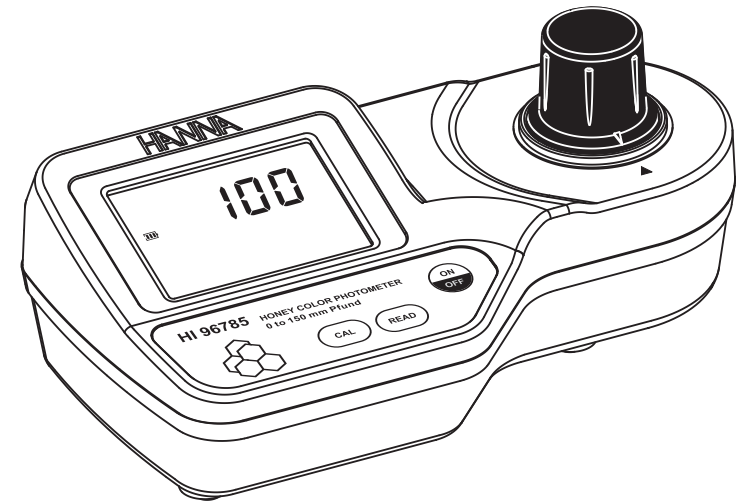


Instruction Manual

HI 96785C Honey Color Analyzer



Dear Customer,

Thank you for choosing a Hanna product. This manual will provide you with the necessary information for the correct use of the instrument. Please read it carefully before using the meter. If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.

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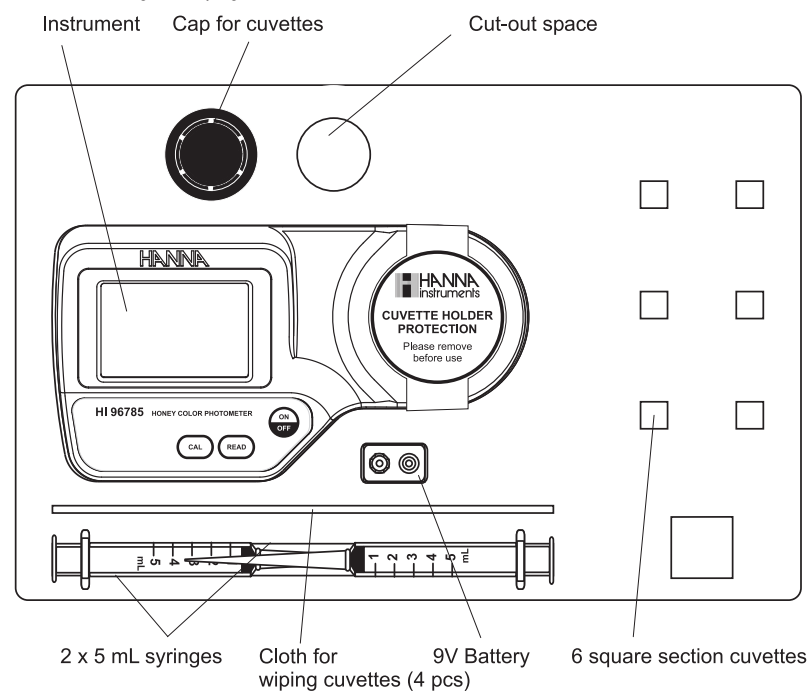
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PRELIMINARY EXAMINATION

Please examine this product carefully. Make sure that the instrument is not damaged. If any damage occurred during shipment, please notify your Dealer.

Each HI 96785 Ion Selective Meter is supplied complete with:

- Five Sample Cuvettes
- One Light Shield Cap
- 30 mL Glycerol (1 bottle)
- 9V Battery
- Cloth for wiping cuvettes
- Instrument quality certificate
- Instruction Manual
- Rigid carrying case



Note: Save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing.

GENERAL DESCRIPTION

The **HI 96785** is an auto diagnostic portable microprocessor meter that benefits from Hanna's years of experience as a manufacturer of analytical instruments. It has the advanced optical system based on two special tungsten lamps and two narrow band interference filters that allows most accurate and repeatable readings. All instruments are factory calibrated and the electronic and optical design minimizes the need of frequent calibration.

Display messages aid the user in routine operation. The meter has an auto-shut off feature that will turn off the instrument after 10 minutes of non use in *measurement mode*.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell.

The **HI 96785** measures the percent of light transmittance of honey compared to analytical reagent grade glycerol. The instrument directly displays the measurement result expressed in mm Pfund.

ABBREVIATIONS

mV: millivolts

mL: milliliter

LCD: Liquid Crystal Display

mm Pfund: milliliters Pfund

USDA: US Department of Agriculture

SIGNIFICANCE AND USE

Honey color varies naturally in a wide range of tonalities, ranging from light yellow to amber, dark amber and black in extreme cases; sometimes green or red hues may also occur.

Color of untreated honey depends on botanical origin: for this reason color is very important for definition and commercial classification of monofloral honeys. Honey darkens with aging, and other changes in color may result from beekeeper's interventions and from the different ways of conservation (e.g.: use of old honeycombs, contact with metals, high temperatures, exposition to light, etc.).

The primary characteristic for commercial honey classification is color. Color classes are expressed in millimeters (mm) Pfund grades, compared to an analytical grade Glycerol Standard Reference.

Table 1 reports the USDA classification for honey samples and the related mm Pfund values.

Table 2 shows the color of different monofloral honeys: data are obtained from a statistical set of honey samples. The table reports for each type of honey: average value of color, standard deviation, and the minimum and maximum values measured.

<u>USDA Color Standards Designation</u>	<u>Color Range Pfund Scale (mm)</u>
Water White	8 or less
Extra White	8 to 17
White	17 to 34
Extra Light Amber	34 to 50
Light Amber	50 to 85
Amber	85 to 114
Dark Amber	more than 114

<u>Honey Type common name</u>	<u>latin name</u>	<u>AVERAGE (mm Pfund)</u>	<u>SD (mm Pfund)</u>	<u>Min. value (mm Pfund)</u>	<u>Max. Value (mm Pfund)</u>
Acacia tree	Robinia pseudoacacia	15	6	11	27
Chestnut tree	Castanea sativa	92	19	62	119
Citrus spp.	Citrus spp.	14	5	11	35
Dandelion	Taraxacum officinalis	54	11	41	71
Eucalyptus	Eucalyptus spp.	58	11	41	71
Fir honeydew		98	8	83	110
Fir tree honeydew		99	16	83	130
French honeysuckle	Hedysarium coronarium	18	6	11	35
Heather	Erica arborea	96	10	83	119
Lime tree	Tilia spp.	43	17	11	71
Rhododendron	Rhododendron spp.	13	5	11	27
Strawberry tree	Arbutus unedo	70	10	55	83
Sunflower	Helianthus annuus	61	6	51	71
Thyme	Thymus spp.	52	16	27	83

SPECIFICATIONS

Range	0 to 150 mm Pfund
Resolution	1 mm Pfund
Accuracy	±2 mm Pfund @ 80 mm Pfund
Typical EMC Deviation	1 mm Pfund
Light Source	Tungsten lamp
Light Detector	Silicon Photocell with narrow band interference filter @ 420 nm and 525 nm
Method	Direct Measurement
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Battery Type	1 x 9 volt
Auto-Shut off	After 10' of non-use in <i>measurement mode</i> ; with last reading reminder.
Dimensions	192 x 102 x 67 mm (7.6 x 4 x 2.6")
Weight	290 g (10 oz.).

REQUIRED STANDARD

<u>Description</u>	<u>Quantity/test</u>
Glycerol	4 mL

PRINCIPLE OF OPERATION

Absorption of Light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices.

If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of the substance according to the Lambert-Beer Law:

$$-\log \frac{I}{I_0} = \epsilon_{\lambda} c d$$

or

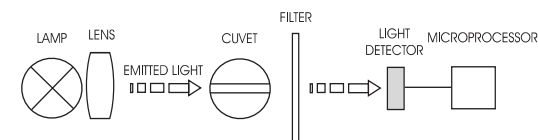
$$A = \epsilon_{\lambda} c d$$

Where:

$-\log \frac{I}{I_0}$	= Absorbance (A)
I_0	= intensity of incident light beam
I	= intensity of light beam after absorption
ϵ_{λ}	= molar extinction coefficient at wavelength λ
c	= molar concentration of the substance
d	= optical path through the substance

Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known.

Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents. Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements. The optical system of Hanna's **HI 96** series colorimeters is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.



HI 96 series block diagram (optical layout)

A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed to the sample contained in the cuvette. The optical path is fixed by the diameter of the cuvette. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity I_0 or I .

The photoelectric cell collects the radiation I that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range.

The microprocessor uses this potential to convert the incoming value into the desired measuring unit and to display it on the LCD.

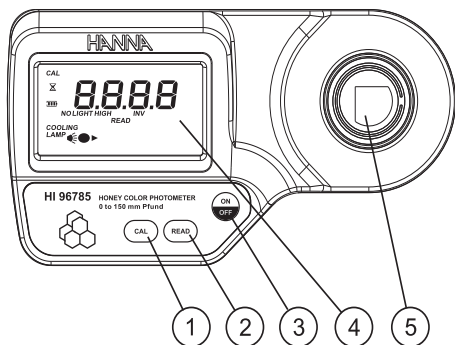
The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed.

The cuvette has a very important role because it is an optical element and thus requires particular attention. It is important that both, the measurement and the calibration (zeroing) cuvettes, are optically identical to provide the same measurement conditions. Whenever possible use the same cuvette for both. It is necessary that the surface of the cuvette is clean and not scratched. This to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvette walls with hands.

Furthermore, in order to maintain the same conditions during the zeroing and the measuring phases, it is necessary to close the cuvette to prevent any contamination.

FUNCTIONAL DESCRIPTION

INSTRUMENT DESCRIPTION



- 1) CAL key
- 2) READ key
- 3) ON/OFF key
- 4) Liquid Crystal Display (LCD)
- 5) Cuvette holder

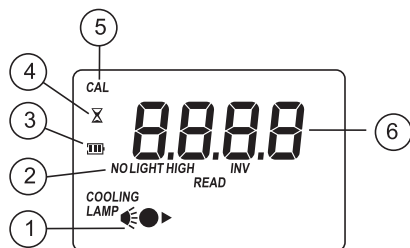
KEYPAD DESCRIPTION

- **ON/OFF**: to turn the meter on and off.
- **CAL**: to calibrate the meter prior to measurement.
- **READ**: to make a measurement.

OPERATING MODES

- *Measurement mode*: default operation mode, enables both **calibration** and **measurement**.

DISPLAY ELEMENTS DESCRIPTION

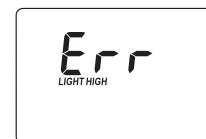


- 1) The measuring scheme (lamp, cuvette, detector), appears during different phases of zero or reading measurement
- 2) Error messages and warnings
- 3) The battery icon shows the charging level of the battery
- 4) The hourglass appears when an internal checking is in progress
- 5) Status message
- 6) Four digit main display

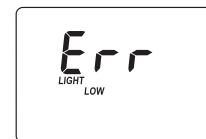
ERRORS AND WARNINGS

The instrument shows clear messages when erroneous condition appears. Messages are also displayed when the obtained values are outside expected range. The beeper is playing a beep on errors.

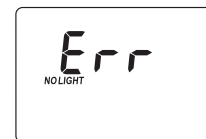
a) on calibration



Light High: There is too much light to perform a measurement. Please check the preparation of the calibration cuvette.

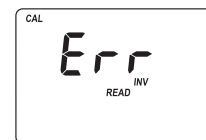


Light Low: There is not enough light to perform a measurement. Please check the preparation of the calibration cuvette.



No Light: The instrument cannot adjust the light level. Please check that the calibration cuvette does not contain any debris.

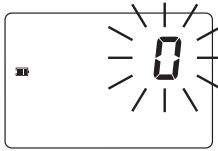
b) on sample reading



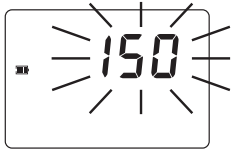
Inverted Cuvettes: The sample and the calibration cuvette are inverted.



CAL: A Calibration reading was not taken. Follow the instructions of the measurement procedure for calibrating the meter.



Under range: A blinking "0" indicates that the sample absorbs less light than the calibration reference. Check the procedure and recalibrate the instrument.

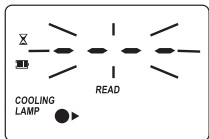


Over Range: A flashing value of the maximum concentration indicates an over range condition. The concentration of the sample is beyond the programmed range.

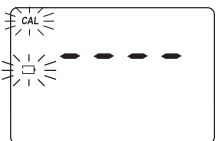
d) other errors and warnings



Cap error: Appears when external light enters in the analysis cell. Assure that the light shield cap is present.



Cooling lamp: The instrument waits for the lamp to cool down.



Battery low: The battery must be replaced soon.

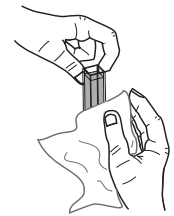


Dead battery: This indicates that the battery is dead and must be replaced. Once this indication is displayed, the meter will lock up. Change the battery and restart the meter.

GENERAL TIPS FOR AN ACCURATE MEASUREMENT

The instructions listed below should be carefully followed during testing to ensure best accuracy.

- Use matched square cuvettes, having 4 clear faces and 10 mm path length.
- Do not touch the cuvette walls with hands.
- Whenever the cuvette is placed into the measurement cell, it must be dry outside, and completely free of fingerprints, oil or dirt. Wipe it thoroughly with **HI 731318** or a lint-free cloth prior to insertion.
- It is important that the sample does not contain any debris. This would corrupt the reading.
- Samples should be completely free of air bubbles. If bubbles are present tap the cuvette on the table to remove them.
- It is recommended to take the sample of honey in the middle of the container.
- It is recommended to take and analyze samples at room temperature.
- Do not use the same cuvette with glycerol for more than 5-10 times to perform calibration and dispose of it after 1 day has passed.
- Never re-use honey sample cuvettes, dispose them after use.



Note: Honey samples exposed to direct sun light and/or air will darken over time. This is caused by microorganisms.

STARTUP

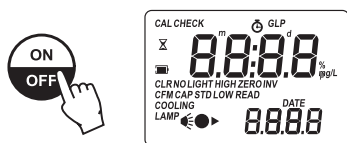
Prepare the instrument for measurement as follows:

- Unpack the instrument by removing the dust protection sleeve from the instrument cuvette holder.
- Place the battery in the instrument as described in the “BATTERY REPLACEMENT” chapter.
- Place the instrument on a flat table.
- Do not place the instrument under direct sun light.

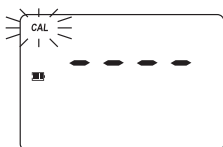
MEASUREMENT PROCEDURE

To compensate the meter for the sample turbidity or color, the measurement takes place in two phases. First, the meter is calibrated using the glycerol. After the honey is measured.

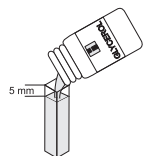
- Turn the meter on by pressing **ON/OFF**. The display briefly shows all tags on.



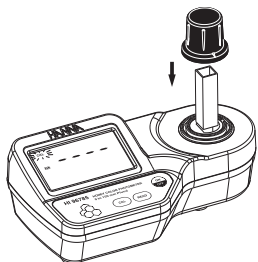
- When the beeper sounds briefly and the LCD displays dashes, the meter is ready. The blinking “CAL” indicates that the instrument needs to be calibrated first.



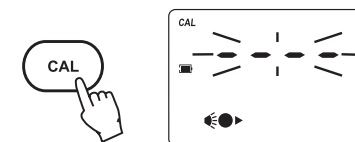
- Fill one cuvette with 4 mL of Glycerol, up to 5 mm (0.2”) below the rim. This is the Glycerol Standard Reference.



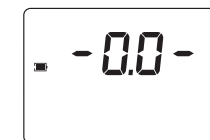
- Place the cuvette into the cuvette holder paying attention to the direction of the light indicated by the arrow on the instrument. Then put the light shield cap on and ensure that the notch on the cap is positioned securely into the groove.



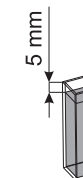
- Press **CAL** and the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.



- After a few seconds, the display will show “-0.0-”. The meter is now calibrated and ready for measurement.

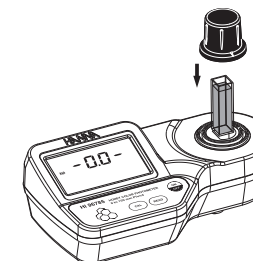


- Remove the Glycerol cuvette.

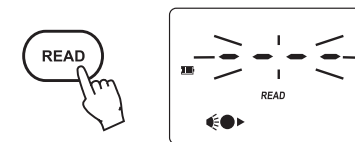


- Add to a second clean cuvette about 4 mL of honey, up to 5 mm (0.2”) below the rim. This is the sample.

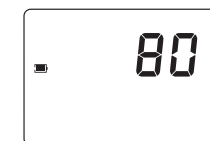
- Place the sample cuvette into the cuvette holder paying attention to the direction of the light indicated by the arrow on the instrument. Then put the light shield cap on and ensure that the notch on the cap is positioned securely into the groove.



- Press **READ** and the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.



- At the end of measurement, the instrument directly displays the honey color intensity value expressed in mm Pfund, as compared to analytical grade Glycerol (fixed at zero Pfund).



INTERFERENCES

Interference may be caused by air bubbles or turbidity in the sample. Scratched or dirty cuvettes will also affect readings. Always check clearness of cuvettes prior to use.

BATTERY MANAGEMENT

To save battery, the instrument shuts down after 10 minutes of non-use in *measurement mode*. If a valid measurement was displayed before auto shut off, the value is displayed when the instrument is switched on. The blinking "CAL" means that a new calibration has to be performed.



One fresh battery lasts for around 350 measurements, depending on the light level. The remaining battery capacity is evaluated at the instrument startup and after each measurement. The instrument displays a battery indicator with three levels as follows:

- 3 lines for 100 % capacity
- 2 lines for 66 % capacity
- 1 line for 33 % capacity
- Battery icon blinking if the capacity is under 10 %.

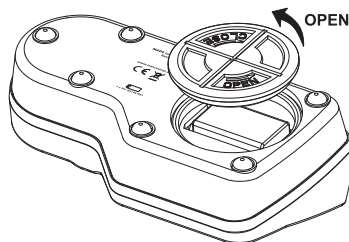
If the battery is empty and accurate measurements can't be taken anymore, the instrument shows "dEAd bAtt" and turns off.

To restart the instrument, the battery must be replaced with a fresh one.

BATTERY REPLACEMENT

To replace the instrument's battery, follow the steps:

- Turn the instrument off by pressing ON/OFF.
- Turn the instrument upside down and remove the battery cover by turning it counterclockwise.



- Extract the battery from its location and replace it with a fresh one.
- Insert back the battery cover and turn it clockwise to close.

ACCESORIES

ANALYSIS KIT

C219/C220 Kit Kit for Honey Color analysis, including: 82 cuvettes, 30 mL of Glycerol and two 5 mL syringe (75 tests average)

OTHER ACCESORIES

C115-00300 5 mL graduated syringe
HI 721310 9V battery (10 pcs.)
HI 731318 Cloth for wiping cuvettes (4 pcs.)
HI 731335 Caps for cuvettes
HI 741218 Carrying case

WARRANTY

HI 96785 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions.

This warranty is limited to repair or replacement free of charge.

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered. If service is required, contact your dealer. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred.

If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service Department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

Recommendations for Users

Before using these products, make sure that they are entirely suitable for your specific application and for the environment in which they are used.

Operation of these instruments may cause unacceptable interferences to other electronic equipments, this requiring the operator to take all necessary steps to correct interferences.

Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance.

To avoid damages or burns, do not put the instrument in microwave oven. For yours and the instrument safety do not use or store the instrument in hazardous environments.

Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.



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