



Technical Bulletin

From Hive to Table; MISCO Digital Honey Refractometer Provides a Sweet Solution for Measuring Honey Moisture Content

Honey; How Sweet it is?

Although designed specifically for state and federal inspectors responsible for the measurement and grading of honey, the MISCO Digital Honey Refractometer is equally beneficial to professional beekeepers, honey producers, honey mixers, honey brokers, or anyone requiring the absolute most accurate, repeatable readings of moisture content and percent solids in honey.

The Palm Abbe Honey Refractometer represents the highest level of development in the field of honey measurement. It far exceeds the requirements for honey refractometers used in the grading and inspection of honey by the USFDA, the Canadian Food Inspection Agency, and the Food and Agriculture Organization of the United Nations.

Simply place the a drop or two of honey in the stainless steel measuring well, close the cover to prevent the absorption of moisture, and then press the <GO> button to receive an instant, accurate reading of moisture content or dissolved solids content.

Balancing Act or Sticky Situation?

The moisture content of honey is critical to its grade and overall quality. If the moisture content is too high, there is a risk of fermentation; too low and it may crystallize or granulate. The battle between fermentation and crystallization in honey production is a delicate balancing act. An accurate measurement of moisture content, using a refractometer, represents the best weapon in this battle.

Honey is a supersaturated solution consisting of various sugars dissolved in water. Supersaturation means that a honey is able to hold more dissolved solids in solution than could usually be dissolved in the same amount of water under the same conditions.

Low water activity is the reason that honey can become supersaturated. Since most of the water molecules are associated with sugar molecules, little water is left for yeast or other microorganisms. Low water activity also causes honey to be hygroscopic, which means that it readily absorbs moisture from the air.

The low water activity and relatively acidic nature of honey helps to prevent bacteria from growing and causing spoilage. However, sugar-tolerant yeasts, naturally occurring in honey, can cause fermentation or spoilage if the moisture content gets too high. Therefore, beekeepers generally try to balance the moisture content of honey in a very narrow range between 17.0 to 18.6% (see sidebar, page 2).

Since yeast is most active and reproduces readily around 80°F, beekeepers either pasteurize (heat-treat) the honey to kill the yeast, or they store the honey at temperatures below 50°F, where the yeast becomes inactive. Storing honey at lower temperatures can help prevent fermentation and spoilage, but it can also increase the risk of crystallization and granulation since the supersaturated sugar/water solution is less able to hold the dissolved solids in solution at lower temperatures.

Pasteurization is a method of heating the honey and then rapidly cooling it to make it more resistant to fermentation. But pasteurization also represents a balancing act in itself. Heating the honey too high, or holding the temperature high for too long, can darken the honey, change its taste, and increase the risk of crystallization.



The ability of honey to keep dissolved solids in solution is a function of both the temperature and water content. If the temperature or water content drops too low, then crystallization or granulation is more likely. During crystallization, glucose is usually the first solid to come out of solution. As solids come out of solution, more water is freed up, thus increasing the moisture content of the honey. If the moisture content gets too high, then fermentation or spoilage is again a possibility.

How is the MISCO Digital Honey Refractometer Different?

Designed as an instrument for government inspectors and professional apiculture, the MISCO Digital Honey Refractometer provides precise readings of both honey moisture content and dissolved solids. No other hand-held refractometer can approach the precision of the MISCO Honey Refractometer.

The magic behind the precision of the MISCO Digital Honey Refractometer is a result of the Palm Abbe OPTICAL-ENGINE®. This Optical-Engine combines high-precision optics with a linear detector array containing 1,024 elements, more than seven times the elements of the leading competitor. This detector array allows the MISCO Honey Refractometer to repeatedly measure better than +/- 0.1% moisture or solids content.

Since honey is comprised of a mixture of mostly fructose, glucose, and water, readings on the MISCO Digital Honey Refractometer are automatically temperature compensated using a special compensation specific to honey. This differs from other refractometers which use "sucrose" temperature compensation, instead of honey compensation. Refractometers using sucrose compensation will have a slight error at 25°C (77°F) and even more error as the temperature increases.

The MISCO Digital Honey Refractometer features a precision-machined stainless steel sample well with a cover that helps prevent further absorption of water. At the bottom of the sample well, a sapphire prism, the next hardest substance to diamond, provides a virtually unscratchable measurement surface.

Why Can't you Measure Honey with a Brix Refractometer?

– Stinging facts you can't ignore.

For years, many beekeepers have measured honey using a traditional Brix Refractometer, primarily because these instruments are inexpensive and are readily available. However, Brix actually represents the percent by weight of sucrose in a sucrose/water solution, and although the relationship between sucrose and refractive index has been well established, the Brix scale cannot provide an accurate indication of the sugar content in honey.

Honey with a moisture content of 17% actually contains only about 1% sucrose, together with a mixture of nearly 70% Fructose and Glucose. Since the relationship between the refractive index of Fructose and Glucose is different than the relationship for sucrose, a standard Brix refractometer is NOT able to give an accurate reading of dissolved solids (actual sugars) or moisture content for honey.

For example: honey with 17% moisture content has 83% dissolved solids and a refractive index of 1.4940 at 20 °C (68°F). A refractive index of 1.4940 on the Brix scale corresponds to 81.25 Brix, or 81.25% sucrose by weight. This would cause an error of nearly 2% for honey read on a Brix refractometer (18.75% moisture content instead of 17%)

If this weren't bad enough, some traditional analog refractometers are not temperature compensated. So honey with 17% moisture content, read at 30°C (86°F) on an uncompensated honey refractometer, would read 17.9%. That is nearly another full percent of error at 30°C (86°F) and even more at higher temperatures.

An uncompensated Brix refractometer used to measure honey at 30°C (86°F) would be off by nearly 3%, and this is before factoring in the plus or minus tolerance of the instrument itself and any calibration error. An error of this magnitude is easily enough to change the grade designation of honey to substandard or worse. With a Brix Refractometer you may as well just stick your finger in it, taste it, and guess.

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The user-interface of the MISCO Digital Honey Refractometer consists of two buttons and is both intuitive and easy to learn. A large two-line 24-character LCD display provides the user with an indication of the unit of measure (percent moisture or percent dissolved solids) and the actual measurement value. Full-text prompts, various menu options, and error messages are also displayed.

If this were not enough, up to five scales of your choice may be programmed into the model [PA203](#) for a truly custom honey refractometer. Scales are available that read in Baume, moisture %, dissolved solids, honey specific gravity, and honey density. You can even mix and match other scales, like Brix or Maple Syrup.

Although the MISCO Digital Honey Refractometer will calibrate to water alone, an optional calibration solution has been specifically prepared with a value of 18.6% Moisture, to help insure the most accurate calibration in this critical area of the scale.

Following is a handy guide to show how the MISCO Digital Honey Refractometer stacks up against the competition.

Manufacturer	MISCO	MISCO	MISCO	Atago
Model	BKPR-1	BKPR-2	BKPR-4	PAL-22S
Number of Scales	1	2	4	1
Sample Cover	YES	YES	YES	NO
Sample Well Material	Machined Stainless Steel	Machined Stainless Steel	Machined Stainless Steel	Cast Aluminum (plated or anodized)
Prism Material	Sapphire	Sapphire	Sapphire	Glass
LCD Display	Large 24-Character	Large 24-Character	Large 24-Character	Small 3-Digits
Elements in Detector Array	1024 Detector Elements	1024 Detector Elements	1024 Detector Elements	128
Moisture Precision	+/- 0.06%	+/- 0.06%	+/- 0.06%	+/- 0.2%
Calibration	Water & Special	Water & Special	Water & Special	Water
Languages	English	English	English, French, Spanish, Russian	N/A
List Price	\$360	\$445	\$535	\$360

MISCO, in business since 1949, is a leader in a very small world-wide community of professional refractometer manufacturers and is very visible within that industry. MISCO has great respect for its competitors and, although comparison between products is inevitable in a free market economy, an attempt has been made here to offer only fair and objective head-to-head comparisons. In the end, it's the customer's ultimate decision to select the company they wish to honor with their business.

The data presented for competitive instruments was compiled from their respective websites, product literature, and our experience with the instruments. This information is being presented to assist a potential buyer in comparing the two major name brands of digital refractometers, and although we have done our best to present the most accurate information known to us, we do not make any claims as to the accuracy of the data. Please feel free to contact the comparison company directly for additional information; we provide contact information below.

We have tried to present the data in such a way that it compares the strength and weakness of all the comparison instruments. Some instruments will naturally fare better in different categories than others. In the event that a customer or competitor finds an error in the data presented here, please contact us and we will gladly update this document.

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