Paper No. 140403

MISCO Digital Beer Refractometer Review
with Anton Paar DMA5000 and Atago WM-7

Table 1. WORT Sample ID	A. Paar DMA5000 MEASURED D20/20	MISCO D.B.R. MEASURED D20/20	MISCO D.B.R. ERROR D20/20	A. Paar DMA5000 MEASURED OE (°P)	ATAGO WM-7 MEASURED Brix %	ATAGO WM-7 ERROR Brix %	MISCO D.B.R. MEASURED %DS	MISCO D.B.R. ERROR %DS
G	1.033	1.033	**0.000**	8.2	8.4	**-0.2**	8.2	**0.0**
B	1.034	1.033	**0.001**	8.4	8.6	**-0.2**	8.4	**0.0**
E	1.034	1.034	**0.000**	8.5	8.7	**-0.2**	8.4	**0.1**
D	1.034	1.034	**0.000**	8.5	8.7	**-0.2**	8.4	**0.1**
A	1.035	1.035	**0.000**	8.7	8.9	**-0.2**	8.6	**0.1**
H	1.035	1.035	**0.000**	8.7	9.0	**-0.3**	8.7	**0.0**
C	1.035	1.035	**0.000**	8.8	9.1	**-0.3**	8.7	**0.1**
F	1.035	1.035	**0.000**	8.8	9.1	**-0.3**	8.7	**0.1**
L	1.037	1.037	**0.000**	9.2	9.6	**-0.4**	9.2	**0.0**
K	1.048	1.049	**-0.001**	12.0	12.6	**-0.7**	12.1	**-0.2**
J	1.075	1.076	**-0.001**	18.2	18.8	**-0.6**	18.2	**0.0**
I	1.079	1.080	**-0.001**	19.1	19.7	**-0.6**	19.1	**-0.1**

INTRODUCTION

When brewers accustomed to using a Brix or Plato Refractometer first realize that their refractometer measurements are based on the mathematical relationship between sucrose and refractive index, and then recognize that there is really very little sucrose in wort, they scratch their heads and ask why hasn't anyone realized this sooner? Wort has a complex sugar profile which includes primarily maltose, with maltotriose, dextrose, and fructose. Only about four to six percent of wort sugars are sucrose. This is why it is necessary to enter a refractometer correction factor into commercially available brewing software and online calculators.

The new MISCO Digital Beer Refractometer (DBR) is designed to help the professional brew chemist make the most accurate possible measurements of wort sugars in the brewing process. Scientifically derived from an actual beer model with a complex sugar profile, which is strongly influenced by maltose, and specific to wort, MISCO's Pro-Brewing Scales™ are more than just another repurposed Brix refractometer.

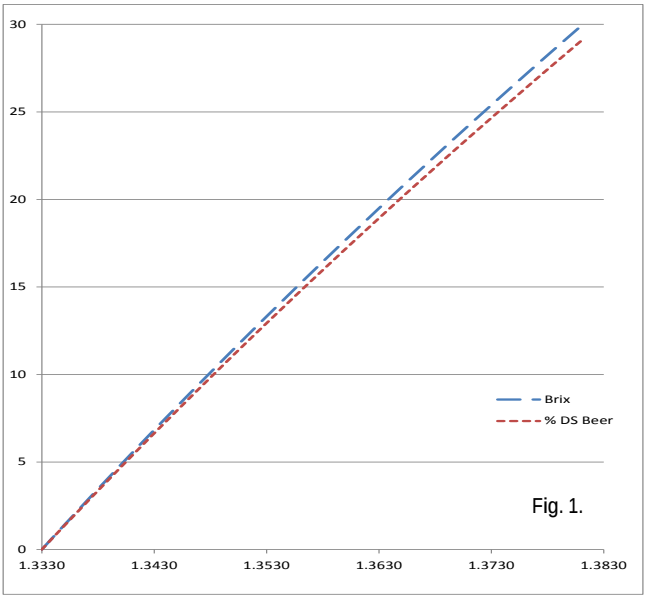

Fig. 1.

Figure 1 shows the difference between sucrose concentration and actual wort dissolved solids relative to refractive index. Since the small Red-Dotted Line represents the true relationship between refractive index and dissolved solids in wort, the readings on the big Blue-Dotted Brix/sucrose line will be incorrect and the error will increase with increasing dissolved solids.

In Table 1, the Original Gravity (OG) of 12 different worts was measured using an Anton Paar DMA5000 benchtop digital density meter (accurate to +/-0.000005 D20/20). The same samples were measured using the D20/20 Specific Gravity scale on the MISCO Digital Beer Refractometer. The results indicate there is almost perfect correlation between the MISCO Digital Beer Refractometer and the Anton Paar meter.

Next, the Original Extract (°P) was measured on the Anton Paar meter and compared with Atago's top-of-the-line sucrose-based WM-7 digital refractometer (accurate to +/- 0.1 Brix) and the percent Dissolved Solids scale on the MISCO Digital Beer Refractometer. Again, the MISCO Digital Beer Refractometer matched the Anton Paar meter to +/- 0.2% or better in all cases. As expected, the sucrose-based Atago unit had an error which increased with sugar concentration showing the need for a refractometer correction factor. No correction factor was needed for the MISCO Digital Beer Refractometer.

More significantly for the use of the Digital Beer Refractometer are the measurements made on finished beers (See table 2). Tests were performed to measure the Original Extract (OE) on an Anton Paar DMA5000 density meter/Beer Alcolyzer and reported as °P. The Apparent Extract (AE) was measured on the MISCO Digital Beer Refractometer after fermentation had begun. It is known, after fermentation has begun, that refractometer readings alone are not reliable since the presence of ethanol in the wort interferes with refractive index readings. However, the AE readings (Dissolved Solids scale on MISCO Beer Refractometer) were plugged into the online calculator on the MISCO website, together with the OE values, and the values for OG, specific gravity (D20/20), and Alcohol by Volume (ABV) were calculated.

Table 2. BEER Sample ID	Wort	A. Paar DMA5000 MEASURED OE	MISCO D.B.R. MEASURED AE	A. Paar DMA5000 MEASURED D20/20	MISCO CALCULATED D20/20	MISCO ERROR D20/20	A. Paar DMA5000 MEASURED %ABV	MISCO CALCULATED %ABV	MISCO ERROR %ABV
839	Session Ale	11.6	6.0	1.010	1.010	**0.000**	4.7	4.7	**0.0**
838	Witbier	12.0	6.3	1.013	1.011	**0.002**	4.7	4.9	**-0.3**
847	Helles	12.3	5.9	1.007	1.007	**0.000**	5.5	5.1	**0.4**
842	Dry Stout	12.4	6.7	1.011	1.012	**-0.001**	5.1	5.2	**-0.1**
837	Pale Ale	13.0	6.5	1.010	1.009	**0.001**	5.6	5.5	**0.0**
840	American Lager	13.3	6.4	1.009	1.008	**0.001**	5.9	5.7	**0.1**
846	Amber Ale	13.6	6.5	1.008	1.008	**0.000**	6.2	5.8	**0.3**
848	Specialty	14.5	6.7	1.007	1.007	**0.000**	6.8	6.3	**0.4**
841	Porter	14.9	8.2	1.015	1.015	**0.000**	6.1	6.6	**-0.5**
844	IPA	15.3	7.5	1.010	1.010	**0.000**	6.9	6.8	**0.0**
845	Brown Ale	15.8	7.7	1.009	1.010	**-0.001**	7.3	7.1	**0.1**
843	Double IPA	17.3	8.0	1.008	1.008	**0.000**	8.3	8.0	**0.2**

The correlation between the Anton Paar meter and the MISCO Digital Beer Refractometer was very good. The average error for specific gravity was <0.001 and two times standard deviation was 0.001, meaning that the MISCO and Anton Paar units should be within +/-0.001 D20/20 with a 95% confidence interval. Calculations using the MISCO online calculator matched the ABV calculations to within +/-0.5% for the tested beers.

SUMMARY

These experiments were performed under the watchful eye of an independent third-party PhD brewing chemist. Granted that sample size of this review was limited, nonetheless the results should be representative of what you can expect when using a MISCO Digital Beer Refractometer in your own laboratory, or a homebrew setting for that matter. These results have been independently verified in a beer laboratory using a much more accurate Anton Paar DMA5000 benchtop density meter. It is noteworthy that the MISCO units give comparably close results to the "officially accepted" and very expensive DMA5000 laboratory instrument. Perhaps the MISCO Digital Beer Refractometer is more comparable to the Anton Paar DMA35 handheld density meter (+/-0.001 accuracy). However, you can buy five MISCO Beer Refractometers for the price of one DMA35, making the MISCO refractometer a great value in terms of price and performance.

ABOUT THIS PAPER

MISCO, in business since 1949, is a leader in a very small worldwide 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.

RESOURCES

MISCO Refractometer
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Website: www.misco.com/beer ● Email: Contact Us

TRADEMARKS & ACKNOWLEDGEMENTS

MISCO Pro-Brewing Scales						
Scale	Unit of Measure	Basis	Range	Resolution	Precision (+/-)	Temp. Comp. Basis
799	Brix	Sucrose	0 to 30	0.1	+/- 0.1	Wort Sugars
800	Dissolved Solids (Sugars)	Wort Sugars	0 to 30	0.1	+/- 0.1	Wort Sugars
801	°Plato	Sucrose	0 to 30	0.1	+/- 0.1	Wort Sugars
802	Specific Gravity (D20/20 °C)	Wort Sugars	1.000 to 1.127	0.001	+/- 0.001	Wort Sugars
803	Specific Gravity (D60/60 °F)	Wort Sugars	1.000 to 1.128	0.001	+/- 0.001	Wort Sugars
804	Brewer's Points @ 20 °C	Wort Sugars	0 to 127	0.1	+/- 0.5	Wort Sugars
805	Ethanol (by Distillation)	Ethanol	0 to 30	0.1	+/-0.2	Sucrose
806	Balling	Sucrose	0 to 30	0.1	+/- 0.1	Wort Sugars
MISCO Propylene Glycol (PG) Scales for Wort Coolers & Chillers						
006	Percent by Volume	PG	0 to 100 %	0.1	+/- 0.1	PG
008	Freeze Point °F	PG	+32 to -60 °F	1	+/- 2	PG
009	Freeze Point °C	PG	0 to -51 °C	1	+/- 1	PG