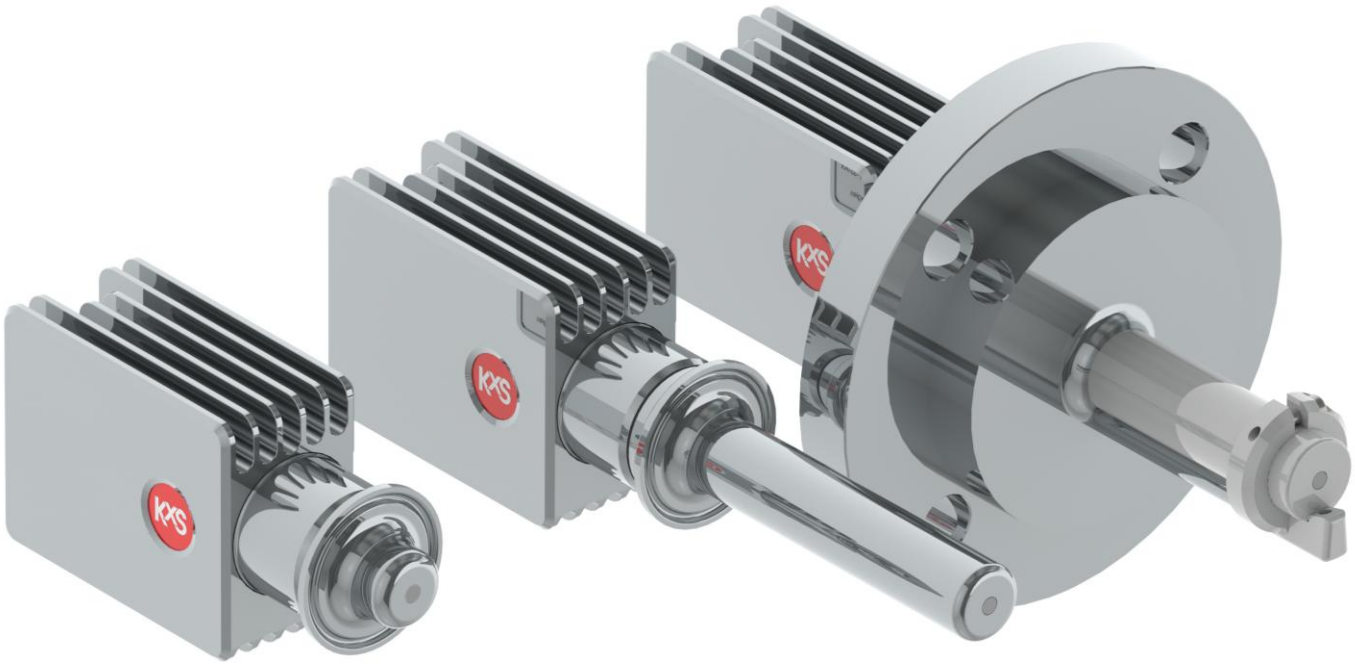
Excellence in refractive index measurement



KxS Inline Brix refractometer DCM-20 for sugar process control

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Technology that is built on over 40 years of industry-leading experience

KxS Inline Brix refractometers are used throughout the entire sugar production process. Whether the source is sugar cane or sugar beet, our inline refractometers monitor Brix from initial processing and refinement to syrups, and final liquid and crystallized products.

The DCM-20 consists of a hygienic compact, or industrial probe sensor and it comes with flange or Sanitary process connections and flow cells for easy installation in process pipes, tanks and crystallizers.

The DCM refractometer provides a full measurement range of 0-100 Brix, utilizing two independent 4-20mA outputs and a digital Modbus TCP output for connectivity to automatic process control systems.

Crystallization

The KxS DCM-20 refractometer enables sugar refineries to transition toward fully predictive, supersaturation-based crystallization control. Supersaturation values are computed in the DCS, combining refractometer concentration, temperature, and known solubility functions. Factories may integrate existing microwave instruments to assist in level control and endpoint determination.

When supersaturation becomes measurable in real time:

- Strikes become faster and more stable
- MA increases and CV narrows
- Product quality improves
- Steam consumption decreases
- Process control becomes scientific rather than experiential

Liquid sugar

- Real-time liquid sugar Brix measurement
- Extraction of sugar juice from beet roots in diffuser process (fast detection of process disturbances during diffusion) and in desugarization of final molasses and green syrup left from massequite centrifugation
- Evaporation control to maximize evaporator capacity and efficiency
- Chromatographic separation for automatic betaine separation and fractionation control

Applications

- Cane sugar milling and refining
- Beet sugar milling and refining
- Liquid sugar production
- Molasses
- Crystallization

"KxS DCM-20 is an exceptionally robust Brix monitor, perfect for all sugar measurements in refineries. Its precise measurement and easy start-up process, combined with the latest sensor technology, ensure reliable performance for decades."

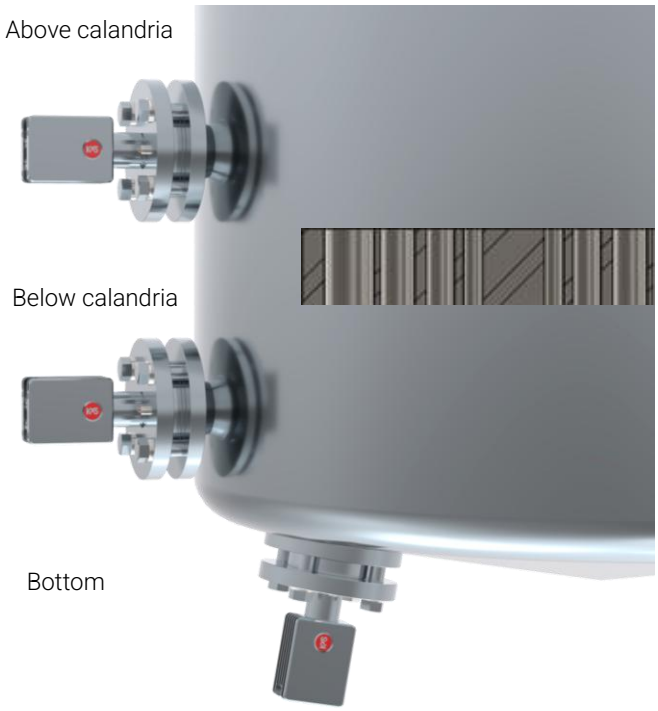
Key features

- High accuracy (±0.1%)
- Fast response suitable for dynamic control
- Drift-free operation
- Fully selective to the liquid phase
- Reliable over entire strike
- Immune to crystal content

In industrial crystallizers, three installation positions have been proven suitable: above the calandria, below the calandria, and at the bottom of the vessel. The appropriate location depends on the crystallizer's circulation pattern and crystallizer design and syrup inlet position.

A counter flange adapter is recommended to eliminate dead pockets where massecuite could remain between strikes.

Recommended DCM-20-P (Probe model) installation points in crystallizer



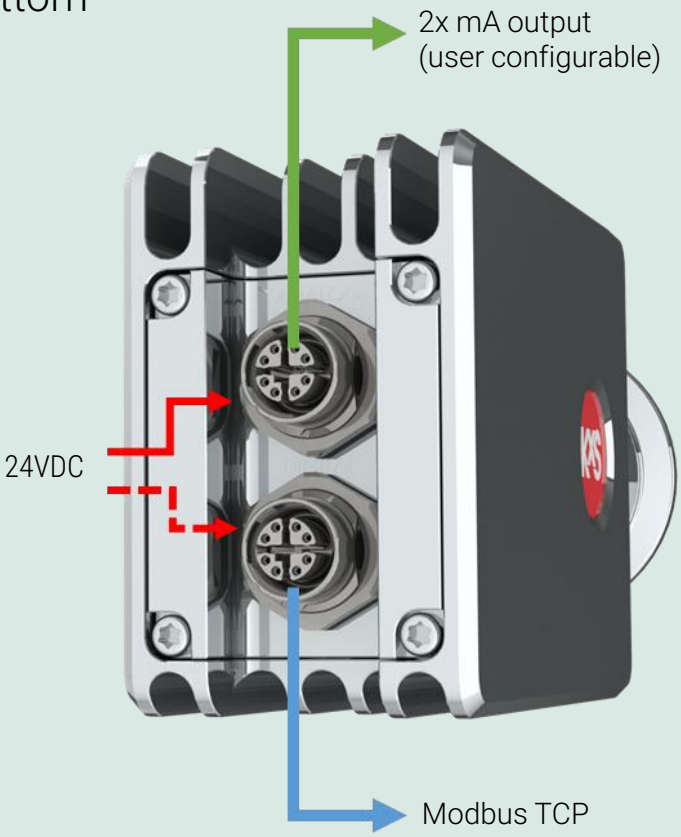
Digital and analog M12 connectors

The DCM-20 operates with a 24 VDC input power supply and offers flexible communication options, including analog (4-20 mA) and digital (Modbus TCP)

When using the analog signal, the digital port serves as a service port for configuration and diagnostics via a computer web browser, external display, or mobile device

All port options can be utilized simultaneously, providing seamless integration and monitoring capabilities

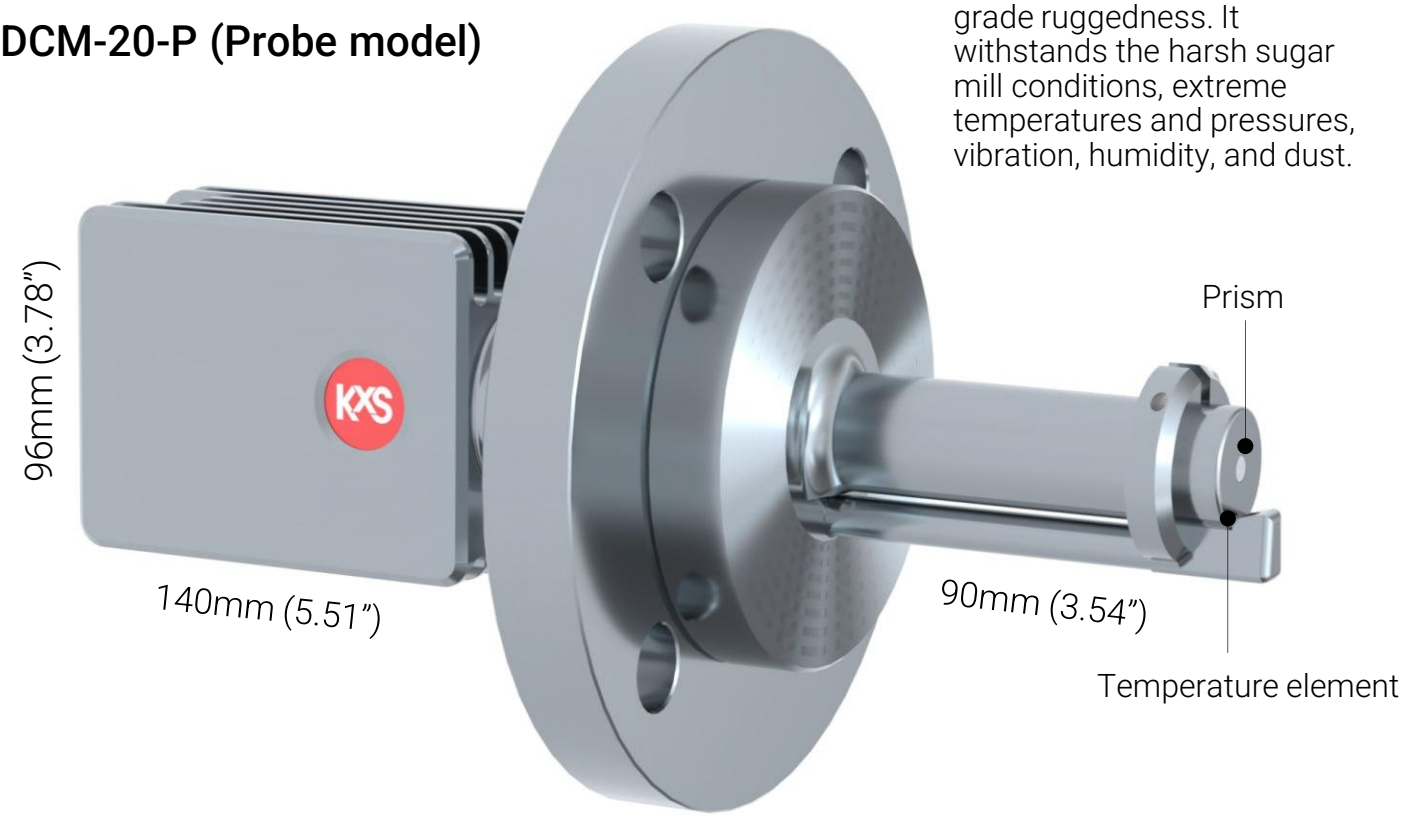
Bottom



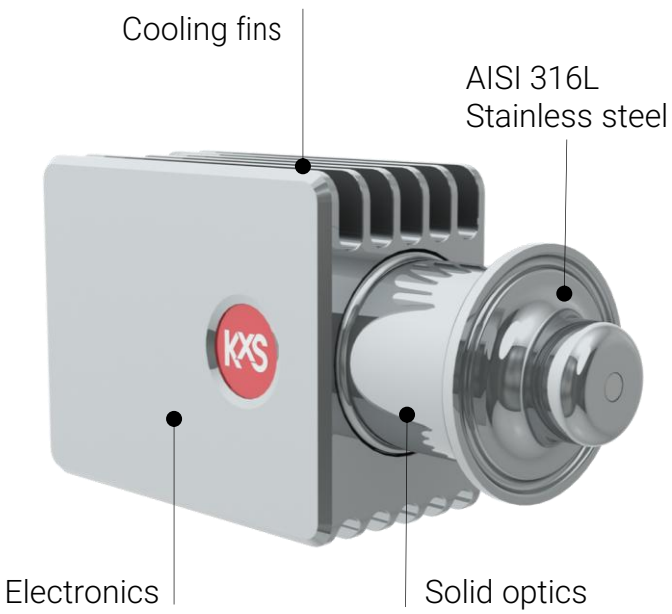
Key design features

The DCM-20 combines high accuracy measurement technology with industrial grade ruggedness. It withstands the harsh sugar mill conditions, extreme temperatures and pressures, vibration, humidity, and dust.

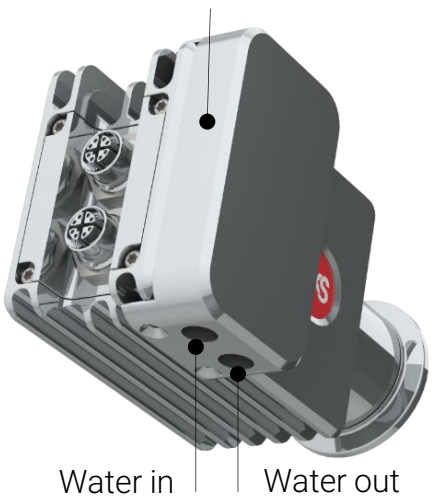
DCM-20-P (Probe model)



DCM-20-L (Compact model)



Cooling cover for high ambient temperature environments, water cooling, 1 l/min

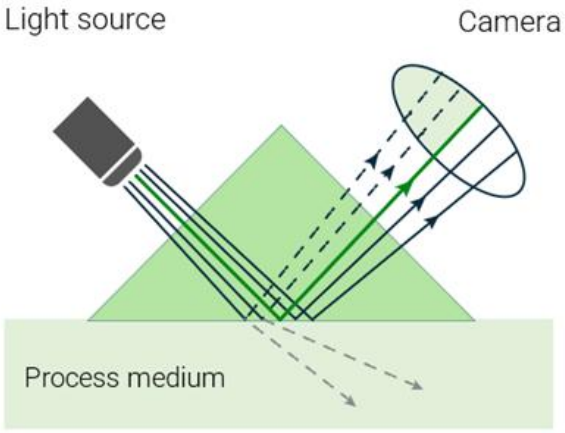


Optical refractive index measurement principle

KxS process refractometers DCM (digital concentration monitoring) employ the physical phenomenon of Refractive Index to define liquid concentration.

Optical concentration measurement is based on Snell's law and the critical angle of total reflection to provide precise readings.

Light is emitted from an LED and directed towards the interface between an optical window and the liquid being measured. As the concentration of the liquid changes, specific angles of the light are totally reflected and partially reflected back, producing light and shadow interface that is captured by a digital camera sensing element.



This interface is detected by the light-activated camera pixels and converted into refractive index (RI).

The RI values can be directly used or further translated into any concentration units, such as Brix or percentage by weight. This method ensures that measurement signals are provided instantaneously, allowing for real-time process control.

User interface

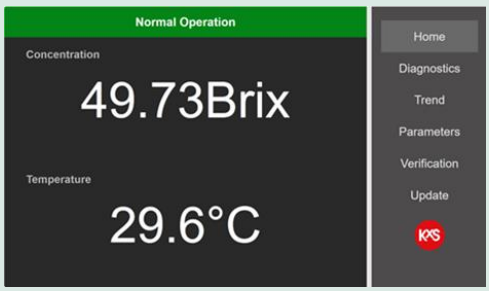
The DCM-20 measures refractive index and displays temperature-compensated concentration units in Brix, % by weight or any engineering unit.

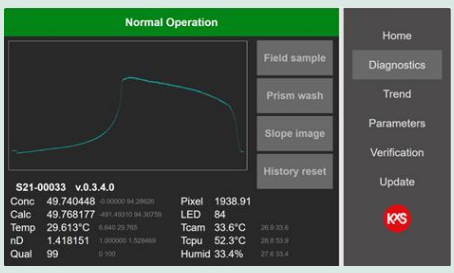
External displays with different sizes are available for connection through the sensor digital port. Computer, tablet or mobile phone with a web browser serves as user interface for accessing sensor diagnostics and settings.

Advanced optical image detection with proprietary pattern recognition.

Modular Connection Unit with wash relays

Web HMI





KxS Inline Brix refractometer DCM-20 for sugar specifications

Refractive Index range:	Full range, nD 1.3200...1.5300 (equals by definition to 0...100 Brix)
Output units:	Brix / Conc% / g/cm^3 / refractive index RI
Measurement precision:	± 0.05 Brix
Measurement accuracy:	± 0.10 Brix in full range 0….100 Brix, 20….90°C
Speed of response:	1 sec. undamped
Optics:	No mechanical adjustments and digital measurement with 4000-pixel CMOS camera, 589 nm wavelength (sodium D-line) light emitting diode (LED) Built-in Pt-1000 temperature sensor (linearization according to IEC 751) Proprietary 6th generation image recognition algorithm for precise optical image and intelligent prism fouling detection
Temperature compensation:	Automatic, individual zero-point calibration
Calibration:	NIST traceable calibration, verification with standard R.I. liquids
Wetted parts:	AISI316L Stainless steel, Sapphire optical window, PTFE gasket Optional: Alloy 20, Hastelloy C-276, Titanium, Tantalum Sensor housing: AISI316/EN 1.4404 Stainless Steel
Process connection:	Industrial refractometer connections with DIN/ANSI/JIS flanges; L clamp or flow cell flanges / Hygienic refractometer connections with 1.5” and 2.5” Tri-clamp or Varinline® Optional flow cell housing connections with Sanitary or DIN/ANSI flanges
Process pressure:	-1...37/45 bar (14.5...535/650 psi) depending on process connection
Process temperature:	Industrial probe refractometer DCM-20-P -40°C (-40°F)...150°C (302°F) continuous process temperature / Hygienic compact refractometer DCM-20-L -15°C (5°F)...100°C (212°F) continuous process temperature. Withstands 130 °C Clean-in-Place CIP and Steam-in-Place SIP sequences
Ambient temperature:	-40°C (-40°F)...65°C (149°F)
Sensor protection class:	IP67, Nema 4X
Installation:	Indoor/Outdoor, unclassified area
Sensor weight:	5.7kg (12.6lbs) DCM-20-P probe model 1.3 kg (2.9 lbs) DCM-20-L compact model
Outputs and connections:	
Digital M12 connector:	24VDC power supply Modbus TCP for user interface and PLC connection, Standard cable length 10 m (33 ft), max 70 m (230 ft)
Analog M12 connector:	24VDC power supply 2 pcs independent 4-20 mA user configurable outputs Standard cable length 10 m(33 ft), max, 200 m(660 ft). Max. load 1000 Ohm
Sensor power consumption:	Max. 2.5W
Options:	Modular Connection Unit enclosure with optional display/user interface Independent 7” Web HMI, full color touch screen interface Optical prism wash with steam, high-pressure water or mechanical wash Direct integration with Rockwell’s PLC for Ethernet IP communications ATEX/IECEx approval for Ex ec mc IIC t4 Gb/Gc

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