



POCKET COLORIMETER™ II ANALYSIS SYSTEMS

INSTRUCTION MANUAL

All Single Wavelength Models

Important Note

This manual is intended for use with the following Pocket Colorimeter™ II instruments:

420 nm	59530-42
450 nm	59530-45
476 nm	59530-47
500 nm	59530-50
528 nm	59530-52
550 nm	59530-55
580 nm	59530-58
600 nm	59530-60
655 nm	59530-65

The Pocket Colorimeter™ II instruments listed above are **not** interchangeable.

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Safety Precautions

Please read this entire manual before unpacking, setting up, or operating this instrument. Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Laboratory Safety

As part of good laboratory practice, please familiarize yourself with the reagents used in these procedures. Read all product labels and the material safety data sheets (MSDS) before using them. It is always good practice to wear safety glasses when handling chemicals. Follow instructions carefully. Rinse thoroughly if contact occurs. If you have questions about reagents or procedures, please contact the manufacturer or distributor.

Use of Hazard Information

If multiple hazards exist, this manual will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

Safety Precautions, continued

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE

Information that requires special emphasis.

Precautionary Labels

Please pay particular attention to labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

 This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.

Specifications

Lamp: Light emitting diode (LED)

Detector: Silicon photodiode

Photometric precision: ± 0.0015 Abs

Filter bandwidth: 15 nm

Wavelength: As specified by model, ± 2 nm

Absorbance range: 0–2.5 Abs

Dimensions: 3.2 x 6.1 x 15.2 cm (1.25 x 2.4 x 6 inches)

Weight: 0.2 kg (0.43 lbs)

Sample cells: 1 cm (10 mL), 25 mm (10 mL)

Operating conditions: 0 to 50 °C (32 to 122 °F); 0 to 90% relative humidity (noncondensing)

Power supply: Four AAA alkaline batteries; approximate life is 2000 tests*

* Backlight usage will decrease battery life.

Specifications, continued

Single Wavelength Pocket Colorimeter™ II Models

Pocket Colorimeter Analysis System	Part Number
420 nm	59530-42
450 nm	59530-45
476 nm	59530-47
500 nm	59530-50
528 nm	59530-52
550 nm	59530-55
580 nm	59530-58
600 nm	59530-60
655 nm	59530-65

See [Table 1](#) on page 1–19 to help select a colorimeter with the appropriate wavelength for the sample to be measured.

Introduction

Pocket Colorimeter™ II instruments* are low-cost, high-quality filter photometers designed for various types of colorimetric measurements. The uncalibrated single wavelength models display a direct readout of absorbance. The instrument has two channels in which measurements can be made.

Each channel will accept a user-defined calibration curve. Up to 10 standards can be used to determine the calibration. The curve is generated by a point-to-point straight line segment between each standard used. Linear and non-linear positive or negative slope calibrations can be performed. See [Calibration Procedure Using Prepared Standards on page 2–17](#).

A calibration curve may also be manually entered from the keypad if a previously determined curve has been made on a Pocket Colorimeter™ II. At least two data pairs (concentration and absorbance) are required. See [Entering a Predetermined Calibration Curve on page 2–20](#).

* U.S. patent 5,083,868

OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

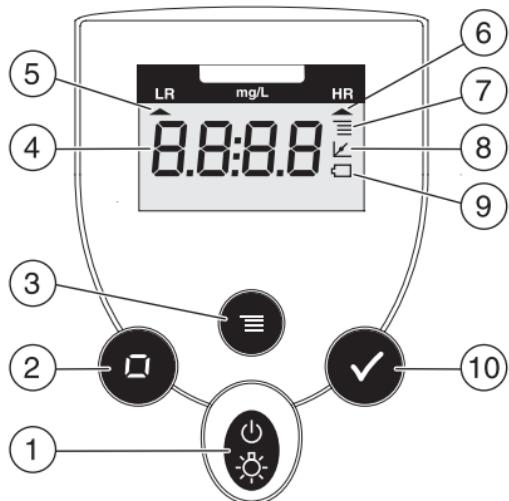
PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

PERICOLO

La manipolazione di campioni, standard e reattivi chimici può essere pericolosa. La preghiamo di prendere conoscenza delle Schede Tecniche necessarie legate alla Sicurezza dei Materiali e di abituarsi con tutte le procedure di sicurezza prima di manipolare ogni prodotto chimico.

Instrument Keys and Display



Item	Description
1	POWER/BACKLIGHT Key
2	ZERO/SCROLL Key
3	 MENU Key
4	Numeric Display
5	Range Indicator
6	Range Indicator
7	Menu Indicator
8	Calibration Adjusted Indicator
9	Battery Low Indicator
10	READ/ENTER Key

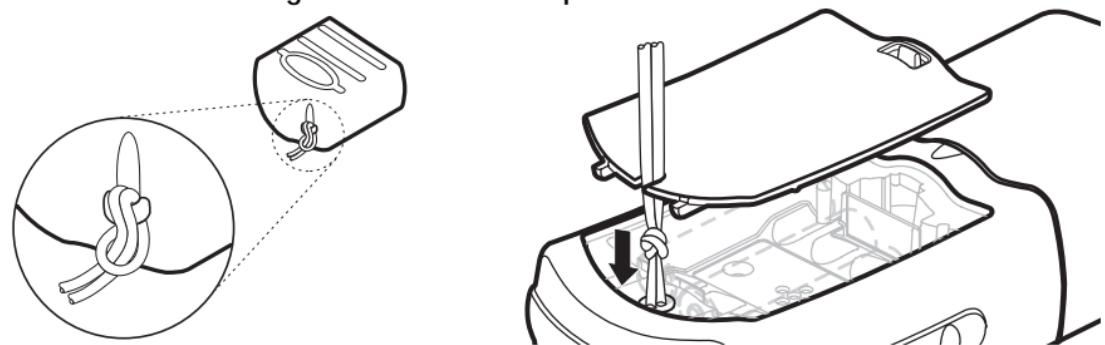
Instrument Cap Cord

The instrument cap for the Pocket Colorimeter™ II doubles as a light shield. Accurate measurements cannot be obtained unless the sample or blank is covered with the cap. Use the instrument cap cord to secure the cap to the body of the colorimeter and prevent loss of the cap. See [Figure 1 on page 1–13](#).

1. Loop the instrument cap cord through the ring on the cap.
2. Remove the battery compartment cover. Press the knotted end of the cord into the hole indicated by the arrow.
3. Slide the cord into the slot on the battery compartment cover. Snap the cover into place.

Instrument Cap Cord, continued

Figure 1 Attaching the Instrument Cap Cord



Basic Colorimetry

Colorimetry is a method of measurement that relates the amount of color in a transparent medium, such as a liquid, to the amount of a particular substance in the liquid. In general, the concentration of the substance being measured is proportional to the intensity of the color in the solution. The darker the color, the higher the concentration. Absorbance (Abs) is a commonly used measure of the amount of light absorbed by the solution. Absorbance is given by:

$$\text{Abs} = -\log T \text{ or } \text{Abs} = -\log (I_T/I_0)$$

Where:

T = Transmittance

I_T = Intensity of light transmitted through the sample

I_0 = Intensity of light entering the sample

Some substances, such as dyes and various metal ions, are already colored and can be measured directly. Other compounds require a chemical reaction in which an indicator reacts with the substance, resulting in a colored product that can be measured. The majority of Hach chemistries are of this variety.

Basic Colorimetry, continued

After the relationship between the amount of color (measured as absorbance) and a sample's concentration is determined, the instrument can be easily used to measure concentrations of unknown samples. While most Hach colorimeters and spectrophotometers already have these relationships preprogrammed, single wavelength Pocket Colorimeter™ II instruments require the operator to use a calibration curve or to manually program the instrument to measure sample concentration.

The amount of color in a sample is determined by measuring the amount of light the solution will absorb. The absorption of light depends on the wavelength of the light and the color of the solution. The light source in a Pocket Colorimeter™ II instrument is an LED that emits a narrow range of wavelengths; an interference filter is used to further narrow the wavelength range. Only samples with certain colors can be measured by any one instrument. The analysis of different colored solutions requires the use of different Pocket Colorimeter™ II instruments, which utilize different LEDs and filters. Hach offers a variety of single wavelength Pocket Colorimeter™ II instruments to accommodate most sample colors. See [Single Wavelength Pocket Colorimeter™ II Models on page 1–8](#).

The wavelength (color) of light used is normally selected so that it has a maximum absorption, but may vary to minimize interferences or other factors. Ideally, the

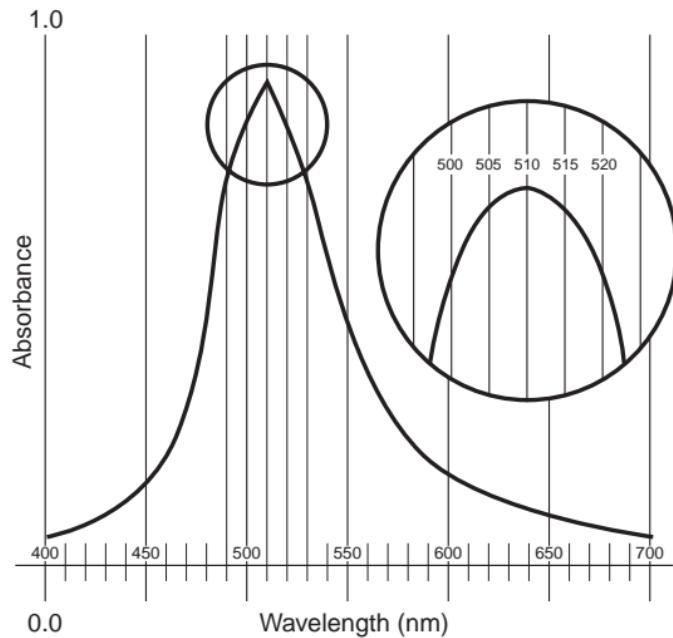
instrument wavelength is selected based on knowledge about the absorbance spectra of the species of interest, as well as the spectra of other colored species which might be present in the sample. [Figure 1 on page 1–18](#) illustrates a typical absorption spectrum.

[Table 1 on page 1–19](#) can be used as a starting point for selecting the appropriate instrument wavelengths for use in testing. This table will not be useful for samples that have more than one absorption region that contribute to the color seen by the eye. For example, a green solution can have a yellow and a blue absorption peak; either peak can be used for measurements if both vary with analyte concentration. Other samples may appear brown due to several contributing spectra.

Other technical references, such as the *Hach Water Analysis Handbook* or *Standard Methods for the Examination of Water and Wastewater* will also list the analytical wavelength that should be used as a reference when considering a calibration on a Pocket ColorimeterTM II.

Basic Colorimetry, continued

Figure 1 Selecting the Best Wavelength, Sample Spectrum



Basic Colorimetry, continued

Table 1 Light Wavelength and Color

Color of Solution ¹	Color of Light Absorbed	Instrument Wavelength
yellow-green	violet	420 nm
yellow	violet-blue	450 nm
orange	blue	476 nm
orange-red	blue-green	500 nm
red	green	528 nm
red-violet	yellow-green	550 nm
blue	yellow	580 nm
greenish-blue	orange	600 nm
bluish-green	red	655 nm

¹Color perceived will vary with absorption spectrum of solution.

Basic Colorimetry, continued

The working range of the Pocket Colorimeter™ II instrument is typically 0 to approximately 1.50 Abs, but may be used up to a range of 2.5 Abs if the chemistry method supports that range. Absorbance increases with increasing sample cell pathlength. The pathlength is the distance the light travels through the sample, which is the internal dimension of the cell. If sample absorbances are greater than 1.50, dilute the sample or use smaller sample cells for the best linearity and accuracy. If a smaller sample cell such as the 1-cm/10-mL cell is used, the calibration should be completed using the smaller cells. Determine the working range for a specific test by observing the calibration curve. The working range is the concentration range in which the deviation from linearity is within acceptable limits.

Calibration curves should ideally intersect the zero absorbance, zero concentration point on the calibration graph. This means that if there is no analyte present in the sample, no absorbance should be measured by the instrument. A non-zero intercept, where no analyte is present in the sample but a positive or negative absorbance is still measured, may occur for several reasons. Factors such as reagent blank, pH, temperature, interfering species, or turbidity differences between the zeroing solution and the sample can cause non-zero intercepts, especially in tests where reagents are used.

Good Analytical Techniques, continued

A reagent blank is the amount of color that is contributed solely by the reagent and not the analyte. In an aqueous sample, the reagent blank is prepared by adding reagents to deionized water. Subtracting a reagent blank value from all measured absorbances can bring the calibration curve closer to the ideal zero intercept.

Some chemistries may be used where the loss of color upon the addition of a reagent determines the concentration of the sample. Such chemistries are referred to as bleaching chemistries because the measured sample is lighter than the solution used to zero the instrument.

The single wavelength Pocket Colorimeter™ II is also capable of reading bleaching or negative absorbance chemistries directly. Zero on the blank (most highly-colored solution) and then read the sample or bleached color directly.

Good Analytical Techniques

Sample cells must be clean and free of scratches where the light passes through them. Ensure that there are no fingerprints or liquid on the outsides of the cells.

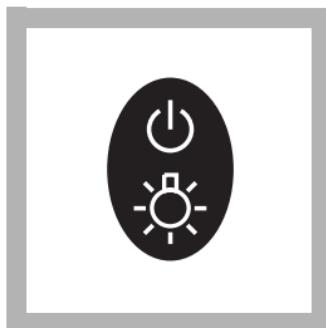
See the *Hach Water Analysis Handbook* (Lit. Code WA01) for detailed information on laboratory practices.

Single Wavelength, Step-by-Step

Note: *The Pocket Colorimeter II is designed to measure solutions contained in sample cells. DO NOT dip the meter in the sample or pour the sample directly into the cell holder.*

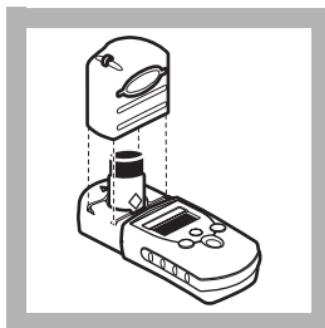


1. Fill a sample cell to the 10-mL line with the blank solution (usually untreated sample).



2. Press the **POWER** key to turn the meter on.
Select a range or channel to enter a user calibration, or select the range of a previously stored calibration.

Note: See [page 2–4](#) for information on selecting the correct range/channel.



3. Remove the meter cap. Place the blank in the cell holder with the diamond mark facing the keypad. Fit the meter cap over the cell compartment to cover the cell.

Note: Wipe excess liquid and finger prints off sample cells.

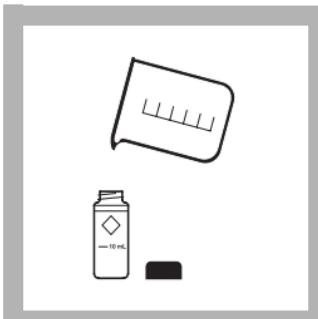
Single Wavelength, Step-by-Step, continued



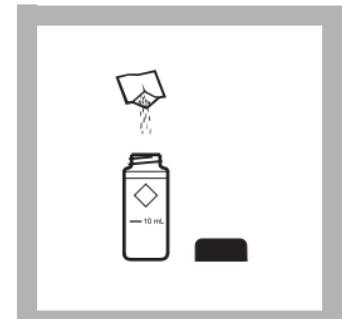
4. Press **ZERO/SCROLL.**

The display will show
" - - - " then "0.000", or the
degree of resolution previously
selected.

Remove the blank from the
cell holder.

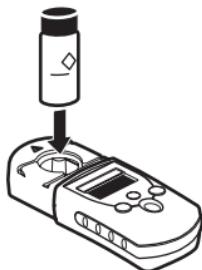


**5. Fill a second clean sample
cell to the 10-mL line with
sample.**

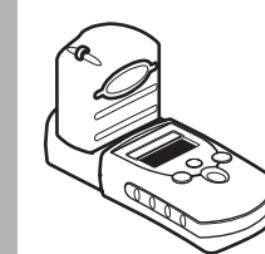


**6. Add the reagents and mix.
When required, wait the
specified reaction time.**

Single Wavelength, Step-by-Step, continued



7. Place the cell containing the prepared sample into the cell compartment.



8. Cover the cell with the instrument cap.



9. Press **READ/ENTER**. The instrument will show “- - - -” followed by the results.

Replacement Parts

Batteries, alkaline, AAA, 1.5 V	4/pkg.....	46743-00
Caps for 1-cm/10-mL Sample Cells	each.....	52626-00
Instrument Cap/Light Shield.....	each.....	59548-00
Instrument Manual	each.....	59582-88
Sample Cells, 10-mL, with caps	6/pkg.....	24276-06
Sample Cells, 1-cm/10-mL.....	2/pkg.....	41658-02

Optional

Water Analysis Handbook	Lit. Code WA01
Standard Methods for the Examination of Water and Wastewater	22708-00



Section 2

Instrument Manual

2-2

Instrument Operation

Key Functions

Key	Description	Function
	POWER	On/Off/Backlight To turn on the backlight, turn on the instrument, then press and hold the power key until the backlight turns on. Press and hold again to turn off the backlight. This key functions the same in all instrument modes and ranges.
	ZERO/SCROLL	In measurement mode, sets the instrument to zero. In menu mode, scrolls through menu options. Also scrolls numbers when entering or editing a value.
	READ/ENTER	In measurement mode, initiates sample measurement. In menu mode, selects a menu option. When entering numbers, moves one space to the right and executes the function when the entry is complete.

Instrument Operation, continued

Key	Description	Function
	MENU	Enter/Exit the menu mode Press and hold for approximately 5 seconds to enter user-entered method mode.

Menu Selections

Press the **MENU** key to access the menu selections.

Switching Ranges

1. Press the **MENU** key. The display will show “SEL”. A flashing arrow indicates the current range.
2. Press the **READ/ENTER** key to toggle between ranges.
3. Press **MENU** again to accept and exit back to the measurement screen.

Setting the Time

1. Press the **MENU** key, then press the **ZERO/SCROLL** key until the display shows a time in the “00:00” format.

2. Press **READ/ENTER**. The digit to be edited will flash.
3. Use the **ZERO/SCROLL** key to change the entry, then press **READ/ENTER** to accept and advance to the next digit. The time is entered in 24-hour format.

Recalling Stored Measurements

1. Press the **MENU** key, then press the **ZERO/SCROLL** key until the display shows RCL. The instrument automatically stores the last 10 measurements.
2. In RCL, press **READ/ENTER** to recall the stored measurements, beginning with the most recent measurement taken. The meter stores the measurement number as 01 (most recent) through 10 (oldest), the time the measurement was taken, and the measurement value. The **ZERO/SCROLL** key allows for selection of a specific measurement by number. The **READ/ENTER** key scrolls through all stored data points.



Battery Installation

[Figure 1 on page 2–7](#) provides an exploded view of battery installation.

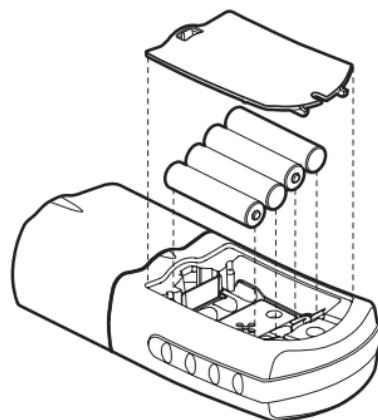
1. Unhook the latch and remove the battery compartment cover. The polarities are shown on the battery holder.
2. Place the four batteries provided with the instrument in the holder as indicated and replace the battery compartment cover. The display will show the software version number (e.g., “P 1.6”) after correct battery installation.

When replacing discharged batteries, always replace the complete set of four alkaline batteries. **Rechargeable batteries are not recommended** and cannot be recharged in the instrument.

Note: *The Low Battery icon will appear on the display when the batteries have 10% battery life remaining. The battery icon will flash when the batteries are too low to complete measurements. See [Instrument Keys and Display on page 1–11](#).*

Instrument Operation, continued

Figure 1 Battery Installation



Error Codes

When the instrument cannot perform the function initiated by the operator, an error message will appear in the display. Refer to the appropriate message information below to determine what the problem is and how it can be corrected. Resolve error messages in the order that they appear on the display. Service Centers are listed in [page 2–37](#).

Error Messages

1. E-0 No Zero (User mode)

Error occurs when trying to read a standard in the user calibration mode before setting the meter to zero.

- Zero the instrument on an appropriate blank.

2. E-1 Ambient Light Error

There is too much light present to take a valid measurement.

- Verify instrument cap is correctly seated.
- If the problem persists, contact a Service Center ([page 2–37](#)).

Error Codes, continued

3. E-2 LED Error

The LED (light source) is out of regulation.

- Replace batteries.
- Verify LED lights up (inside the cell holder) when the **READ/ENTER** or **ZERO/SCROLL** key is pressed.
- If the problem persists, contact a Service Center ([page 2–37](#)).

Note: When an E-1 or E-2 error occurs on a measurement, the display will show “_.__”. (The decimal place is determined by the chemistry.) If the E-1 or E-2 error occurs while zeroing the meter, the meter will require the user to re-zero.

4. E-3 Standard Adjust Error

The value obtained on the prepared standard exceeds the adjustment limits allowed for the standard concentration, or the concentration of the standard is outside the concentration range allowed for standard calibration adjust.

- Prepare the standard and rerun according to the procedure.
- Prepare a standard at or near the recommended concentrations given in the procedure.
- Verify that the concentration of the standard has been entered correctly.

- If the problem persists, contact a Service Center ([page 2–37](#)).
- 5. E-6 Abs Error (User mode)**
- Indicates that the absorbance value is invalid, or indicates an attempt to make a curve with less than two points.
- Enter or measure the absorbance value again.
 - If the problem persists, contact a Service Center ([page 2–37](#)).
- 6. E-7 Standard Value Error (User mode)**
- Standard concentration is equal to another standard concentration that is already entered.
- Enter the correct standard concentration.
 - If the problem persists, contact a Service Center ([page 2–37](#)).
- 7. E-9 Flash Error**
- The meter is unable to save data.
- If the problem persists, contact a Service Center ([page 2–37](#)).

Error Codes, continued

8. Underrange—flashing number below stated test range

- Verify instrument cap is correctly seated.
- Check zero by measuring a blank. If error recurs, re-zero the instrument.
- If the problem persists, contact a Service Center ([page 2–37](#)).

Note: See [Maximum/Minimum Displayed Value on page 2–26](#) for more information.

9. Overrange—flashing number above stated test range

Note: Flashing value will be 10% over the upper test limit.

- Check for light blockage.
- Dilute and retest sample.

Note: See [Maximum/Minimum Displayed Value on page 2–26](#) for more information.

Standard Calibration Adjust

The Pocket Colorimeter™ II instrument is factory-calibrated and ready for use without user calibration. Use of the factory calibration is recommended unless the user is required to generate a calibration. The Standard Calibration Adjust can be used to meet regulatory requirements.

This feature allows the factory default calibration curve to be adjusted with a known standard. Use the standard described in the procedure.

1. Place a blank in the meter (in measurement mode). Press **ZERO/SCROLL**.
2. Place the reacted standard in the meter. Press **READ/ENTER**.
3. Press **MENU**, then press **ZERO/SCROLL** until the display shows “SCA”.
4. Press **READ/ENTER** to display the standard calibration adjust value.
5. Press **READ/ENTER** to adjust the curve to the displayed value. The meter will return to the measurement mode and the Calibration Adjusted icon will appear in the display window.

If an alternate concentration is used, or if a standard concentration is not given:

6. Repeat steps 1–4.

Standard Calibration Adjust, continued

7. Press **ZERO/SCROLL** to access the Edit function, then press **READ/ENTER** to begin editing. The digit to be edited will flash. Use the **ZERO/SCROLL** key to change the entry, then press **READ/ENTER** to accept and advance to the next digit.

When the last digit is entered, press **READ/ENTER** and the meter will adjust the curve to the value entered. The meter will return to measurement mode and the Calibration Adjusted icon will appear in the display window.

To turn off Standard Calibration Adjust (SCA):

1. Press **MENU**.
2. Press **ZERO/SCROLL** until “SCA” appears in the display.
3. Press **READ/ENTER**, then press **ZERO/SCROLL** until “Off” appears in the display.
4. Press **READ/ENTER** to turn off SCA.

Note: Perform another standard calibration adjust to turn SCA on again.

Note: For meters with factory-calibrated ranges or methods, Standard Calibration Adjust (SCA) will be disabled when a user-entered method is programmed into the meter. To turn SCA back on, restore the meter to factory default calibration. See Retrieving the Factory Calibration on page 2–25.

User-Entered Calibration

Overview

The Pocket Colorimeter™ II will accept a user-prepared calibration curve. The curve can extend from 0 to 2.5 absorbance. A user-prepared calibration curve may be entered into any channel that does not contain a factory-programmed curve. These channels are labeled “abs” on instruments having a single factory calibration or are labeled “1” and “2” on the uncalibrated single wavelength instruments. Any chemistry that can be run at the instrument wavelength may be user-entered in these channels.

Using prepared standard solutions that cover the range of interest, the meter generates a calibration curve by calculating the straight-line segments between each standard entered. A calibration curve may be entered using the keypad. Factory-entered calibration curves may also be recalculated or adjusted using the same procedure.

To enter the user-entered calibration mode, press the **MENU** key and hold it down until the display shows “USER” (about 5 seconds), followed by “CAL”. Press **ZERO/SCROLL** to scroll through the options.

User-Entered Calibration, continued

- CAL—Used to enter and edit standard values and measure absorbance values, or review the existing calibration.
- Edit—Used to enter and edit standard values and absorbance values with the keypad or review the existing calibration. Used to enter a predetermined calibration curve.
- dFL—Used to return the instrument back to the default factory calibration. User-entered calibrations are stored upon exit from the calibration or edit modes.

Note: To return to factory settings, following the instructions in [Retrieving the Factory Calibration on page 2–25](#).

If the instrument is shut off or loses power during data entry, all edits will be lost. Automatic shut-off in user-entered calibration entry mode is 60 minutes.

CAL and Edit Submenus

In CAL mode, standard values are entered and absorbance values are measured. In Edit mode, standard and absorbance values are entered.

- To select CAL from the User menu, press **READ/ENTER**.
- To select Edit from the User menu, press **ZERO/SCROLL** and **READ/ENTER**.

- Once in the CAL or Edit option, press the **READ/ENTER** key to navigate through each option.

*Note: Press **ZERO/SCROLL** to quickly scroll through each option.*

Calibration Procedure Using Prepared Standards

Note: *Deionized water or a reagent blank can be used to zero during the calibration procedure. Calibrations generated with deionized water as the zero will give less accurate results if the reagent blank is significantly more turbid or colored than deionized water. Use the deionized water or the reagent blank as the zero concentration point (S0) in the following calibration procedure.*

- Turn on the instrument and select the range to be calibrated. An arrow at the top of the display will point to the selected range. To change ranges, press the **MENU** key, then use the **READ/ENTER** key to toggle between ranges 1 and 2. Press **MENU** again to return to measurement mode.
- Follow the procedure for the chemical method to be calibrated. Prepare a reagent blank (if needed) and a standard solution. Allow the color to develop fully.

User-Entered Calibration, continued

3. Insert the reagent blank or deionized water into the meter and cover with the cap. Press the **ZERO/SCROLL** key. The meter will display “- - - -”, followed by “0.000”. This initializes (zeroes) the meter.
4. Press the **MENU** key and hold it down until the display shows “USER”, followed by “CAL”. Press **READ/ENTER** to enter the calibration mode.
5. In factory-calibrated meters, S0 will appear in the display.

Note: When recalibrating a factory-calibrated meter or range, RES (resolution) cannot be changed.

6. In uncalibrated meters or meters with ranges labeled Abs, “RES” will appear. Press **ZERO/SCROLL** to review the current resolution (decimal placement). Press **ZERO/SCROLL** again to accept the current resolution. To change the resolution, press **READ/ENTER**, then **ZERO/SCROLL** to change the resolution. Press **READ/ENTER** to accept the new resolution. “S0” will appear on the display.
7. Press the **READ/ENTER** key again, then enter the blank value.
*Note: Press the **READ/ENTER** key to move from digit to digit. Use the **ZERO/SCROLL** key to change the number.*
8. After completing entry of the blank value, press the **READ/ENTER** key. The display will show “A0”.

User-Entered Calibration, continued

9. Insert the reagent blank or deionized water into the cell holder. Cover the blank with the instrument cap.
10. Press the **READ/ENTER** key. The meter will measure and display the absorbance value for “S0”.
11. Remove the sample blank. Press the **ZERO/SCROLL** key. “S1” will appear. Press the **READ/ENTER** key, then enter the first standard value.

*Note: Press the **READ/ENTER** key to move from digit to digit. Use the **ZERO/SCROLL** key to change the number.*

12. After completing entry of the first standard value, press the **READ/ENTER** key. The display will show “A1”.
13. Insert the first reacted standard solution into the cell holder. Cover the prepared standard with the instrument cap.
14. Press the **READ/ENTER** key. The meter will measure and display the absorbance value for S1.
15. The calibration is complete with two points. If additional standards are required, press **ZERO/SCROLL** until “Add” appears on the display. Repeat steps **11–14** to enter additional standards.

User-Entered Calibration, continued

16. Press the **MENU** key twice to exit and accept the changes. The instrument will use this calibration to determine the displayed concentration of future sample measurements.

Entering a Predetermined Calibration Curve

Note: Entering a predetermined calibration curve requires at least two data pairs. Each data pair requires a concentration value and the absorbance value for the given concentration. Up to 10 data pairs may be entered. This procedure uses the Edit mode.

1. Turn on the instrument and select the range to be calibrated. An arrow at the top of the display will point to the selected range. To change ranges, press the **MENU** key, then use the **READ/ENTER** key to toggle between ranges 1 and 2. Press **MENU** again to return to measurement mode.
2. Press the **MENU** key and hold it down until the display shows “USER”, followed by “CAL”. Press **ZERO/SCROLL** to scroll to EDIT. Press **READ/ENTER**.
3. In uncalibrated meters or in Abs range, “RES” will appear. Press **ZERO/SCROLL**. To change the resolution (decimal placement), press **READ/ENTER**. Press **ZERO/SCROLL** to select the new resolution, then press **READ/ENTER** to accept. “S0” will appear on the display.

User-Entered Calibration, continued

4. Enter the concentration value and absorbance value of the first data pair (S0, A0).
5. To enter the S0 value, press **READ/ENTER**. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the S0 concentration value is entered.
6. After editing the S0 value, press **READ/ENTER** to accept. “A0” will appear on the display.
7. To enter the absorbance value for S0, press the **READ/ENTER** key to go to entry mode. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the absorbance value for S0 is entered.
8. After entering A0, press **READ/ENTER** to accept. “S1” will appear on the display.
9. Repeat steps **5** through **8** for each standard value and absorbance value pair in the calibration curve

*Note: After A1 is entered, Add will appear in the display. If additional data pairs are to be entered, press **READ/ENTER** and continue with step **9**.*

User-Entered Calibration, continued

- When all the calibration data has been entered, press **MENU** twice to return to the measurement mode.

Editing a User-entered or Factory Calibration Curve

- Press the **MENU** key and hold it down until the display shows “USER”, followed by “CAL”. Press **ZERO/SCROLL** until EDIT appears.
- Press the **READ/ENTER** key to enter Edit mode. In factory-calibrated meters, “S0” will appear in the display.

Note: When editing a factory-calibrated meter or range, RES (resolution) cannot be changed.

*Note: When RES or S0 appears in the display, press **ZERO/SCROLL** to quickly scroll to the data to be edited.*

- In uncalibrated meters or in Abs range, “RES” will appear. Press **ZERO/SCROLL** to review the current resolution. Press **ZERO/SCROLL** again to accept the displayed resolution. To change the resolution (decimal placement), press **READ/ENTER**. Press **ZERO/SCROLL** to select the new resolution, then press **READ/ENTER** to accept. “S0” will appear on the display.
- Press **READ/ENTER**. The current concentration value for S0 will appear on the display.

User-Entered Calibration, continued

5. To edit the S0 value, press **READ/ENTER**. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the S0 concentration value is entered.
6. After editing the S0 value, press **READ/ENTER** to accept. “A0” will appear on the display.
7. To edit the absorbance value for S0, press the **READ/ENTER** key to go to entry mode. Use the **ZERO/SCROLL** key to select the numerical value, then press the **READ/ENTER** key to accept the entry and advance to the next decimal place. Repeat this sequence until the absorbance value for S0 is entered.
8. After editing A0, press **READ/ENTER** to accept. “S1” will appear on the display.
9. Repeat steps **4** through **8** for each standard value and absorbance value pair in the calibration curve.
10. When all calibration data has been reviewed or edited, “ADD” will appear in the display.
11. Press **READ/ENTER** to add more calibration points, or press **MENU** twice to return to the measurement mode.

User-Entered Calibration, continued

Note: When a factory calibration curve has been edited, the “calibration adjust” icon will appear in the display.

Exiting the Calibration Routine

Exit the calibration routine by pressing the **MENU** key to return to measurement mode. The instrument uses the last completed user-entered calibration or the factory calibration if no user-entered calibration has been completed.

Deleting Calibration Points

1. Select the range containing user-entered calibration points. See [Switching Ranges on page 2–4](#).
2. Press and hold the **MENU** key until “USER”, then “CAL” appears. Press **READ/ENTER**.

Note: Calibration points can also be deleted in Edit mode.

3. Press **ZERO/SCROLL** to select the point to delete (e.g., S0 or S1 or S2). Press **READ/ENTER**.
4. The left digit will flash. Press **ZERO/SCROLL** until “dEL” appears. (“dEL” will appear after the numeral 9.)

5. Press **READ/ENTER** to delete. Repeat for all points to be deleted.

Note: The minimum number of valid points is two. For example, if five points have been entered, three can be deleted using this feature.

6. Press **MENU** to return to the measurement mode.

Retrieving the Factory Calibration

1. Select the range to restore factory default calibration. See [Switching Ranges on page 2–4](#).
2. Press and hold the **MENU** key until “USER”, then “CAL” appears.
3. Press the **ZERO/SCROLL** key to find dFL.
4. Press the **READ/ENTER** key to select dFL and restore the instrument to the factory default calibration.

Note: For meters with factory-calibrated ranges or methods, Standard Calibration Adjust (SCA) will be disabled when a user-entered method is programmed into the meter. To turn SCA back on, restore the meter to factory default calibration.

User-Entered Calibration, continued

Maximum/Minimum Displayed Value

In meters with absorbance (Abs) ranges, the maximum displayed value and minimum displayed value is related to the value of the standards entered in a user calibration.

Measurements that exceed the minimum or maximum standards entered in the user calibration will return a flashing number indicating “underrange” or “overrange”. See *Error Codes* (page [2–12](#)) for more information.

Example 1

For a calibration with the following standards:

$$S_0=0.000$$

$$S_1=1.000$$

Maximum Displayed Value	1.000
Minimum Displayed Value	0.000

User-Entered Calibration, continued

Example 2

For a calibration with the following standards:

$$S_0=1.00$$

$$S_1=2.00$$

$$S_2=4.00$$

Maximum Displayed Value	4.00
Minimum Displayed Value	1.00

For Hach-calibrated programs, the maximum and minimum displayed values always equal the factory-calibrated values and cannot be changed.

Certification

Hach Company certifies this instrument was tested thoroughly, inspected, and found to meet its published specifications when it was shipped from the factory.

The Pocket Colorimeter™ II instrument has been tested and is certified as indicated to the following instrumentation standards:

EMC Immunity:

Per 89/ 336/ EEC EMC: EN 61326: 1998 (Electrical Equipment for measurement, control and laboratory use—EMC requirements). Supporting test records by Hach Company, certified compliance by Hach Company.

Standard(s) include:

IEC 1000-4-2: 1995 (EN 61000-4-2: 1995) Electro-Static Discharge Immunity (Criteria B)

IEC 1000- 4- 3: 1995 (EN 61000- 4- 3: 1996) Radiated RF Electro- Magnetic Field Immunity (Criteria A)

Additional Immunity Standard(s) include:

ENV 50204: 1996 Radiated Electromagnetic Field from Digital Telephones

(Criteria A) Radio Frequency Emissions:

Per 89/ 336/ EEC EMC: EN 61326: 1998 (Electrical Equipment for measurement, control and laboratory use—EMC requirements) “Class B” emission limits.

Supporting test records from Hach EMC Test Facility, certified compliance by Hach Company.

Additional Radio Frequency Emissions Standard(s) include:

EN 55022 (CISPR 22), Class B emissions limits.

Canadian Interference-causing Equipment Regulation, IECS-003, Class A:

Supporting test records from Hach EMC Test Facility, certified compliance by Hach Company.

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

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

FCC Part 15, Class “A” Limits: Supporting test records from Hach EMC Test Facility, certified compliance by Hach Company.

Certification, continued

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Remove power from the Pocket Colorimeter instrument by removing one of its batteries to verify that it is or is not the source of the interference.
2. Move the Pocket Colorimeter instrument away from the device receiving the interference.
3. Reposition the receiving antenna for the device receiving the interference.
4. Try combinations of the above.



GENERAL INFORMATION

At Hach Company, customer service is an important part of every product we make.

With that in mind, we have compiled the following information for your convenience.

How to Order

By Telephone:

6:30 a.m. to 5:00 p.m. MST

Monday through Friday

(800) 227-HACH (800-227-4224)

By FAX:

(970) 669-2932 (Hach Loveland)

Information Required:

- Hach account number (if available)
- Billing address
- Shipping address
- Your name and phone number
- Purchase order number
- Catalog number
- Brief description or model number
- Quantity

How to Order, continued

Technical and Customer Service (USA only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use and to take your orders. Specialists in analytical methods, they are happy to put their talents to work for you.

Call **1-800-227-4224** or E-mail techhelp@hach.com.

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send E-mail to intl@hach.com or call (970) 669-3050.

In Canada

Hach Instrument Service Centre, Winnipeg, Manitoba, Canada

Telephone: (204) 632-5598; (800) 665-7635

FAX: (204) 694-5134

Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:

Hach Company
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (USA only)
FAX: (515) 232-3835

Latin America, Caribbean, Africa,

Far East, Indian Subcontinent:
Hach Company World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Canada:

Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

Europe, the Middle East,

or Mediterranean Africa:
HACH Company, c/o
Dr. Bruno Lange GmbH & CO. KG
Willstätterstr. 11
40549 Düsseldorf, Germany
Telephone: +49/(0)211/52 88-0
FAX: +49/(0)211/52 88-134

Warranty

Hach Company warrants this product to the original purchaser against any defects that are due to faulty material or workmanship for a period of **two years from date of shipment.**

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- damage caused by misuse, neglect, accident or improper application or installation
- damage caused by any repair or attempted repair not authorized by Hach Company
- any product not used in accordance with the instructions furnished by Hach Company
- freight charges to return merchandise to Hach Company
- freight charges on expedited or express shipment of warranted parts or product
- travel fees associated with on-site warranty repair

Warranty, continued

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.