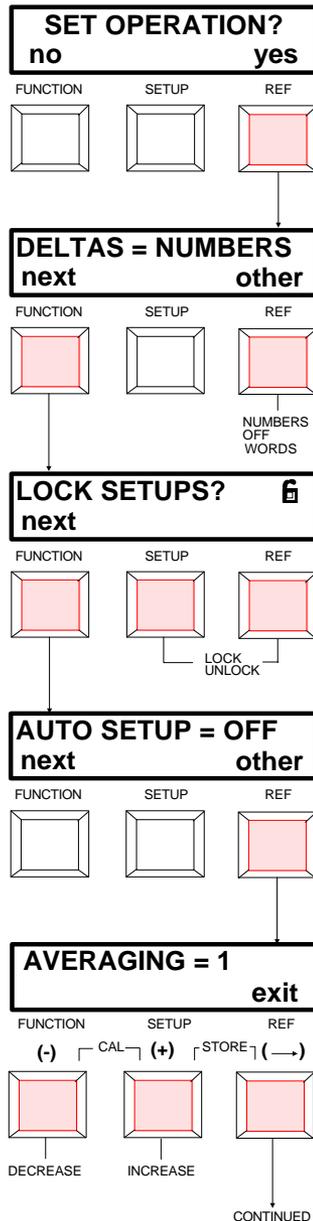
4) Select Deltas option. Repeatedly pressing the [REF] (other) key increments through: "NUMBERS", "OFF", and "WORDS."  
After making selection, press the [FUNCTION] (next) key to save setting and advance to next option.

5) Select Lock option. Simultaneously press the [SETUP] key and [REF] key. Lower unit to shoe to close read switch. Each time this procedure is performed, the display will alternate between "LOCK SETUPS?" and "UNLOCK SETUPS?."  
After making selection, press the [FUNCTION] (next) key to save setting and advance to next option.

☞ A closed lock icon indicates setups are locked.

6) Select Auto Setup/Averaging option. When "AUTO SETUP = OFF" is displayed, pressing [REF] (other) key will causes the averaging menu to display.

- Select average number (1-5). Press the [-] key to decrease number and press the [+] key to increase number. Press the [REF] (exit) key after selection (continued).





## 7.2 Setting I/O Options

---

The 978 comes equipped with a serial port that allows data to be transmitted/received to/from an external device. Listed below are available I/O options followed by selection procedure.

**Baud Rate** - Determines the input/output rate (characters per second) of the RS-232 port. Available outputs are: "300", "600", "1200", "2400", "4800", and "9600." The factory default setting is 9600 baud.

**Line Feed with Carriage Return (LF with CR)** - Varies the delimiter at the end of each line of data. When set to OFF, just a carriage return is sent at the end of a line of data. When set to ON, a carriage return then a line feed are sent at the end of the line of data. The factory default setting is LF with CR.

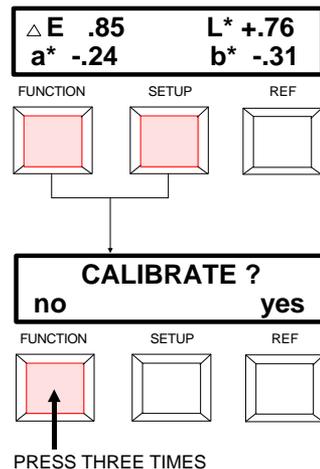
**Handshake** - Used for data transmission. Handshake may be set to "Off", "CTS", "BUSY", or "XON/XOFF Enabled." Handshake should be set to "Off" when not being used. The factory default setting is Off.

### *To configure I/O options:*

The configuration can be exited at any time by pressing **[FUNCTION]** key and **[SETUP]** key simultaneously.

- 1) Press the **[FUNCTION]** key and **[SETUP]** key simultaneously.
- 

- 2) Press **[FUNCTION]** (no) three times.

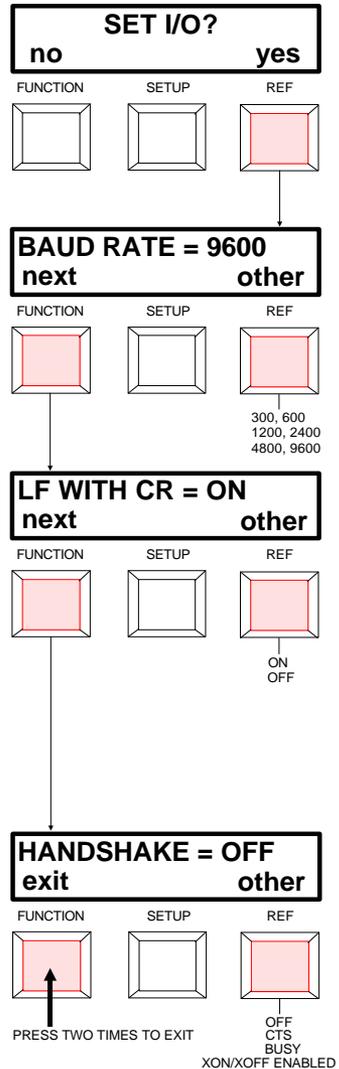


3) Press the **[REF]** (yes) key to enter I/O Options.

4) Select Baud Rate. Repeatedly pressing the **[REF]** (other) key will increment through: "300", "600", "1200", "2400", "4800", and "9600." After making selection, press the **[FUNCTION]** (next) key to save setting and advance to next option.

5) Select Line Feed option. Press **[REF]** (other) key to alternate between "LF WITH CR=OFF" and "LF WITH CR=ON." After making selection, press the **[FUNCTION]** (next) key to save setting and advance to next option.

6) Select Handshake option. Repeatedly pressing the **[REF]** (other) key increments through "OFF", "CTS", "BUSY", and "XON/XOFF ENABLED." After making selection, press the **[FUNCTION]** (exit) key two times to save and exit.



## 7.3 Setting Printout Format Options

Setting the printout options will determine what information will be transmitted out the RS-232 port after a measurement. Listed below are the available options that can be set followed by selection procedure.

**Format** - determines if the measurement data is output in "Spectral Data" (400nm - 700nm in 10nm increments), or "Color Space Data" (L\*a\*b\*, etc.).

**Print Header** - enables or disables the header (L\*a\*b\*, etc.) from printing during a data transmit.

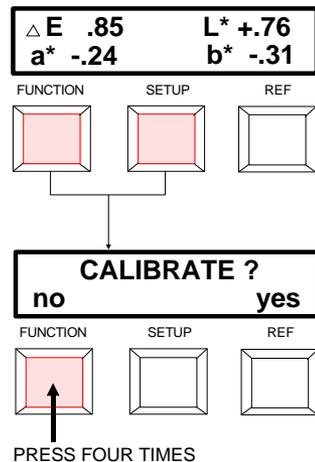
**Print Reference** - enables or disables the reference data from printing (if any) during a data transmit.

### *To configure Printout Format options:*

The configuration can be exited at any time by pressing [FUNCTION] key and [SETUP] key simultaneously.

- 1) Press the [FUNCTION] key and [SETUP] key simultaneously.

- 2) Press [FUNCTION] (no) four times.



- 3) Press the [REF] (yes) key to enter I/O Options.
- 

- 4) Select Print Format option. Press the [REF] (other) key to increment through: "OFF", "SPACE", and "SPECTRAL."

After making selection, press the [FUNCTION] (next) key to save setting and advance to next option.

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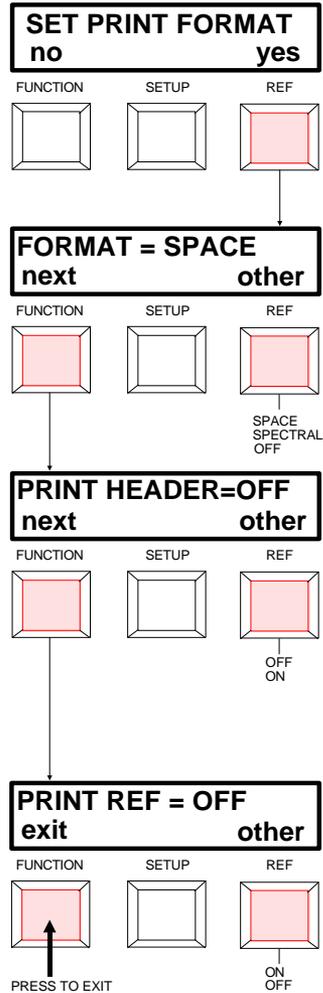
- 5) Select Header option. Press the [REF] (other) key to alternate between "PRINT HEADER=OFF" and "PRINT HEADER=ON."

After making selection, press the [FUNCTION] (next) key to save setting and advance to next option.

---

- 6) Select Print Ref option. Press the [REF] (other) key to alternate between "PRINT REF=OFF" and "PRINT REF=ON."

After making selection, press the [FUNCTION] (exit) key to save setting and exit.



The following examples illustrate the different data output formats that can be obtained from the 978 with a serial printer interfaced.

---

**Example 1 - Color Space Format "ON"**  
**Header "ON"**  
**Reference "ON"**



**Example 2 - Color Space Format "ON"**  
**Header "OFF"**  
**Reference "OFF"**

```
L   -.18 C   +.04 h   .00 E   .18
```

**Example 3 - Spectral Format "ON"**  
**Header "ON"**  
**Reference "OFF"**

SPECTRAL DATA	D65_10	13:09:56 05/20/93
WAVELENGTH	VALUE	
400	60.81	
410	47.25	
420	38.77	
430	36.51	
440	37.05	
450	37.09	
460	37.39	
470	37.49	
480	37.71	
490	38.28	
500	39.02	
510	40.73	
520	41.26	
530	41.73	
540	42.38	
550	43.02	
560	43.58	
570	43.92	
580	43.81	
590	43.40	
600	42.56	
610	41.84	
620	41.61	
630	42.17	
640	43.87	
650	46.87	
660	51.89	
670	57.57	
680	62.64	
690	67.52	
700	67.89	

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# SECTION 8

## GENERAL MAINTENANCE

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Subjects covered in Section 8 are:

- \* 8.1 Cleaning the Instrument
- \* 8.2 Cleaning the Optics
- \* 8.3 Replacing the Batteries
- \* 8.4 Replacing the Target Window
- \* 8.5 Reading Lamp Replacement Information
- \* 8.6 Changing the Aperture
- \* 8.7 Troubleshooting Tips

The X-Rite 978 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 978 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.

### 8.1 Cleaning the Instrument

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The exterior of the instrument may be wiped clean with a cloth dampened with water or a mild cleaner whenever required.

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

## 8.2 Cleaning the Optics

---

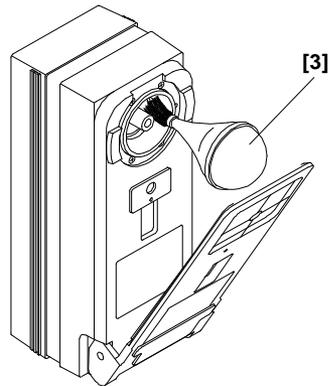
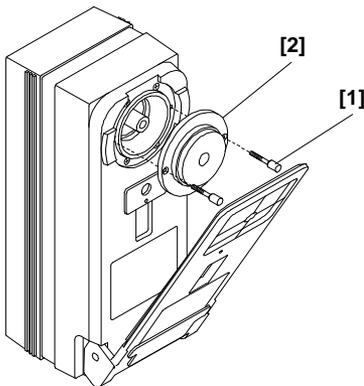
The target window and optics should be cleaned once a week in normal environments; and more often in dirty or dusty environments.

### Target Window

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

### Optics

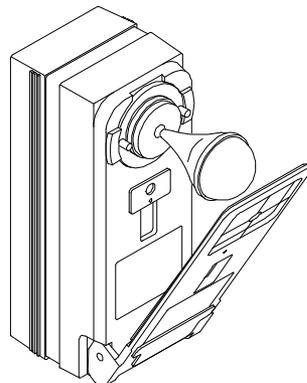
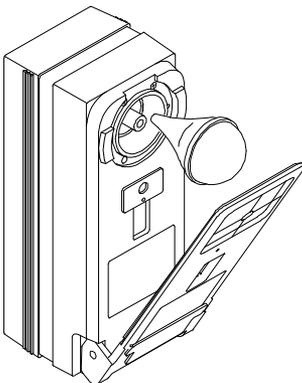
- 1) Unscrew the two thumb screws [1] and remove the nose piece [2]. Remove dust from aperture with camel hair brush or a camera lens cleaner [3].



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.

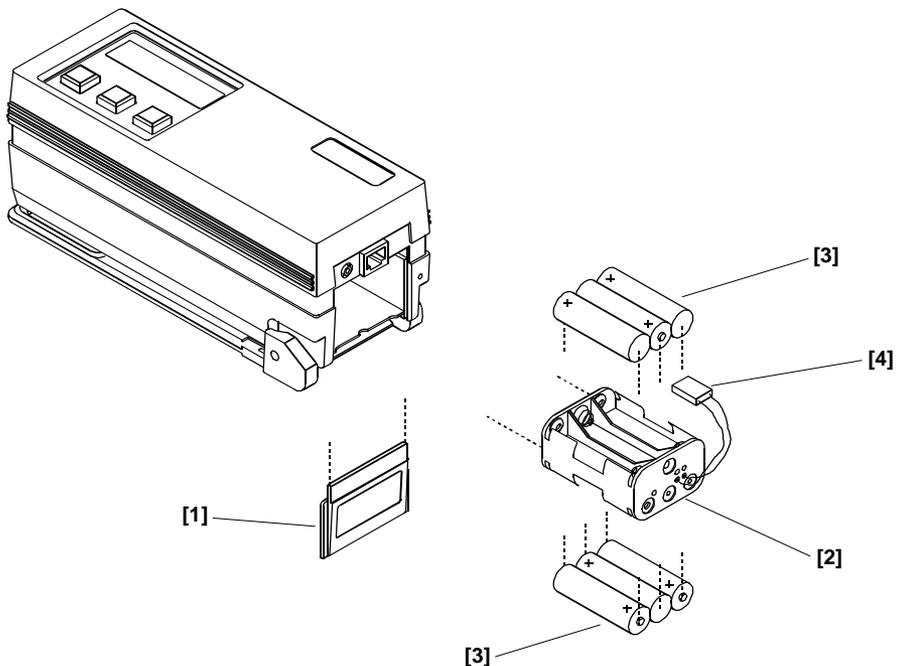


## 8.3 Replacing the Batteries

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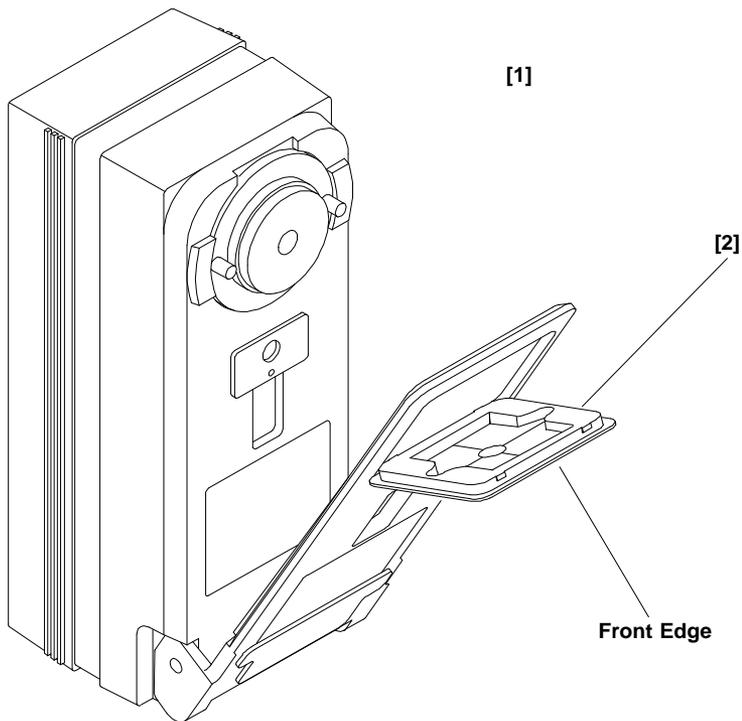
- 1) Set the 978 on it's side and lock shoe in place. The shoe must be locked.
- 2) Slide battery access door [1] toward bottom of unit and remove.
- 3) Disconnect plug [4] and pull battery pack [2] out of unit.
- 4) Remove old AA NI-CAD batteries [3], and install six fresh AA NI-CAD (recognizing proper 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)**



## 8.4 Replacing the Target Window \_\_\_\_\_

- 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.



## 8.5 Reading Lamp Replacement Information

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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 should last approximately one million measurements and is covered by a one year limited warranty. Refer to the Limited Warranty statement on page iii.

## 8.6 Changing the Aperture

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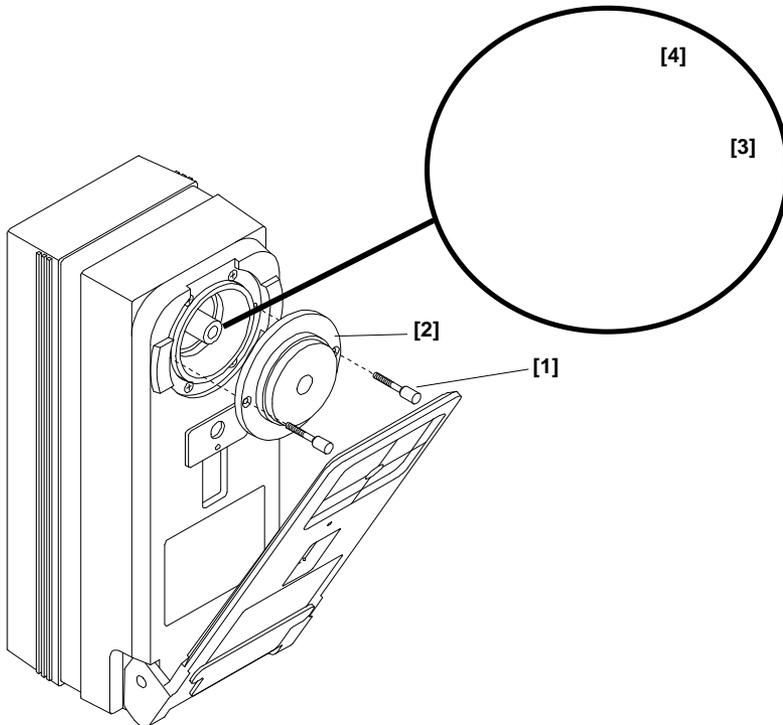
X-Rite has three different aperture kits available for the 978.

- \* 8mm/4mm Aperture Kit (P/N 968-100-08)
- \* 8mm UV Excluded Aperture Attachment (P/N 968-61-08)E
- \* 20mm Aperture Kit (P/N 968-100-20)

Each aperture kit includes the aperture, sensor nose, extra target windows, and a specially designed aperture wrench.

### Aperture Installation

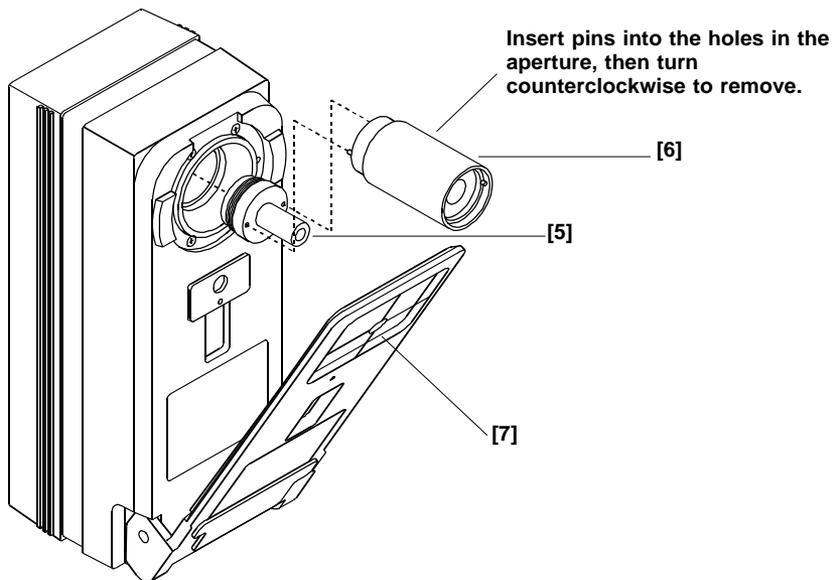
- 1) Unscrew the two thumb screws [1], then remove the nose piece [2].
- 2) **To install the 4mm aperture attachment;** screw the 4mm aperture attachment [3] onto the 8mm aperture [4]. **The 4mm aperture attachment must be screwed on finger tight;** then advance to Step 6 on following page.  
**To install the 8mm or 20mm aperture;** advance to Step 3.



- 3) Unscrew the existing aperture [5] with the aperture wrench [6].

**Note:** The aperture wrench tool has two sides, one side fits the 8mm aperture and the other fits the 20mm aperture.

The aperture wrench has two pins that fit into the holes in the aperture.



- 4) Screw in the new aperture using the aperture wrench. **IMPORTANT!** The new aperture must be clean.

- 5) Attach the new nose piece to the housing with two thumb screws.

**Note:** When you tighten the thumb screws, be sure that the nose piece is flush against the housing. Gently tighten one screw, then the other. Then finish tightening both screws. **IMPORTANT!** The new nose piece must be clean.

- 6) Replace the existing target window [7] with the new target window.

**Refer to Section 8.4, Target Window Replacement for this procedure.**

**Note:** If you switch back and forth between the 4mm and 8mm aperture, it is possible to use the 8mm target window with the 4mm aperture.

- 7) Refer to next page to change aperture setting.

## Aperture Selection

When a different size aperture is installed in the instrument, the setting must be changed. The instrument must also be recalibrated.

### *To change aperture setting:*

- 1) Press **[FUNCTION]** key and **[SETUP]** key simultaneously.

- 2) Press **[REF]** (yes) key to select calibration.

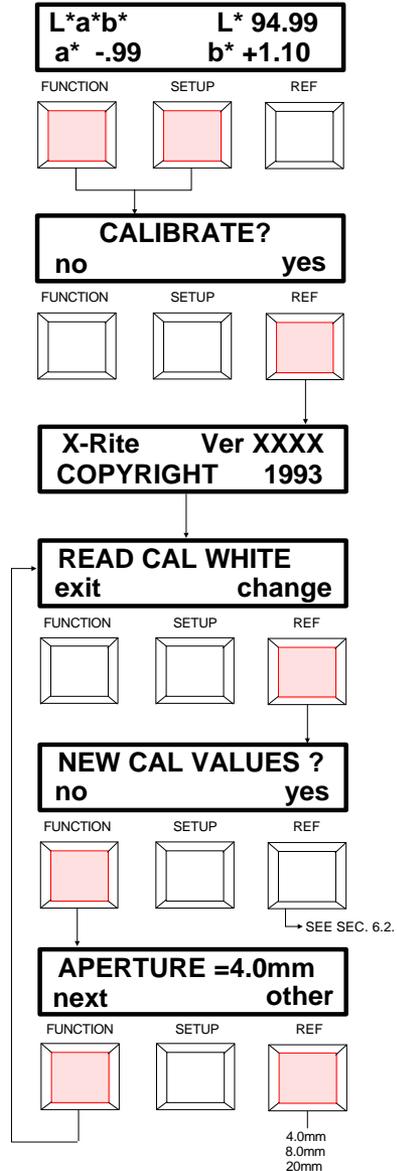
The copyright and software version are momentarily displayed.

- 3) Press **[REF]** (change) key.

- 4) Press **[FUNCTION]** (no) key to enter Aperture menu.

- 5) Select Aperture Size.

- \* Press **[REF]** (other) key to page through "4.0mm", "8.0mm", and "20mm."
- \* After aperture selection, press **[FUNCTION]** (next) key to go to "READ CAL WHITE" menu. White cal and zero reflectance must be measured after aperture change (see Sec. 6.2).



## 8.7 Troubleshooting Tips

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**A. *Incorrect measurement data continually displays.***

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.

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## SECTION 9

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# BAR CODE READER (Optional)

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Subjects covered in Section 9 are:

- \* 9.1 Attaching SP78-200 Bar Code Reader to an Instrument
- \* 9.2 Scanning a Bar Code
- \* 9.3 Troubleshooting

The Optional SP78-200 Bar Code Reader is used to scan bar codes. When the BCR is used in conjunction with an X-Rite instrument, a scanned bar code becomes a tag for the measurement(s) taken with the instrument. When the data is uploaded into a software program (e.g., QA-Master®) the bar code tag(s) become sample tag(s).

### 9.1 ATTACHING THE SP78-200 BCR TO THE INSTRUMENT

Attach the BCR to the instrument's I/O Port. The instrument must be operating in the Storage mode before the BCR will operate.

*To attach the SP78-200 BCR:*

- 1) Insert the connector on the BCR into the I/O port of the instrument until it locks, usually indicated by an audible click. The connector inserts in one direction, (tab up) *DO NOT FORCE*. See Figure 1.
- 2) Power the instrument up, "**BAR CODE READER DETECTED**" will appear on the instrument display if the BCR is properly attached.

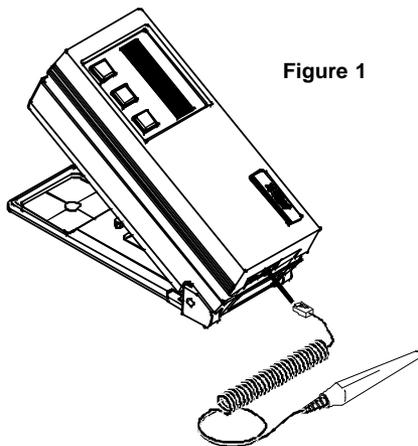


Figure 1

*To disconnect the SP78-200 BCR:*

- 1) Depress the tab on the connector and remove the connector from the instrument.

## 9.2 SCANNING A BAR CODE

*Follow these guidelines for successful bar code scanning.*

- 1) Turn on the X-Rite instrument. Be sure the instrument is in the Storage mode.
- 2) Hold the BCR in your hand as you would a pencil. The BCR works best when tilted from  $10^\circ$  to  $30^\circ$ , although any angle from  $5^\circ$  to  $45^\circ$  will work. See Figure 2.

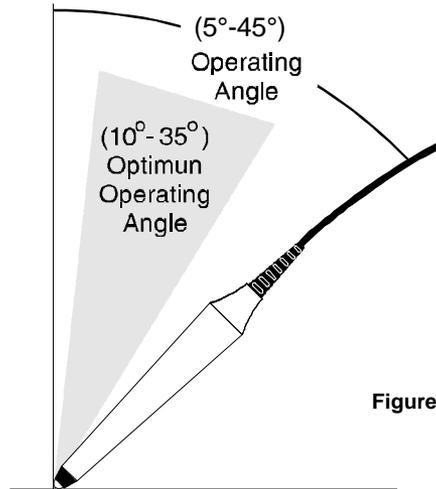


Figure 2

- 3) Place the tip of the BCR on the white space to the left or right of the bar code. Drag the BCR smoothly and lightly across the bar code. Do not lift the tip of the BCR from the surface of the bar code. See Figure 3.
- 4) The instrument will display the title of the bar code if the scan was successful. If the display appears blank try scanning the bar code again. If after several scanning attempts the display still appears blank, see Section 9.3, Troubleshooting.

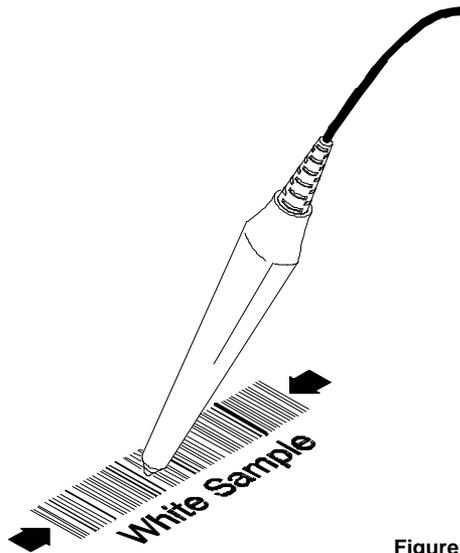


Figure 3

## 9.3 TROUBLESHOOTING

The factory default mode can be restored if the SP78-200 BCR is placed into an unusable or unknown configuration.

*To restore the factory default mode:*

- 1) Disconnect the BCR from the instrument.
- 2) Reconnect the BCR to the instrument.
- 3) Scan the default configuration bar codes shown in the SP78-200 Bar Code Reader Instruction Sheet (P/N SP78-510).

### **Does the SP78-200 BCR have power?**

- \* A red light will be visible at the tip of the BCR if it has power.
- \* Check the connection between the BCR and the instrument. Be sure the connector is correctly inserted.
- \* Check the power supply for the instrument. Refer to the instrument User's Manual, Troubleshooting section if the instrument does not have power.

### **Is the SP78-200 BCR configuration correct?**

*To restore the factory default mode:*

- 1) Disconnect the BCR from the instrument.
- 2) Reconnect the BCR to the instrument.
- 3) Scan the default configuration bar codes.

### **Does the SP78-200 BCR wavelength of light match the bar code?**

The BCR will not read bar codes that are designed to be secure (black on black.) The optical signal returning from the bar code is not adequate for measuring the bars and spaces.

### **Is the SP78-200 BCR being held at the correct angle?**

The BCR will operate when held at an angle of 5° to 45°. The optimum operating angle is from 10° to 30°.

### **Was the entire bar code scanned?**

- \* Drag the BCR through the entire bar code at a constant speed. Increase the scanning speed. Typically the BCR is moved too slowly.
- \* Be sure the BCR scans the entire bar code.
- \* Be sure the BCR maintained contact with the surface of the bar code.
- \* Be sure the bar code is not damaged, dirty or worn. Try to scan an area without these defects.

### **Does the SP78-200 BCR tip need replacement?**

If the tip becomes damaged or shows signs of excessive wear, it must be replaced.

*To replace the tip:*

- 1) Disconnect the BCR from the instrument.
- 2) Unscrew the tip from the wand.
- 3) Replace using part number SE124-01-01.

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# APPENDIX A

# TECHNICAL SPECIFICATION

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<b>Measuring Function:</b>	Absolute Color, Simple Compare, Pass/Fail, 555 Shade Tag, and 555 & Pass/Fail Indication. Based on L*a*b*, L*C*h°, XYZ, Lab (Hunter), Wht, Yel, and ECMC
<b>Display:</b>	2 row by 16 character Supertwist dot matrix LCD
<b>Measuring Geometry:</b>	0°/45°, fiber optic pickup, multi-sensor array
<b>Measuring Area:</b>	8.0mm & 4.0mm (20mm optional)
<b>Light Source:</b>	Gas filled tungsten lamp, approx. 2856°K (corrected for D65 illuminant)
<b>Illuminant Types:</b>	C, D <sub>65</sub> , D <sub>50</sub> , A, F2 (cool white fluorescent), F7 (broad-band white fluorescent), F11 (TL84), & F12 (Ultralume 3000)
<b>Standard Observers:</b>	2° & 10°
<b>Measurement Range:</b>	0 to 200% reflectance
<b>Spectral Range:</b>	400nm - 700nm
<b>Spectral Interval:</b>	20nm (15nm bandwidth)
<b>Resolution:</b>	.01%
<b>Inter-Instrument Agreement:</b>	0.20ΔE* <sub>ab</sub> average (Based on average of 12 BCRA tiles)
<b>Short Term Repeatability:</b>	0.05 max ΔE* <sub>ab</sub> on a white ceramic (20 measurements)
<b>Warm Up Time:</b>	None
<b>Measurements Per Charge:</b>	Approx. 1000 typical
<b>Measuring Time:</b>	Approx. 2 seconds
<b>Data Interface:</b>	Patented Bi-directional RS-232, 300 to 9600 baud (user selectable), bipolar output
<b>Power Supply:</b>	Six rechargeable AA NiCad batteries 7.2v total rated @ 600mAh (included)
<b>Charge Time:</b>	Approx. 14 hours
<b>AC Adaptor Requirements:</b>	978 90 - 130VAC, 50 - 60Hz, 18W Max. 978X 180 - 260VAC, 50 - 60Hz, 20W Max. 12VDC @ 700ma: Positive Tip
<b>Operating Temp. Range:</b>	50° - 104°F (10° - 40°C)
<b>Storage Temp. Range:</b>	-4° - 122°F (-20° - 50°C)
<b>Weight:</b>	2.3 lbs. (1050 grams)
<b>Dimensions:</b>	3 3/16" H x 3" W x 7 3/4" L (81mm H x 76mm W x 197mm L)

<b>Safety</b>	UL 122
<b>FCC</b>	Part 15, Class A, Digital Device
<b>Industry Canada</b>	ICES-003 Issue 2, Revision 1
<b>International EMC</b>	EN50081-1:1992 Class B Generic Emission Standard EN50082-1:1992 Generic Immunity Standard
<b>Safety</b>	IEC950/EN60950
<b>Accessories Provided:</b>	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.

## 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.

"**REFERENCE - NOT CHANGED**" is displayed after leaving the Reference Select function, when no change was made.

"**REFERENCE UPDATED**" is displayed when exiting reference mode.

## 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] key.

"**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.

"**CAL ERROR ### - CELL CHANGE**" make sure that calibration plaque is clean and instrument is positioned exactly on the white spot. If the error persists, the number that is displayed should be reported to X-Rite or an authorized service center.

"**INVALID ENTRY**" is displayed when the numbers entered for the white values are inappropriate.

### *Miscellaneous Messages*

"**BARCODE IN STORE MODE ONLY**" indicates that a bar code was scanned when the instrument was not in storage mode.

"**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 1993**" is displayed when first activating calibration. #### represents the datecode of the software.

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# APPENDIX C

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## OPTIONAL ACCESSORIES

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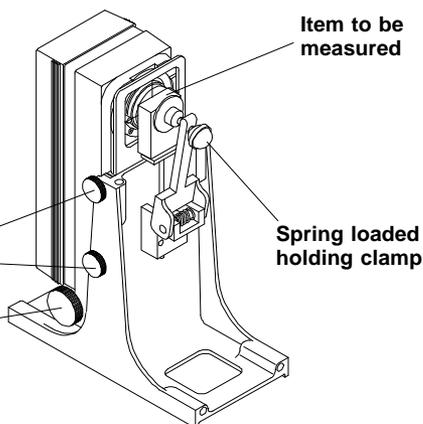
	<u>Part Number</u>
• QA-Master® Software Package.....	1255-10
• Security Cable.....	418-75
• 4/8mm Aperture Kit.....	968-100-08
• 20mm Aperture Kit.....	968-100-20
• 8mm Aperture Attachment (UV excluding) .....	968-61-08E
• Zero Reflectance Black Trap .....	SP68-105
• Portable Thermal Printer (115VAC).....	418-113
• Portable Thermal Printer (230VAC).....	418X-113
• Interconnect cable for Macintosh® computers with 8 pin mini-DIN connector.....	418-79
• Modular Interconnect Cable (requires adaptor below).....	SE108-69
• DB25P DCE (Null Modem) Interface Adaptor .....	418-70
• DB25S DCE (Null Modem) Interface Adaptor .....	418-71
• DB25P DTE (Normal) Interface Adaptor .....	418-80
• DB25S DTE (Normal) Interface Adaptor .....	418-81
• DB9P Interface Adaptor .....	418-90
• DB9S Interface Adaptor .....	418-91
• 4mm Target Window .....	968-121-04
• 8mm Target Window .....	968-121-08
• 20mm Target Window .....	968-121-20
• 948/968 Spectrophotometer Stand (see below).....	968-80

### *X-Rite Mounting Fixture*

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

Hold unit closed



The color check procedure will help you track instrument color performance to assure measurement accuracy. Initially, the three patches on the standard should be measured once a day for a period of 10 days to determine the reference values. Thereafter, a periodic check (once a week depending on usage) is all that is required.

Located on the back of the reference standard envelope is a color check label. The reference data should be recorded there for quick reference.

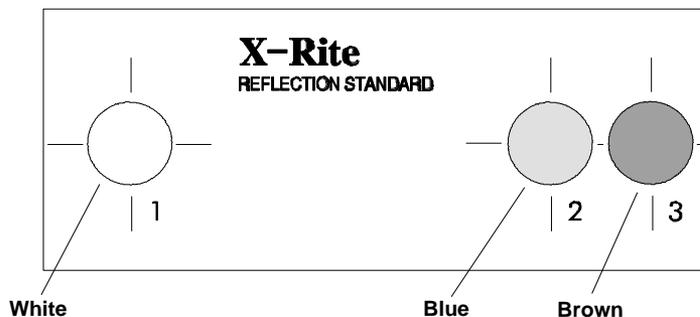
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## Reference Data Procedure

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### *To obtain reference values:*

- 1) Clean instrument optics and reference standard if necessary.
- 2) Calibrate instrument according to procedure in operation manual. **Note:** The reference standard is dramatically affected by smudge marks and dust; and must be kept clean.
- 3) Select  $L^*a^*b^*$  absolute function and desired illuminant/observer. **Note:** The selected illum/obs must be the same whenever the color check is performed.
- 4) Measure the White (1), Blue (2), and Brown (3) patches on the reference standard.



- 5) Record the  $L^*a^*b^*$  values for each color on a piece of paper.
- 6) Repeat steps 1-5 for 10 days.



- 7) After 10 days average the white, blue, and brown values and enter data in the designated place on the color check label.
- 8) Enter date, illuminant, observer, aperture size, temperature, instrument model, and serial number on color check label. **Note:** Temperature of the reference standard should be maintained ( $\pm 2^{\circ}\text{C}$ ) throughout color check sequence.

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### Periodic Color Check Procedure

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- 1) Copy reference data located on the color check label to the shaded areas on the color check record located on the next page.
- 2) Perform steps 1-4 in reference data procedure.
- 3) Record the measured white, blue, and brown values and date on the color check record on the next page. **Note:** You may want to make several copies of the color check record before entering any data. This will allow you to have additional pages available when they are needed.
- 4) Compare measured values to the reference values.
  - \* If values are off, clean optics and reference standard and remeasure.
  - \* Consistent  $L^*$ ,  $a^*$ , or  $b^*$  differences exceeding .30 (or obvious trends away from the reference data) may require the unit to be serviced. Contact X-Rite or authorized service center if this is the case.
  - \* Always verify color performance with the same aperture size, illum/obs, and temperature.





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