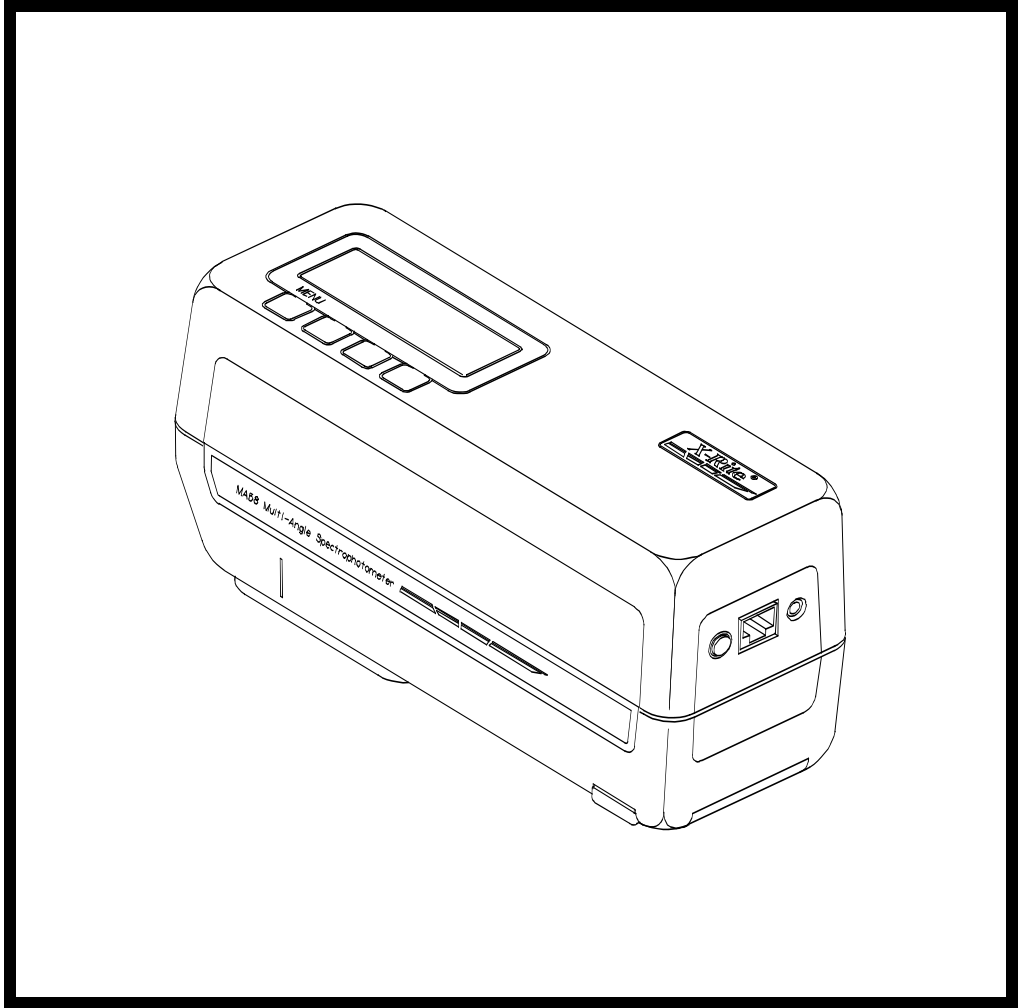


X-Rite[®] MA68[™]

Multi-Angle Spectrophotometer



User's Manual

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

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

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

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

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

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

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

ADVERTENCIA - NO use este aparato en los ambientes explosivos.

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

AVVERTIMENTO - NON usare questo apparecchio in ambienti esplosivi.

CAUTION: Do not place battery pack in pocket. Dispose of batteries properly

VORSICHT: Der Akkupack soll nicht auf Ihrer Person getragen werden. Beseitigen Sie ihn richtig.

ADVERTENCIA: No lleva las pilas en el bolsillo. Disponga de las pilas propiamente.

ATTENTION: Ne pas porter le bloc de batteries dans sa poche. S'en débarrasser de façon appropriée.

AVVERTENZA: Non mettere gli pacchi d'accumulatori in tasca. Disporre degli accumulatori propiamente.

CAUTION: Operational hazard exists if battery charger other than X-Rite SE30-61 (115V) or SE30-62 (230V) is used. Use only X-Rite battery pack MA58-05, other types may burst causing personal injury.

VORSICHT: Es besteht Betriebsgefahr bei der Verwendung von einem Adapter außer X-Rite SE30-61 (115 U) oder SE30-62 (230 U). Verwenden Sie nur den X-Rite Akkupack MA58-05, mit anderen Akkus läuft die Gefahr von Explosion und Verletzung.

ADVERTENCIA: No use otro cargador de las pilas que no sea la pieza X-Rite SE30-61 (115V) o SE30-62 (230V), por 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: Ne pas utiliser d'adaptateur autre que SE30-61 (115V) ou SE30-62 (230V) de X-Rite au risque de mauvais fonctionnement de l'appareil. 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 SE30-61 (115V) o SE30-62 (230V), per 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.

Dear Customer:

Congratulations! We at X-Rite, Incorporated are proud to present you with an X-Rite Multi-Angle Spectrophotometer. This instrument represents the very latest in microcontrollers, integrated circuits, fiber optics, and display technologies. As a result, your X-Rite MA68 is a rugged and reliable instrument whose performance and design exhibit the qualities of a finely engineered instrument, which is not surpassed.

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

Thank you for your trust and confidence.

*Ted Thompson
Chairman and CEO*

Proprietary Notice

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

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

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4,479,718 5,387,977 5,400,138

Other patents pending. Foreign patent numbers provided on request.

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

Limited Warranty

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

THERE ARE NO WARRANTIES OF MERCHANTABILITY OR FITNESS. THIS WARRANTY OBLIGATION IS LIMITED TO SERVICING THE UNIT RETURNED TO X-RITE, INCORPORATED or AN AUTHORIZED SERVICE DEALER FOR THAT PURPOSE.

X-Rite, Incorporated offers a flat rate repair program for instruments out of warranty. For more information, refer to your Flat-Rate Service Policy or contact X-Rite Technical Services Department.

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

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

CAUTION: The instrument is not for use in explosive environments.

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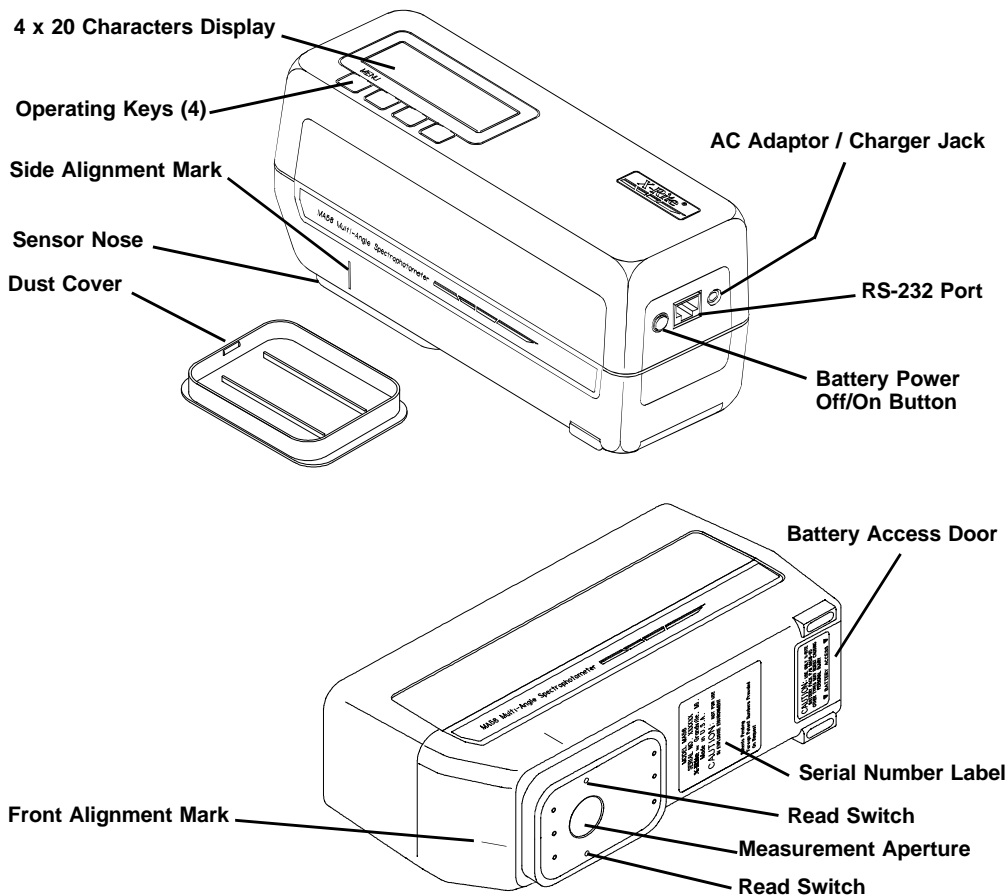
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General Description

The X-Rite MA68 is a multi-angle spectrophotometer 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°), using an electro-mechanical shutter system to sequentially view the different angles. Wavelength discrimination is accomplished with an array of interference filters.

To ensure measurement accuracy, the MA68 also includes a dual 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 License From E.I. DuPont de Nemours and Co., Inc. U.S. Patent No. 4,479,718.

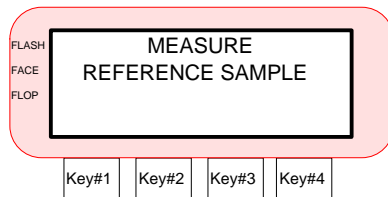
User Interface

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

- In the text portion of this manual the MA68 key names are shown with brackets on both sides and in boldface (e.g., [**cnfg**], etc.). When this is not applicable, the keyswitch will be shown as a number with quotation marks (e.g., “**Key #1**”, etc.). Switches are numbered from left-to-right.
-

- When a key is momentarily depressed, the word “press” will be used (e.g., Press [**cal**] or Press “**Key #2**”).
-

- Information that will appear in the display window will be shown with quotation marks on each side and in boldface (e.g., “**MEASURE REFERENCE SAMPLE**”).



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



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



What To Do First!

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

- Section 1*** - shows what the packaging contains; explains how to install the battery pack, apply power, and charge the batteries properly; describes the menu keys and display; and explains how to attach the wrist strap.
- Section 2*** - illustrates the proper positioning required for the instrument to obtain accurate and repeatable measurements.
- Section 3*** - explains all the necessary steps required for calibrating your instrument.
- Section 4*** - describes all the operating functions of the instrument (e.g., color space and illuminant/observer selection, reference and sample measurements, and averaging operation).
- Section 5*** - explains tolerance adjustment and pass/fail operation.
- Section 6*** - describes the procedure for storing measurements and then printing the stored data.
- Section 7*** - shows the different configuration options and how to set them for your particular requirements.
- Section 8*** - covers basic maintenance and troubleshooting. Read through this section and see what it contains, then refer to it as required.
- Section 9*** - explains how to attach the optional bar code reader to the instrument, and the proper procedure for scanning bar codes.
- Appendix A*** - lists the technical specifications of the instrument.
- Appendix B*** - lists error messages that may occur during operation or calibration and the proper action to take.
- Appendix C*** - lists optional accessories available from X-Rite or an Authorized Service Center.

SECTION 1 GETTING STARTED

Subjects covered in Section 1 are:

- 1.1 Unpacking and Inspection
- 1.2 Installing the Battery Pack
- 1.3 Applying Power
- 1.4 Charging the Battery Pack
- 1.5 Menu Page Selection
- 1.6 Display Description
- 1.7 Attaching the Wrist Strap

1.1 Unpacking and Inspection

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

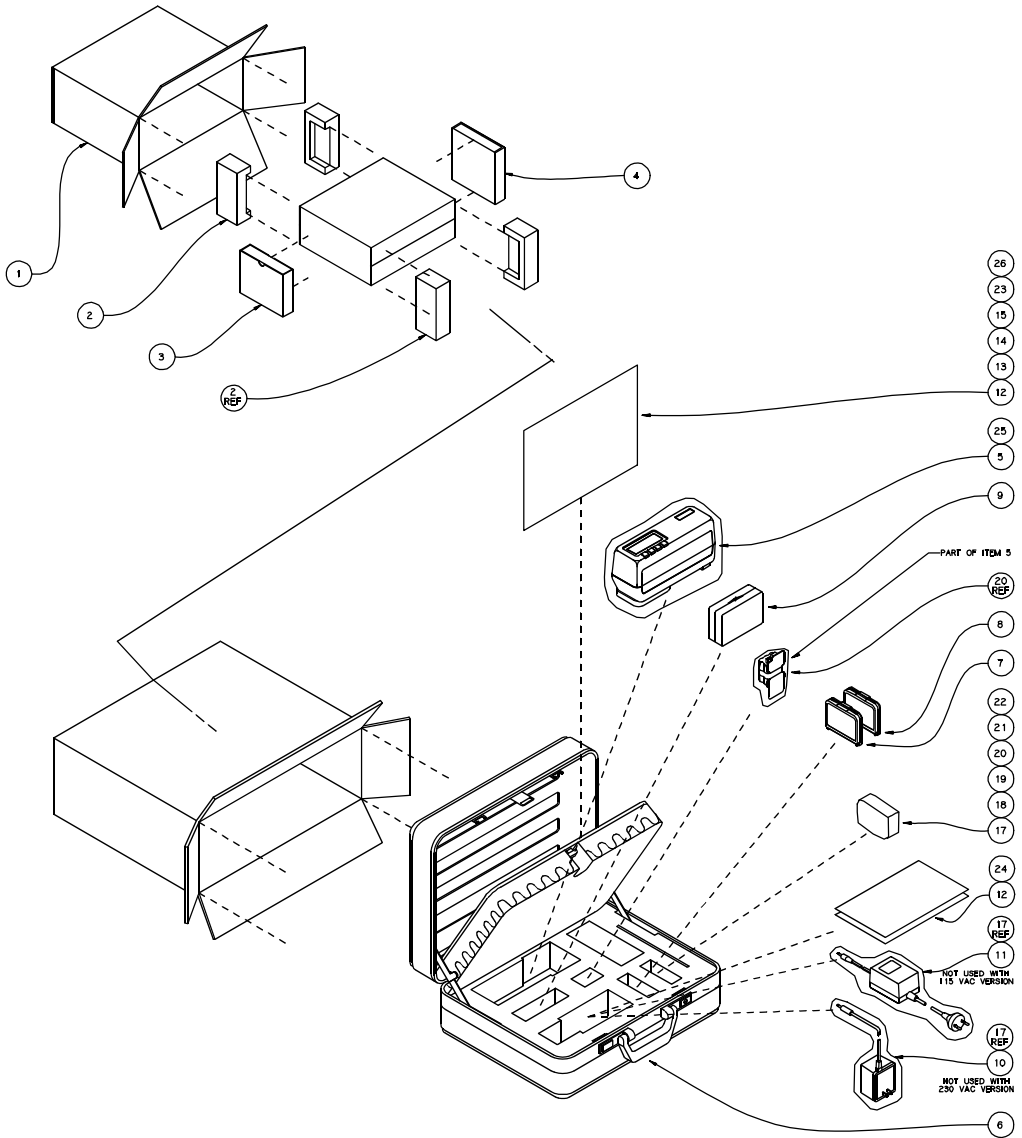
If damage is not evident, check and make sure that all items are included (refer to the parts list below and the following page for packaging illustration).

Your unit was packaged in a specially designed carton to assure against damage. If reshipment is necessary, the instrument should be packaged in the original carton. If the original carton is not available, a new one can be obtained from X-Rite Inc.

26	1	1	1	1	SD01-41	CERTIFICATE OF CALIBRATION
25	1	1	1	1	SD65-10	PLASTIC BAG
24	1	1	1	1	SP68-513	BATTERY REPLACEMENT INSTRUCTIONS
23	1	1	1	1	SD43-MA68-11	REFLECTANCE LABEL
22	4	4	4	4	SD82-316	SCREW, 2-56 x 3/8 FLAT PHIL
21	2	2	2	2	MA58-67	FOOT PAD
20	2	2	2	2	SD65-03	PLASTIC BAG
19	1	1	1	1	MA58-573	INSTRUCTION SHEET
18	1	1	1	1	MA58-99-01	SAFETY STRAP
17	2	2	2	2	SD65-13	PLASTIC BAG
16	1	1	1	1	SP68-511	IMPORTANT NOTICE
15	1	-	1	-	SD01-30	FLAT RATE POLICY BROCHURE
14	1	1	1	1	SD01-04	WARRANTY REGISTRATION
13	1	1	1	1	MA68-500	OPERATION MANUAL
12	1	1	1	1	SD68-10	ENVELOPE
11	-	1	-	1	SE30-62	AC/DC ADAPTOR 230 VAC, 50/60 Hz
10	1	-	1	-	SE30-61	AC/DC ADAPTOR 115 VAC, 50/60 Hz
9	1	1	1	1	MA58-57-01	CLEANING KIT
8	1	1	1	1	MA58-163	REFLECTION STANDARD ASSY, BLK
7	1	1	1	1	MA68-162	REFLECTION STANDARD ASSY, WHT
6	1	1	1	1	SD67-06-01	INSTRUMENT CASE
5	-	-	1	1	MA68N-00-01	MULTI-ANGLE SPECTROPHOTOMETER ASSY
	1	1	-	-	MA68-00-01	MULTI-ANGLE SPECTROPHOTOMETER ASSY
4	1	1	1	1	MA58-75	INTERFACE CABLE KIT
3	1	1	1	1	1254-10	METALLIX-QC SOFTWARE PACKAGE
2	4	4	4	4	SD200-MA58-02	CORNER PAD
1	1	1	1	1	SD200-MA58-01	CARTON
ITEM	MA68 QTY	MA68X QTY	MA68N QTY	MA68NX QTY	PART NUMBER	DESCRIPTION

PARTS LIST

Packaging Illustration

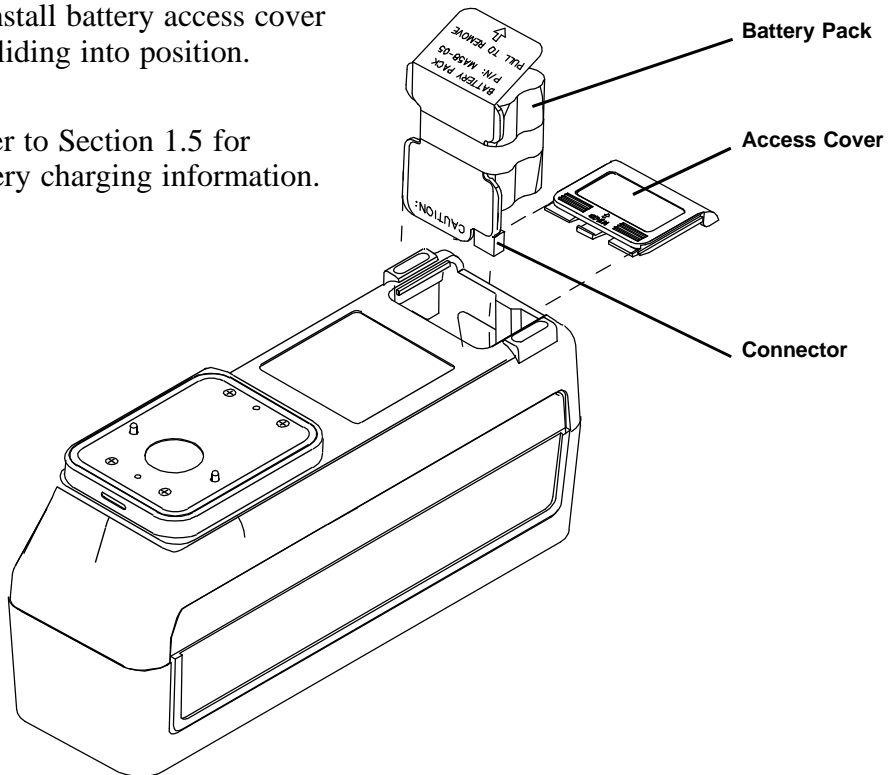


1.2 Installing the Battery Pack

The instrument is shipped from the factory with the battery pack removed. The battery pack is located in the instrument case (refer to packaging illustration for location) and **must be** installed before the instrument is used.

To Install Battery Pack

1. Carefully place instrument on it's top.
2. Remove battery access cover by sliding towards rear of unit.
3. Slide battery pack into instrument (with connector end down) until properly seated. Refer to illustration.
4. Reinstall battery access cover by sliding into position.
5. Refer to Section 1.5 for battery charging information.



1.3 Applying Power

Battery Operation

The MA68 is activated during battery operation by pressing the “Power On/Off” switch located on the rear of the instrument. The unit will automatically turn off after 45 seconds of non-operation.

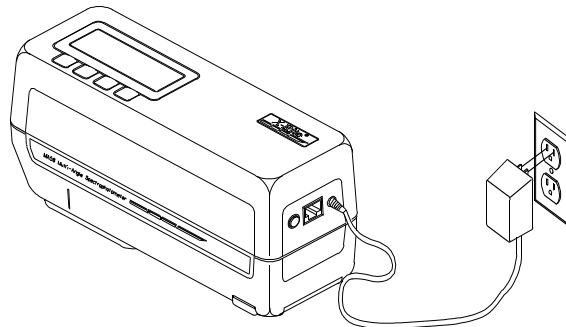
If the MA68 is allowed to power down after 45 seconds, simply taking a measurement or pressing any key will reactivate the unit. The MA68 will always wakeup in the same operation function (e.g., $L*a*b^*$, $L*C*h^\circ$, etc.) as when it powered down. The instrument can also be turned off by pressing the power On/Off switch on the rear of the unit. The switch should always be used to turn off the unit when it is going to be stored. This will prevent any inadvertent measurement from being taken.



AC Operation

- * The battery pack must be installed before plugging in the AC adaptor (refer to Sec. 1.2).

As long as the AC adaptor is connected to the instrument, the MA68 will remain on. The power on/off switch has no affect on the instrument when the AC adaptor is connected.



1.4 Charging the Battery Pack

“The Battery Pack Must Be Charged Before Use!”

The MA68 is powered by six nickel-metal hydride batteries in a removable battery pack. The battery pack must be in the instrument for proper operation. The AC adaptor charges the batteries when it is plugged in, but does not eliminate the need for the batteries.

The MA68 can be operated while the batteries are being charged. Before plugging in the AC adaptor, make sure that the voltage indicated on the adaptor complies with the AC line voltage in your area. If not, contact X-Rite or your Authorized Representative.

The instrument battery pack should be fully charged (100%) in 16 hours and should provide approximately 1000 measurements. Charging the battery pack for less than 16 hours will reduce the operating time of the unit (see charging tips).

Charging Tips

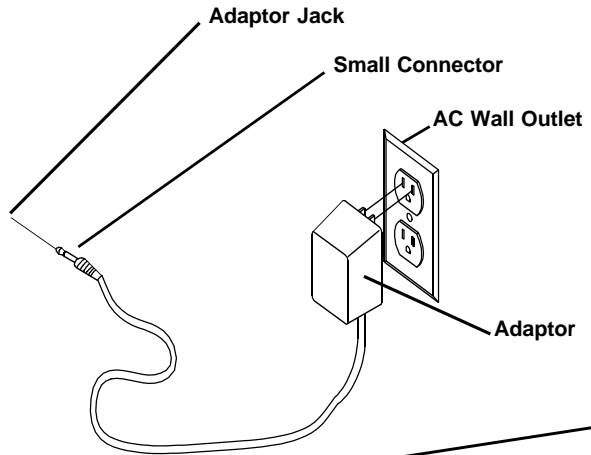
- The instrument features a “fast charge” cycle which will charge a fully discharged battery pack to 50% capacity in 4 hours. A 100% charge will be restored to a fully discharged pack in 16 hours.
- A “Battery Low” message will appear on the display when there are approximately 50 measurements left. The charger should be plugged in as soon as possible. A “Batteries Very Low - Must Be Charged” message will appear when there is insufficient charge to operate the instrument. Once this message appears, the charger must be connected before any more measurements can be taken.
- The removable battery pack is equipped with a 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.
- If you are going to store the instrument for an extended period of time (over 6 months), the battery pack should be removed from the unit.

NOTE: Do not plug the AC adaptor into the instrument without a battery pack installed. The instrument will not function with the battery pack out. Refer to Section 1.2 for installation procedure.

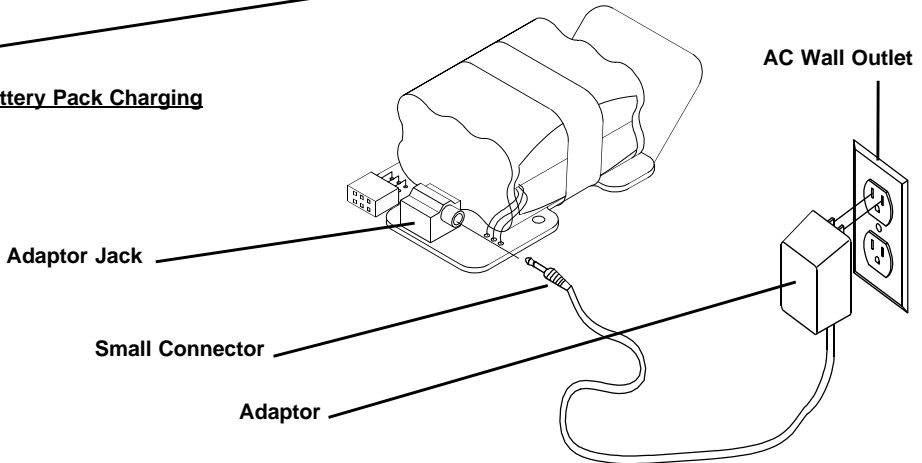
AC Adaptor Connection Procedure

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

Instrument Charging



Battery Pack Charging



* The unit will not lose any of the preset information (i.e., cal, ref, etc.) if the battery pack is removed. Refer to Battery Pack Replacement in Section 6 for proper removal and installation.

1.5 Menu Page Selection

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

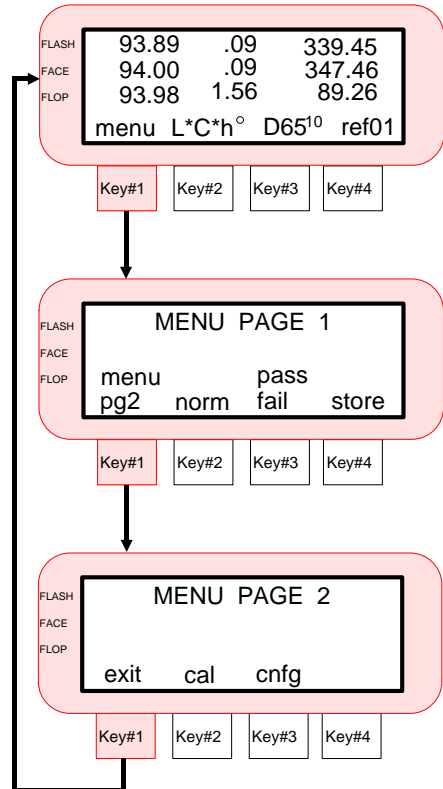
norm (normal) - this key will always return the display to the main screen (L*a*b*, L*C*h°, etc.).

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

store (storage) - storage mode allows measurement data to be stored, printed and deleted from selected groups. This function can also be used with X-Rite's MetalliX-QC software program.

cal (calibration) - the cal key accesses the calibration function where white calibration and zero reflectance measurements are performed.

cnfg (configuration) - operation options, printing formats, date/time, and communication parameters are set under this function.

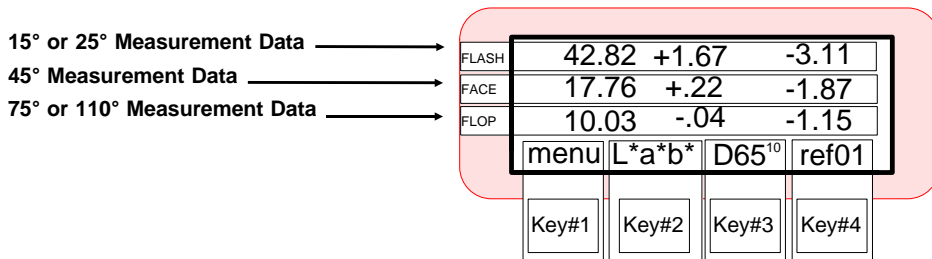


1.6 Display Description

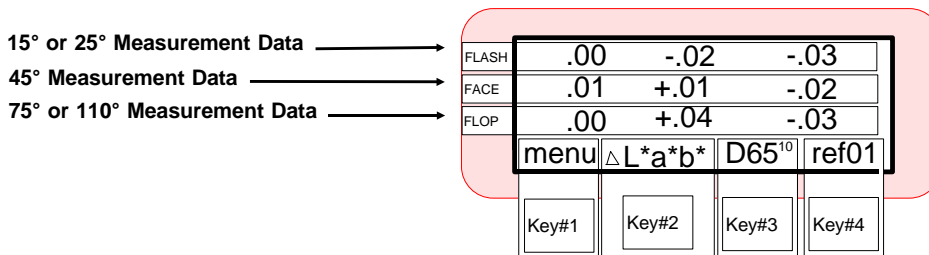
The characters in the display above each keyswitch dictate which function will be selected or which action will take place when a keyswitch is pressed. Normally, uppercase lettering is used for display messages, and lower-case lettering is used for menu options that are selectable by the user.

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 7.2.

Absolute Measurement Display



Difference Measurement Display

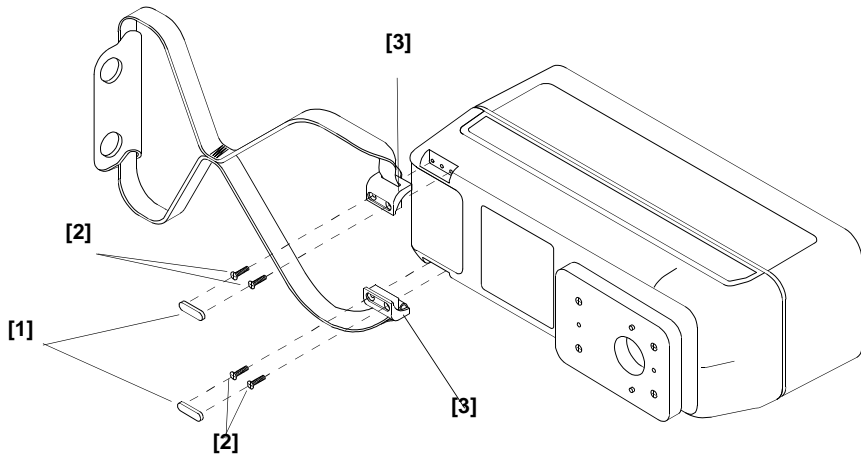


1.7 Attaching the Wrist Strap

A security wrist strap is included with your MA68 and may be installed if desired.

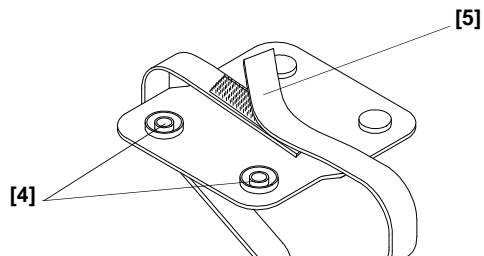
Strap Installation

1. Disconnect AC adaptor and turn battery switch off.
2. Carefully place instrument on its side.
3. Remove the rubber pads [1] from the bottom of the standard instrument supports.
4. Remove the four screws [2] from the two instrument supports [3] and remove supports from instrument.
5. Place new supports [3] with straps on instrument as shown.
6. Secure supports [3] with four screws [2] provided.
7. Peel the paper backing off the two rubber pads [1] and place them in the recessed areas over the screws [2].



Strap Adjustment

1. Unfasten the two snaps [4].
2. Separate the velcro on the straps [5] and adjust to fit wrist properly.
3. Fasten the two snaps [4].



SECTION 2

INSTRUMENT POSITIONING & MEASUREMENT TECHNIQUES

General

In order for the MA68 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 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. **Do Not** lift the back of the instrument. 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.

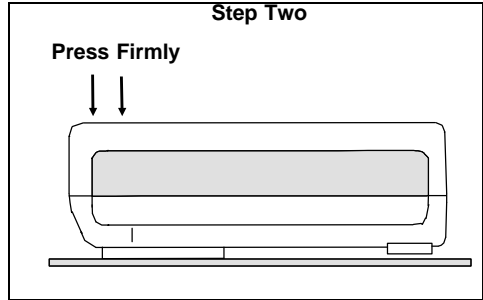
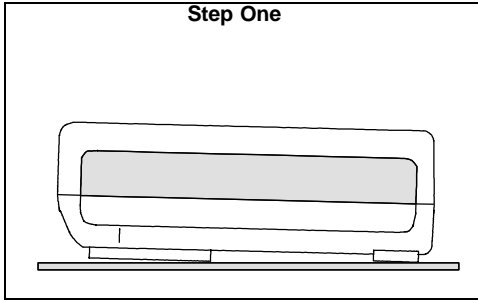
Refer below and to the next page for measurement examples.

Averaging Measurements

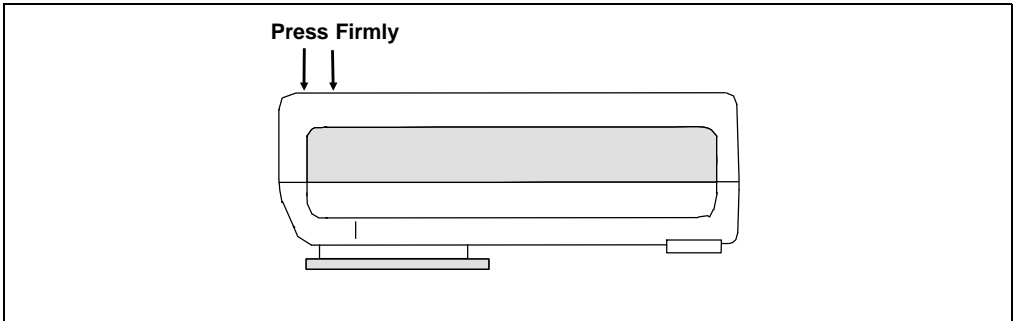
When measuring dark colors or non-uniform samples, several readings should be averaged together for a single measurement. The instrument can be set to average up to 16 measurements. Statistical Measurement Control (SMC) can also be selected. SMC is a method of performing a statistical analysis of several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

Refer to Section 7.2 for details on using averaging.

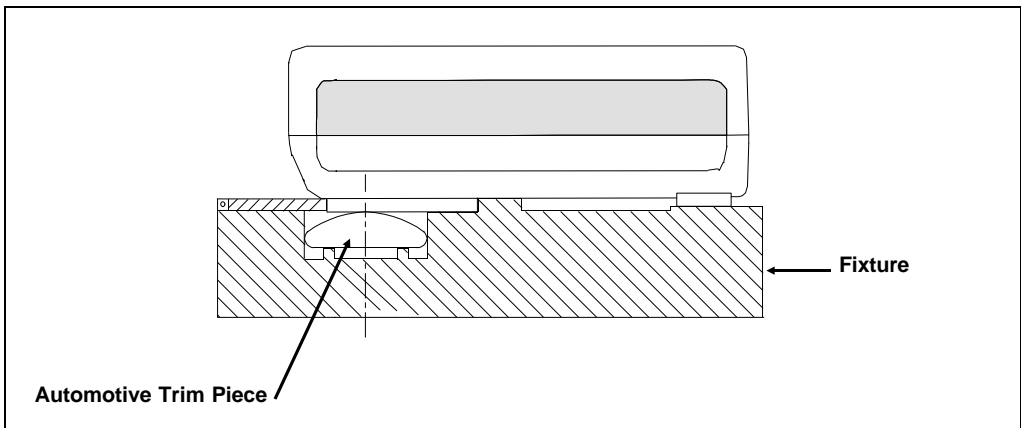
LARGE SAMPLE MEASUREMENT METHOD



SMALL SAMPLE MEASUREMENT METHOD



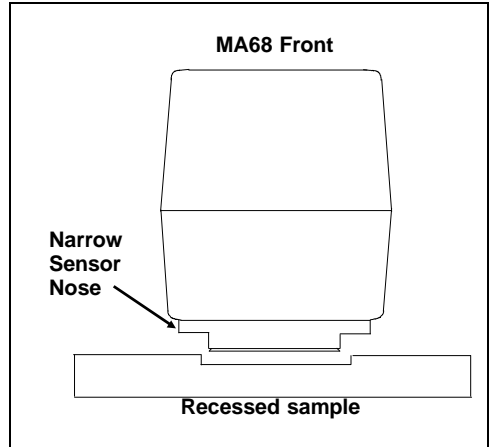
SAMPLE MEASUREMENT USING A FIXTURE



Narrow Sensor Nose & Read Key Operation

The MA68 can be configured to allow a key depression to take a measurement. This configuration option is intended for use with the optional narrow sensor nose (P/N MA58-102), which allows measurements in recessed areas. The read key option can be enabled for measuring samples that are slightly curved, where normal read switch depression is difficult. However, any measurements taken with the sensor nose not completely flat on the sample can result in inconsistent measurement data.

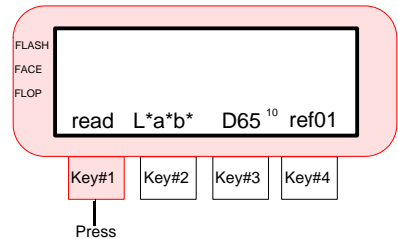
With the optional narrow sensor nose installed, the dual read switches are eliminated and the instrument must be configured to allow a key depression to take a measurement.



Your instrument is sent from the factory with the “read key” option disabled. The read option is set in the same manner as the other operation options. Refer to Setting Operation Options, Section 7.2.

Once the read key feature is activated, the “menu” key #1 will change to “read” key #1.

1. To use, position instrument on sample and press down on front of unit.
2. Press the **[read]** key #1 and hold until measurement is initiated, then release.
3. To access the menu pages with the read key option activated, quickly press the **[read]** key #1 twice, menu page 1 will appear.



SECTION 3

CALIBRATION

Subjects covered in Section 3 are:

- 3.1 Positioning the Instrument on the Calibration Standard
- 3.2 Quick Calibrating to the Standard
- 3.3 Long Calibrating to the Standard
- 3.4 Measuring Zero Reflectance

The MA68 should be quick calibrated to the X-Rite white standard the first thing each day and every four hours of operation thereafter. The long calibration procedure and zero reflectance need only be performed once a week to maintain calibration accuracy. The long calibration procedure may be used each time if desired. In any event, a **“NEED CALIBRATION”** message will appear in the display when:

- The calibration procedure (quick or long) has not been performed for 12 hours.
- A 10°C change in temperature has occurred since last calibration.
- Zero reflectance or white cal is measured improperly.

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

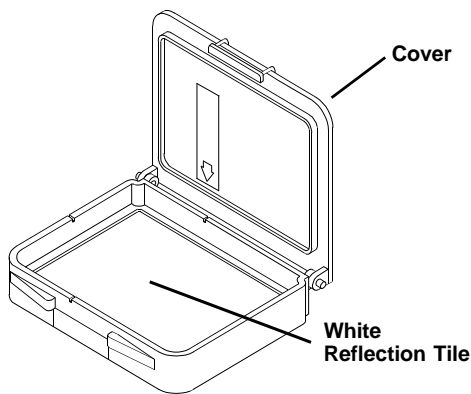
Calibration Notes:

- Dirt or dust in the optics area will cause an inaccurate calibration reading. Refer to Section 8.2 Optics Cleaning.
- **The White Reflection Standard is dramatically affected by smudge marks, dust, and finger prints.** The standard should be cleaned periodically using a mild soap and warm water solution, thoroughly rinsed with warm water, and wiped dry with a lint free cloth. You must let the standard dry completely before taking a calibration reading.
- **The zero reflection standard (Black Glass) is dramatically affected by smudge marks, dust and fingerprints.** Smudges and fingerprints should be cleaned with a lens tissue and a few drops of the lens cleaner provided. **The standard should always be polished with lens tissue and dusted with the blower brush before being measured.**
- Do not move the MA68 while taking a calibration measurement. If motion is detected an error message will be displayed and calibration aborted.

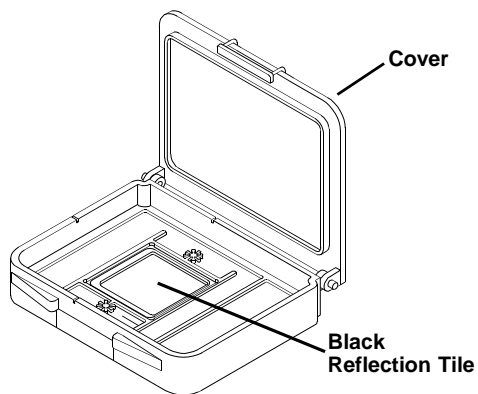
3.1 Positioning the Instrument on the Standards

The MA68 calibration standards are designed to keep the reflection tiles free of dust and debris. The calibration plaques are concealed in separate cases that have hinged covers. Depending on what calibration procedure is being measured (white cal or zero reflectance), the sensor nose is positioned in the appropriate case and the measurement taken. Make sure the the reflection tile is positioned under the measurement aperture.

White Cal Standard

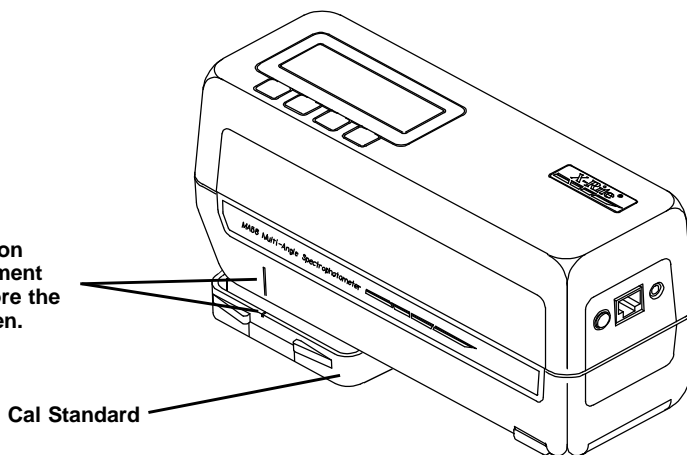


Zero Reflectance Standard



Cal Positioning

Notches on calibration standard and instrument must be aligned before the measurement is taken.

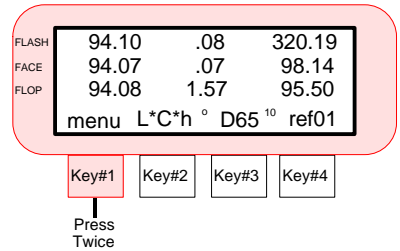


3.2 Quick Calibrating to the Standard

To perform a quick cal measurement:

1) Make sure white cal standard is clean.

2) Press **[menu]** key #1 twice to enter menu selection.



3) Press **[cal]** key #2 to enter calibration function.

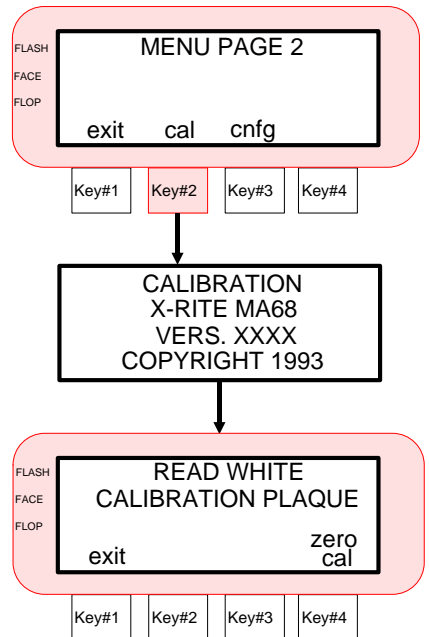
- The software datecode and copyright are momentarily displayed.

- "READ WHITE CALIBRATION PLAQUE" is displayed.

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

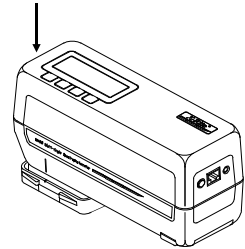
Pressing **[zero cal]** key #4 will activate zero reflectance measurement.

If "Read Zero Reflectance" is displayed, refer to Measuring Zero Reflectance in this section.



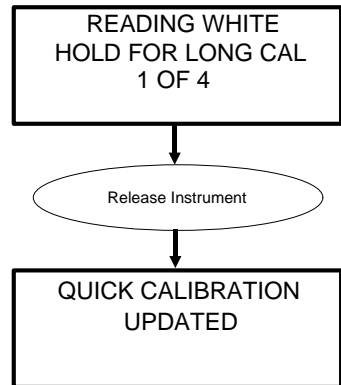
- 4) Position the instrument on the white standard and take measurement. To maintain accuracy and repeatability, always press firmly on the front of the instrument.

Press Firmly



- 5) Release unit after **first** cal measurement is complete.

- “**QUICK CALIBRATION UPDATED**” is displayed and the procedure is finalized.
- The unit returns back to normal operation.



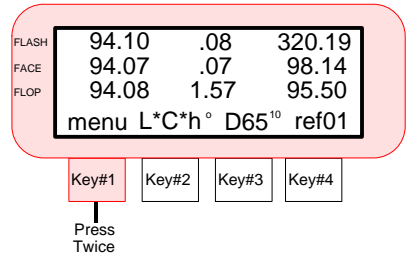
✉ If an error message occurs during calibration, try reading plaque again. If error message still occurs, refer to Display Messages in Appendix B.

3.3 Long Calibrating to the Standard

To perform a long cal measurement:

1) Make sure white cal standard is clean.

2) Press **[menu]** key #1 twice to enter menu selection.



3) Press **[cal]** key #2 to enter calibration function.

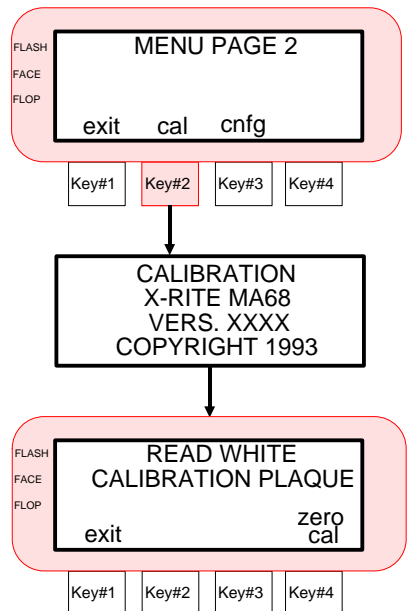
- The software datecode and copyright are momentarily displayed.

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

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

Pressing **[zero cal]** key #4 will activate zero reflectance measurement.

If **“READ ZERO REFLECTANCE”** is displayed, refer to Measuring Zero Reflectance in this section.



4) Position the instrument on the white standard and take measurement. Hold instrument down until all 4 calibration readings are complete. To maintain accuracy and repeatability, always press firmly on the front of the instrument.

- “READING WHITE HOLD FOR LONG CAL 1 OF 4)” is displayed, then “LONG CALIBRATION UPDATED.”

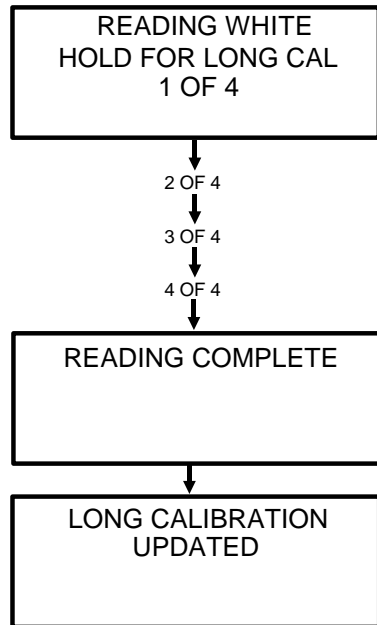
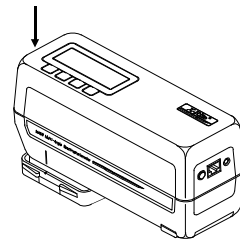
- The procedure is finalized and the unit returns back to normal operation.

✉ If an error message occurs during calibration, try reading plaque again. If error message still occurs, refer to Display Messages in Appendix B.

If “PLEASE WAIT XX (1-30) SECONDS” is displayed during calibration, continue to hold in down position until calibration readings are over. This will only occur if the calibration procedure is performed within 30 seconds of a previous measurement.

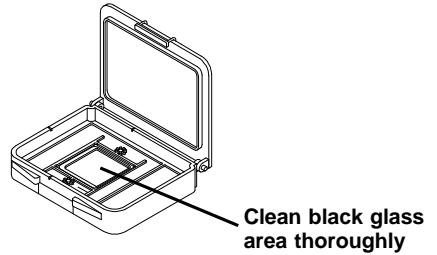
If “READ ZERO REFLECTANCE” is displayed after reading the white standard, refer to Step 5 of Measuring Zero Reflectance procedure. This will only occur if the calibration values for zero reflectance have drifted.

Press Firmly



3.4 Measuring Zero Reflectance

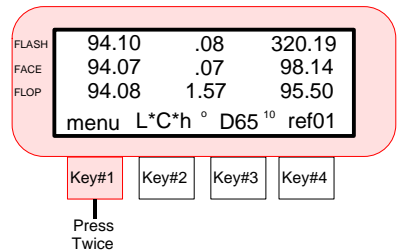
- ☒ The zero reflection standard (black glass) is dramatically affected by smudge marks, dust and fingerprints. Smudges and fingerprints should be cleaned with a lens tissue and a few drops of the lens cleaner provided. The standard should always be polished with lens tissue and dusted with the blower brush before being measured.



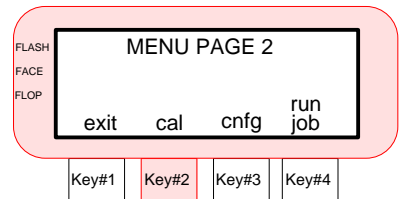
To perform a zero reflectance measurement:

- 1) Clean black glass on zero reflection standard.

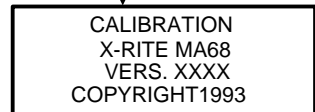
- 2) Press [menu] key #1 twice to enter menu selection.



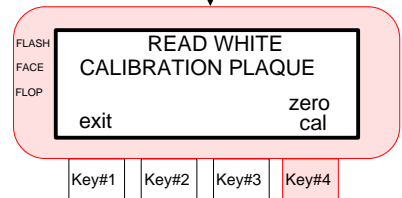
- 3) Press [cal] key #2 to enter calibration function.



- The software datecode and copyright are momentarily displayed.



- "READ WHITE CALIBRATION PLAQUE" is displayed.

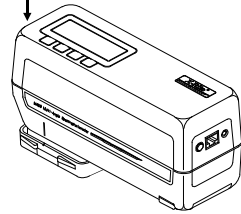


- 4) Press [zero cal] key #4 to advance to zero reflectance menu.

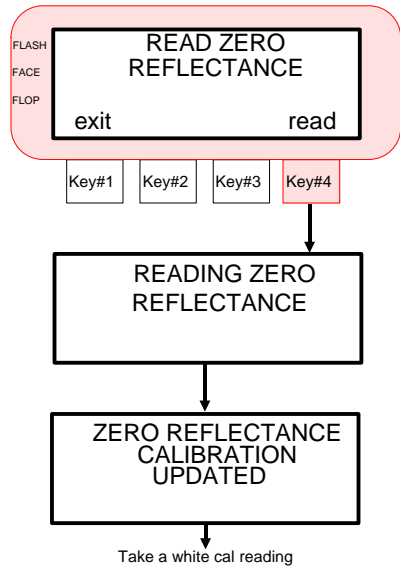


5) Position the instrument on the zero reflectance standard and press firmly.

Press Firmly



6) Press [read] key #4.



- “READING ZERO REFLECTANCE” and “ZERO REFLECTANCE CALIBRATION UPDATED” is displayed.

✉ If an error message occurs during the zero reflectance, try reading again. If error message still occurs, refer to Display Messages in Appendix B.

The white standard should be measured after zero reflectance measurement, if zero reflectance was manually selected.

SECTION 4 NORMAL OPERATION

Subjects covered in Section 4 are:

- 4.1 Color Space Selection
- 4.2 Illuminant/Observer Selection
- 4.3 Reference Entry
- 4.4 Sample Measurement
- 4.5 Using Measurement Averaging

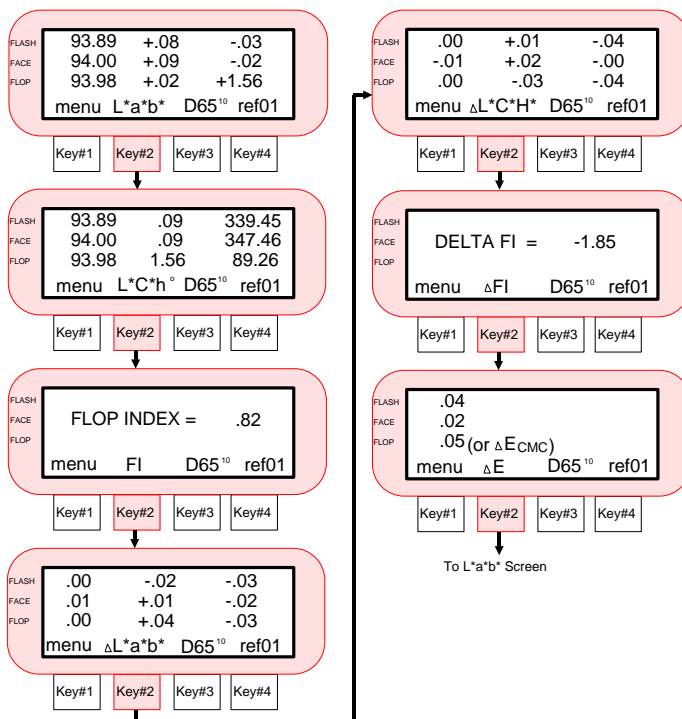
4.1 Color Space Selection

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), $\Delta L^*a^*b^*$, $\Delta L^*C^*H^*$, Delta FI, and ΔE (or ΔE_{CMC}).

ΔE is the factory preset. To select ΔE_{CMC} , refer to Operation Options (Section 7.2).

To select a color space:

- Repeatedly press “Key #2.”

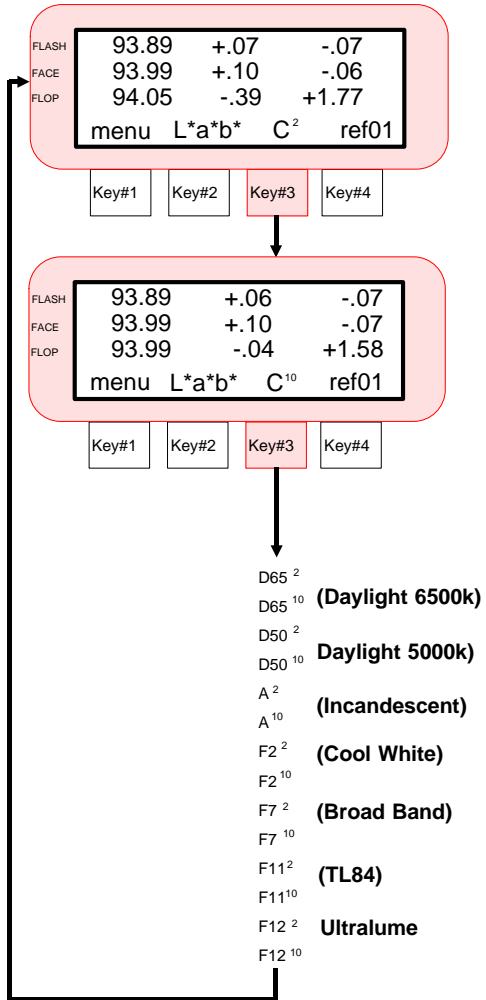


4.2 Illuminant/Observer Selection

The MA68 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:

- Repeatedly press “**Key #3.**”



⊠ All illuminant/observer combinations may not display. Certain combinations may be turned off in Operation Options (Section 7.2). D65¹⁰, A¹⁰, and F2¹⁰ are preset on at the factory.

4.3 Reference Entry

The MA68 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, the operator has to manually select the reference location before a measurement. Once you have selected a reference, that reference will be used until a different reference is selected.

Refer to Setting Operation Options Section 7.2 for manual and auto reference selection.

To measure a reference:

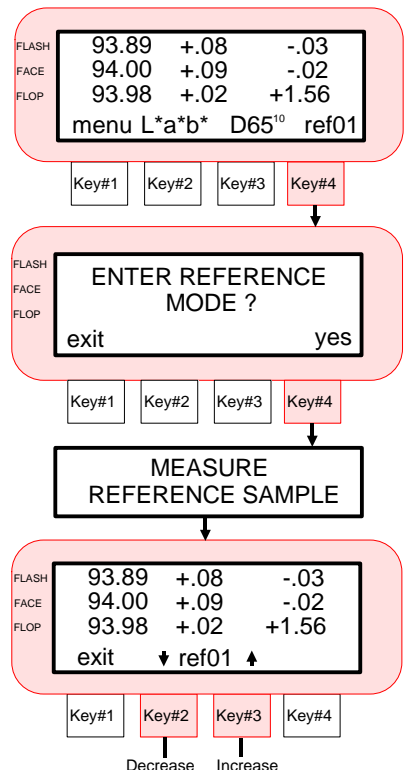
- 1) Select desired color space and illuminant/observer.

- 2) Press the [ref] key #4 to enter reference menu.

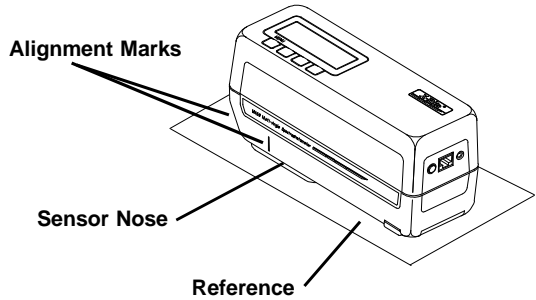
- 3) Press the [yes] to enter reference menu.

- **“MEASURE REFERENCE SAMPLE”** is displayed.

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

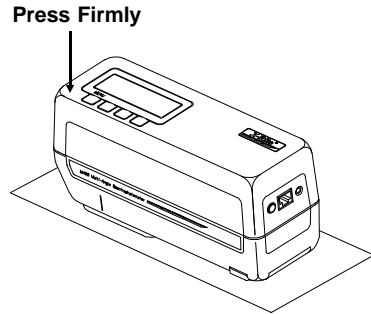


- 5) After selecting reference location, center measurement aperture in sensor nose over reference to measure. Use the alignment marks on the front and sides of the unit for positioning.



- 6) Press firmly on the front of the unit until sensor nose is flat on reference and both read switches are activated.

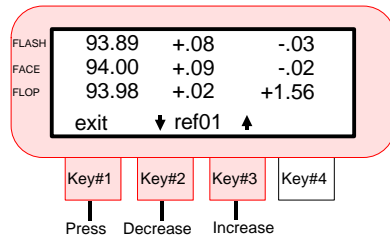
- Remove unit from reference after **“READING COMPLETE”** is displayed.



- ✉ 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.



4.4 Sample Measurement

Measurement data can be displayed as absolute or difference. The MA68 measures five angles but will only display three, due to display limitations. If desired, all five angles can be printed after a measurement when the instrument is interfaced to a serial printer. The three angles displayed can be changed in Operation Options (refer to Sec. 7.2).

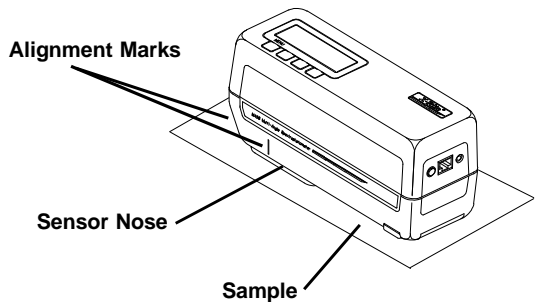
To take a sample measurement:

- 1) If taking a difference measurement, make sure a reference is entered into the instrument (refer to Section 4.3 Reference Entry).
- 2) Select color space by pressing “**Key #2.**” Select illuminant/observer by pressing “**Key #3.**”

FLASH	-.01	-.01	-.05
FACE	-.03	+.02	-.06
FLOP	-.04	-.01	-.02
menu $\Delta L^*a^*b^*$ D65 ¹⁰ ref01			

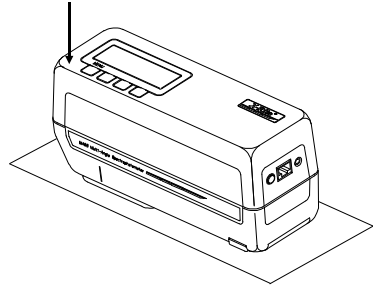
Key#1 Key#2 Key#3 Key#4

- 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.

Press Firmly

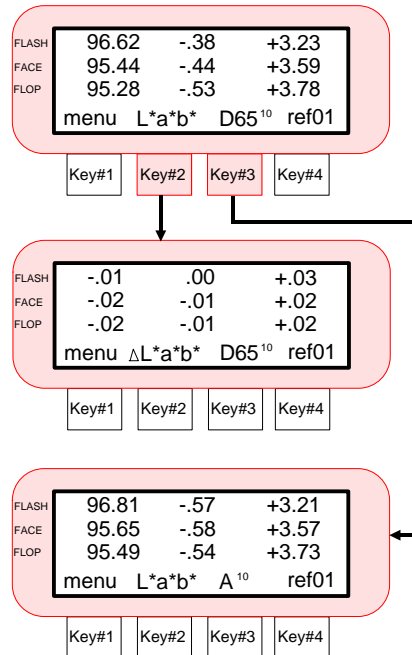


- Remove unit from sample after **“READING COMPLETE”** is displayed.

☒ If an error message occurs during the measurement, try reading sample again. If error message still occurs, refer to Display 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.”**



☒ If auto reference is “on”, the instrument will select the reference that is the closest match to the sample.

4.5 Using Measurement Averaging

- ☒ Measurement Averaging must be activated in Operation Options before averaging can take place. Refer to Section 7.2 for procedure.

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

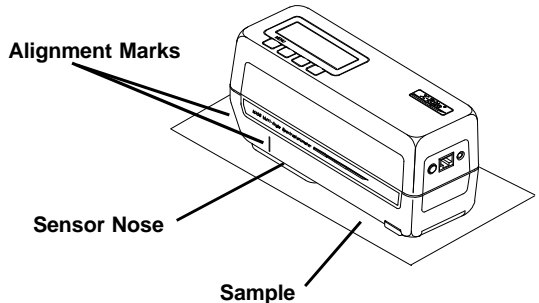
Measurement averaging can be set “1 - 16” or “SMC.” Statistical Measurement Control (SMC) requires a minimum of 5 measurements taken at various locations on a sample. Refer to Section 7 Operation Options for additional information on SMC.

The following example has an average setting of “2.”

To take an average measurement:

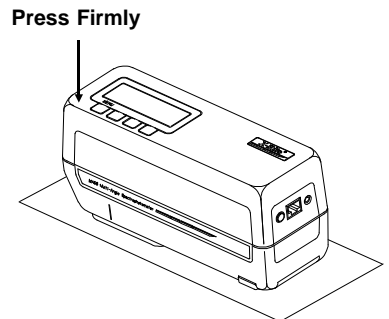
- 1) Select measurement function (i.e, normal, storage, or pass/fail).

- 2) Center measurement aperture in sensor nose over the first sample area to be measured.



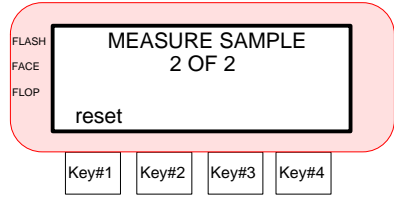
- 3) Take measurement by positioning sensor nose flat on sample.

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

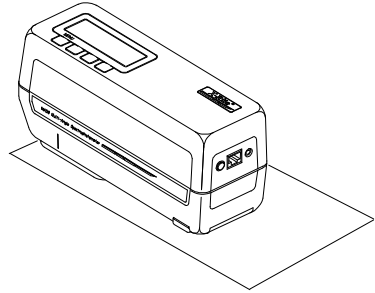


4) “**MEASURE SAMPLE 2 OF 2**” is displayed.

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

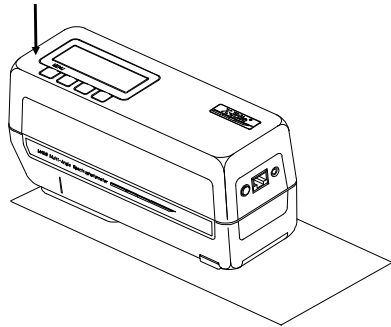


5) Center measurement aperture in sensor nose over second area on sample.

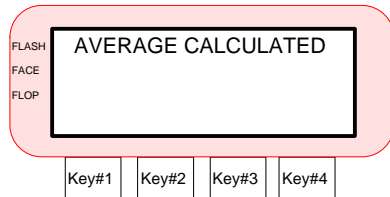


6) Take measurement.

Press Firmly



7) “**AVERAGE CALCULATED**” is displayed and then the averaged measurement data.



SECTION 5

PASS/FAIL OPERATION

Subjects covered in Section 5 are:

- 5.1 Adjusting Tolerance Values
- 5.2 Pass/Fail Measurement

The Pass/Fail feature 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 Flop Index and ΔE^* (or ΔE_{CMC}).

5.1 Adjusting Tolerance Values

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

- $\Delta L^*a^*b^*$ and $\Delta L^*C^*H^*$ method allows high/low tolerance settings for each angle.
- ΔFI method allows high/low tolerance setting for the flop index.
- ΔE^* method allows tolerance settings for each angle.
- ΔE_{CMC} method allows a global adjustment for “l” (lightness factor) and “c” (chromaticity factor). The “cf” (commercial factor) can be adjusted for each angle.

“ ΔE ” is the factory default that will appear as one of the pass/fail methods. Refer to Section 7.2, Setting Operation Options if “ ΔE_{CMC} ” 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:

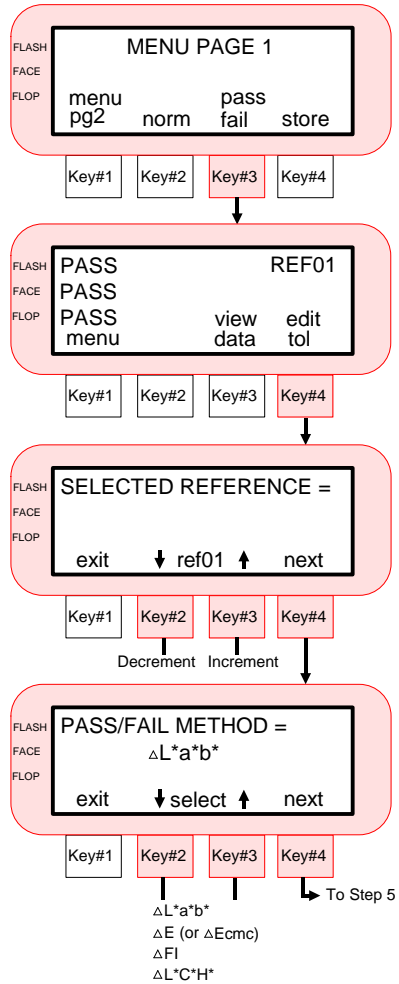
1) At “MENU PAGE 1”, press [pass/fail] key #3 to enter pass/fail option.

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: $\Delta L^*a^*b^*$, $\Delta L^*C^*H^*$, ΔFI , or ΔE (or ΔE_{CMC}).



IMPORTANT!
The following pages cover each tolerance method separately.



PASS/FAIL METHOD = $\Delta L^*a^*b^*$ or $\Delta L^*C^*H^*$

☒ 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.

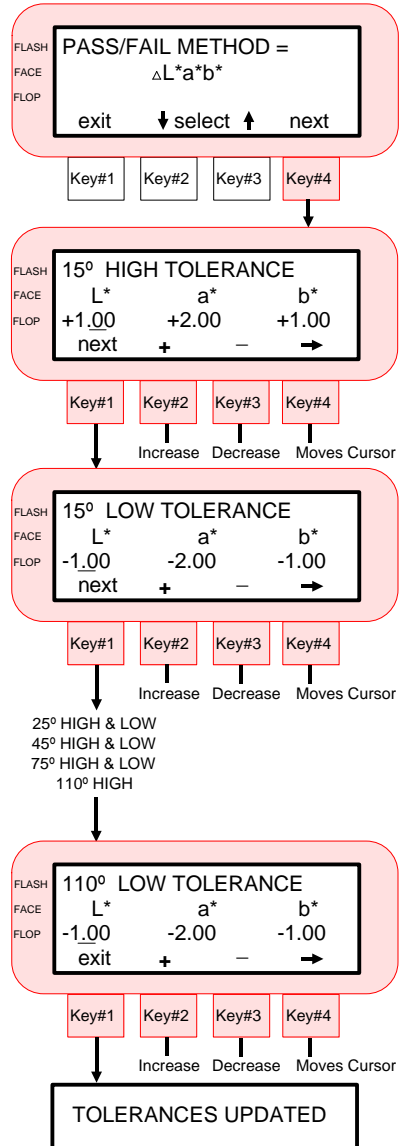
7) Set 15° low tolerance values by pressing the **[→]** key #4 to move cursor to desired attribute. Press **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- 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.

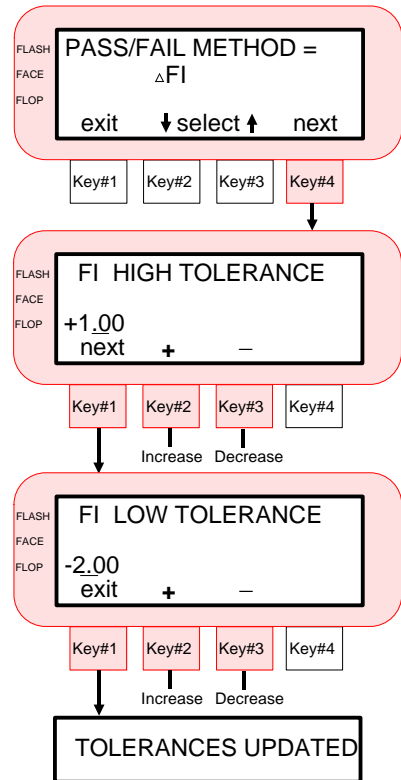
6) Set FI high tolerance values by pressing the **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- 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

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

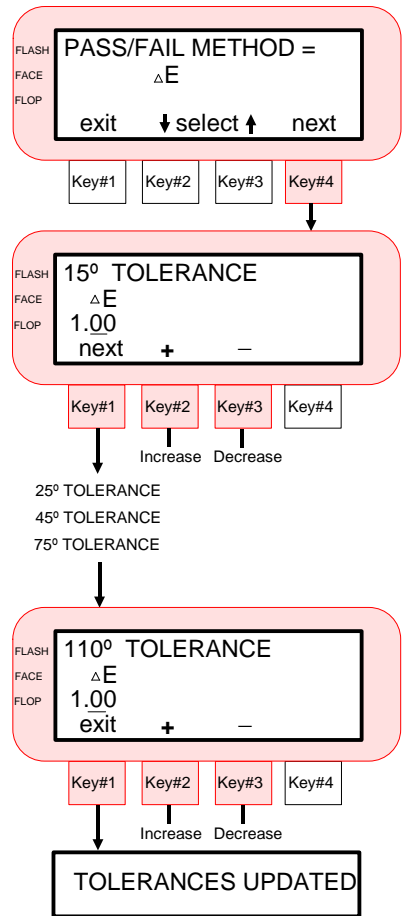
6) Set 15° tolerance value by pressing **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- 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 = ΔE_{CMC}

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.

✉ 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.

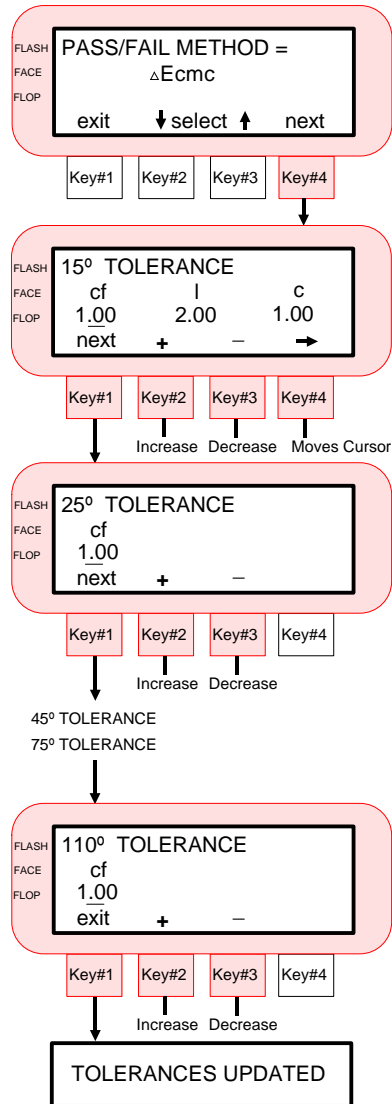
7) Set 25° “cf” tolerance value. Press **[+]** key #2 to increase value or **[-]** key #3 to decrease value.

- 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.



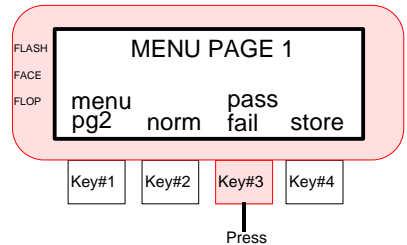
5.2 Pass/Fail Measurement

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:

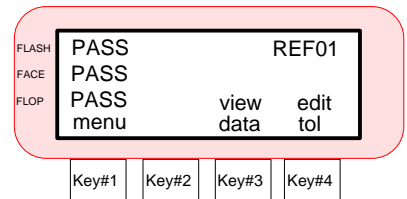
- ☒ References must be measured and tolerances edited before a pass/fail measurement will display usable data. Refer to Sections 4.3 and 5.1.

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



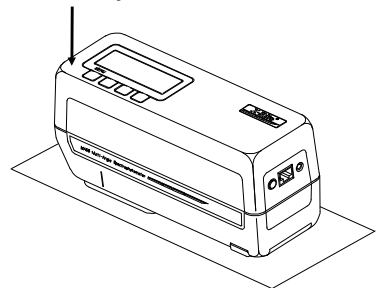
- 2) The Pass/Fail measurement screen is displayed.

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



- 3) Take measurement by positioning sensor nose flat on sample and pressing firmly.

Press Firmly



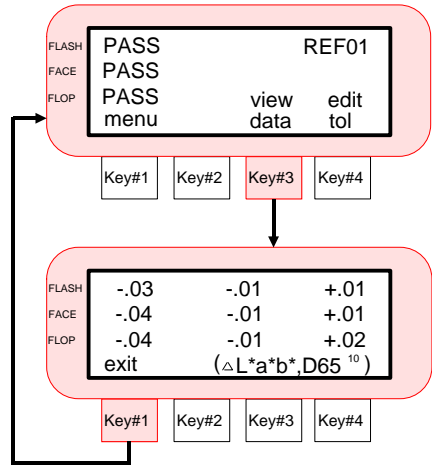
4) A “**PASS**” or “**FAIL**” (1 long beep) will display for each selected angle to indicate the sample’s status.

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

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

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

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



SECTION 6

STORAGE OPERATION

Subjects covered in Section 6:

- 6.1 Storing Measurements
- 6.2 Viewing Stored Measurements
- 6.3 Deleting Stored Measurements
- 6.4 Printing Stored Measurements
- 6.5 Tagging and Storing Operation (with optional BCR)
- 6.6 MetalliX-QC “Run Job” Operation

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

When the MA68 is used in conjunction with X-Rite’s MetalliX-QC® software program, stored measurement data is “uploaded” directly into the application for visual analysis.

6.1 Storing Measurements

Storage allows sample measurements to be assigned to group numbers. Once in storage mode, the operator can randomly select group numbers and measure as many samples as desired in the selected group. The instrument allows a maximum of 999 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 Section 6.5 for more information.

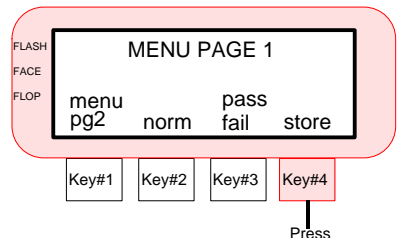
To store a measurement:

1) Select desired color space and illuminant/observer.

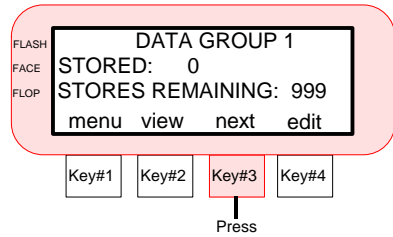
- Stored data will display in the last color space and illuminant/observer combination selected if pass/fail indication is not used.

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

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



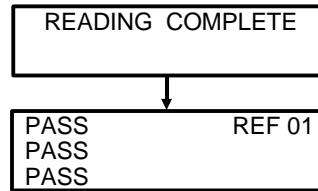
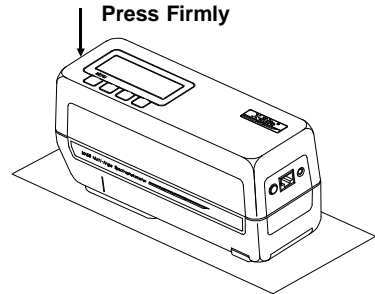
- 3) Select desired data group number by repeatedly pressing [next] key #3.



- 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.

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

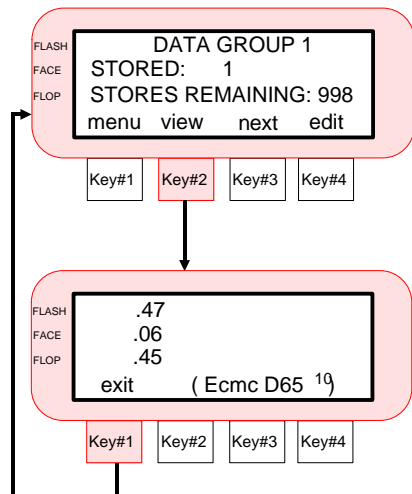


- 5) The last measurement data can be displayed by pressing [view] key #2.

- ☒ 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.



- ☒ The “data group name” can be customized by “downloading” group names with MetallX-QC software package.

6.2 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.

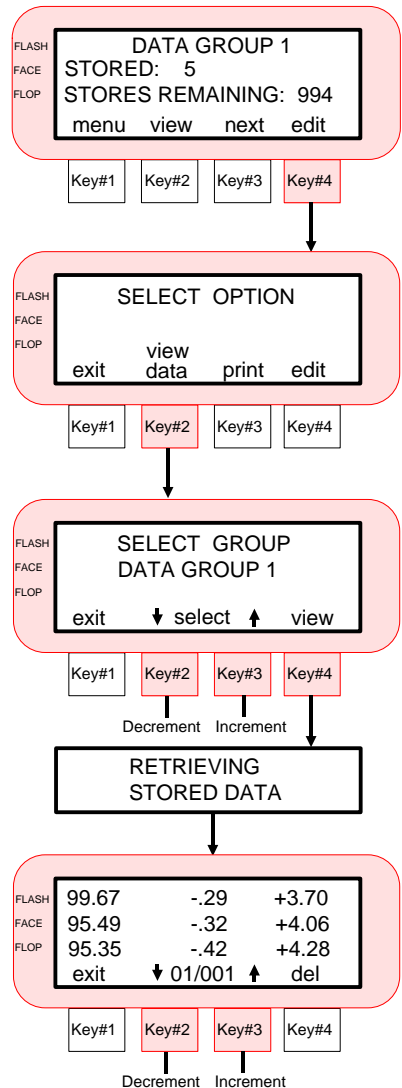
3) Press [↓] key #2 or [↑] key #3 to select desired group.
- After group is selected, press [view] key #4.

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

☒ 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.



6.3 Deleting Stored Measurements

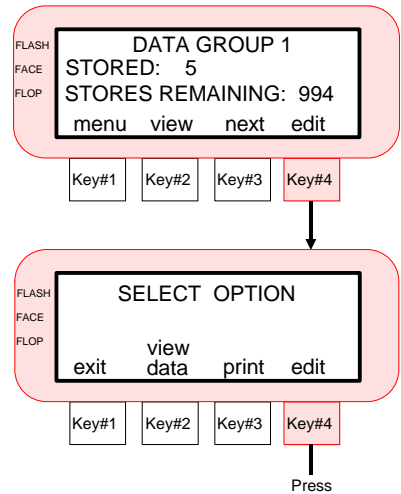
There are three methods that can be used to delete stored measurements.

- ❑ **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.

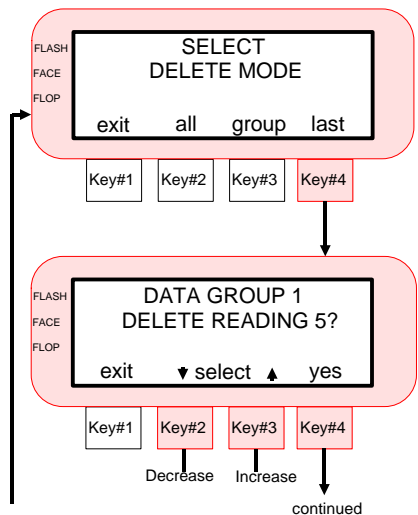


Delete Last

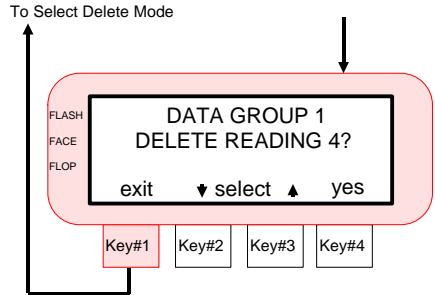
3) Press **[last]** key #4.

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

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



- 5) Press **[exit]** key #1 to return to the delete mode menu.



Delete Group

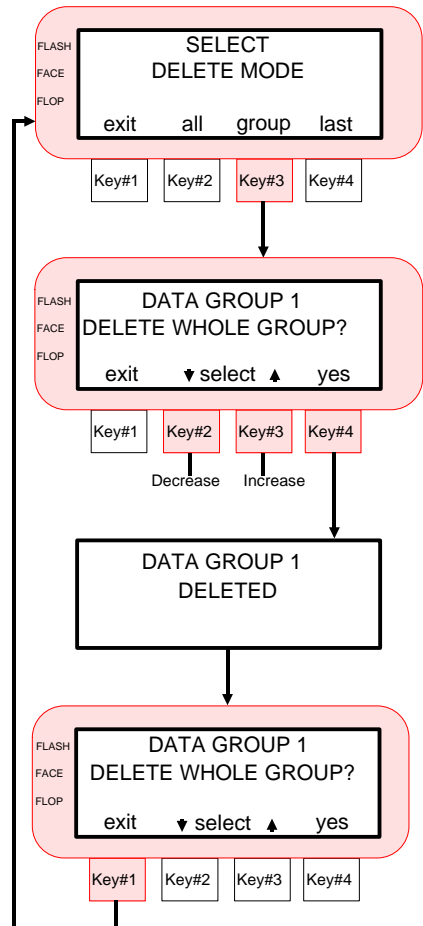
- 3) Press **[group]** key #3.

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

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

- **“DATA GROUP # DELETED”** is displayed.

- 5) Press **[exit]** key #1 to return to the delete mode menu.



Delete All

3) Press **[all]** key #2.

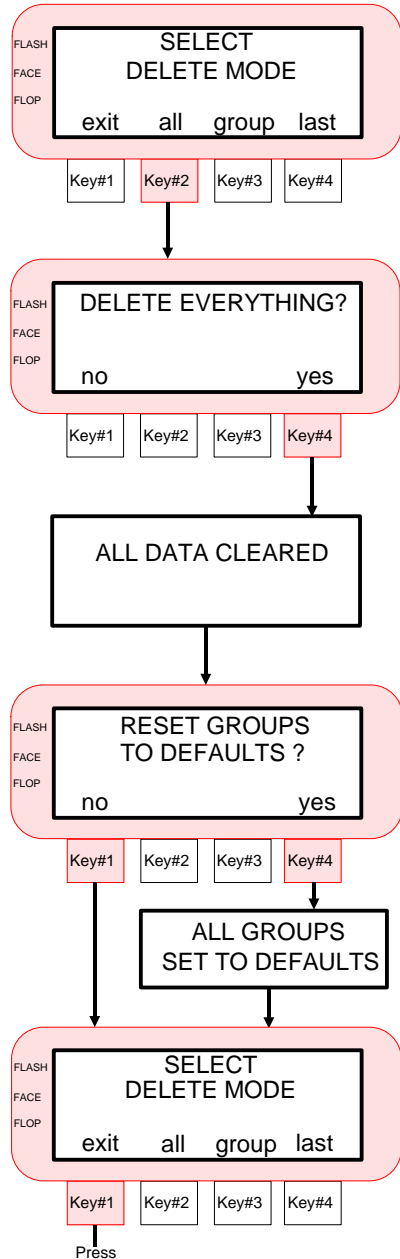
4) Press **[yes]** key #4 to clear all stored data in all groups.

- **“ALL DATA CLEARED”** is displayed.

5) **“RESET GROUPS TO DEFAULTS?”** is displayed.

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

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



6.4 Printing Stored Measurements

The MA68 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 7.3.

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.

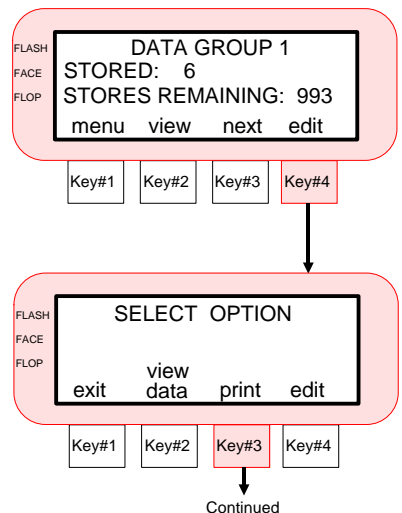
Simplified Printing Format

To print stored measurements:

- 1) Refer to Section 6 to set RS-232 and Printout Options, if required.

- 2) In storage mode, press **[edit]** key #4 to enter “**SELECT OPTION**” screen.

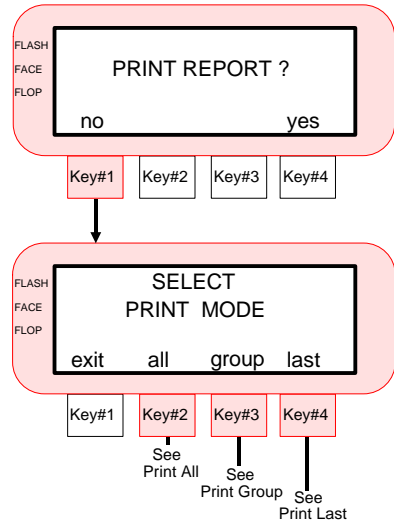
- 3) Press **[print]** key #3 to enter “**PRINT REPORT ?**” screen.



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

There are three modes of print that can be accessed during stored data printout.

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

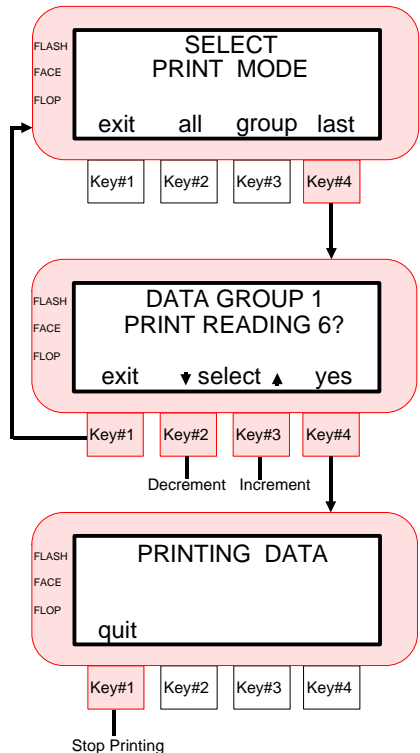


Print Last

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

6) Press the [↓] key #2 or [↑] key #3 to select desired group.
 - Press **[yes]** key #4 to print last measurement in the selected group.

7) “**PRINTING DATA**“ is displayed and then the display returns to “**DATA GROUP**” menu.
 - Press **[quit]** key #1 to stop printing.



Print Group

5) Press **[group]** key #3 to enter print group mode.

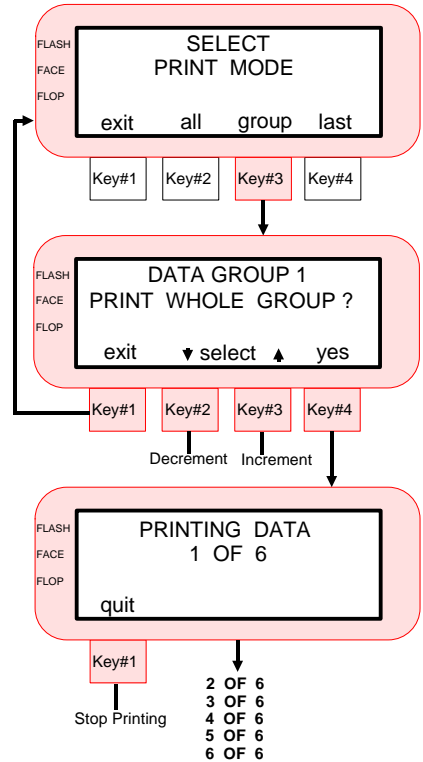
6) Press **[↓]** key #2 or **[↑]** key #3 to select desired group.

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

☒ If **[↑]** key #3 is depressed one more time after "DATA GROUP 20" is displayed, "PRINT ALL GROUPS ?" will display. Selecting this option will printout all groups with existing measurement data.

7) "PRINTING DATA # OF #" is displayed until all data is printed, then the display will return to **DATA GROUP** menu.

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

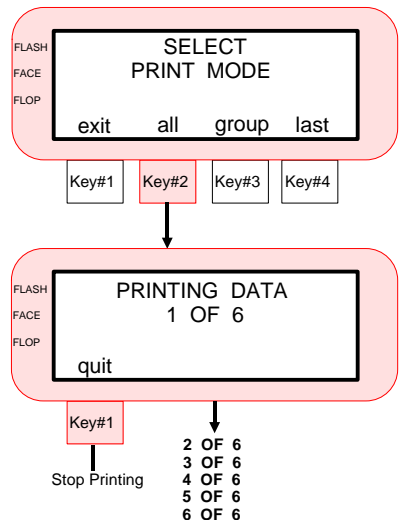


Print All

5) Press **[all]** key #2.

6) "PRINTING DATA # OF #" is displayed until all data is printed, then the display will return to "SELECT PRINT MODE" menu.

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



Report Printing Format

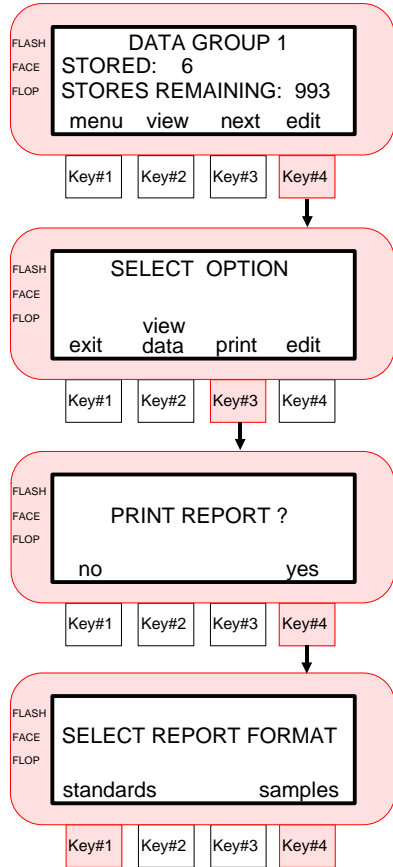
To print reports:

- 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.

- Refer to the following pages for “**standards**” and “**samples**” printing procedures.



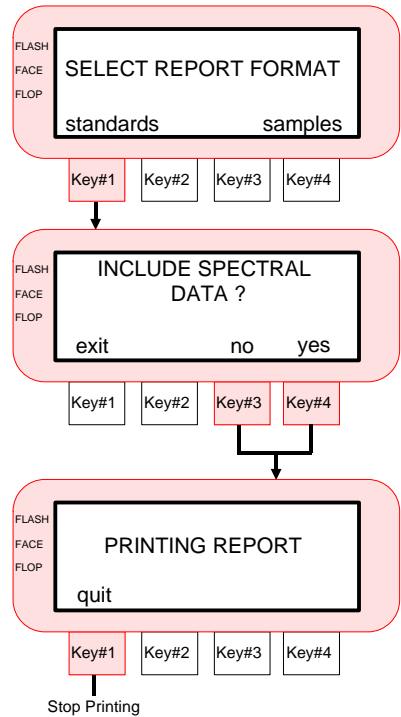
Standards

- 4) Press **[standards]** key #1 to enter “**INCLUDE SPECTRAL DATA ?**” screen.

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

- 6) “**PRINTING REPORT**” is displayed and then the display returns to “**SELECT OPTIONS**” menu. Press **[quit]** key #1 at anytime to abort printing operation.

- Refer to page 6-13 for sample printout of the “Standards” report.



Samples

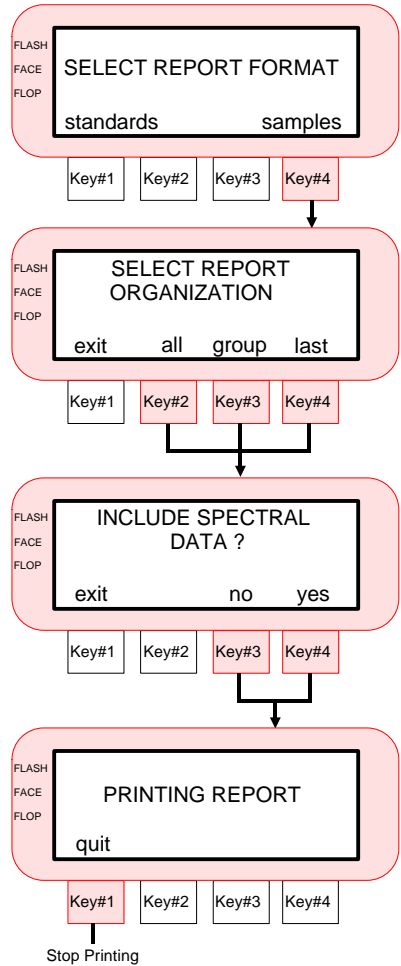
4) Press **[samples]** key #4 to enter “**SELECT REPORT ORGANIZATION**” screen.

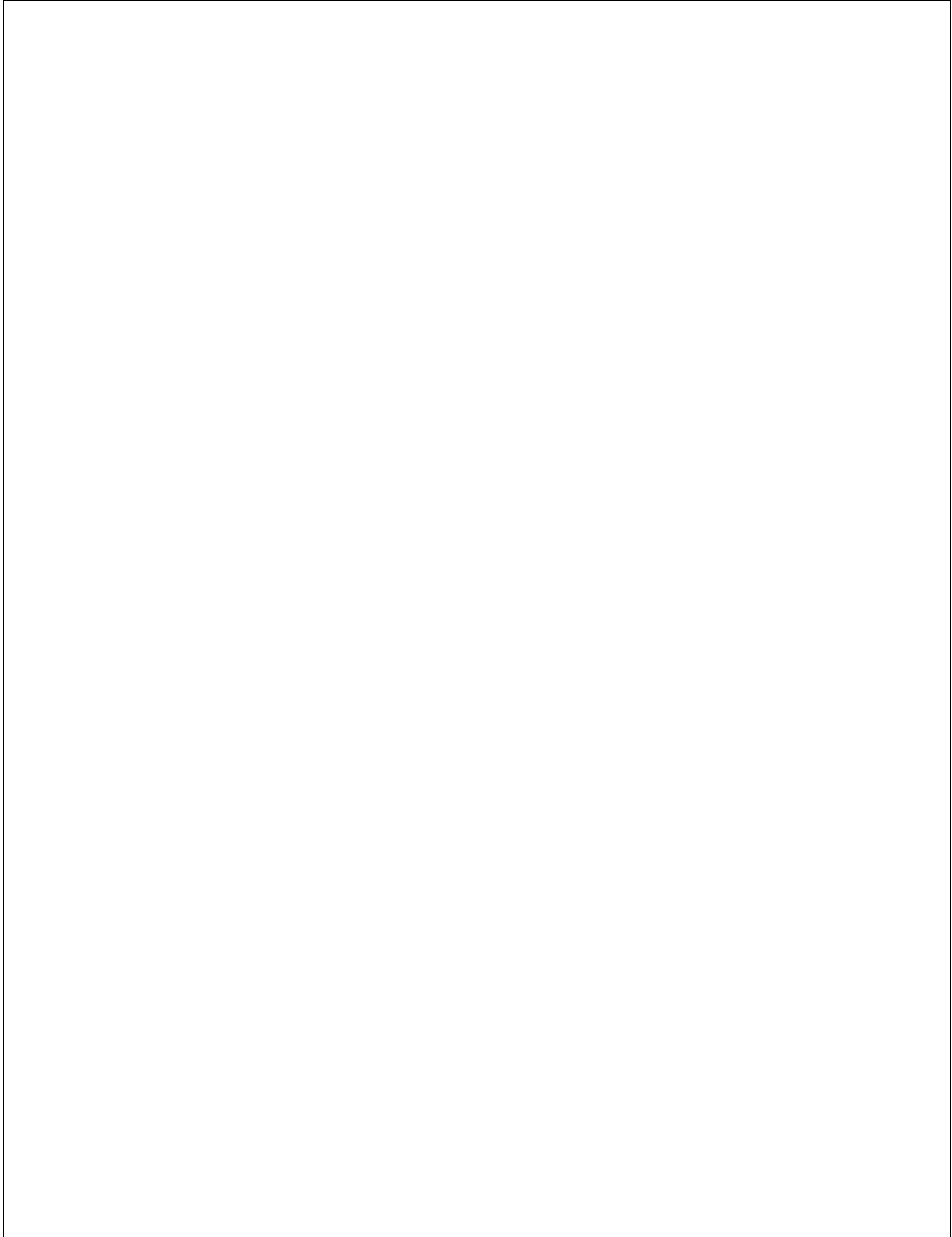
5) Press **[all]** key #2, **[group]** key #3, or **[last]** key #4 to select format. If required, refer to Simplified Printing Format procedure for explanation.

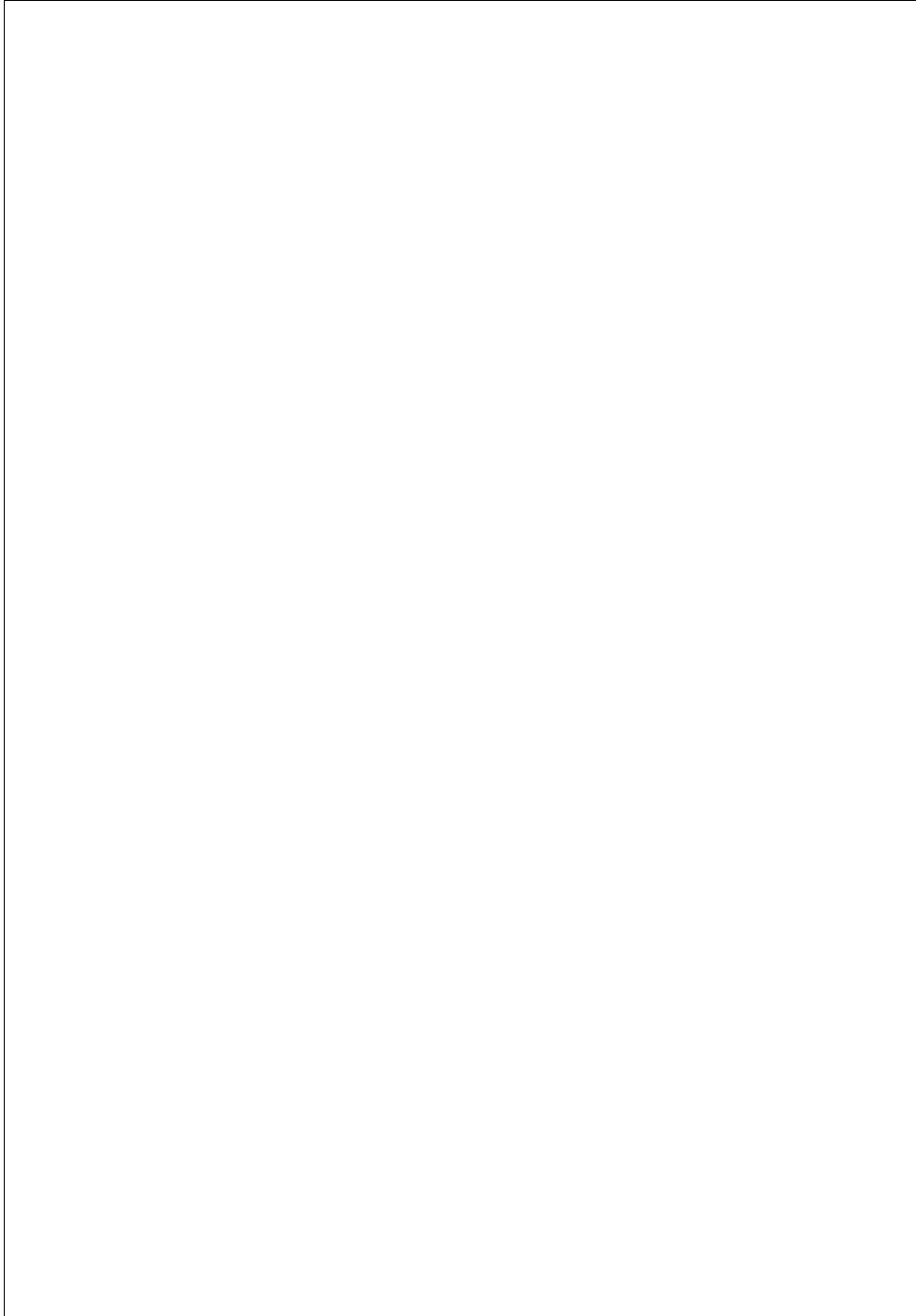
6) Press **[yes]** key #4 to include spectral data, or press **[no]** key #3 to **not** include spectral data.

7) “**PRINTING REPORT**” is displayed and then the display returns to “**SELECT OPTIONS**” menu. Press **[quit]** key #1 at anytime to abort printing operation.

- Refer to page 6-14 for sample printout of the “Samples” report.







6.5 Tagging and Storing Operation (with optional BCR)

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

Tags are used as a method to label stored measurement samples for identification. The sample data can then be printed or uploaded to X-Rite's MetalliX-QC[®] with tags applied.

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

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

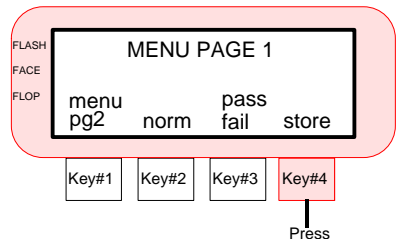
Tag Group - This option will only appear on the instruments display when a new group is selected that has no stored measurements. Any measurement taken in that group after "group" is selected will have the scanned tag attached. The first tag that is scanned under group will also be used as the group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

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

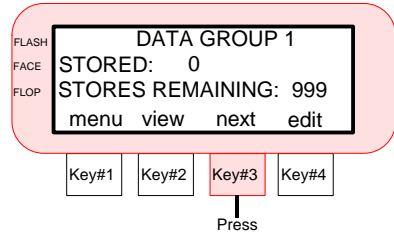
When the stored measurement data from the instrument is uploaded to X-Rite's MetalliX-QC software program, all tags that were attached will also transfer.

To tag and store a measurement:

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



- 2) Select desired data group number (or name downloaded from MetalliX-QC) by repeatedly pressing the **[next]** key 3.



- 3) Connect Bar Code Reader to I/O port if not already connected, and scan the desired bar code. Refer to Section 9 to attach or if scan did not work correctly.



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

- Press **[tag all]** key #2 if every measurement that is to be stored will receive the scanned tag.

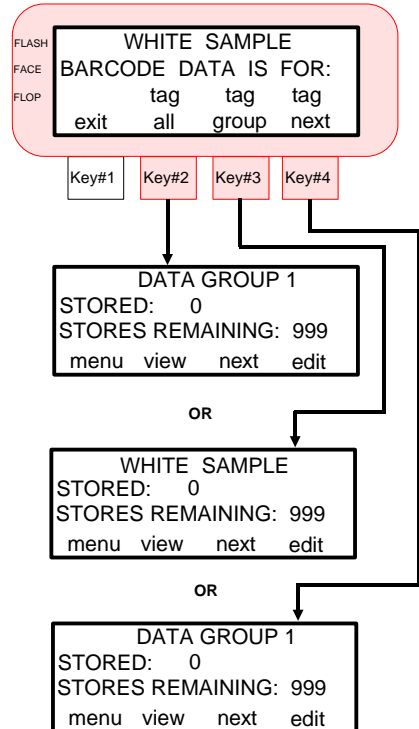
☒ **"tag all"** will not appear if any measurements have previously been stored.

- Press **[tag group]** key #3 if all measurements in the selected group will have the same scanned tag.

☒ If a group is not named and **"tag group"** is selected, the scanned tag name will take the place of the data group # on the first line of the instrument display.

"tag group" will not appear if any measurements have previously been stored in the group.

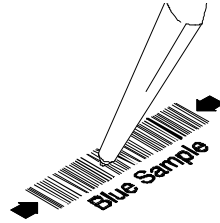
- Press **[tag next]** key #4 if the measurement to follow will be the only sample with the scanned tag attached.



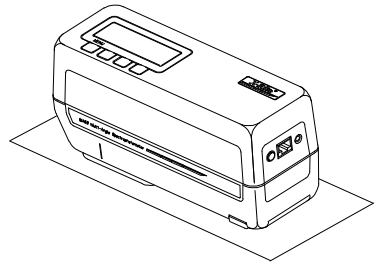
- A total of “6” tags can be attached to each measurement. The total of “6” tags includes combinations of “all”, “group”, and “next” tag selections.

5) Scan additional bar codes if more are required for “all”, “group”, or “next” samples.

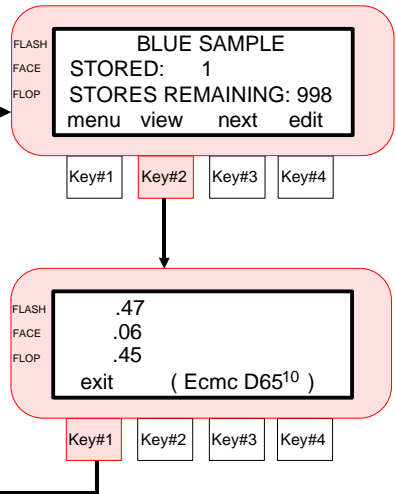
- ☒ If no tag method is selected before a measurement is taken, the instrument assumes a “next tag” selection.



- 6) Take measurement by lowering the unit to the target window on the sample.
- Lift unit off sample after “READING COMPLETE” indication is displayed.



7) The measurement data can be displayed by pressing [view] key #2.



8) Press the [exit] key #1 to return to the storage display.

9) Continue with additional tag storage measurements if required.

MetalliX-QC Group Name Special Feature

The MA68 has a unique feature that allows the user to automatically switch to a “group” that uses the same name as the scanned tag.

For example, if “GROUP #5” is named “Light Blue #6” and the scanned tag has the same name, the MA68 will display a **[group]** key. Pressing this key allows you to switch to that group if desired.

The **[tag]** key that displays works in the same manner as “next tag.” Pressing this key will store the scanned tag with the originally selected group.

The **[group]** key will only appear if tags that are scanned have the same names as downloaded “group names.”

MetalliX-QC Sample Tagging Special Feature

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

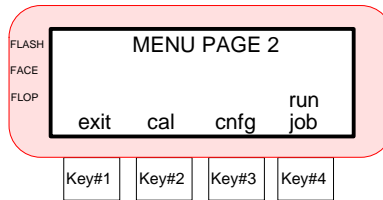
Notes:

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

6.6 MetalliX-QC “Run Job” Operation

The “Run Job” function is used to activate a series of tagging and storing operations that can be programmed in the unit by X-Rite’s MetalliX-QC software package. A typical “job” would allow multiple information tags to be applied to each stored measurement. See the MetalliX-QC Users Manual for further information.

A [run job] key will appear on “**MENU PAGE 2**” of the instrument display once a job is downloaded. This key is used to activate a job.



SECTION 7

SETTING SYSTEM CONFIGURATION

Subjects covered in Section 7 are:

- 7.1 Setting RS232 Communication Options
- 7.2 Setting Operation Options
- 7.3 Setting Printout Options
- 7.4 Setting Date and Time

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

7.1 Setting RS232 Communication Options

The MA68 comes equipped with a serial port that allows data to be transmitted/received to/from an external device. Listed below are selectable I/O options.

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.

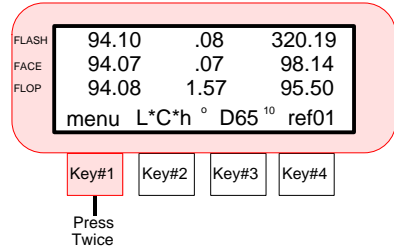
Line Feed Operation - varies the delimiter at the end of each line of data. When set to No LF with CR, just a carriage return is sent at the end of a line of data. When set to LF with CR, a carriage return then a line feed are sent at the end of the line of data. The factory default setting is LF with CR.

Handshake Operation - 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.

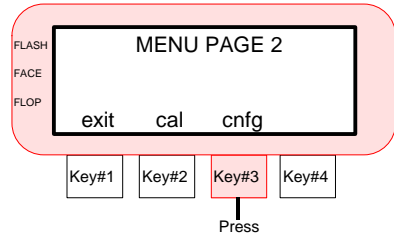


To change the communication options:

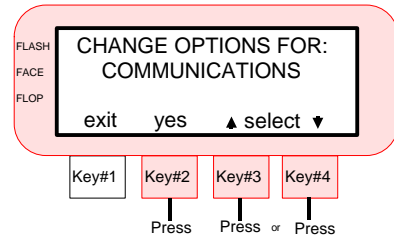
- 1) Press **[menu]** key #1 twice to enter “MENU PAGE 2” screen.



- 2) Press **[cnfg]** key #3 to enter configuration functions.



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



☒ On certain options the [↓] key #2 will page down through the available settings, while the [↑] key #3 will page up through the available settings.

4) Select the baud rate by pressing [↓] key #2 or [↑] key #3. The available rates are: “300”, “600”, “1200”, “2400”, “4800”, “9600”, and “19200.”

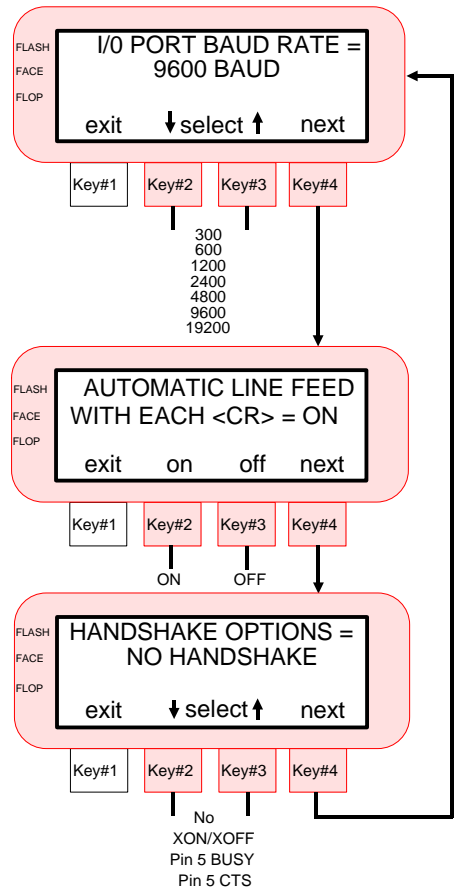
- Press [next] key #4 to advance to next option.

5) 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.

6) 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.



7.2 Setting Operation Options

There are ten operation options to edit. Listed below is a description of each option followed by the editing procedure.

Set Averaging - 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 Method - allows you to select which method will be used to express Delta E. The two methods to select from are: CIELAB Delta E or Delta E_{CMC}. ΔE_{CMC} parameters are (2:1), where the “2” is the lightness factor and “1” is the a chromaticity factor.

Select Illuminant/Observer - 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 will be seen on the display and used for pass/fail determination. Available settings 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. This configuration option is intended for use with the optional narrow nose (P/N MA58-102), which allows measurement in recessed areas.

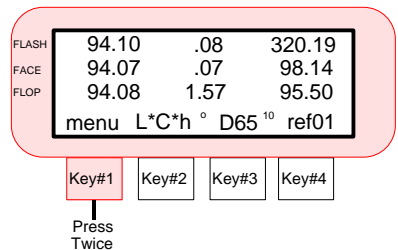
Beeper Operation - determines the volume level that is output on the instruments beeper. Available settings are: “Soft” and “Loud.”

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.

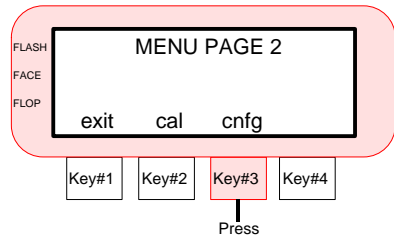
SMC GRADE Limit - The Grade Limit function is used to set the quality limit for the SMC function. Use Grade Limit to alter the number of measurements required in SMC. Increasing the grade limit value loosens the SMC requirements. Decreasing the grade limit value tightens the SMC requirements. The Grade 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 set the operation options:

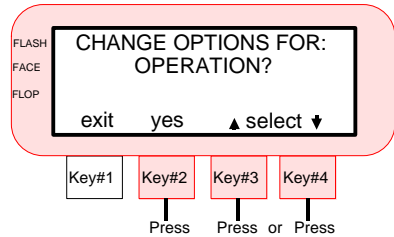
- 1) Press [menu] key #1 twice to enter “MENU PAGE 2” screen.



2) Press **[cnfg]** key #3 to enter configuration functions.



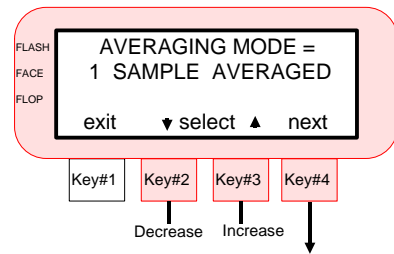
3) Press **[↑]** key #3 or **[↓]** key #4 to select Operation Options, then press **[yes]** key #2.



☒ On certain options the **[↓]** key #2 will page down through the available settings, while the **[↑]** key #3 will page up through the available settings.

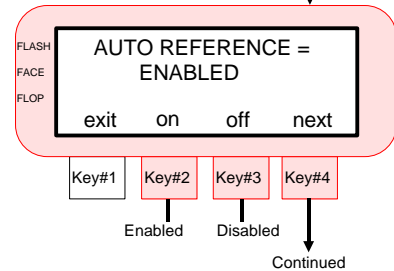
4) Select the number of samples averaged (1 to 16) or SMC Mode. Press **[↓]** key #2 to decrease and the **[↑]** key #3 to increase average number.

- Press **[next]** key #4 to advance to the next option.

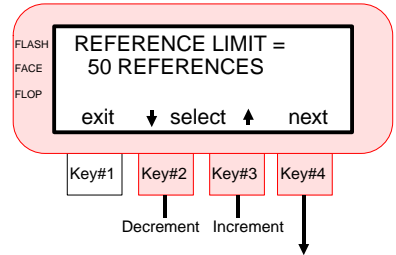


5) Select Auto Reference operation by pressing **[on]** key #2 to select “ENABLED” or the **[off]** key #3 to select “DISABLED.”

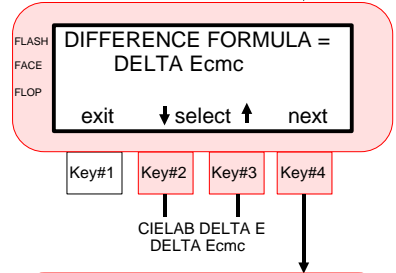
- Press **[next]** key #4 to advance to the next option.



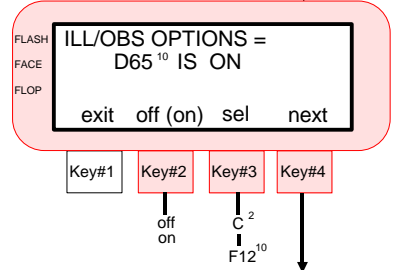
- 6) Select the number of reference locations required (1 - 200). Press [↓] key #2 to decrement or [↑] key #3 to increment.
- Press [next] key #4 to advance to the next option.



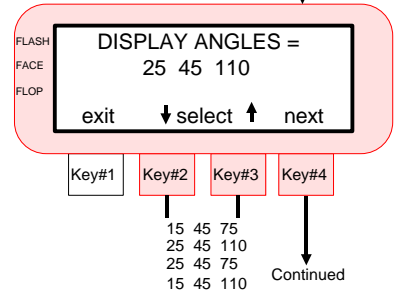
- 7) Select Delta E display method by pressing [↓] key #2 or [↑] key #3. The available setting are: “CIELAB DELTA E” and “DELTA E_{CMC}.”
- Press [next] key #4 to advance to the next option.



- 8) 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.

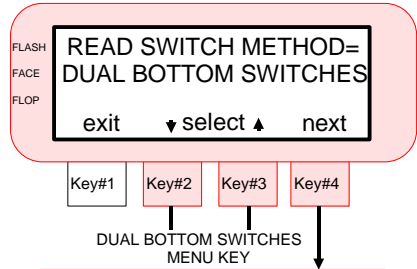


- 9) Select the display angles for viewing and pass/fail monitoring by pressing [↓] key #2 or [↑] key #3.
- Press [next] key #4 to advance to the next option.



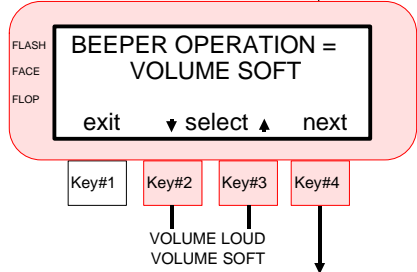
10) Select read switch method by pressing [↓] key #2 or [↑] key #3. The available settings are: “**DUAL BOTTOM SWITCHES**” and “**MENU KEY.**”

- Press [next] key #4 to advance to the next option.



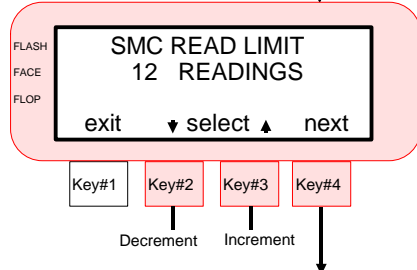
11) Select the beeper volume by pressing [↓] key #2 or [↑] key #3. The available settings are: “**SOFT**” and “**LOUD.**”

- Press [next] key #4 to advance to the next option.



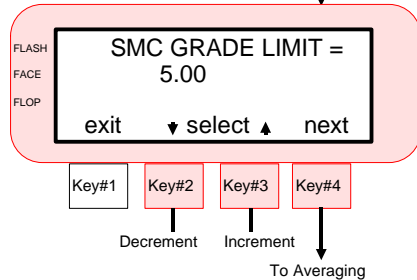
12) Select the SMC read limit (1 - 12). Press [↓] key #2 to decrease or [↑] key #3 to increase SMC readings.

- 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.



7.3 Setting Printout Options

Setting the printout options will determine what data will be transmitted out of the RS232 port for normal and storage operation. Listed below are the available options.

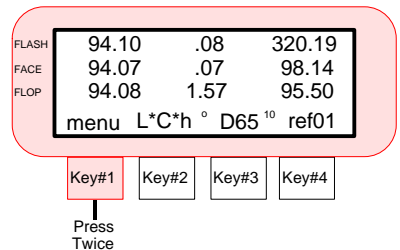
Printout Format - determines if the measurement data is output as “Spectral Data” (400nm - 700nm in 10nm increments), or “Color Space Data” (L*a*b*, etc.).

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

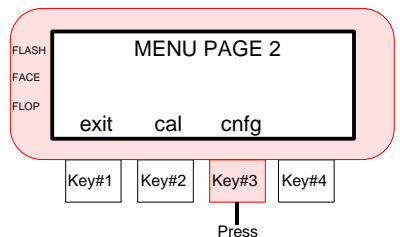
Reference Operation - enables or disables the reference data from printing (if any) during a data transmit.

To set printout options:

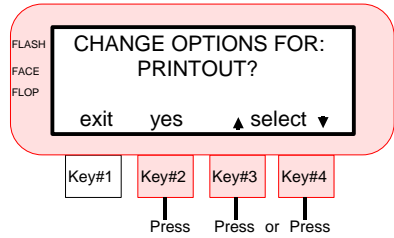
- 1) Press **[menu]** key #1 twice to enter menu selection.



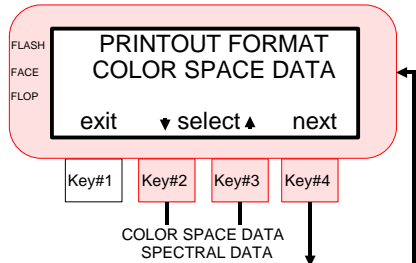
- 2) Press **[cnfg]** key #3 to enter configuration functions.



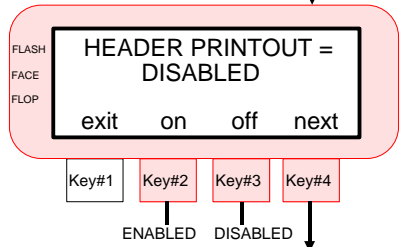
- 3) Press [↑] key #3 or [↓] key #4 to select Printout Options, then press [yes] key #2.



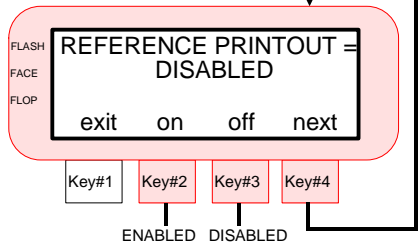
- 4) Select the printout format by pressing [↓] key #2 or [↑] key #3. The available settings are: “COLOR SPACE DATA” or “SPECTRAL DATA.”
- Press [next] key #4 to advance to the next option.



- 5) 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.



- 6) 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.

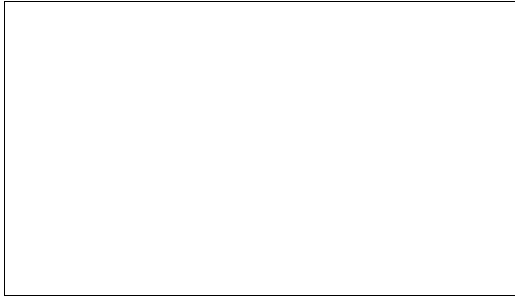


- Press [exit] key #1 once to return to Printout Options main menu, or press key #1 twice to return to normal operation.



The following examples illustrate the different output data that can be obtained from the MA68 with a serial printer interfaced.

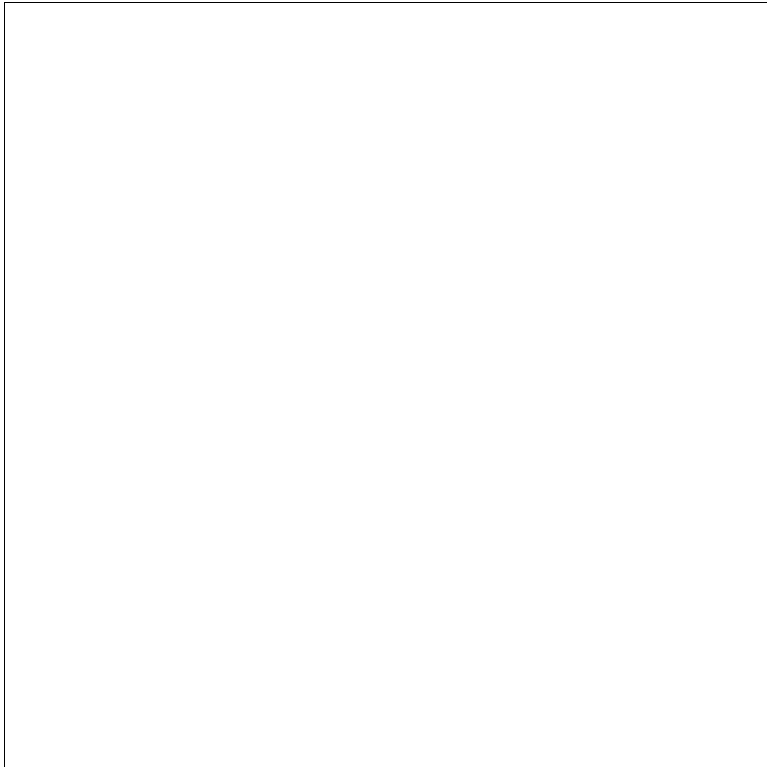
Example 1 - Color Space Format "ON"
Header "ON"
Reference "ON"



Example 3 - Color Space Format "ON"
Header "OFF"
Reference "OFF"



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



7.4 Setting Date and Time

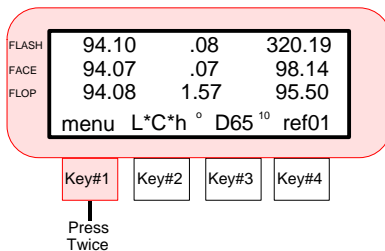
The date and time function allows you to adjust the instruments internal clock. Eastern Time Zone is the factory default setting.

The date and time will be printed (if “Header” is On) with each measurement when data is output to a printer. Refer below for setting procedure.

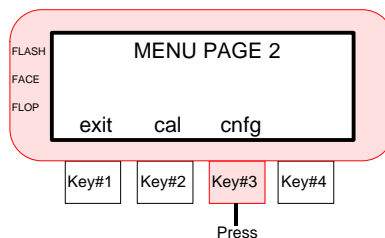
- ☒ If data is downloaded to the instrument from X-Rite's MetalliX-QC software program, the instrument's clock will automatically be set to the computer's time and date.

To set the date and time:

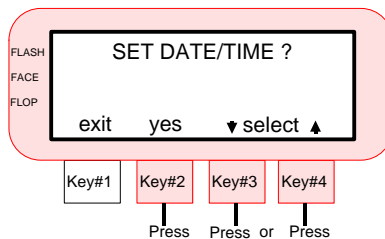
- 1) Press **[menu]** key #1 twice to enter **MENU PAGE 2**.



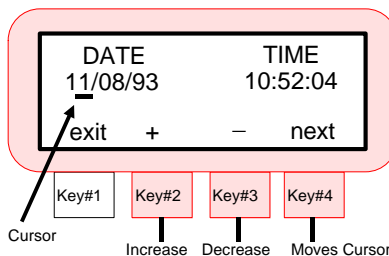
- 2) Press **[cnfg]** key #3 to enter configuration functions.



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



- 4) Set Date and Time.
 - Press **[next]** 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.



SECTION 8

GENERAL MAINTENANCE

Subjects covered in Section 8 are:

- 8.1 Cleaning the Instrument
- 8.2 Cleaning the Optics
- 8.3 Replacing the Battery Pack
- 8.4 Reading Lamp Replacement Information
- 8.5 Troubleshooting Tips

The X-Rite MA68 is covered by a one year limited warranty (excluding battery pack) and should be referred to the factory or authorized service center for repair within the warranty period. Attempts to make repairs within this time frame may void the warranty.

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

X-Rite will repair any MA68 past warranty at a cost based on a flat rate repair program. Shipping costs to the factory or to an authorized service center shall be paid by the customer and the instrument shall be submitted in its original carton, as a complete unaltered unit.

8.1 Cleaning the Instrument

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

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

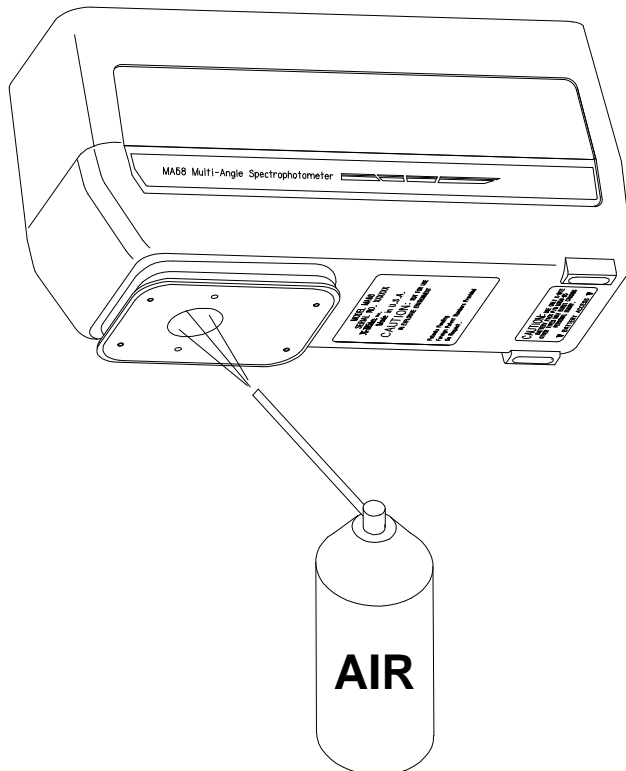
8.2 Cleaning the Optics

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

- 1) **Unplug the AC adaptor and turn the power switch Off.**
- 2) Carefully lift the instrument up and blow short bursts of clean air into the measurement aperture. This should remove any accumulated dust in the optics area.

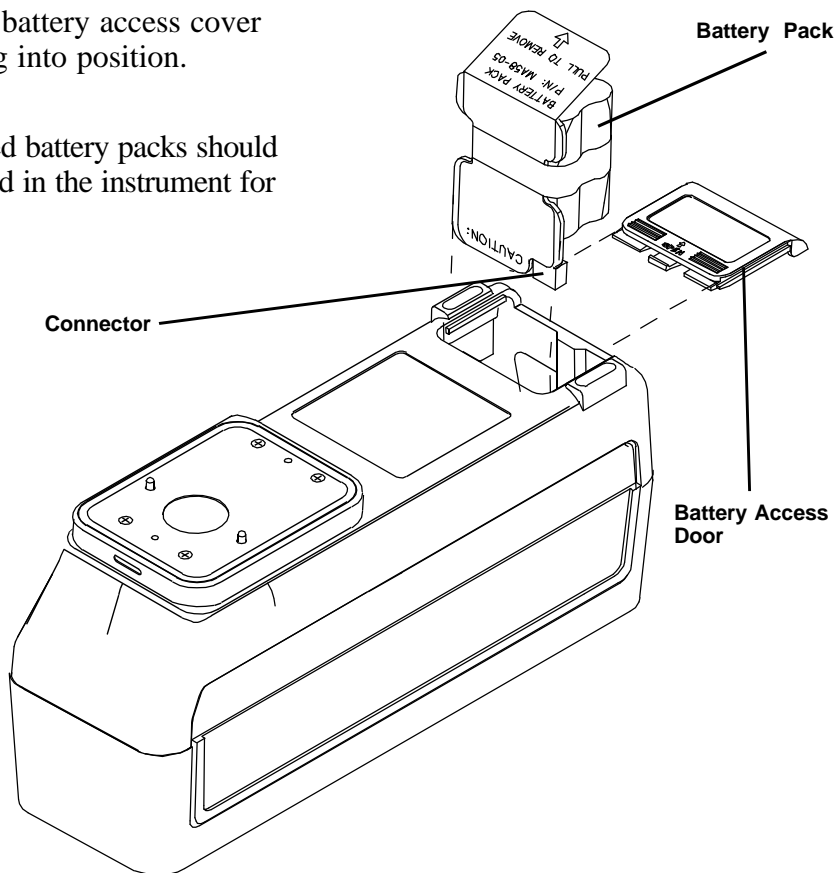
WARNING:

- € Do not invert cans that use freon as a propellant. Doing so could cause damage to the optics assembly.
- € The cleaning fluid provided is for the calibration standards only. DO NOT use this fluid on the instruments optics!



8.3 Replacing the Battery Pack

- 1) Unplug the AC adaptor and turn the power switch Off.
- 2) Carefully place the instrument on it's top and remove battery access cover by sliding towards rear of unit.
- 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.



8.4 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 one year limited warranty. Refer to the Limited Warranty statement on page iii.

8.5 Troubleshooting Tips

Instrument will not turn On (on display):

- 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. 3).
- Clean optics (see Sec. 8.2).
- Contact X-Rite or Authorized Service Center.

Measurement drifts:

- Clean optics (see Sec. 8.2).
- Calibrate instrument (see Sec. 3).
- Contact X-Rite or Authorized Service Center.

Instrument will not calibrate properly:

- Calibration standard needs to be cleaned (see Sec. 3).
- Clean optics (see Sec. 8.2).
- Contact X-Rite or Authorized Service Center.

SECTION 9

BAR CODE READER (optional)

Subjects covered in Section 9 are:

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

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

9.1 Attaching The SP78-200 BCR to the Instrument _____

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

To attach the SP78-200 BCR:

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

To disconnect the SP78-200 BCR:

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

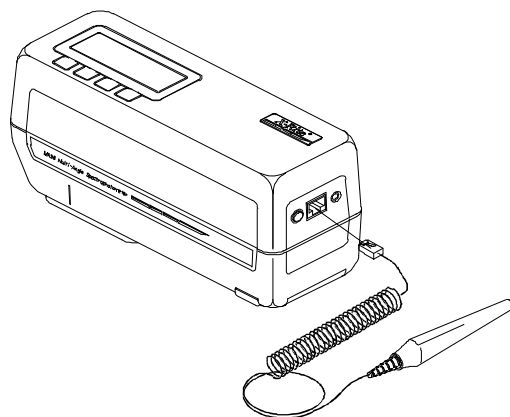


Figure 1

9.2 Scanning a Bar Code

Follow these guidelines for successful bar code scanning.

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

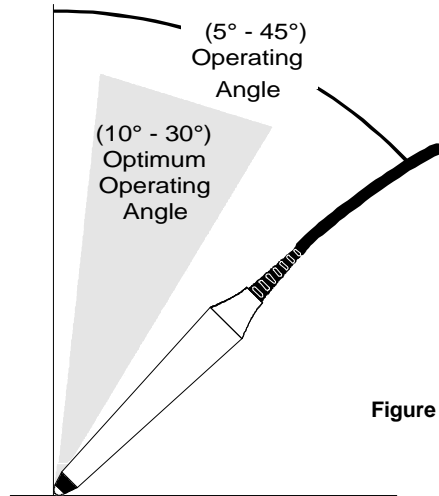


Figure 2

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

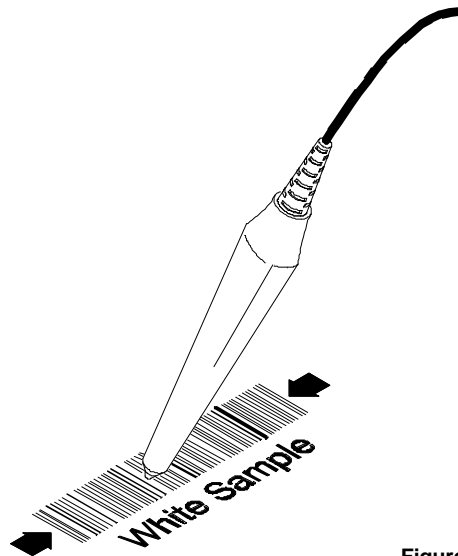


Figure 3

9.3 Troubleshooting

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

To restore the factory default mode:

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

Does the SP78-200 BCR have power?

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

Is the SP78-200 BCR configuration correct?

To restore the factory default mode:

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

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

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

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

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

Was the entire bar code scanned?

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

Does the SP78-200 BCR tip need replacement?

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

To replace the tip:

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

APPENDIX - A

TECHNICAL SPECIFICATIONS

Measuring Geometries:

45° illumination
15°, 25°, 45°, 75°, 110° off
specular viewing
Angular accuracy $\pm 0.2^\circ$
Fiber optic pick-up with
multi-sensor array

Measuring Area:

.5 inch dia (12mm)

Light Source:

Gas-filled tungsten lamp, approx.
3000°K

Illuminant Types:

C, D65, D50, A, F2, F7, F11, &
F12

Standard Observers:

2° & 10°

Receiver:

Blue-enhanced silicon
photodiodes

Spectral Range:

400nm - 700nm

Spectral Interval:

20nm - measured (15nm
bandwidth)
10nm - output

Storage (five angles):

200 Standards
999 Samples

Measurement Range:

0% - 500% Reflectance

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^*_{ab} 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 Adaptor Requirements:

MA68: 90-130VAC, 50-60Hz, 18W
Max
MA68X: 180-260VAC, 50-60Hz, 20W
Max
12VDC @ 700ma: Positive Tip

Charge Time:

In Instrument - 4 hours (50%), 16
hours (100%)
External Pack - Approx. 16 hours

Measurements per charge:

1000 5-angle measurements
(continuous measurements @ 10
sec. 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)

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

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 cm (3.0 in)

Length - 22.5 cm (8.85 in)

Accessories:

Carrying Case, Calibration Standards, Users Manual and AC Adaptor

APPENDIX - B

DISPLAY MESSAGES

The most likely reasons for error messages to display are described below. 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 (500%).
- “**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 zero reflectance standard; 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.



Calibration Error Messages - continued

“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
- SP78-200 Bar Code Reader.....	SP78-200
- Calibration Standard Cleaning Kit	MA58-57
- Portable Thermal Printer (115VAC)	418-113
- Portable Thermal Printer (230VAC)	418X-113
- Wrist Strap.....	MA58-99
- Narrow Sensor Nose.....	MA68-102
- Interconnect cable for Macintosh® computers with 8 pin mini-DIN connector	418-79
- Modular Interconnect Cable (requires adaptor below)	SE108-69
- DB25P DCE (Null Modem) Interface Adaptor	418-70
- DB25S DCE (Null Modem) Interface Adaptor	418-71
- DB25P DTE (Normal) Interface Adaptor	418-80
- DB25S DTE (Normal) Interface Adaptor	418-81
- DB9P Interface Adaptor	418-90
- DB9S Interface Adaptor	418-91



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