MA68II

MULTI-ANGLE SPECTROPHOTOMETER

Operator's Manual

x-rite

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

WARNUNG: Das Gerät darf 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.

CAUTION: Operational hazard exists if battery charger other than SE30-177 (100-240V) is used. Use only X-Rite battery pack MA58-05, other types may burst causing personal injury.

VORSICHT: Betriebs- und Verletzungsgefahr besteht bei Gebrauch von anderen Adaptern als X-Rite SE30-177 (100-240 V). Verwenden Sie nur den X-Rite Akkupack MA58-05.

ADVERTENCIA: No use otro cargador de las pilas que no sea la pieza X-Rite SE30-177 (100-240V), para evitar el riesgo de mal funcionamiento del equipo. Use solamente las pilas MA58-05 de X-Rite, es posible que los otros tipos puedan estallar y causar daños corporales.

ATTENTION: Pour ne pas causer un mauvais fonctionnement de l'appareil, veillez à utiliser uniquement les chargeurs de batterie X-Rite SE30-177 (100-240 V). Utiliser seulement le bloc de batteries MA58-05 de X-Rite, il y a danger d'explosion et de blessures avec les autres types.

AVVERTENZA: Non usare un altro caricabatterie che non è del pezzo X-Rite SE30-177 (100-240V), per evitare il rischio di malfunzionamento dell'apparecchio. Usare solamente gli accumulatori MA58-05 di X-Rite, è possibile che altri tipi possano scoppiare e causare danno personale.

Warning:

Use of this equipment in a manner other than that specified by X-Rite, Incorporated may compromise design integrity and become unsafe.

Connect the power plug to an easily accessible socket-outlet near the unit.

CE DECLARATION

CE Hereby, X-Rite, Incorporated, declares that this MA68B is in compliance with the essential requirements and other relevant provisions of Directive(s) EMC 2004/108/EC, LVD 2006/95/EC, and RoHS 2011/65/EU (Category 9, industrial).

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.

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

The Manufacturer: Der Hersteller: El fabricante: Le fabricant: Il fabbricante:	X-Rite, Incorporated 4300 44th Street, S.E. Grand Rapids, Michigan 49512
Declares that: gibt bekannt: advierte que: avertit que: avverte che:	Multi-Angle Spectrophotometer MA68II

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 connettuto a reti di telecomunicazioni pubblici.

Instructions for disposal: Please dispose of Waste Electrical and Electronic Equipment (WEEE) at designated collection points for the recycling of such equipment.

Dear Customer:

Congratulations! We at X-Rite are proud to present you with an X-Rite MA68II Multi-Angle Spectrophotometer. This instrument represents the very latest in microcontrollers, integrated circuits, fiber optics, and display technologies. As a result, your X-Rite MA68II 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 instrument with a two 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.

X-Rite, Incorporated

PROPRIETARY NOTICE

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

The contents of this manual are the property of X-Rite, Incorporated and are copyrighted. Any reproduction in whole or part is strictly prohibited Publication of this information does not imply any rights to reproduce or use this manual for any purpose 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.

This instrument may be covered by one or more patents. Refer to the instrument for actual patent numbers.

LIMITED WARRANTY

X-Rite warrants this Product against defects in material and workmanship for a period of twelve (12) months from the date of shipment from X-Rite's facility, unless mandatory law provides for longer periods. During such time, X-Rite will either replace or repair at its discretion defective parts free of charge.

X-Rite's warranties herein do not cover failure of warranted goods resulting from: (i) damage after shipment, accident, abuse, misuse, neglect, alteration or any other use not in accordance with X-Rite's recommendations, accompanying documentation, published specifications, and standard industry practice; (ii) using the device in an operating environment outside the recommended specifications or failure to follow the maintenance procedures in X-Rite's accompanying documentation or published specifications; (iii) repair or service by anyone other than X-Rite or its authorized representatives; (iv) the failure of the warranted goods caused by use of any parts or consumables not manufactured, distributed, or approved by X-Rite; (v) any attachments or modifications to the warranted goods that are not manufactured, distributed or approved by X-Rite. Consumable parts and Product cleaning are also not covered by the warranty.

X-Rite's sole and exclusive obligation for breach of the above warranties shall be the repair or replacement of any part, without charge, which within the warranty period is proven to X-Rite's reasonable satisfaction to have been defective. Repairs or replacement by X-Rite shall not revive an otherwise expired warranty, nor shall the same extend the duration of a warranty.

Customer shall be responsible for packaging and shipping the defective product to the service center designated by X-Rite. X-Rite shall pay for the return of the product to Customer if the shipment is to a location within the region in which the X-Rite service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations. Proof of purchase in the form of a bill of sale or receipted invoice which is evidence that the unit is within the Warranty period must be presented to obtain warranty service. Do not try to dismantle the Product. Unauthorized dismantling of the equipment will void all warranty claims. Contact the X-Rite Support or the nearest X-Rite Service Center, if you believe that the unit does not work anymore or does not work correctly.

THESE WARRANTIES ARE GIVEN SOLELY TO BUYER AND ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF

MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION, AND NON-INFRINGEMENT. NO EMPLOYEE OR AGENT OF X-RITE, OTHER THAN AN OFFICER OF X-RITE, IS AUTHORIZED TO MAKE ANY WARRANTY IN ADDITION TO THE FOREGOING.

IN NO EVENT WILL X-RITE BE LIABLE FOR ANY OF BUYER'S MANUFACTURING COSTS, OVERHEAD, LOST PROFITS, GOODWILL, OTHER EXPENSES OR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES BASED UPON BREACH OF ANY WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT TORT, OR ANY OTHER LEGAL THEORY. IN ANY EVENT OF LIABILITY, X-RITE'S MAXIMUM LIABILITY HEREUNDER WILL NOT EXCEED THE PRICE OF THE GOODS OR SERVICES FURNISHED BY X-RITE GIVING RISE TO THE CLAIM.

Table of Contents

This manual is organized into eight sections and four appendices. In order to make the best use of your instrument, it is recommended that you read all sections and appendices.

SECTION ONE

Getting Started

This section covers unpacking, inspection, and general setup of your instrument. Product description and positioning techniques are also included. You should read through this entire section to familiarize yourself with your instrument.

Section One Contents

UNPACKING AND INSPECTION

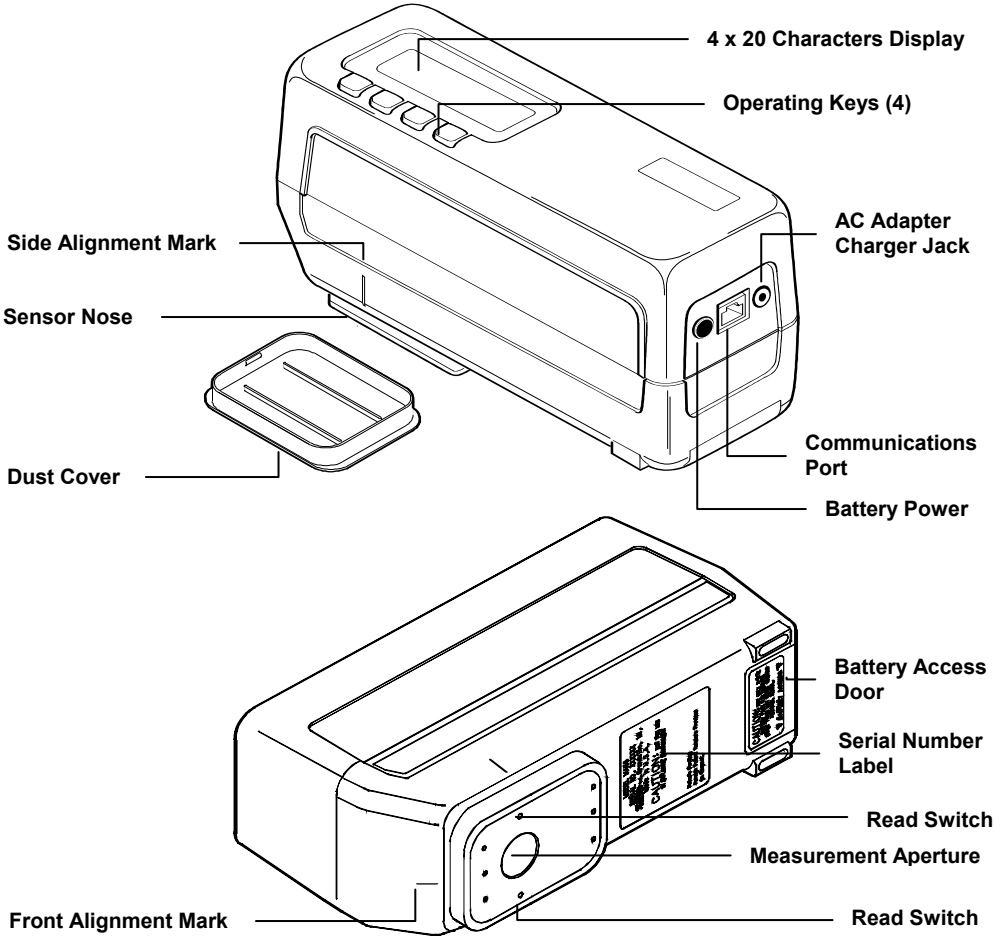
After removing the instrument from the shipping carton, inspect for possible damage. If any damage occurred during shipping, immediately contact the transportation company. Do not proceed with installation until the carrier's agent has inspected the damage.

Your instrument 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, contact X-Rite to have a replacement shipped to you.

PRODUCT DESCRIPTION

The X-Rite MA68II multi-angle spectrophotometer is designed for measuring color on metallic and pearlescent paint finishes. The instrument incorporates a single light source and five fixed—aspecular—viewing angles (15°, 25°, 45°, 75°, and 110°).

To ensure measurement accuracy, the MA68II also includes a two read switch triggering mechanism. This allows a measurement to be taken only after the spectrophotometer has been properly positioned.



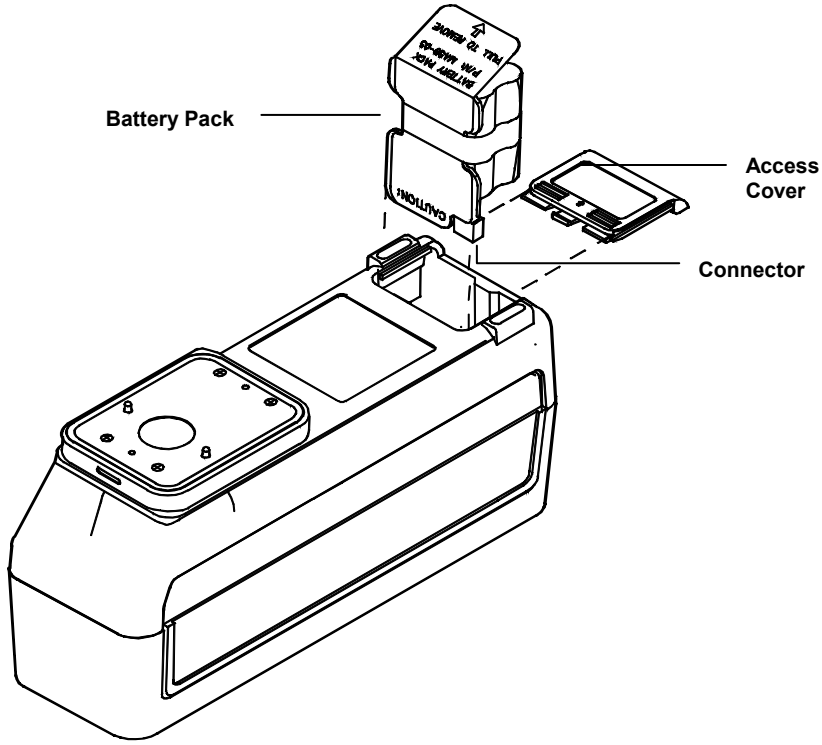
15°/45°/110° viewing geometry by licence from E.I. DuPont de Nemours and Co., Inc. U.S. Patent No. 4,479,718

INSTALLING BATTERY PACK

The instrument is shipped from the factory with the battery pack removed. **The battery pack is located in the instrument case and must be installed before the instrument is used.**

To Install Battery Pack:

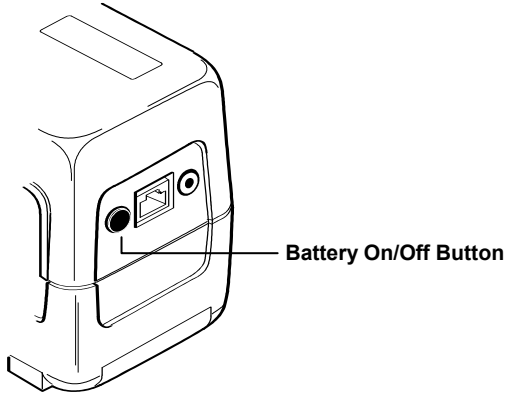
- Carefully turn instrument over and remove battery access cover by sliding outward away from instrument.
- Slide battery pack into unit—with connector end down—until properly seated.
- Reinstall battery access cover by sliding into position.
- Refer to the following pages for battery charging information.



APPLYING POWER

NOTE: The battery pack must be installed before plugging in the AC Adapter.

During battery operation, power is applied by pressing the “On/Off” button located at the rear of the instrument. When the battery power is left On, the instrument will automatically shut off after “45 seconds” of non-use to conserve battery life. If the instrument is allowed to power-down, simply taking a measurement or pressing any key will reactivate the instrument. The power switch should always be used to turn Off the instrument when storing.



The instrument will remain “On” at all times when the AC adapter is used. The power On/Off button will act as a “reset” and return the instrument to its main mode.

CHARGING THE BATTERY PACK

NOTE: The battery pack must be charged before use.

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

The instrument is powered by six, AA nickel-metal hydride batteries in a removable battery pack. The battery pack *must* remain in the instrument at all times for proper operation. The AC adapter charges the batteries when it is plugged in, but does not eliminate the need for the batteries. The instrument can be operated while the batteries are being charged.

The instrument's batteries should be fully charged in 16 hours and should provide approximately 1000 measurements. Charging the batteries for less than 16 hours will reduce the operating time of the instrument—see charging tips.

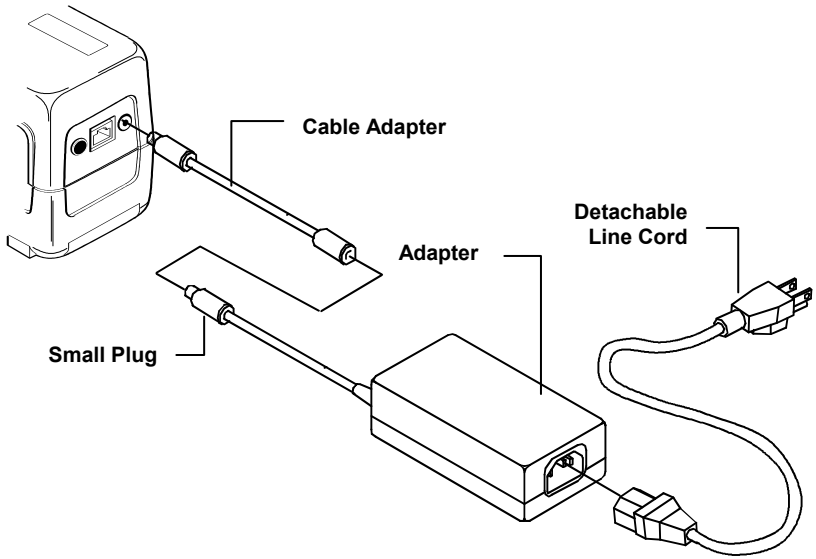
Charging Tips:

- The instrument features a "fast charge cycle" which will charge a fully discharged battery pack to 50% capacity in 4 hours. A 100% charge will be restored to a fully discharged pack in 16 hours.
- A **"Battery Low"** message will appear on the display when there are approximately 50 measurements remaining. The adapter should be plugged in as soon as possible when this message appears. A **"Batteries Very Low - Must Be Charged"** message will appear when there is insufficient charge to operate the instrument. Once this message appears, the adapter must be connected before any more measurements can be taken.
- The removable battery pack is equipped with a built-in charger jack for external charging. This allows an additional pack to be charged while one is in use in the instrument. A fully discharged pack will be completely charged in 16 hours. The battery pack does not incorporate the "smart" charging circuitry contained in the instrument. When charging batteries externally, do not charge for extended periods of time (over 48 hours). Extended periods of continuous charging can reduce the battery pack's capacity.
- If the instrument is to be stored for an extended period of time—over 6 months—remove the battery pack.

AC Adapter Connection:

NOTE: Do not plug the AC adapter into the instrument without a battery pack installed. The instrument will not function with the battery pack out. Refer to Installing Battery Pack, page 1-3.

- Insert the small plug from the adapter into the cable adapter, and then into the input of the power-input connector on the instrument. (If you are using the serial cable, you may insert the small plug into the power connector at the end of the cable.)
- Plug the detachable line cord into the adapter.
- Plug the line cord into an AC wall receptacle.



- As an alternate charging method, you can charge the battery back by connector the AC adapter to the adapter jack located on the battery pack

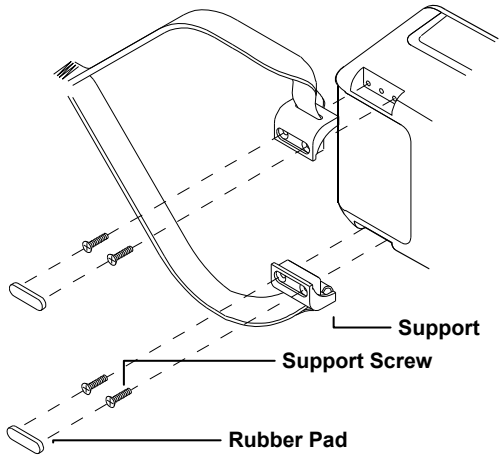
NOTE: The unit is equipped with a battery backed memory and will not lose any of the preset information or stored measurements if the battery pack is removed. Refer to Battery Pack Replacement in Section Seven for proper removal and installation.

ATTACHING AND ADJUSTING THE WRIST STRAP

A security wrist strap is included with your MA68II. Refer below for installation and adjustment procedures.

Strap Installation:

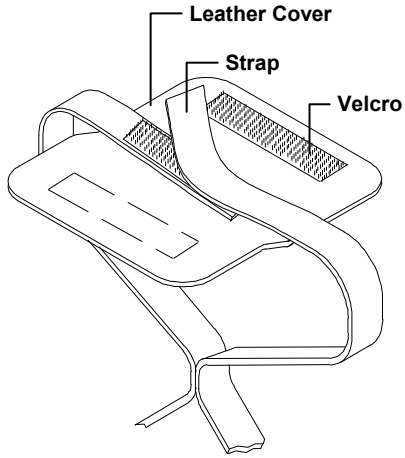
- Disconnect AC adapter and turn battery switch off.
- Carefully place instrument on its side.
- Remove the rubber pads from the bottom of the standard instrument supports.
- Remove the four screws from the two instrument supports and remove supports from instrument.



- Place new supports with straps on instrument as shown.
- Secure supports with four screws provided.
- Peel the paper backing off the two rubber pads and place them in the recessed areas over the screws.

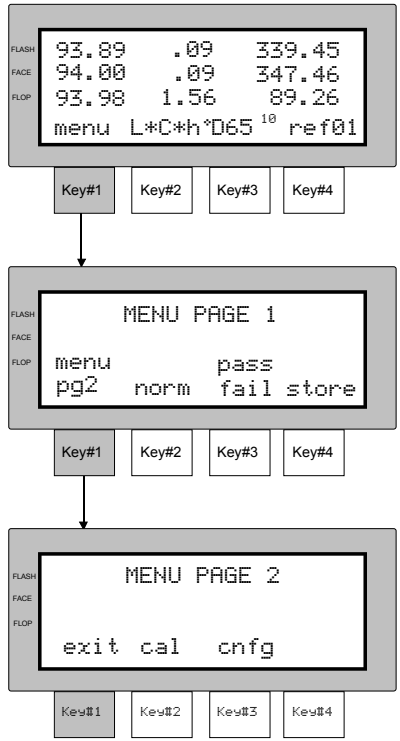
Strap Adjustment:

- Separate the Velcro on the leather cover.
- Separate the Velcro on the straps and adjust to fit wrist properly.
- Reattach the Velcro on the leather cover.



MENU PAGE SELECTION AND DISPLAY DESCRIPTION

The main menu is contained in two pages. To advance through the page menus, continually press Key #1.



norm (normal)

The norm key will always return the display to the main screen (L*a*b*, L*C*h°, etc.).

pass/fail

The pass/fail key is used to access pass/fail operation and tolerance editing.

store (storage)

The store key is used to access storage operation. From this mode measurement data is stored, printed and deleted from selected groups. This function can also be used with X-Rite's X-RiteColor® Master software program.

cal (calibration)

The cal key accesses the calibration function where white calibration and zero reflectance measurements are performed.

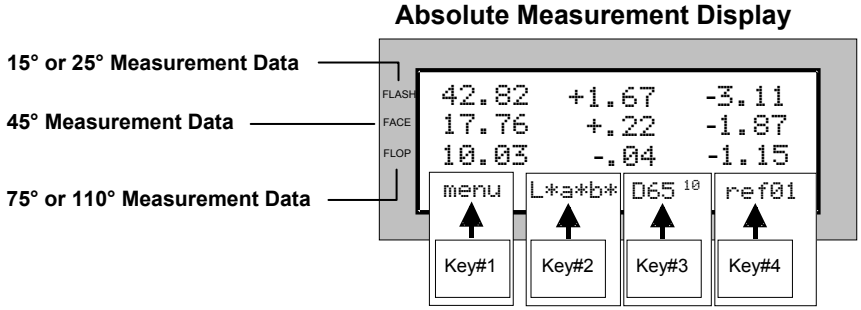
cnfg (configuration)

The cnfg key is used to access the operation options, printing formats, date/time, and communication parameters.

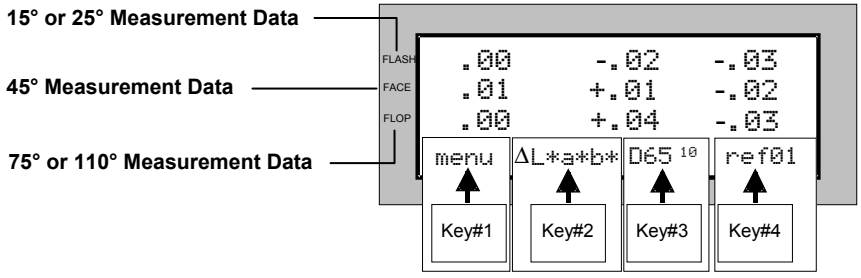
The characters in the display above each keyswitch dictate which function will be selected or which action will take place when a keyswitch is pressed. Normally, uppercase lettering is used for display messages, and lower-case lettering is used for menu options that are selectable by the user.

The left side of the display label lists the measurement angle description. Each description is adjacent to the data in the display that reflects that angle. The "Flash" displays 15° or 25° angle data, "Face" displays 45° angle data, and "Flop" displays 75° or 110° angle data. Display angles are selected in Operation Options, Section Three.

Absolute Measurement Display



Difference Measurement Display



INSTRUMENT POSITIONING AND MEASUREMENT TECHNIQUES

In order for the MA68II to obtain accurate and repeatable measurements, the bottom of the sensor nose must be flat with the surface to be measured. Any movement of the sensor nose can cause the measurement angles to vary, greatly affecting measurements on metallic and pearlescent paint finishes.

Measurements performed on a surface with a curve can cause measurement errors especially at the near specular angles (15° and 25°). Whenever possible measurements should be made on the flattest part of a sample. When measuring parts where a flat area is not available, a fixture should be made to repeatedly and accurately position the sample tangent to the measurement plain.

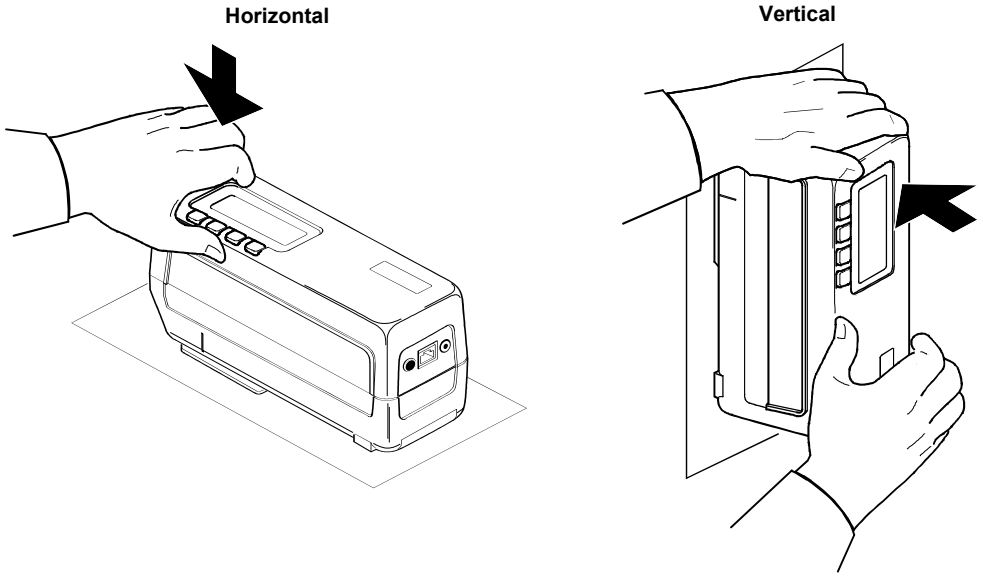
The ideal measurement condition is to have the entire instrument positioned on the measurement surface before measuring. If this is not possible, just the sensor nose can be positioned on a small sample to achieve an accurate measurement.

A measurement will take place when both switches are activated on the bottom of the sensor nose. To achieve the best measurement repeatability, ***Always Press Firmly*** on the front of the instrument—see next page. ***Do Not*** lift the back of the instrument. The beginning and end of the measurement will be signaled by audible beeps. Hold the instrument firmly until **"READING COMPLETE"** message is displayed. The alignment marks located on the front, left, and right side of the instrument are used as guides to center the measurement aperture over the desired sample area.

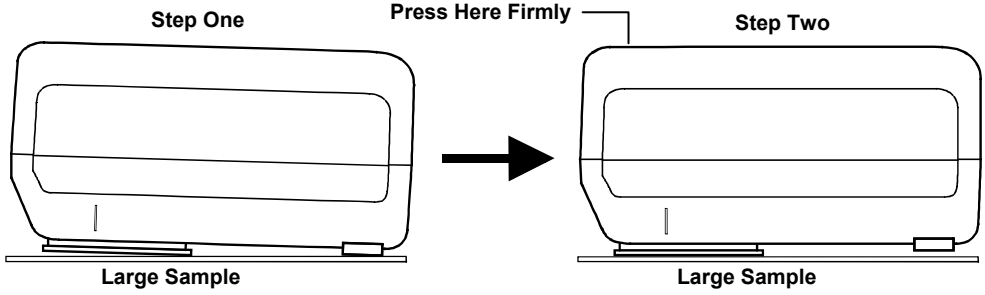
Averaging Measurements

When measuring dark colors or non-uniform samples, several readings should be averaged together for a single measurement. The instrument can be set to average up to 16 measurements. Statistical Measurement Control (SMC) can also be selected. SMC is a method of performing a statistical analysis of several measurements. This method will determine the quality of the measurements and/or the sample before an average value is calculated. Refer to Section Three for details on using and setting average.

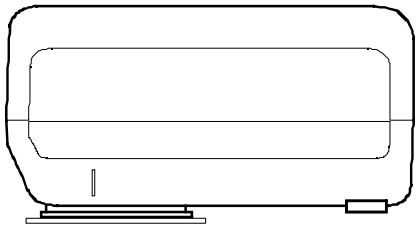
MEASUREMENT METHOD



CORRECT METHOD FOR LARGE SAMPLE

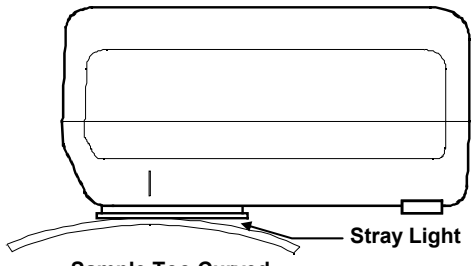


CORRECT METHOD FOR SMALL SAMPLE



Small Sample

INCORRECT METHOD



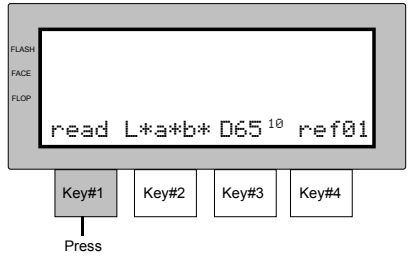
Sample Too Curved

Read Key Operation

Your instrument is sent from the factory with the "read key" option disabled. The read key option is set in the same manner as the other operation options. Refer to Setting Operation Options, Section Three.

Once the read key feature is activated, the **"menu"** key #1 will change to **"read"** key #1.

- To use, position instrument on sample and press down firmly on front of instrument.
- Press **[read]** key #1 and hold until measurement is initiated, then release.



NOTE: To access the menu pages with the read key option activated, quickly press **[read]** key #1 twice, menu page 1 will appear.

SECTION TWO

Instrument Calibration

Regular calibration of the instrument is important in maintaining accurate measurements.

Section Two Contents

CALIBRATION INFORMATION

The instrument should be calibrated **the first thing each day, and every four hours of operation thereafter**. A **"NEED CALIBRATION"** message will appear in the display when:

1. calibration procedure has not been performed for 12 hours.
2. a 10°C change in temperature has occurred since last calibration.
3. zero reflectance or white cal is measured incorrectly.

Whenever this message appears in the display, the calibration procedure must be performed before another measurement can take place.

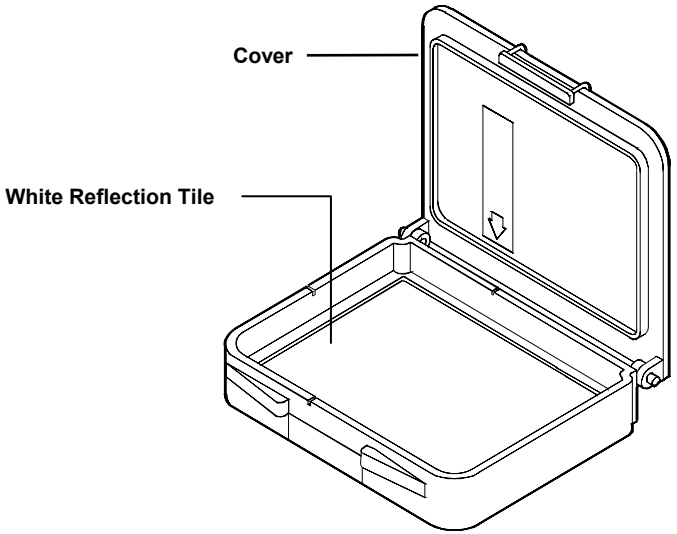
Calibration Notes

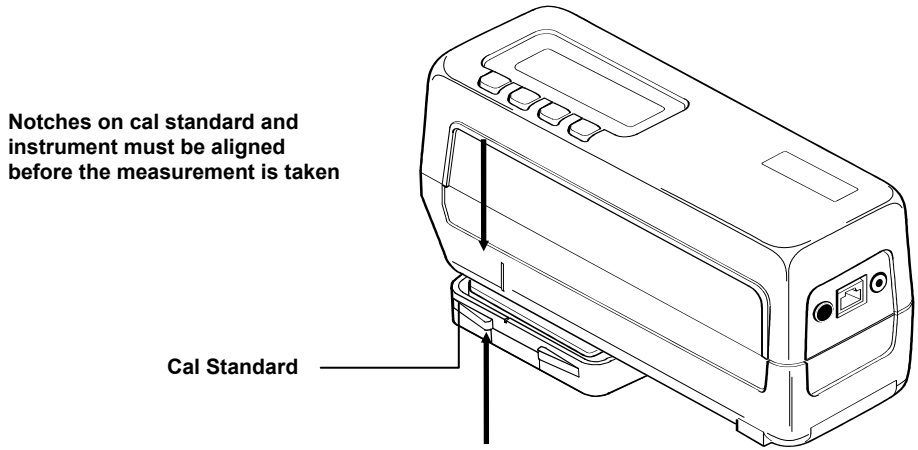
- Dirt or dust in the optics area will cause an inaccurate calibration reading. Refer to Section Seven for optics cleaning procedure.
- The **white ceramic reflection standard is dramatically affected by smudge marks, dust, and finger prints**. Refer to Section Seven for white calibration cleaning procedures.
- The **black trap should be cleaned periodically to remove any dust or contamination**. Clean trap with a dry, lint free cloth.
- **Do not move instrument while taking a calibration measurement**. If motion is detected, an error message will be displayed and calibration aborted.

POSITIONING THE INSTRUMENT ON THE CALIBRATION STANDARD AND BLACK TRAP

White Calibration Standard

The white calibration standard is designed to keep the reflection tile free of dust and debris. The white calibration plaque is concealed in a case that has a hinged cover. The sensor nose is positioned in the case and the measurement taken. Make sure the reflection tile is positioned under the measurement aperture. Use the alignment marks located on the sensor nose and case as guides.

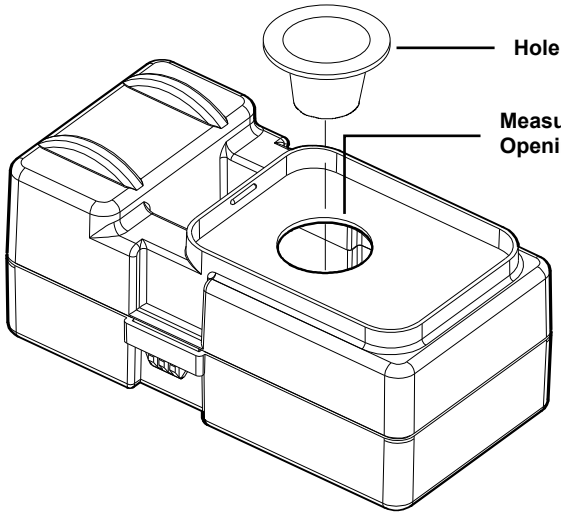




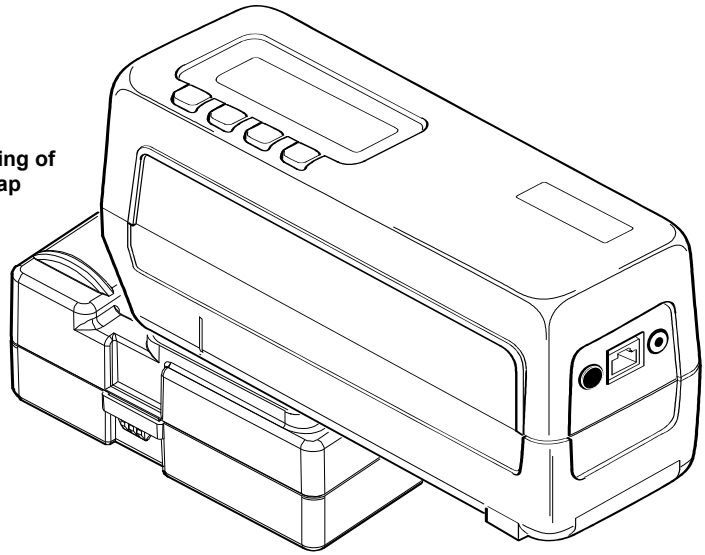
Black Trap

The black trap is used to perform the zero reflectance measurement. The instrument's nose is positioned over the opening and the "read" key pressed. The black trap snaps onto the instrument's nose and can only be positioned in one direction, see below. The black trap can be taken apart for easy cleaning, refer to Section Seven for procedure.

Always store black trap with hole plug in place when not in use.



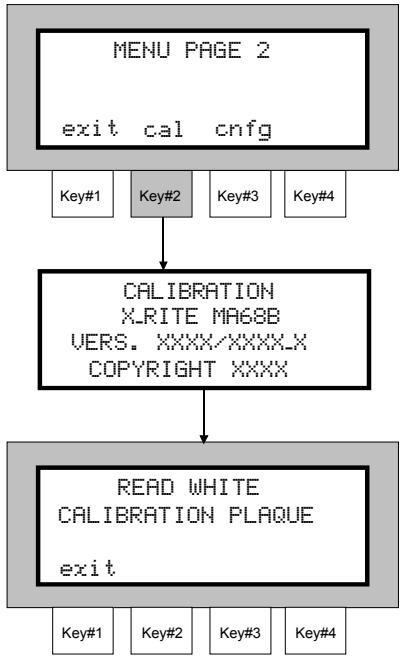
Correct positioning of instrument on trap



CALIBRATION PROCEDURE

NOTE: Make sure that the white calibration standard and black trap are clean. Refer to Section Seven.

1. Press **[cal]** key #2 located on Menu Page 2 to access **READ WHITE CALIBRATION PLAQUE** screen.

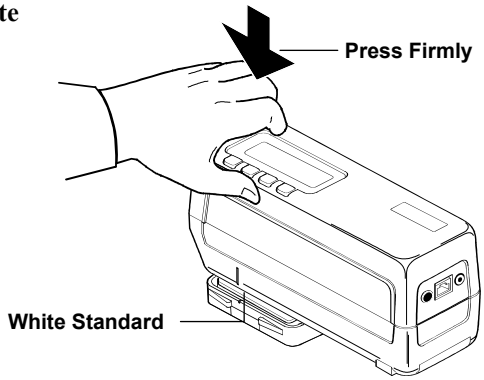


- The software datecode and copyright are momentarily displayed.

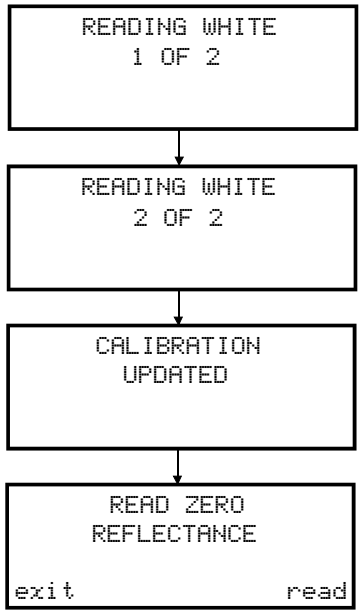
- **READ WHITE CALIBRATION PLAQUE** is displayed.

NOTE: Pressing **[exit]** key #1 will abort the calibration procedure and calibration will not be updated.

2. Position instrument on **white standard**—as previously discussed. Hold instrument down until calibration readings are complete. To maintain accuracy and repeatability, always press firmly on the front of the instrument.



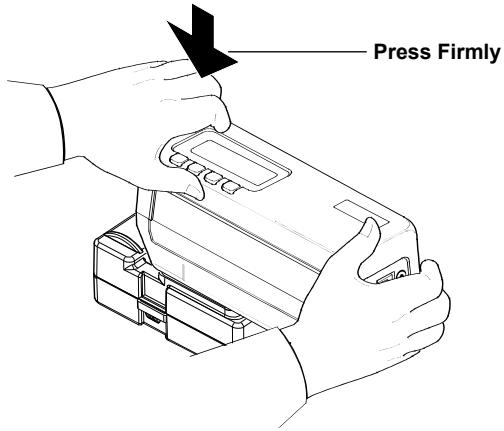
- **READING WHITE - 1 OF 2, 2 OF 2** is displayed**.**



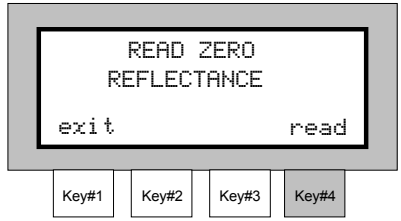
NOTE: If an error message occurs during calibration, try reading plaque again. If error message still occurs, refer to Appendix A.

- After white calibration readings are complete**, CALIBRATION UPDATED** is momentarily displayed and then **READ ZERO REFLECTANCE.**

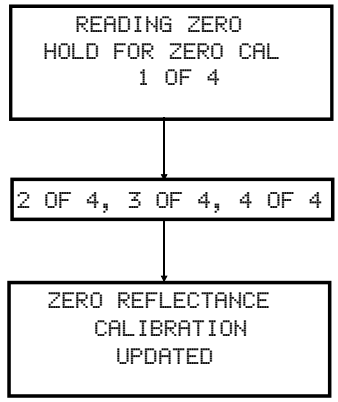
3. Position instrument on **black trap**—as previously discussed—and press firmly on front of instrument.



4. Press **[read]** key #4.



- **READING ZERO - HOLD FOR ZERO CAL 1 OF 4, 2 OF 4, 3 OF 4, 4 OF 4** is displayed.



- After zero calibration readings are completed, the procedure is finalized and instrument returns back to normal operation.

NOTE: If an error message occurred during calibration, clean trap (see Section Seven) and try reading again. If message still occurs, refer to Appendix A.

Setting System Configuration

The system configuration allows you to setup your instrument for your requirements. The configuration should be viewed and edited if required before any measurements are taken.

Section Three Contents

RS-232 COMMUNICATION OPTIONS

The MA68II comes equipped with a serial port that allows data to be transmitted/received to/from an external device. Listed below is a description of the communication options, followed by the selection procedure.

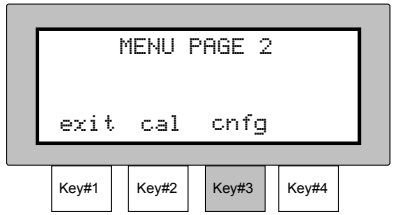
IO Port Baud Rate - determines the input/output rate (characters per second) of the RS232 port. Available outputs are: 300, 600, 1200, 2400, 4800, 9600, and 19200. The factory default setting is 9600 baud.

Automatic Line Feed With Each <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 ON.

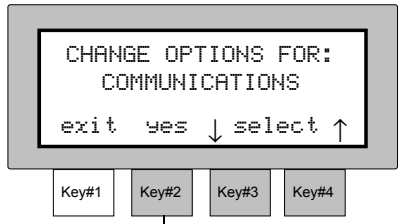
Handshake Option - is used for data transmission. Handshake may be set to No Handshake, PIN 5 is CTS SIGNAL, Pin 5 is BUSY SIGNAL, or XON/XOFF. Handshake should be set to "No" when not being used. The factory default setting is No Handshake.

To Edit Communication Options:

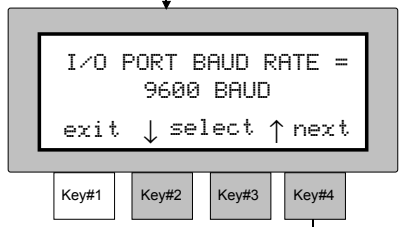
1. Press **[cnfg]** key #3 located on Menu Page 2 to access configuration function screen.



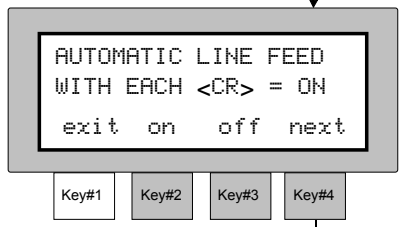
2. Press **[↓]** key #3 or **[↑]** key #4 to select Communication Options, then press **[yes]** key #2.



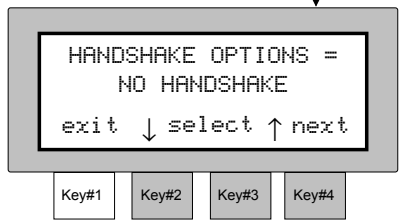
3. Select the baud rate by pressing **[↓]** key #2 or **[↑]** key #3. The available rates are: **"300", "600", "1200", "2400", "4800", "9600"**, and **"19200."**
- Press **[next]** key #4 to advance to next option.



4. Set the line feed option to On or Off. Press **[on]** key #2 to set line feed (on), or press **[off]** key #3 to set **"no"** line feed (off).
- Press **[next]** key #4 to advance to next option.



5. Select the handshake operation by pressing **[↓]** key #2 or **[↑]** key #3. The available options are: **"NO HANDSHAKE", "PIN 5 IS CTS SIGNAL", "PIN 5 IS BUSY SIGNAL",** and **"XON/XOFF."**



- Press **[exit]** key #1 once to return to Communication Options main menu, or press key #1 twice to return to normal operation.

OPERATION OPTIONS

The operation options are used to configure the instrument's operating parameters. Listed below is a description of the available options followed by the selection procedure.

Averaging Mode - averaging mode is used to select "1 - 16" measurements for calculating a single sample reading. Measurements are taken at different locations on a sample to achieve average measurement values. Average mode is also used to select Statistical Measurement Control. Statistical Measurement Control (SMC) is a method of performing a statistical analysis of several measurements to determine the quality of the measurements and/or the sample, before an average value is calculated. The calculation includes a test for outliers, a stability test of the average values and an overall "grade" that indicates the quality of the averaged measurements. These tests are performed automatically in the SMC mode and are transparent to the user. SMC requires a minimum of 5 measurements taken at various locations on the sample. A statistical analysis of the measurements' mean and standard deviations eliminates outliers and determines the variability of the measurements. Additional measurements may be required until a minimum of 5 outlier-free measurements are achieved, or the sample is determined too variable.

Auto Reference - when set to "Enable", the reference with the smallest color difference is automatically selected during a measurement. When set to "Disabled", a reference must be selected before a measurement.

Reference Limit - allows you to select the number of references that can be available when selecting a reference location. The number of references can be set "1 - 200."

Difference Formula - allows you to select which method is used to express Delta E. The two methods to select from are: CIELAB Delta E, Delta E94, Delta Ecmc, DIN6175-2 Delta Ec, DIN6175-2 Delta Ep and DIN6175-2 Delta Ee.

Illum/Obs Options - individual illuminant/observer pairs may be turned Off or On depending on your requirements. This allows only the illuminant/observers you want to be displayed during operation.

Display Angles - allows the user to select which three angles are seen on the display and used for pass/fail determination. Available setting are: "15°/45°/75°", "25°/45°/75°", "25°/45°/110°", and "15°/45°/110°."*

* 15°/45°/110° viewing geometry by license from E.I. DuPont de Nemours and Co., Inc. U.S. Patent No. 4,479,718.

Read Switch Method - allows a measurement to be taken with a key depression when the "Menu Key" option is enabled. Refer to Read Key Operation, page 1-12 for additional information.

Beeper Operation - determines the volume level that is output on the instruments beeper. Available settings are: “Volume Soft” and “Volume Loud.”

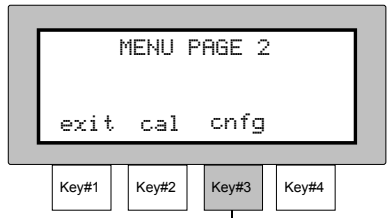
Language – allows you to select what language the instrument will display. Available settings are: “English” and “Francais.”

SMC Read Limit - The Read Limit function is the number of measurements allowed in SMC before the sample is determined too variable for providing useful data. The Read Limit can be set “5 - 50.” The factory default setting is “12” measurements.

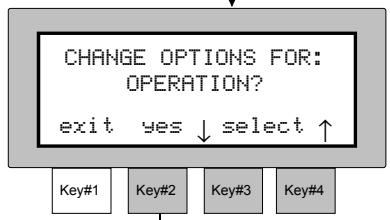
SMC Grade Limit - The Grade Limit function is used to set the quality limit for the SMC function. Use Grade Limit to alter the number of measurements required in SMC. Increasing the grade limit value loosens the SMC requirements. Decreasing the grade limit value tightens the SMC requirements. The Grade Limit can be set “5.00 - 50.00.” The factory default setting is “5.00”, this is a good value for typical metallic finishes.

To Edit Operation Options:

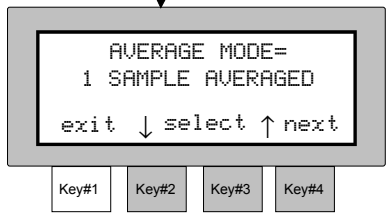
1. Press **[cnfg]** key #3 located on Menu Page 2 to access configuration function screen.



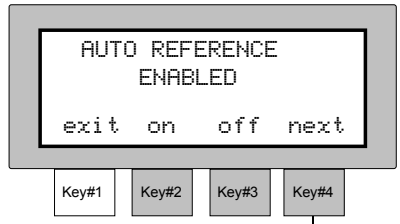
2. Press **[↓]** key #3 or **[↑]** key #4 to select Operation Options, then press **[yes]** key #2.



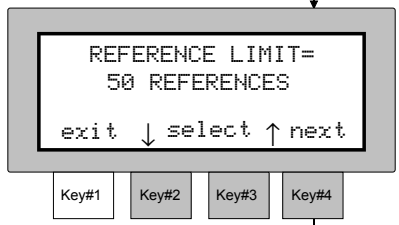
3. Select the number of samples averaged (1 to 16) or SMC Mode. Press **[↓]** key #2 to decrease and the **[↑]** key #3 to increase average number.
   - Press **[next]** key #4 to advance to the next option.



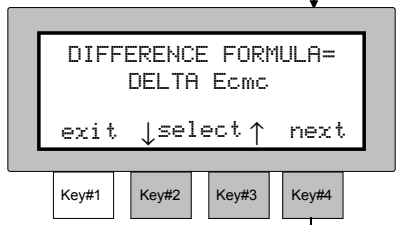
4. Select Auto Reference operation by pressing **[on]** key #2 to select **"ENABLED"** or the **[off]** key #3 to select **"DISABLED."**
- Press **[next]** key #4 to advance to the next option.



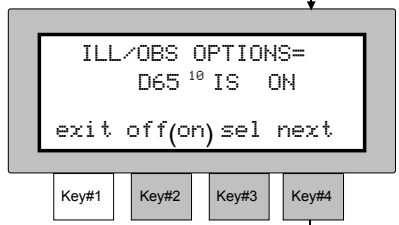
5. Select the number of reference locations required (1 - 200). Press **[↓]** key #2 to decrement or **[↑]** key #3 to increment.
- Press **[next]** key #4 to advance to the next option.



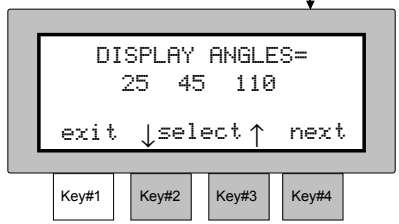
6. Select Delta E display method by pressing **[↓]** key #2 or **[↑]** key #3. The available setting are: **"CIELAB DELTA E"**, **"DELTA ECMC", etc.**
- Press **[next]** key #4 to advance to the next option.



7. Select the illuminant/observer combinations you want to display.
- Press **[sel]** key #3 to select illuminant/observer and press "Key #2" to turn illuminant/ observer Off or On. An illuminant/observer turned Off will not display during measurement sequence.
- Press **[next]** key #4 to advance to the next option.



8. Select the display angles for viewing and pass/fail monitoring by pressing **[↓]** key #2 or **[↑]** key #3.
- Press **[next]** key #4 to advance to the next option.



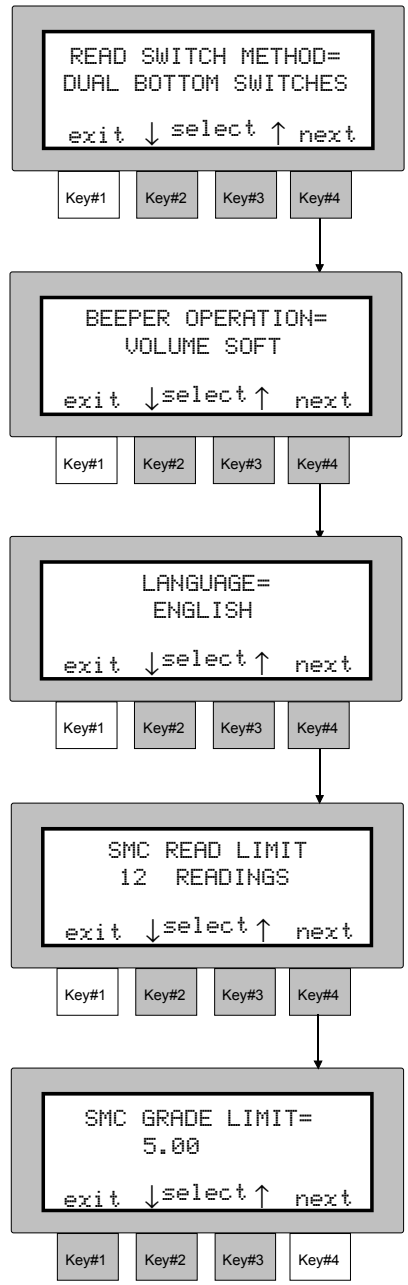
9. Select read switch method by pressing **[↓]** key #2 or **[↑]** key #3. The available settings are: **"DUAL BOTTOM SWITCHES"** and **"MENU KEY."**
   - Press **[next]** key #4 to advance to the next option.

10. Select the beeper volume by pressing **[↓]** key #2 or **[↑]** key #3. The available settings are: **"SOFT"** and **"LOUD."**
    - Press **[next]** key #4 to advance to the next option.

11. Select the instrument display language by pressing **[↓]** key #2 or **[↑]** key #3. The available settings are: **"ENGLISH"** and **"FRANCAIS."**
    - Press **[next]** key #4 to advance to the next option.

12. Select the SMC read limit (1 - 12). Press **[↓]** key #2 to decrease or **[↑]** key #3 to increase SMC readings.
    - Press **[next]** key #4 to advance to the next option.

13. Select the SMC grade limit (5.00 - 50.00). Press **[↓]** key #2 to decrease or **[↑]** key #3 to increase SMC grade limit.
    - Press the **[exit]** key #1 once to return to Operation Options main menu, or press key #1 twice to return to normal operation.



PRINTOUT OPTIONS

Setting the printout options determines what data is transmitted out of the I/O port for normal and storage operation. Listed below are the available options.

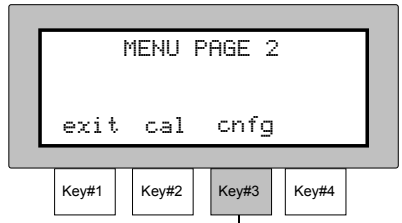
Printout Format - determines if the measurement data is output as "Spectral Data" (400nm - 700nm in 10nm increments), or "Color Space Data" (L*a*b*, etc.).

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

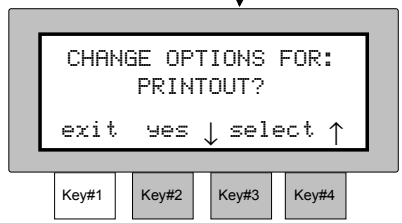
Reference Printout - enables or disables the reference data from printing (if any) during a data transmit.

To Edit Printout Options:

1. Press **[cnfg]** key #3 located on Menu Page 2 to access configuration function screen.



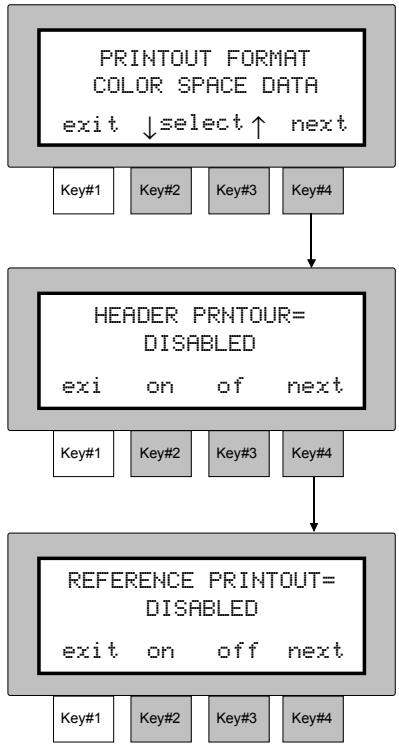
2. Press **[↓]** key #3 or **[↑]** key #4 to select Printout Options, then press **[yes]** key #2.



3. Select the printout format by pressing **[↓]** key #2 or **[↑]** key #3. The available settings are**: "COLOR SPACE DATA"** or **"SPECTRAL DATA."**
   - Press **[next]** key #4 to advance to the next option.

4. Set the header printout to Enabled or Disabled. Press **[on]** key #2 to print header (enabled), or press **[off]** key #3 to disable header print.
   - Press **[next]** key #4 to advance to the next option.

5. Set the reference printout to Enabled or Disabled. Press **[on]** key #2 to print reference (enabled), or press **[off]** key #3 to disable reference print.
   - Press **[exit]** key #1 once to return to Printout Options main menu, or press key #1 twice to return to normal operation.



The following sample printouts illustrate the different output data that can be obtained from the MA68II with a serial printer interfaced.

Samples 1 - Color Space Format "ON"
"ON"
Header "ON"
Reference "ON"

d(L*C*H*)		D65_10	11:15:37	01/23/02	
15 DEGR.	L	-.05 C	+.05 h	-.04 E	.08
25 DEGR.	L	-.03 C	.00 h	.00 E	.03
45 DEGR.	L	-.03 C	.00 h	.00 E	.03
75 DEGR.	L	-.05 C	.00 h	.00 E	.05
110 DEGR.	L	-.03 C	-.02 h	-.02 E	.04
REF 01					
15 DEGR.	L	99.23 C	3.11 h	95.74	
25 DEGR.	L	96.66 C	3.38 h	96.97	
45 DEGR.	L	95.40 C	3.75 h	96.91	
75 DEGR.	L	95.27 C	3.96 h	97.86	
110 DEGR.	L	93.24 C	3.78 h	99.92	

Sample 3 - Color Space Format

Header "OFF"
Reference "OFF"

L	+.05 C	-.09 h	.00 E	.10
L	-.01 C	-.01 h	-.02 E	.02
L	-.01 C	.00 h	.00 E	.01
L	.00 C	-.01 h	.00 E	.01
L	+.02 C	-.03 h	-.02 E	.04

Samples 2 - Spectral Data "ON"
Header "ON"
Reference "OFF"

SPECTRAL DATA		D65_10	11:15:37 01/23/02		
WAVE	15 DEGR.	25 DEGR.	45 DEGR.	75 DEGR.	110 DEGR.
400	r 85.24	r 77.58	r 73.72	r 72.47	r 69.84
410	r 88.20	r 80.62	r 77.04	r 76.22	r 72.62
420	r 90.45	r 83.08	r 79.65	r 78.08	r 74.91
430	r 91.91	r 84.98	r 81.51	r 80.94	r 76.71
440	r 93.02	r 86.35	r 82.84	r 82.22	r 78.11
450	r 94.24	r 87.20	r 83.83	r 83.28	r 79.14
460	r 95.21	r 87.83	r 84.59	r 84.14	r 79.95
470	r 95.61	r 88.53	r 85.32	r 84.92	r 80.69
480	r 95.85	r 89.21	r 86.00	r 85.65	r 81.36
490	r 96.59	r 89.89	r 86.72	r 86.36	r 82.03

610	r 99.41	r 92.68	r 89.90	r 89.61	r 84.71
620	r 99.72	r 92.05	r 89.98	r 89.69	r 84.81
630	r 99.88	r 93.01	r 90.14	r 89.79	r 84.91
640	r 100.07	r 93.24	r 90.40	r 69.98	r 85.08
650	r 100.40	r 93.67	r 90.80	r 90.40	r 85.43
660	r 100.74	r 94.06	r 91.19	r 90.82	r 85.75
670	r 100.97	r 94.23	r 91.36	r 90.91	r 85.82
680	r 101.10	r 94.27	r 91.40	r 90.86	r 85.77
690	r 101.06	r 94.21	r 91.33	r 90.82	r 85.71
700	r 100.90	r 95.05	r 91.16	r 90.74	r 85.60

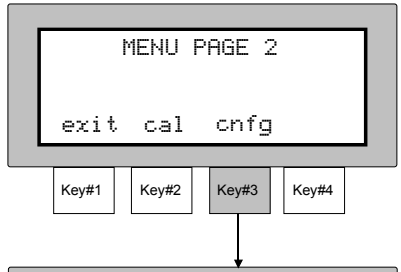
SETTING DATE AND TIME

The date and time function allows you to adjust the instruments internal clock. Eastern Time Zone is the factory default setting. The date and time will print (if "Header" is On) with each measurement when data is output to a printer. Refer below for setting procedure.

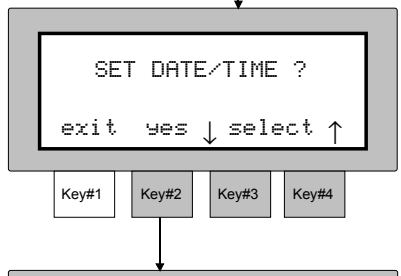
NOTE: If data is downloaded to the instrument from X-RiteColor® Master software program, the instrument's clock will automatically be set to the computer's time and date.

To Edit Date and Time:

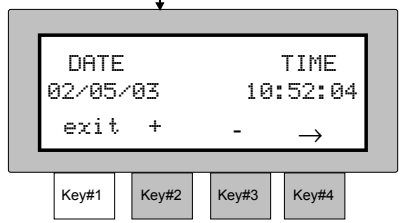
1. Press **[cnfg]** key #3 located on Menu Page 2 to access configuration function screen.



2. Press **[↑]** key #3 or **[↓]** key #4 to select Date/Time, then press **[yes]** key #2.



3. Set Date and Time.



- Press **[→]** key #4 to move cursor to desired position on date or time.
- Press **[+]** key #2 to increase.
- Press **[-]** key #3 to decrease.
- Press the **[exit]** key #1 once to return to Date/Time main menu, or press key #1 twice to return to normal operation.

Normal Operation

Normal operation is used to enter reference data and measure samples. Sample data can then be viewed under various color spaces and illuminant/ observer combinations. Samples measured in normal mode are not stored.

Section Four Contents

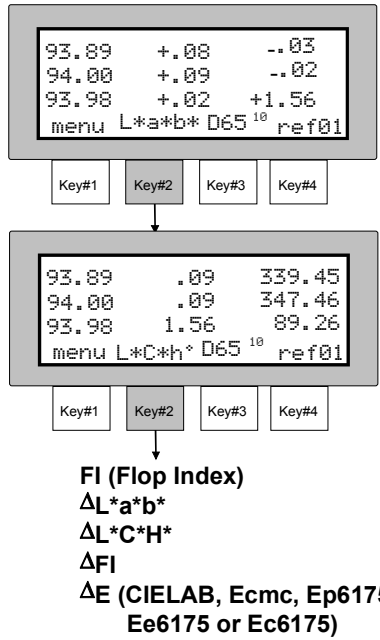
COLOR SPACE SELECTION

There are seven colorimetric systems (absolute and difference) that can be selected when displaying measurement data. Each momentary depression of "Key #2" will page through: L*a*b*, L*C*h°, Flop Index (FI), ΔL*a*b*, ΔL*C*H*, Delta FI, and ΔE (CIELAB, CMC, Ep6175, Ee6175, or Ec6175).

To select a color space:

NOTE: ΔE is the factory preset. To select ΔECMC, refer to Operation Options (Section Three).

- Repeatedly press **"Key #2."**



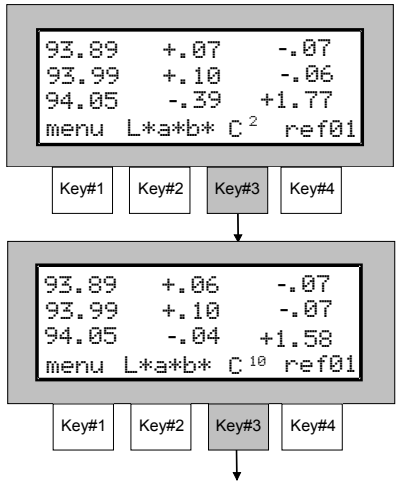
ILLUMINANT/OBSERVER SELECTION

The MA68II has sixteen illuminant/observer combinations that can be selected. Any illuminant/observer can be selected after a measurement to view the values under different conditions.

To select an illuminant/observer:

NOTE: All illuminant/observer combinations may not display. Certain combinations may be turned off in Operation Options (Section Three). $D65^{10}$, A^{10}, and $F2^{10}$ are preset on at the factory.

- Repeatedly press **"Key #3."**



$D65^2$ / $D65^{10}$ (Daylight 6500k)
$D50^2$ / $D50^{10}$ (Daylight 5000k)
A^2 / A^{10} (Incandescent)
$F2^2$ / $F2^{10}$ (Cool White)
$F7^2$ / $F7^{10}$ (Broad Band)
$F11^2$ / $F11^{10}$ (TL84)
$F12^2$ / $F12^{10}$ (Ultralume)

REFERENCE ENTRY

The MA68II can display the difference between a reference and a sample. In order to display these differences the reference must first be entered into memory. There are 200 locations to store references.

The references are stored spectrally and the tristimulus values are recalculated each time a different illuminant/observer is selected.

The instrument can be set to operate in **"automatic reference enabled"** mode. In this mode, the unit will automatically select the closest reference during a measurement.

In **"auto reference disabled"** mode, you must manually select the reference location before a measurement. Once selected, that reference is used until a different reference is selected.

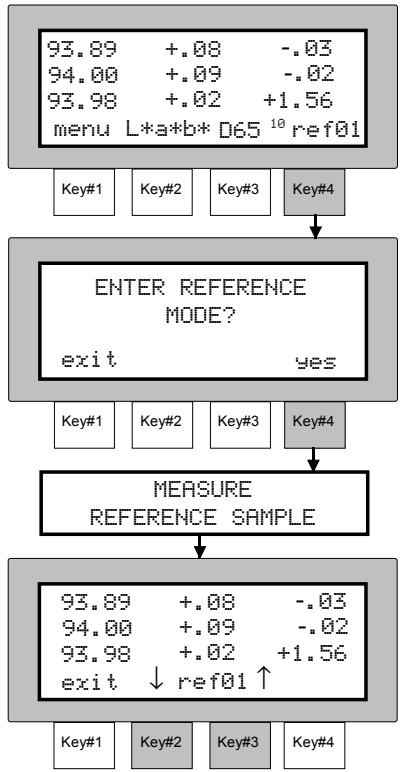
Refer to Setting Operation Options Section Three for manual and auto reference selection.

To Measure a Reference:

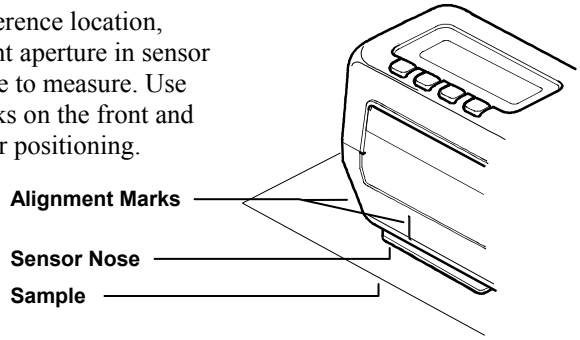
1. Select desired color space and illuminant/observer.
2. Press the **[ref]** key #4 to enter reference menu.
3. Press the **[yes]** to enter reference menu.

- **"MEASURE REFERENCE SAMPLE"** is displayed.

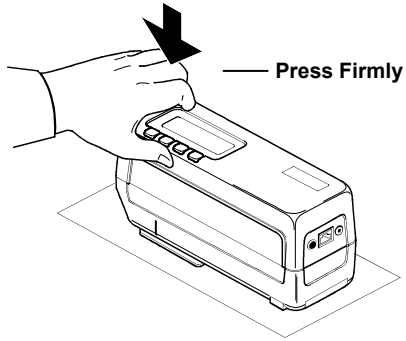
4. Press **[↓]** key #2 or **[↑]** key #3 to select reference location.



5. After selecting reference location, center measurement aperture in sensor nose over reference to measure. Use the alignment marks on the front and sides of the unit for positioning.



6. Press firmly on the front of the unit until sensor nose is flat on reference and both read switches are activated. The beginning and end of the measurement will be signaled by audible beeps. Hold instrument firmly until **"READING COMPLETE"** message is displayed.

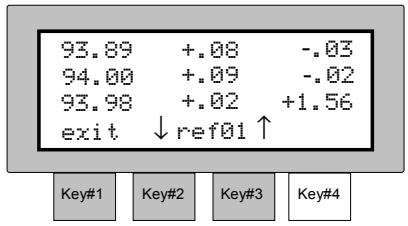


NOTE: If an error message occurs during the measurement, try reading reference again. If error message still occurs, refer to Display Messages in Appendix B.

---

7. The measurement data is entered into the selected reference location.

- Press **[exit]** key #1 to return to normal operation, or press **[↓]** key #2 or **[↑]** key #3 to select a different reference location.



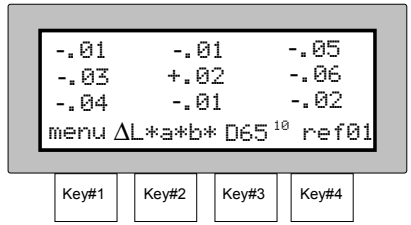
SAMPLE MEASUREMENT

Measurement data is displayed as absolute or difference. The MA68II measures and stores five angles but will only display three—due to display limitations. All five angles can be printed when the instrument is interfaced to a serial printer, or transmitted to a PC via the RS-232 serial port. The three angles displayed are changeable in Operation Options (refer to Section Three).

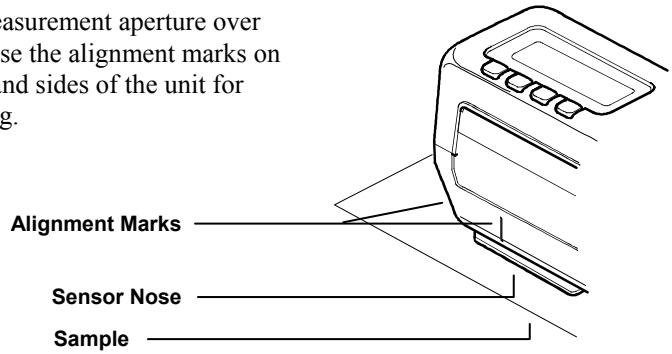
To Take a Sample Measurement:

1. If taking a difference measurement, make sure a reference is entered into the instrument (refer to Reference Entry).

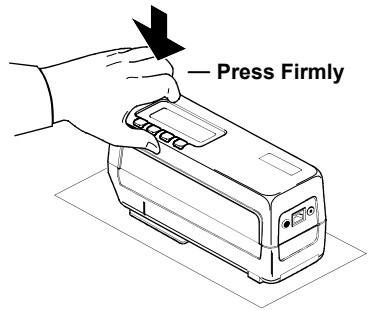
2. Select color space by pressing **"Key #2."** Select illuminant/ observer by pressing **"Key #3."**



3. Center measurement aperture over sample. Use the alignment marks on the front and sides of the unit for positioning.



4. Press firmly on the front of the unit until sensor nose is flat on sample and both read switches are activated. The beginning and end of the measurement will be signaled by audible beeps. Hold instrument firmly until **"READING COMPLETE"** message is displayed.

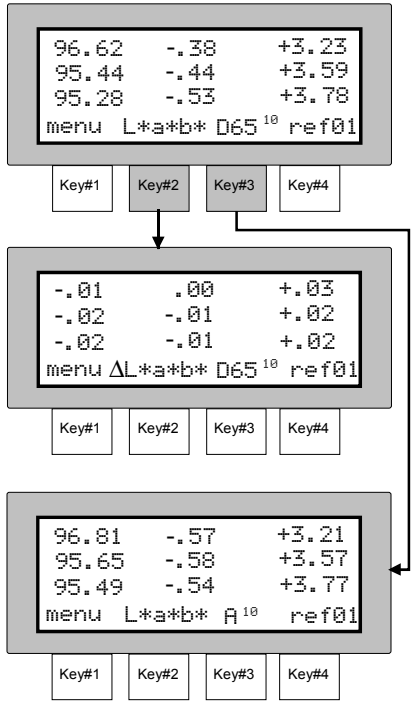


NOTE: If an error message occurs during the measurement, try reading sample again. If error message still occurs, refer to Display Messages in Appendix B.

5. The instrument will display the absolute or difference measured for the selected angles.

- The sample data can be viewed under different illuminant/ observer conditions by pressing "Key #3." The data can also be viewed in a different color space by pressing "Key #2."

NOTE: If auto reference is "on", the instrument will select the reference that is the closest match to the sample.



USING MEASUREMENT AVERAGING

NOTE: Measurement Averaging must be activated in Operation Options before averaging can be performed. Refer to Section Three for procedure.

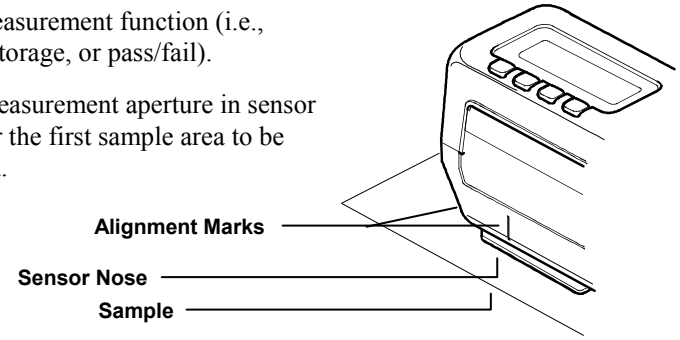
When averaging is activated, the averaging sequence will be required for all functions (i.e., normal, storage, and pass/fail).

Measurement averaging can be set "1 - 16" or "SMC." Statistical Measurement Control (SMC) requires a minimum of 5 measurements taken at various locations on a sample. Refer to Section Three, Operation Options for additional information on SMC.

The following example has an average setting of "2."

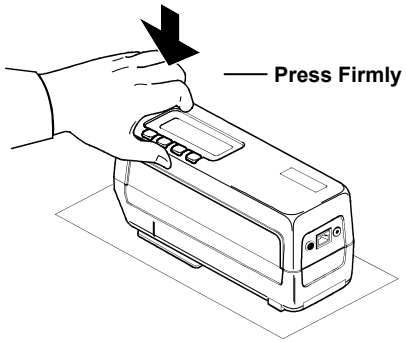
To Take an Average Measurement:

1. Select measurement function (i.e., normal, storage, or pass/fail).
2. Center measurement aperture in sensor nose over the first sample area to be measured.

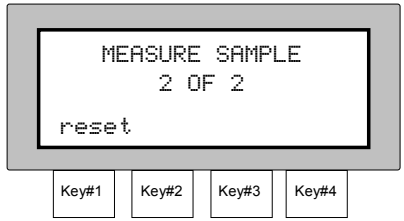


3. Take measurement by positioning sensor nose flat on sample.

- Lift unit off of first area on sample when **"READING COMPLETE"** is displayed.

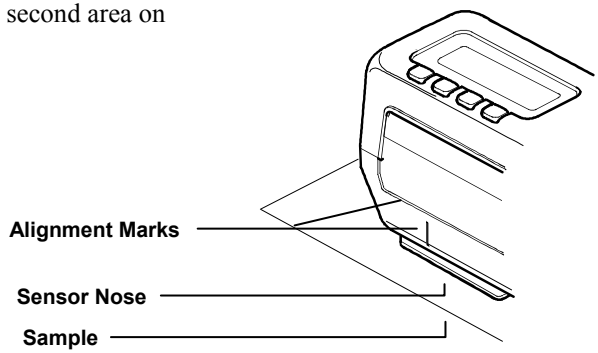


- **"MEASURE SAMPLE 2 OF 2"** is displayed.

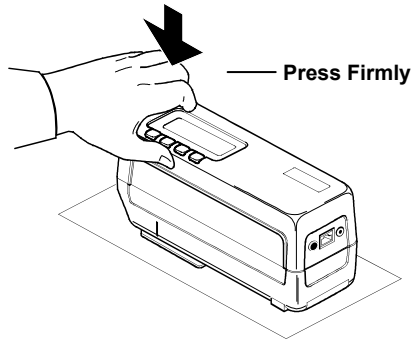


NOTE: Measurement averaging can be aborted at anytime by pressing **[reset]** key #1. The last measurement taken will be the data that is displayed.

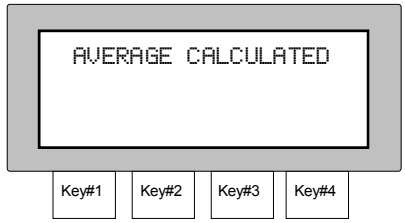
4. Center measurement aperture in sensor nose over second area on sample.



5. Take measurement.



- **"AVERAGE CALCULATED"** is displayed and then the averaged measurement data.



SECTION FIVE

Pass/Fail Operation

The Pass/Fail function will indicate a “pass” or “fail” signal on a sample measurement, based on the tolerance assigned to a reference. Asymmetrical tolerances can be set for CIELAB and CIELCH functions. Tolerances can also be set for ΔFI, ΔE*, ΔE94, ΔECMC, ΔEc6175, ΔEp6175 and ΔEe6175.

Section Five Contents

ADJUSTING TOLERANCE VALUES

The tolerance adjustment feature allows the user to manually set the pass/fail method and tolerance values for each reference.

- ΔL*a*b* and ΔL*C*H* method allows high/low tolerance settings for each angle.
- ΔFI method allows high/low tolerance setting for the flop index.
- ΔE*, ΔE94, ΔEc6175, ΔEp6175 and ΔEe6175 methods allow tolerance settings for each angle.
- ΔECMC method allows a global adjustment for “l” (lightness factor) and “c” (chromaticity factor). The “cf” (commercial factor) can be adjusted for each angle.

NOTE: “ΔE” is the factory default that will appear as one of the pass/fail methods. Refer to Section Three, Setting Operation Options if “ΔECMC” method is required.

The pass/fail method selected will cause the tolerance editing procedures to differ. Each tolerance method selected will be covered separately. The initial tolerance procedure will be covered in steps 1 - 4. Thereafter, each tolerance method will start at Step 5.

To Adjust Tolerance Values:

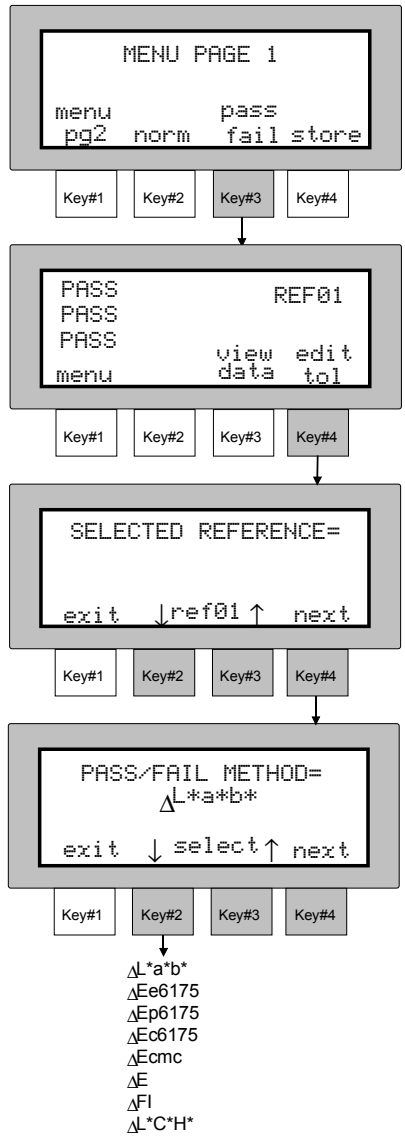
1. At **"MENU PAGE 1",** press **[pass/fail]** key #3 to enter pass/fail option.

2. Press **[edit tol]** key #4 to enter **the "SELECT REFERENCE"** screen.

3. Select reference by pressing **[↓]** key #2 to decrement or **[↑]** key #3 to increment. The available references are: 1 through 200.

- Press **[next]** key #4 to advance to **"PASS/FAIL METHOD"** screen.

4. Select pass/fail method by pressing **[↓]** key #2 or **[↑]** key #3. The available methods are: ΔL*a*b*, ΔL*C*H*, ΔFI, ΔE, ΔECMC, ΔEe6175, ΔEp6175 and ΔEc6175).



IMPORTANT!
The following pages cover each tolerance method separately.

PASS/FAIL METHOD = ΔL*a*b* or ΔL*C*H*

NOTE: The L*a*b* and L*C*H* tolerance setups are similar and will be covered in the same procedure.

5. Press **[next]** key #4 to advance to **"15° HIGH TOLERANCE"** screen.

6. Set 15° high tolerance values by pressing the **[→]** key #4 to move cursor to desired attribute. Press **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

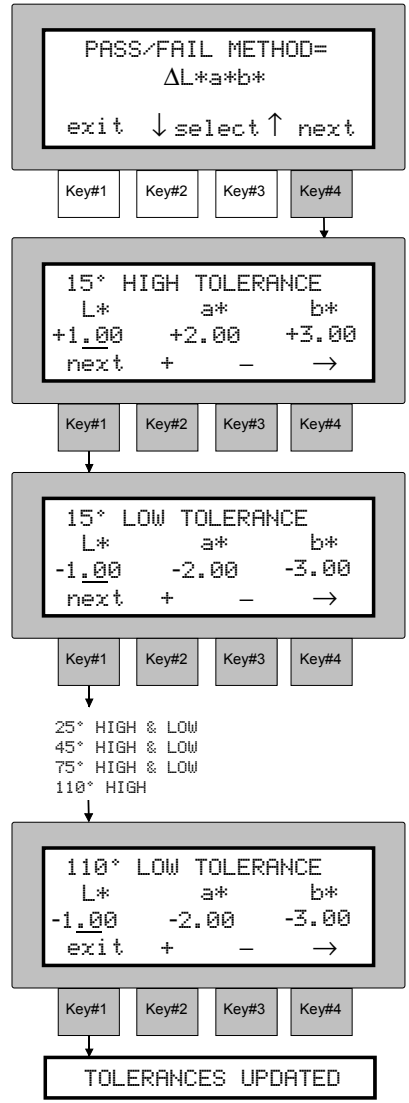
- Press **[next]** key #1 to advance to **"15° LOW TOLERANCE"** screen.

7. Set 15° low tolerance values by pressing the **[→]** key #4 to move cursor to desired attribute. Press **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- Press **[next]** key #1 to advance to **"25° HIGH TOLERANCE"** screen.

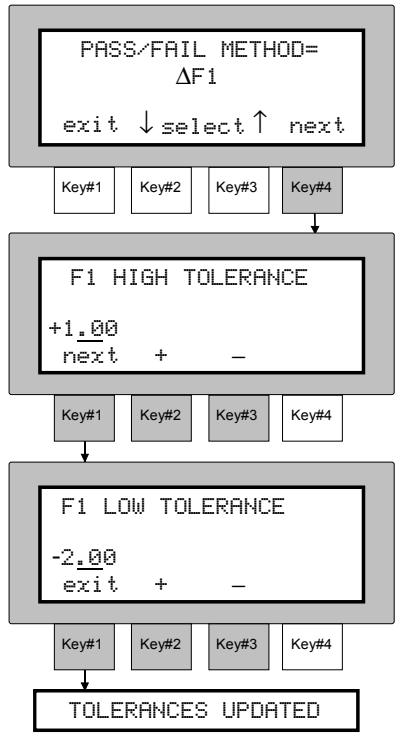
8. Repeat Step 6 and 7 for all angles through **"110° LOW TOLERANCE"** setting.

- Press **[exit]** key #1 to save and exit tolerance procedure. **"TOLERANCES UPDATED"** is displayed and the procedure exited.



PASS/FAIL METHOD = ΔFI (Flop Index)

5. Press **[next]** key #4 to advance to **"FI HIGH TOLERANCE"** screen.



6. Set FI high tolerance values by pressing the **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- Press **[next]** key #1 to advance to **"FI LOW TOLERANCE"** screen.

7. Set FI low tolerance values by pressing **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- Press **[exit]** key #1 to exit tolerance procedure.

- **"TOLERANCES UPDATED"** is displayed and the procedure exited.

PASS/FAIL METHOD = ΔE, ΔE94, ΔEe6175, ΔEp6175 or ΔEc6175

5. Press **[next]** key #4 to advance to **"15° TOLERANCE"** screen.

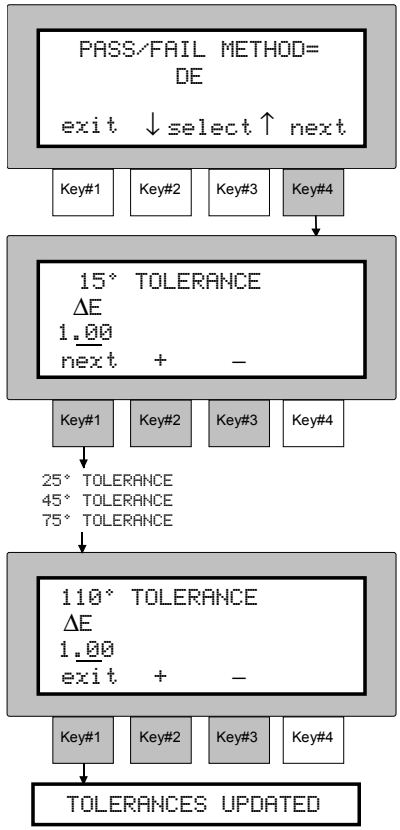
6. Set 15° tolerance value by pressing **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- Press **[next]** key #1 to advance to **"25° TOLERANCE"** screen.

7. Repeat Step 6 for all angles through **"110° TOLERANCE"** setting.

- Press **[exit]** key #1 to save and exit tolerance procedure.

- **"TOLERANCES UPDATED"** is displayed and the procedure exited.



PASS/FAIL METHOD = ΔECMC

5. Press **[next]** key #4 to advance to **"15° TOLERANCE"** screen.
6. Set 15° tolerance values by pressing the **[→]** key #4 to move cursor to desired "cf", "l", & "c" attribute. Press **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- Press **[next]** key #1 to advance to **"25° LOW TOLERANCE"** screen.

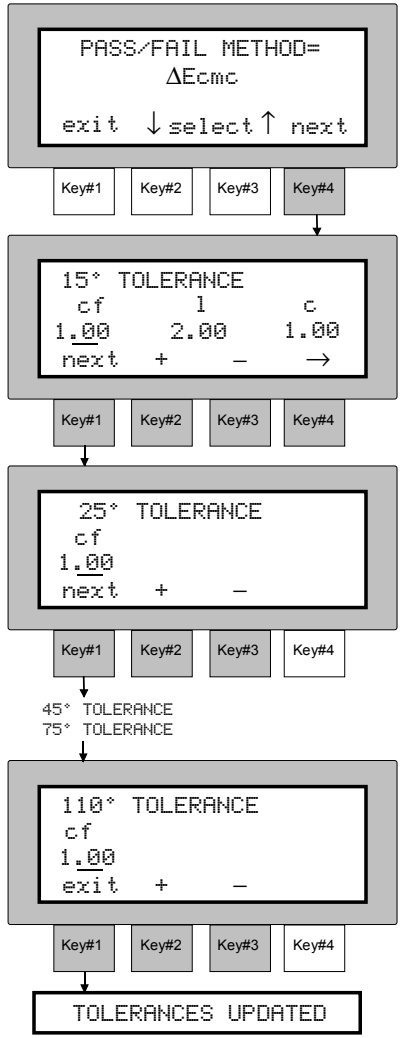
NOTE: The lightness factor "l" and the chromaticity factor "c" are set at 15° only and are identical for all angles. The commercial factor "cf" can be set for each angle.

7. Set 25° "cf" tolerance value. Press **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- Press **[next]** key #1 to advance to **"45° TOLERANCE"** screen.

8. Repeat Step 7 for all angles through **"110° TOLERANCE"** setting.

- Press **[exit]** key #1 to save and exit tolerance procedure.



- **"TOLERANCES UPDATED"** is displayed and the procedure exited.

PASS/FAIL MEASUREMENT

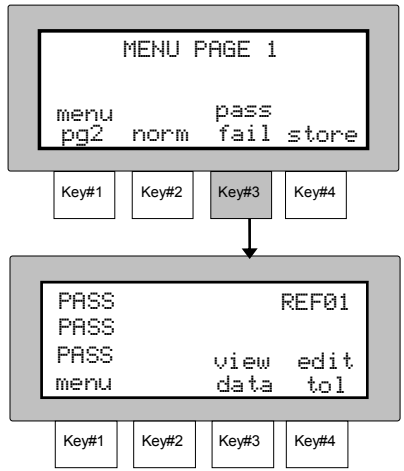
The Pass/Fail measurement will indicate a pass or fail signal only for the three angles selected. Difference data can also be viewed for the last sample measured.

To Take a Pass/Fail Measurement:

NOTE: References must be measured and tolerances edited before a pass/fail measurement will display usable data.

---

1. Press **[pass/fail]** key #3 at the "**MENU PAGE 1"** level to enter pass/fail function.

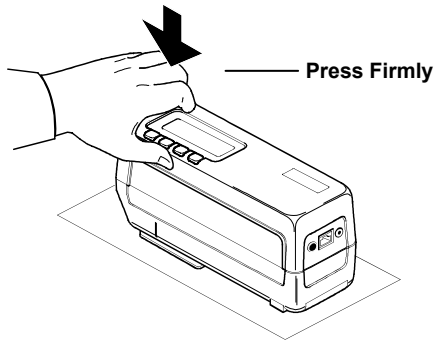


- The Pass/Fail measurement screen is displayed.

NOTE: A reference must be selected if "Auto Reference" is disabled in Operation Options. Press the **[edit tol]** key #4 to access reference menu.

---

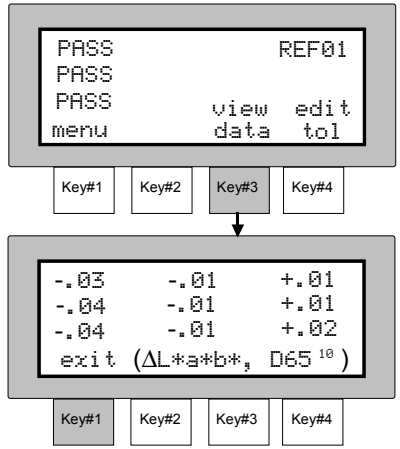
2. Take measurement by positioning sensor nose flat on sample and pressing firmly.



3. A **"PASS"** (2 short beeps) or **"FAIL"** (1 long beep) will display for each selected angle to indicate the sample's status.

- Sample difference values are viewed by pressing **[view data]** key #3.

4. Press the **[exit]** key #1 to return to the pass/fail indication screen.



NOTE: Samples will only indicate a pass or fail message using the three angle selected in Operation Options.

Measurements can be taken in the data view mode if desired.

SECTION SIX

Storage Operation

Storage operation allows measurement data to be stored, viewed, edited, and output to a computer or printer.

When the MA68II is used in conjunction with X-RiteColor® Master software program, stored measurement data is "uploaded" directly into the application for visual analysis.

Section Six Contents

STORING MEASUREMENTS

Storage allows sample measurements to be assigned to group numbers. Once in storage mode, the operator randomly selects group numbers and measures as many samples as desired in the selected group. The instrument allows a maximum of 890 samples to be stored in 20 groups.

Stored sample measurements can also have scanned tags attached by use of the "optional" bar code reader. Group names can be assigned by scanning a tag. Individual measurements can have up to 6 tags attached. Refer to Tagging and Storing Operating for more information.

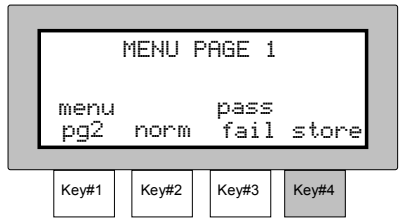
To Store a Measurement:

1. Select desired color space and illuminant/observer.

NOTE: Stored data displays in the last color space and illuminant/observer combination selected when pass/fail indication is not used.

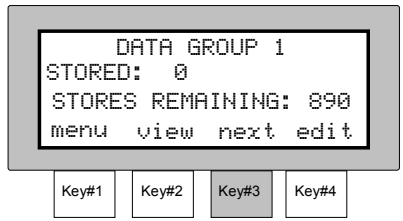
---

2. Press **[store]** key #4 at the **"MENU PAGE 1"** level to enter storage function.



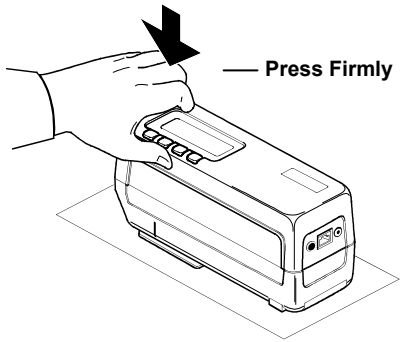
NOTE: Pressing the **[pass fail]** key #3 and **[store]** key #4 simultaneously will place the instrument in storage mode with pass/fail indication.

3. Select desired data group number by repeatedly pressing **[next]** key #3.

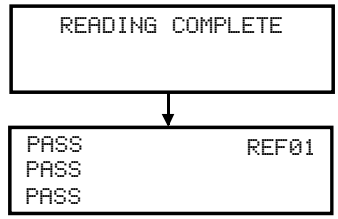


4. Take measurement by positioning sensor nose flat on sample and pressing firmly on instrument.

- Lift unit off sample after **"READING COMPLETE"** and **"PASS/FAIL"** indication is displayed.

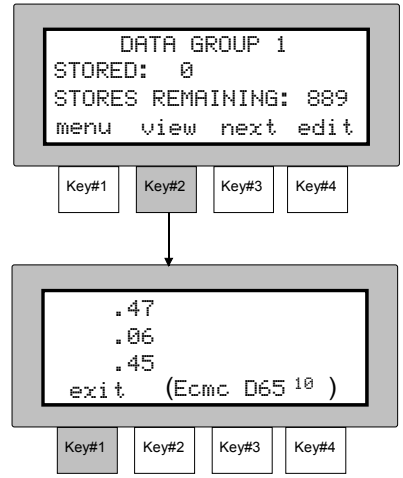


NOTE: "Pass/Fail" indication will only display if the pass/fail storage option is activated (see previous page).



5. The last measurement data can be displayed by pressing **[view]** key #2.

NOTE: Measurements can be taken in the view mode if desired.



6. Press **[exit]** key #1 to return to the storage display.
7. Continue with additional measurements if required.

NOTE: The "data group name" can be customized by "downloading" group names with X-RiteColor® Master software package.

VIEWING STORED MEASUREMENTS

Any measurement stored can be retrieved by the instrument for viewing at a later time. The absolute measurement data will display in the last color space and illuminant/observer combination selected in normal function.

To View a Stored Measurement:

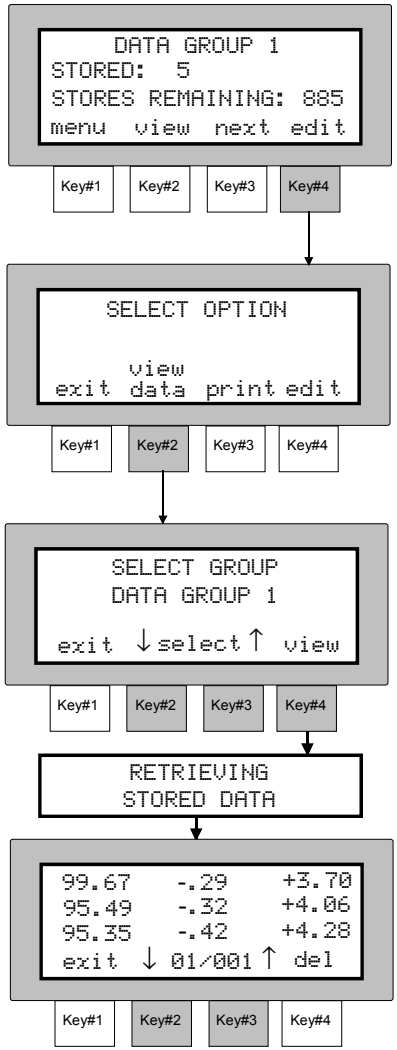
1. At Storage Menu level, press **[edit]** key #4 to enter **"SELECT OPTION"** menu.

2. Press **[view data]** key #2 to enter **"SELECT GROUP"** menu.

3. Press **[↓]** key #2 or **[↑]** key #3 to select desired group.

   - After group is selected, press **[view]** key #4.

4. Press **[↓]** key #2 or **[↑]** key #3 to view individual measurements in the selected group.



NOTE: The **[del]** key #4 will give you the option of deleting the displayed measurement.

"NO READINGS FOR THIS GROUP" will display when no data exist in the selected group.

The **[exit]** key will return the display to the **"SELECT OPTION"** menu.

DELETING STORED MEASUREMENTS

There are three methods that can be used to delete stored measurements.

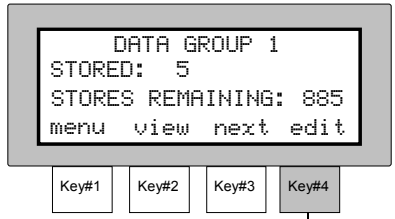
Delete Last - Allows only the last measurement taken in the selected group to be deleted from stored memory.

Delete Group - Deletes all stored measurements in the selected group.

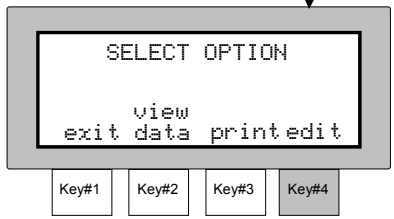
Delete All - Causes all stored measurements in all twenty groups to be deleted.

To Delete a Measurement:

1. At Storage Menu level, press **[edit]** key #4 to enter **"SELECT OPTION"** menu.



2. Press the **[edit]** key #4 to enter the **"SELECT DELETE MODE"** menu.

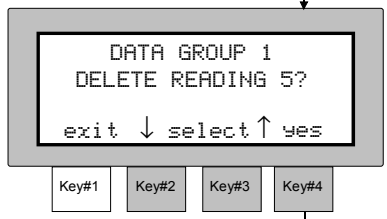


Delete Last

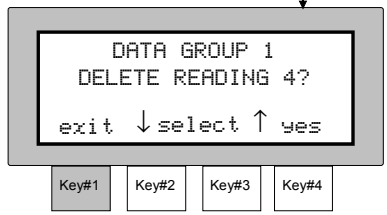
1. Press **[last]** key #4.

2. Press **[↓]** key #2 or **[↑]** key #3 to select desired group number.

- Press **[yes]** key #4 to delete last measurement in the selected group.

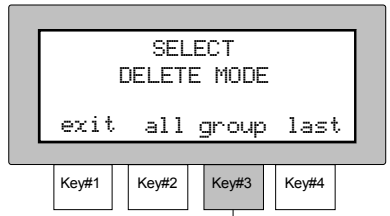


3. Press **[exit]** key #1 to return to the delete mode menu.



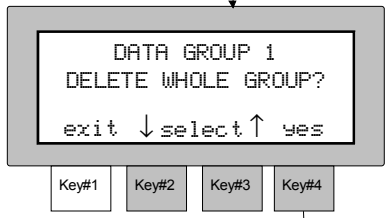
Delete Group

1. Press **[group]** key #3.



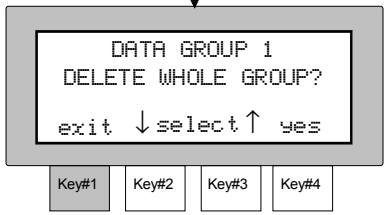
2. Press **[↓]** key #2 or **[↑]** key #3 to select desired group number.

- Press **[yes]** key #4 to delete selected group.



- **"DATA GROUP # DELETED"** is displayed.

3. Press **[exit]** key #1 to return to the delete mode menu.



Delete All

1. Press **[all]** key #2.

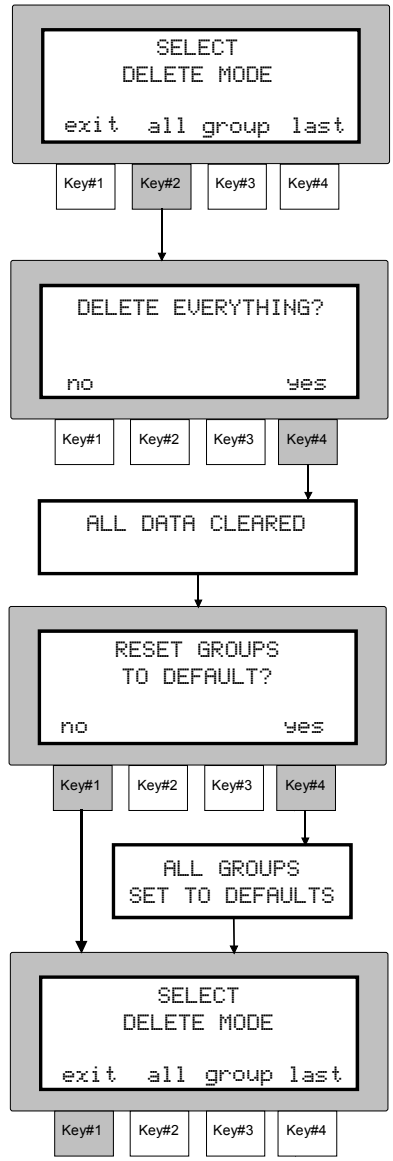
2. Press **[yes]** key #4 to clear all stored data in all groups.

- **"ALL DATA CLEARED"** is displayed.

- **"RESET GROUPS TO DEFAULTS?"** is displayed.

3. Press **[no]** key #1 to keep preset group names (i.e., names set in X-RiteColor® Master). Press **[yes]** key #4 to reset names to factory defaults (i.e., Data Group 1, etc.).

4. Press **[exit]** key #1 to exit delete mode.



PRINTING STORED MEASUREMENTS

The MA68II has the ability to output stored measurement data directly to a serial printer or a computer. Stored data can be output in a "simplified" format or a more detailed "report" format.

Data printed in the "simplified" format is controlled by the Printout Options select in Section Three.

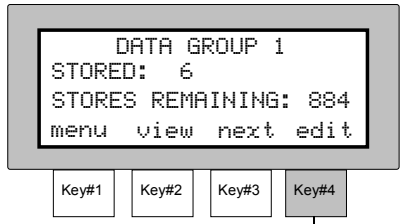
The "report" format allows standard or sample data to be printed. The Standards selection prints all stored reference values and their associated illuminant/observers and tolerances. The Samples selection prints each stored sample with associated identifying information: Group Names, Tags, Illum/Obs, Reading Date and Time. Each sample's associated standard number, color difference values and pass/fail indication for each angle is also printed. Both the Standard and Sample format will allow spectral data to be printed for each measurement if desired.

Measurement data printed in the "simplified" format will be covered first followed by data printed in the "report" format.

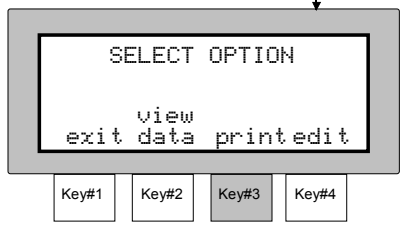
Simplified Printing Format

1. Refer to Section Three to set RS-232 and Printout Options, if required.

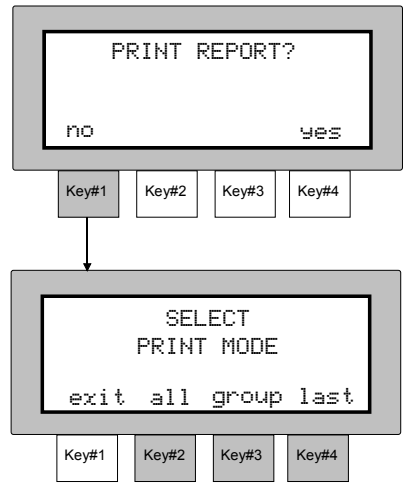
2. In storage mode, press **[edit]** key #4 to enter **"SELECT OPTION"** screen.



3. Press **[print]** key #3 to enter **"PRINT REPORT ?"** screen.



4. Press **[no]** key #1 to enter **"SELECT PRINT MODE ?"** screen.

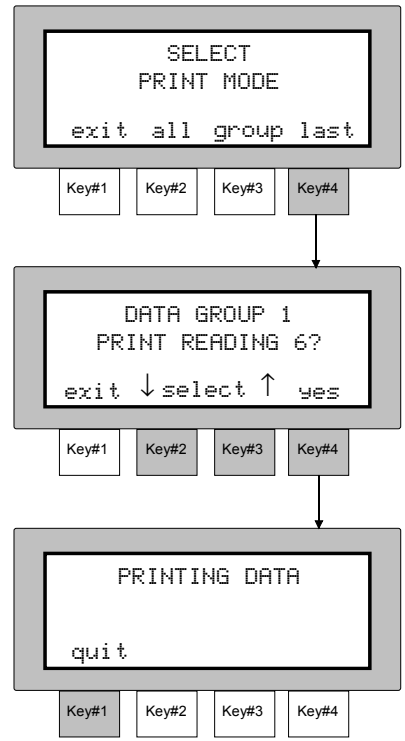


There are three print modes available.

- **Print Last -** prints the data of the last measurement taken in the selected group.
- **Print Group** - prints all measurements that are currently in the selected group. The group printout function also prints out the "Group #" for each group that has data.
- **Print All** - all measurements stored are printed.

Print Last

1. Press **[last]** key #4 to enter print last mode.



2. Press the **[↓]** key #2 or **[↑]** key #3 to select desired group.

- Press **[yes]** key #4 to print last measurement in the selected group.

- **"PRINTING DATA"** displays and then **"DATA GROUP"** menu.

3. Press **[quit]** key #1 to stop printing.

Print Group

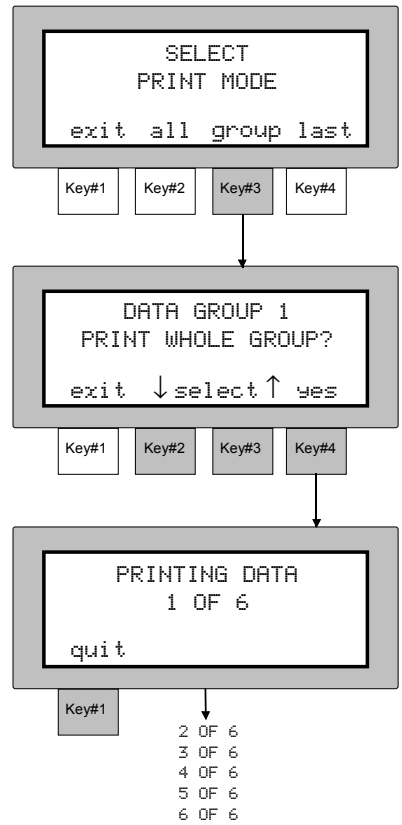
1. Press **[group]** key #3 to enter print group mode.
2. Press **[↓]** key #2 or **[↑]** key #3 to select desired group.

- Press **[yes]** key #4 to print all measurement data in the selected group.

NOTE: If **[↑]** key #3 is depressed one more time after **"DATA GROUP 20"** is displayed, **"PRINT ALL GROUPS ?"** displays. Selecting this option prints out all groups with existing measurement data.

- **"PRINTING DATA # OF #"** displays until all data is printed, then the display returns to **"DATA GROUP"** menu.

3. Press **[quit]** key #1 at anytime to abort printing operation.

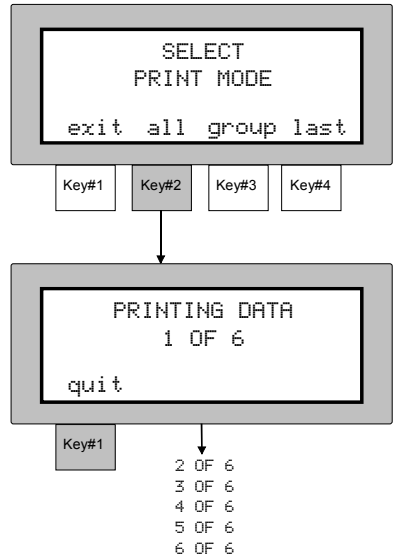


Print All

1. Press **[all]** key #2.

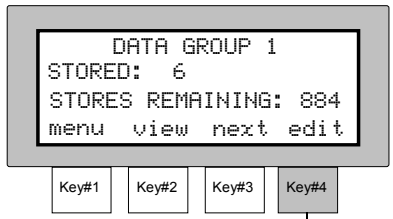
- **"PRINTING DATA # OF #"** displays until all data is printed, then the display returns to **"SELECT PRINT MODE"** menu.

2. Press the **[quit]** key #1 at anytime to abort printing operation.

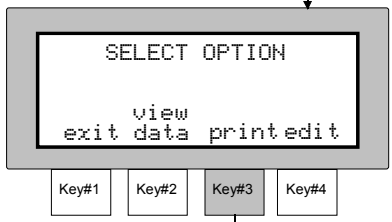


Report Printing Format

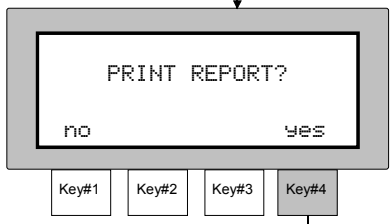
1. In storage mode, press **[edit]** key #4 to enter **"SELECT OPTION"** screen.



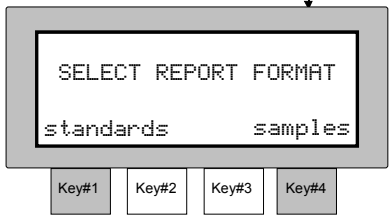
2. Press **[print]** key #3 to enter **"PRINT REPORT ?"** screen.



3. Press **[yes]** key #4 to enter **"SELECT REPORT FORMAT"** screen.

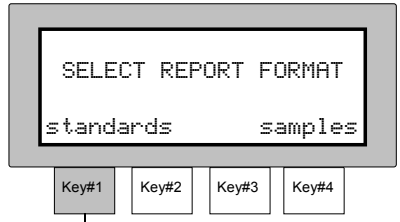


4. Refer to the following pages for **"standards"** and **"samples"** printing procedures.

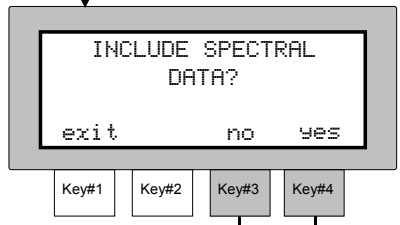


Standards

1. Press **[standards]** key #1 to enter **"INCLUDE SPECTRAL DATA ?"** screen.



2. Press **[yes]** key #4 to include spectral data, or press **[no]** key #3 to not include spectral data.



3. **"PRINTING REPORT"** displays and then the display returns to **"SELECT OPTIONS"** menu. Press **[quit]** key #1 at anytime to abort printing operation.

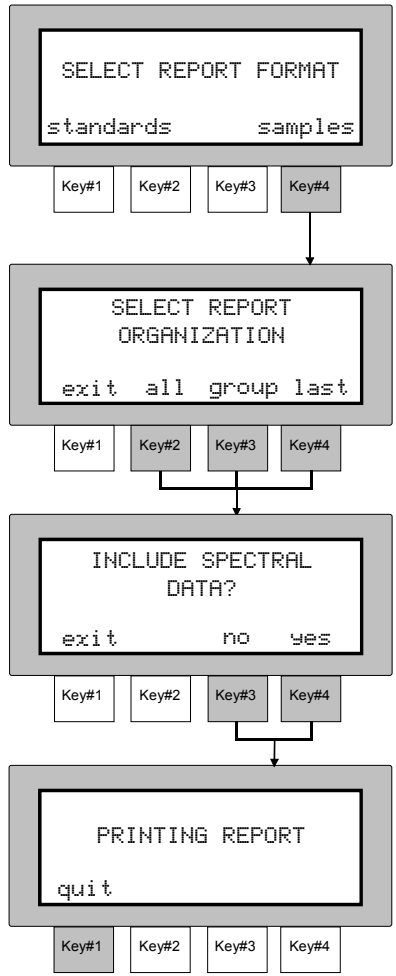
4. Refer to page 6-15 for sample printout of the "Standards" report.

Samples

1. Press **[samples]** key #4 to enter **"SELECT REPORT ORGANIZATION**" screen.

2. Press **[all]** key #2, **[group]** key #3, or **[last]** key #4 to select format. Refer to Simplified Printing Format procedure for explanation.

3. Press **[yes]** key #4 to include spectral data, or press **[no]** key #3 to not include spectral data.



- **"PRINTING REPORT"** displays and then the display returns to **"SELECT OPTIONS"** menu.

4. Press **[quit]** key #1 at anytime to abort printing operation.

5. Refer to page 6-16 for sample printout of the "Samples" report.

Example Data Report for Standards

DATA REPORT FOR STANDARDS
---------- PAGE : 1

INSTRUMENT TYPE: MA68II DATE: 01-23-02
INSTRUMENT SERIAL #: 00104 TIME: 11:57:36

****

STANDARD 001

****

LabCh DATA FOR STANDARDS

ANGLE	L*	a*	b*	C*	h	
15	99.23	-.31	+3.09	3.11	95.74	ILLUM/OBS: D65/10
25	96.66	-.41	+3.36	3.38	96.97	
45	95.40	-.45	+3.72	3.75	96.91	FLOP INDEX: .39
75	95.27	-.54	+3.92	3.95	97.86	
110	93.24	-.65	+3.72	3.78	99.92	

TOLERANCES

ANGLE	cf	l	c
15	1.00	2.00	1.00
25	1.00	2.00	1.00
45	1.00	2.00	1.00
75	1.00	2.00	1.00
110	1.00	2.00	1.00

****

STANDARD 002

****

LabCh DATA FOR STANDARDS

ANGLE	L*	a*	b*	C*	h	
15	40.29	-1.87	-32.82	32.88	266.73	ILLUM/OBS: D65/10
25	38.66	-1.30	-32.95	32.98	267.73	
45	36.52	-.62	-33.01	33.02	268.92	FLOP INDEX: .03
75	37.45	-.24	-33.15	33.15	269.58	
110	40.04	-.25	-35.64	35.64	269.60	

	HIGH TOLERANCES			LOW TOLERANCES		
ANGLE	dL*	dC*	dH*	dL*	dC*	dH*
15	+1.00	+2.00	+1.00	-1.00	-2.00	-1.00
25	+1.00	+2.00	+1.00	-1.00	-2.00	-1.00
45	+1.00	+2.00	+1.00	-1.00	-2.00	-1.00
75	+1.00	+2.00	+1.00	-1.00	-2.00	-1.00
110	+1.00	+2.00	+1.00	-1.00	-2.00	-1.00

Example Data Report for Samples

DATA REPORT FOR SAMPLES
PAGE : 1

INSTRUMENT TYPE: MA68II
INSTRUMENT SERIAL #: 00104
DATE: 01-23-02
TIME: 11:57:36

GROUP 01 GROUP NAME: DATA GROUP 1 SAMPLE 001

TAG 1:
TAG 2:
TAG 3:
TAG 4:
TAG 5:
TAG 6:

LabCh DATA FOR STANDARDS

ANGLE	L*	a*	b*	C*	h	
15	99.23	-.31	+3.09	3.11	95.74	ILLUM/OBS: D65/10
25	96.66	-.41	+3.36	3.38	96.97	READING DATE: 01/23/02
45	95.40	-.45	+3.72	3.75	96.91	READING TIME: 11:47:53
75	95.27	-.54	+3.92	3.95	97.86	FLOP_INDEX: .38
110	93.24	-.65	+3.72	3.78	99.92	DELTA FI: -.01

DELTA LabCH STANDARD NUMBER: 001

ANGLE	dL*	da*	db*	dC*	dH*	dEcmc	STATUS
15	-.29	+.01	-.01	-.02	.00	.10	PASS
25	-.10	-.01	+.01	+.02	.00	.04	PASS
45	-.15	.00	.00	.00	.00	.05	PASS
75	-.18	-.01	-.02	-.02	.00	.06	PASS
110	-.14	+.03	-.04	-.05	-.02	.09	PASS

GROUP 01 GROUP NAME: DATA GROUP 1 SAMPLE 002

TAG 1:
TAG 2:
TAG 3:
TAG 4:
TAG 5:
TAG 6:

LabCh DATA FOR STANDARDS

ANGLE	L*	a*	b*	C*	h	
15	99.16	-.34	+3.12	3.14	96.23	ILLUM/OBS: D65/10
25	96.58	-.41	+3.4	3.37	97.01	READING DATE: 01/23/02
45	95.37	-.45	+3.68	3.71	96.98	READING TIME: 11:47:53
75	95.18	-.55	+3.88	3.92	98.08	FLOP_INDEX: .38
110	93.27	-.63	+3.69	3.74	99.70	DELTA FI: -.01

DELTA LabCH STANDARD NUMBER: 001

ANGLE	dL*	da*	db*	dC*	dH*	dEcmc	STATUS
15	-.07	-.03	+.03	+.03	+.02	.06	PASS
25	-.08	.00	-.02	-.01	.00	.03	PASS
45	-.03	.00	-.04	-.04	.00	.05	PASS
75	-.09	-.01	-.04	-.04	+.02	.07	PASS
110	+.03	+.02	-.03	-.04	.00	.05	PASS

SECTION SEVEN

Service and General Maintenance

This section covers repair information, cleaning, general maintenance, and troubleshooting tips for your instrument.

Section Seven Contents

REPAIR INFORMATION

The X-Rite® MA68II is covered by a two-year limited warranty—excluding battery pack—and should be referred to factory or authorized service center for repairs 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 repairs should be referred to the factory or an authorized service center (call: 1-888-826-3042 or 1-616-803-2100).

X-Rite will repair any MA68II instrument past warranty. Shipping cost to the factory or authorized service center shall be paid by the customer, and the instrument shall be submitted in the original carton, as a complete unaltered unit.

Reading Lamp Replacement Information

Due to the circuit complexity, critical 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 500,000 measurements and is covered by a two year limited warranty. Refer to the Limited Warranty statement at the front of this manual.

CLEANING THE INSTRUMENT

Your instrument requires very little maintenance to achieve years of reliable operation. However, to protect your investment and maintain reading accuracy, a few simple cleaning procedures should be performed from time to time.

General Cleaning

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

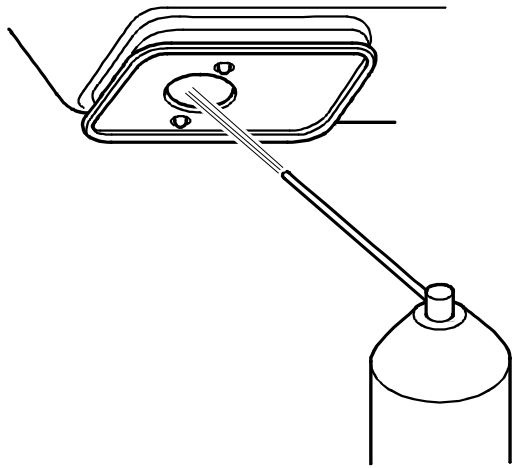
NOTE: *DO NOT* use any ketone solvents to clean the unit, this causes damage to the cover.

Cleaning the Optics

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

- Carefully lift instrument and blow shorts bursts of clean, dry air into the measurement aperture. This should remove any accumulated dust in the optics area.

WARNING:
DO NOT invert cans that use freon as a propellant, doing so could cause damage to the optics assembly.



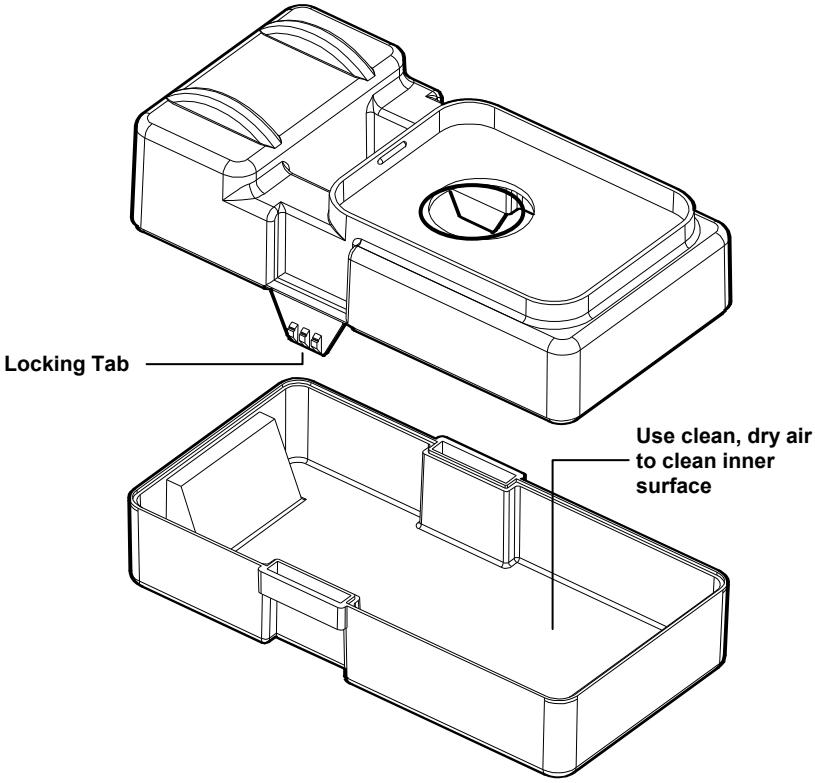
Cleaning the White Calibration Standard

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. You must let the standard dry completely before taking a calibration reading.

Cleaning the Black Trap

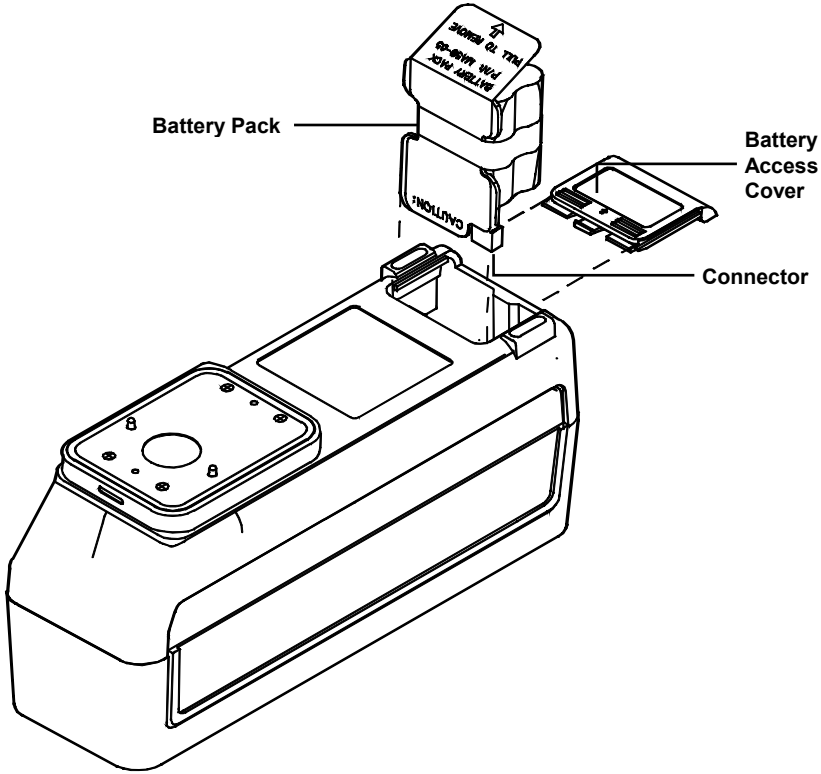
The black trap should be cleaned with clean, dry air from time to time to remove any dust or contamination.

The black trap is taken apart for easy cleaning by compressing the two locking tabs on both sides of the case with your fingers, and separating the two sections.



REPLACING THE BATTERY PACK

1. Unplug the AC adapter and click power switch to OFF.
2. Carefully set instrument on its top and slide battery access cover toward rear of instrument and remove.
3. Grasp plastic tab that extends from battery pack and pull until pack is removed.
4. Slide new—or charged—battery pack into instrument until connector is properly seated.
5. Reinstall battery access cover by sliding into position.
6. Discharged battery packs should be charged in the instrument for 16 hours.



TROUBLESHOOTING TIPS

Instrument does not turn On:

- Power Switch Off (battery operation only).
- Batteries are very low and in need of charge.
- Contact X-Rite or Authorized Service Center.

Instrument will display but not measure:

- Battery pack not installed.
- Contact X-Rite or Authorized Service Center.

Incorrect measurement data continually displays:

- Check standard material.
- Calibrate instrument (see Sec. 2).
- Clean optics (see Sec. 7).
- Contact X-Rite or Authorized Service Center.

Measurement drifts:

- Clean optics (see Sec. 7).
- Calibrate instrument (see Sec. 2).
- Contact X-Rite or Authorized Service Center.

Instrument will not calibrate properly:

- Calibration standard needs to be cleaned (see Sec. 2).
- Clean optics (see Sec. 7).
- Contact X-Rite or Authorized Service Center.

APPENDIX A

Technical Specifications

Measuring Geometries:

45° Illumination

15°, 25°, 45°, 75°, 110° off specular viewing

Angular accuracy ±0.2°

Fiber optic pick-up with Dynamic Rotational Sampling (DRS)

Measuring Area:

.5 inch dia. (12mm)

Light Source:

Gas-filled tungsten lamp, approx. 3000°K

Illuminant Types:

C, D_{65}, D_{50}, A, F2, F7, F11, & F12

Standard Observers:

2° & 10°

Receiver:

Blue-enhanced silicon photodiodes

Spectral Range:

400nm - 700nm

Spectral Interval:

Measurement
10nm, 400nm - 640nm
20nm - 640nm - 700nm
15nm bandwidth

Data Output
10nm, 400nm - 700nm

Storage (five angles):

200 Standards

890 Samples

Measurement Range:

0% - 400% Reflectance @ 15°

Measuring Time:

Approx. 2.0 seconds

Inter-instrument Agreement:

0.20 ΔE* avg. on reference BCRA tile set

0.40 ΔE* max on any chromatic tile

0.15 ΔE* max on any grey tile

Short Term Repeatability:

0.10 ΔE* on white ceramic

Lamp Life:

Approx. 500,000 measurements

Power Supply:

Six rechargeable AA Ni-metal hydride batteries included - Removable battery pack 7.2VDC rated @ 1100mAh

AC Adapter Requirements:

MA68B: 100-240VAC, 50-60Hz

12VDC @ 700ma: Positive Tip

Charge Time:

In Instrument - 4 hours (50%), 16 hours (100%)

External Pack - Approx. 16 hours

Measurement per charge:

1000, 5-angle measurements (continuous measurements @ 10 second intervals)

Data Interface:

Patented bi-directional RS-232, 300 - 19200 baud

Display:

4-row by 20-character supertwist dot matrix LCD

Operating Temperature Range:

10°C to 40°C (50°F to 104°F)

85% relative humidity maximum (non-condensing)

Storage Temperature Range:

-20°C to 50°C (-4°F to 122°F)

Weight:

1.4 Kg (3 lbs., 2oz.)

Dimensions:

Height - 11.6 cm (4.56 in.)

Width - 7.62 (3.0 in.)

Length - 22.5 cm (8.85 in.)

Accessories:

Carrying Case

White Calibration Standard and Black Trap

AC Adapter

User Manual

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

Specifications and design subject to change without notice.

15°/45°/110° viewing geometry by license from E.I. DuPont de Nemours and Co., Inc. U.S. Patent No. 4,479,718

APPENDIX B

Display Messages

Below is a list of typical error messages that could occur on your instrument. If any of the error messages listed—or any error message not listed—should appear, make a note of it and take the appropriate steps to try to correct it. If an error message is consistently displayed, contact X-Rite or an authorized service center.

Measurement Error Messages

INVALID READING - BATTERIES VERY LOW, MUST BE CHARGED - indicates batteries are too low to operate the unit. Plug in charger and wait 5 minutes before attempting to take accurate measurements.

INVALID READING - LIGHT LEAKAGE - stray light is getting into measurement aperture. Make sure measurement surface is flat.

INVALID READING - MAXIMUM REFLECTANCE EXCEEDED - surface measured is greater than the maximum range of the instrument .

INVALID READING - MOTION ERROR - instrument was not pressed down firmly (or moved) during a measurement.
This message may also occur if your instrument is used to take measurements while directly connected to your computer system, and the computer power supply is not grounded properly. If this message persistently appears, first verify that the computer power supply is properly grounded.

INVALID READING - MOTOR ERROR - Instrument could not establish motor position. Measure again.

INVALID READING - RESET DURING READ, CHECK BATTERIES - this message may appear if the instrument is stored for an extended period of time. Recharge the batteries for 16 hours. If batteries are not charged after 16 hours, replace battery pack.

INVALID READING - SWITCH RELEASED TOO SOON - both read switches were not closed during entire reading. Try taking reading again.

Calibration Error Messages

CALIBRATION ERROR #### - calibration requires that the instrument remains motionless during the long white cal. 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.

MAXIMUM ZERO REFLECTANCE EXCEEDED - zero reflectance measurement was taken on something other than the black trap; or optics and/or zero reflectance standard requires cleaning.

NEED CALIBRATION - DUE TO ABORTED CAL, READ WHITE - the user aborted the calibration procedure during measurement sequence.

NEED CALIBRATION - DUE TO BAD ZERO CAL - zero reflectance calibration measurement was not properly updated.

NEED CALIBRATION - DUE TO TEMPERATURE, READ WHITE - a 10°C change in temperature occurred since the last calibration.

NEED CALIBRATION - DUE TO 12 HOUR FLAG, READ WHITE - a calibration procedure has not been performed for 12 hours.

Miscellaneous Error Messages

BATTERY 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. The instrument will still take accurate measurements.

LAMP FAILURE - LAMP MUST BE REPLACED - the lamp intensity is too weak for accurate measurements. The lamp should only be replaced by X-Rite or an authorized service center.

LAMP WARNING - REPLACE LAMP SOON - the lamp is marginal and should be replaced as soon as is conveniently possible.

APPENDIX C

Optional Accessories

- Battery Pack Assembly MA58-05
- Interconnect Cable for Macintosh® computers with 8 pin mini-DIN connector 418-79
- Modular Interconnect Cable (requires adapter below)..... SE108-69
  - DB25P DCE (Null Modem) Adapter..... 418-70
  - DB25S DCE (Null Modem) Adapter..... 418-71
  - DB25P DTE (Normal) Adapter 418-80
  - DB25S DTE (Normal) Adapter 418-81
  - DB9P Adapter..... 418-90
  - DB9S Adapter..... 418-91
- Green Calibration Verification Tile* MA68-164

  * The Green Calibration Verification Tile is a tool for verifying the long-term performance of your X-Rite Multi-Angle Spectrophotometer. The tile is a pale green porcelain-on-steel tile mounted in a protective case. The case also provides repeatable alignment of the instrument on the measurement area.

  The absolute accuracy of your instrument is verified at the time it is built. The Instrument Verification Tile is not intended to replace the comprehensive BCRA tile test performed at the factory, but rather to provide a “tracking” method for the instrument.

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P/N MA68B-500 Rev. W