Application Note
Food & Beverage Industry

SCHMIDT HAENSCH

Inline Brix concentration measurement in jam production

Controlling Brix Value During Marmalade or Jam Cooking in Real Time

Jam, marmalade, and similar fruit preserves are produced by concentrating fruit mixtures with sugar to achieve a stable gel-like consistency and long shelf life. The final product quality strongly depends on the Brix value, which defines the concentration of dissolved solids, mainly sugar.

Typical Brix ranges are:
Jam: 10 – 70 Brix
Marmalade: 50 – 85 Brix

In standard jam formulations, products often consist of approximately 50 % fruit and 50 % sugar, resulting in final concentrations around 60–70 Brix. Maintaining this concentration is essential for taste, texture, preservation, and product stability. Modern food production increasingly requires continuous inline monitoring to ensure consistent quality and efficient process control. Traditionally, measurements were carried out offline using laboratory refractometers. However, modern production processes require continuous inline monitoring to improve efficiency and automation.

Why Monitoring Is Essential
Jam production is typically carried out in batch processes of 500 to 3000 kg, lasting 1–3 hours, and involves several key phases:

1. Ingredients Addition: Fruits, sugar, pectin, and water are mixed; frozen fruits thaw as temperature rises.

2. Sweetening Cooking: Sugar is absorbed by the fruit until equilibrium is reached (below 90 °C).

3. Pasteurization: Temperature increases to 100–150 °C for microbial stabilization.

4. Cooling: Product is cooled to 20–40 °C, and aromas may be added.

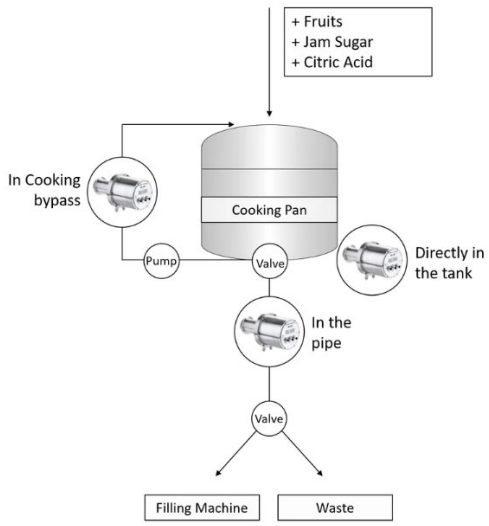
Throughout these phases, sugar concentration, temperature, and viscosity continuously change, directly influencing the final product quality (as illustrated in the process diagram on page 1 of the jam cooking note).

Without real-time monitoring, this can lead to:
- Inconsistent product quality
- Excessive sugar usage
- Increased production time
- Higher risk of batch rejection

Refractive Index as Process Analytical Tool (PAT)
The refractive index (RI) is directly correlated with the Brix value and therefore ideal for monitoring sugar concentration in jam and marmalade production. Inline refractometers measure the refractive index continuously and convert it into a Brix scale, enabling precise real-time control of the cooking process.

Inline refractometers measure continuously and provide:
- Measurement ranges typically from 0 to 100 °Brix
- Real-time output signals (e.g., 4–20 mA or digital) for process control
- Immediate detection of deviations

This approach allows:
- Continuous tracking of concentration changes
- Optimization of cooking time
- Reduction of raw material consumption
- Stable and reproducible product quality



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Solution from SCHMIDT + HAENSCH

Using the SCHMIDT + HAENSCH Full-Range Inline Process Refractometer iPR FR² provide a reliable method for monitoring the Brix values during jam and marmalade production. The refractometer can be mounted directly in the cooking pan, providing real-time measurement during the entire cooking process. This enables immediate control of concentration and ensures the desired final product quality.

Alternatively, the system can be installed in a bypass line. In addition to inline process control, SCHMIDT + HAENSCH offers laboratory and at-line refractometers for quality assurance and process validation, the Laboratory Refractometer ATR V/VT or ATR P. Ideal for high-precision Brix measurements in laboratory environments. It supports quality control of raw materials, intermediate products, and final jam or marmalade batches.

iPR FR²

Product packages	Product	ID-N°
Process Refractometer	iPR FR² Full-Range Inline Process Refractometer	**10970**
Accessories	VARINLINE® housings (several ends and diameters)	
Accessories	VariVent Tank weld-in flange	**07516**

Advantages

- Accurate, reliable, and fast measurement
- Continuous inline monitoring
- Reduced production time and costs
- Lower sugar consumption
- Improved yield and productivity
- Reduced risk of downtime
- Consistent high product quality

Typical industries

- Food production
- Jam and marmalade manufacturing
- Fruit processing industry