

# Pro-Juice Refractometer

## ACHIEVING HIGHLY REPRODUCIBLE °BRIX MEASUREMENT OF ORANGE JUICE USING A PRO-JUICE REFRACTOMETER

For many years now, beverage manufacturers have adopted digital refractometers as their primary instrument for measuring the final dilution ratio (°Brix) of re-constituted fruit juice not only to assure product quality but also in an attempt to reduce losses by tightly controlling concentrate yields. For most fruit types this has been successful but for one of the most commonly produced juices, the high accuracy measurement achieved by the latest digital refractometers has unmasked an erratic behaviour within an orange juice sample that prevents tighter dilution control. Consequentially, this negates any opportunity of cost reduction by way of lowering target values without the risk of compromising minimum specifications defined by regulation. As a functional food, it is therefore essential that the quality of orange juice is rigorously monitored.

*Figure 1 - Readings of three orange juice applications on a digital refractometer*

Previous reports into the phenomenon have cited varying deviations between sample, instrument and ambient temperatures causing an irregular stabilization period between sample analysis compounding the effects of solid particles settling on to the prism surface as being the root cause. Others have discussed possible electrostatic affects or absorption as possible causes. However, until now, no manufacturer has managed to provide an absolute, or more importantly, practical solution to resolve the issue.

Recently, leading refractometer manufacturer Bellingham + Stanley, part of Xylem's analytical businesses, has been working alongside a major fruit juice producer in order to develop an instrument that can achieve the same high accuracy results for orange juice samples as it can for other fruit based juices. By focusing on the practical handling of the sample prior to high accuracy measurement, Bellingham + Stanley has designed an instrument based on its leading RFM340+ refractometer that offers a measurement accuracy of 0.01 °Brix for sucrose solutions and more importantly, a reproducibility of 0.02 °Brix between orange juice samples, regardless of temperature deviation or operator skill level.

*(Figure 2 - Comparison of reading deviation from average on different refractometers)*



**END USER:** UK Major Fruit Juice Producer  
**ORDER DATE:** 2012  
**COMPLETION:** 2012  
**XYLEM'S ROLE:** Solution Provider  
**Product Code:** 22-10

**XYLEM SCOPE:**

Following extensive on-site trials, Xylem's role was to design, manufacture, deliver, install and commission a number of Pro-Juice refractometers so that the customer could refine production line blend ratios to an extent that losses were significantly reduced; enabling the customer to maximize juice yield from concentrate that in turn contributed to an increase in profitability.

The Pro-Juice solves the traditional problems of refractometric analysis of orange juice measurement by carefully combining dynamic measurement with intelligent thermal conditioning. The system employs a peristaltic pump to keep the sample in constant motion, preventing the particles from settling on the prism surface. In addition, the importance of practical use should never be understated when designing an instrument to be used in the factory by non-technical operators. The on-screen menu guides the operator through every stage of measurement and as cleanliness is of utmost importance when looking for such a high accuracy result, the software ensures that this is taken care of prior to giving a result.

Filling machines are often on hold whilst final dilution is established prior to packaging a product, meaning that the turnaround time for off-line sample analysis is significant in plant efficiency. This latest technology has been configured to provide °Brix analysis within two and a half minutes including sample preparation and cleaning cycle in order to reduce down time no matter what the temperature difference between sample and instrument. Emerging systems are also built for use in the factory environment as well as the laboratory (Figure 3 - Orange Juice Reading Distribution Comparison)

The Bellingham + Stanley Pro-Juice is not however exclusively designed for diluted orange juice analysis. On-board software using a METHODS system together with the quick release flow cell facilitates conventional "single shot measurement" of any sample up to 95 °Brix in a matter of seconds so that other diluted juices or even concentrates may be measured. The METHODS system also provides a means of handling product information and may therefore be configured to display and record measurement values only after applying recipe specific citric acid correction and verifying its reading limit. User data and instrument configuration such as calibration audit trails are also logged, presenting a completely auditable measurement analysis

Routine maintenance of the Pro-Juice has also been considered. An externally mounted peristaltic pump facilitates rapid tube exchange while the air filters protecting the solid state heat exchangers from airborne sugar vapour and dust can be changed in seconds. Verifying the instrument's performance is equally simple as the METHODS system incorporates specific routines for regular zero calibration with water and a span calibration. This system uses a certified sucrose solution manufactured in accordance with EN ISO/IEC 17025 by Bellingham + Stanley, a UKAS certified laboratory no. 0831. Further verification of the Pro-Juice is achieved by way of an orange juice control sample supplied by Bellingham + Stanley.

In a competitive market where constantly increasing commodity prices raise the bottom line, fruit juice producers need to look to the latest technology to ensure that the most effective processes for °Brix analysis are in place. These systems will not only prove a viable method to help reduce costs by tightly controlling product yield for all fruit juice types including orange juice with or without added pulp, but will do so without putting lucrative contracts at risk.

For more information and to download the full technical article, please visit [www.bellinghamandstanley.com](http://www.bellinghamandstanley.com)

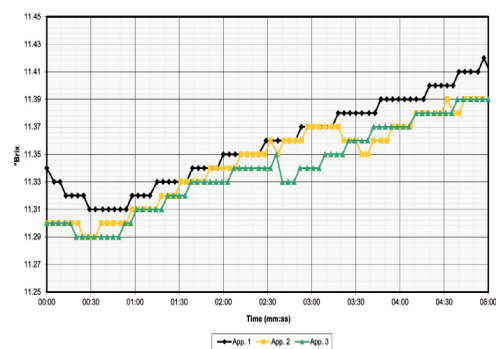


Figure 1 - Readings of three orange juice applications on a digital refractometer

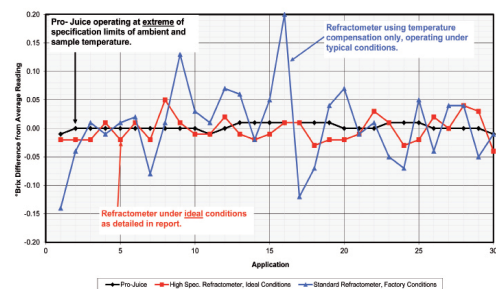


Figure 2 - Comparison of reading deviation from average on different refractometers

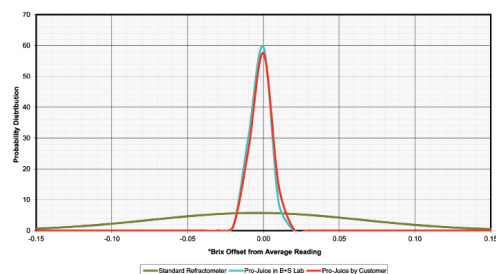


Figure 3 - Orange juice reading distribution comparison